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GIS based Fire Emergency Agriculture of Shandong Province

Highlights

Image Retrieval with Relational Indexing Color and Gray Images

Discovering Thoughts, Inventing Future

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GIS based Fire Emergency Response System for Mandalay

By San Hay Mar Shwe & Htet Ne Oo
University of Technology

Abstract- Urban fire is one of the most disturbing problems not only for developing countries but also for developed countries. In spite of the modern techniques of fire prevention and suppression, urban fires continue to damage properties and lives. To tackle this problem, it is required to develop an effective response system on a regional scale. The objective of this paper is therefore to establish a system that can identify the best route from any fire incident to the nearest or closest rescue places such as urban fire emergency services, hospitals, police stations and so on. GIS-based technology is applied in this system for finding the best route by considering traffic data. Both graph theory and network analysis tools in GIS are applied for the purpose of modeling and analyzing transportation networks. A transportation network can be referred to as a valued graph consisting of a set of vertices and a set of edges. In order to compute length of the shortest path from the source to each of the remaining points in the graph, Dijkstra's algorithm can be used. Comparing to the normal shortest route, the algorithm in this system can provide an optimal route selection, which costs less time and has a higher average speed.

Keywords: traffic data, network analysis, optimal route, geographic information systems (GIS) dijkstra's algorithm.

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GIS based Fire Emergency Response System for Mandalay

San Hay Mar Shwe [α] & Htet Ne Oo [σ]

Abstract- Urban fire is one of the most disturbing problems not only for developing countries but also for developed countries. In spite of the modern techniques of fire prevention and suppression, urban fires continue to damage properties and lives. To tackle this problem, it is required to develop an effective response system on a regional scale. The objective of this paper is therefore to establish a system that can identify the best route from any fire incident to the nearest or closest rescue places such as urban fire emergency services, hospitals, police stations and so on. GIS-based technology is applied in this system for finding the best route by considering traffic data. Both graph theory and network analysis tools in GIS are applied for the purpose of modeling and analyzing transportation networks. A transportation network can be referred to as a valued graph consisting of a set of vertices and a set of edges. In order to compute length of the shortest path from the source to each of the remaining points in the graph, Dijkstra's algorithm can be used. Comparing to the normal shortest route, the algorithm in this system can provide an optimal route selection, which costs less time and has a higher average speed.

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I. Introduction

Nowadays, there are various kinds of disasters such as earthquakes, landslides, floods, fires and so on. So, it is needed to handle that emergency cases effectively. Emergency is a course of events that endangers or adversely affects people, property, or the environment. To reduce these damages and losses by these, disaster management information system (DMIS) and decision support system for emergence response (DSSER) is needed. Disaster management can be defined as the discipline and profession of applying science, technology, planning and management to deal with extreme events. Disaster management activity is divided into the following phases as: Planning, Mitigation, Preparedness, Response (to provide accurate information on exact location of an emergency situation, to save time during the determination of trouble areas (Quick Response) and to use as floor guide for evacuation routes) and Recovery This paper intends to provide emergency system as the response phase of disaster management. In this phase, GIS can be used to making the detailed pictures of the event tracking and the evacuation plans. This system provides a useful decision support system to determine the best route for emergency response.

Geographic information system is an automated information system that is used to support decision making for planning and management of land use, natural resources, environment, transportation, urban facilities and so on. GIS incorporates an elaborate way of capturing, analyzing and visualizing geo-relevant phenomena. GIS is used to analyze the features that present on the earth surface and the events that take place on it. Also, it is an effective tool for determining emergency vehicle routing and solving the emergency vehicle shortest path routing problem. In case of any emergency, it is important to reach the location on a priority basis and even a minor delay may cause major problems. Path finding solutions are becoming a major path of many GIS applications. Shortest path analysis helps in such critical situations by calculating the shortest path or most optimal route. Depending on the type of cost, the shortest path can be referred to as the shortest, fastest, or most optimal path or route. In the research, the fastest route will be calculated depending on traffic data that means sometimes the shortest route can consume more time than more longer route if there is traffic jam. Traffic data are given information about how travel speeds on specific road segments change over time. In network analysis, traffic is important because it affects travel times, which in turn affect results. If traffic routing from one location to another is not considered, the expected travel and arrival times could be far from accurate. Another reason to account for traffic is that it gives the routing opportunities that avoiding the slower, more congested roads, which saves time. This system can find the fastest route to reach destination by avoiding traffic jam. To do this, GIS offers powerful capabilities for network analysis and management of urban traffic network. There are two common spatial data models being used in GIS today: vector and raster. In this system, vector data model is applied with three basic types: points, lines, and polygons. In case of any incident, an emergency responder needs a smart decision support system to reach the incident location as soon as possible. The fastest possible response is needed to dispatch the emergency services to the location of disaster. GIS was designed to support geographical inquiry and ultimately, spatial decision making. The main objective of this

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research is to find the most optimized route by considering traffic data and representing this valuable spatial information to end-users in an efficient way using GIS software.

II. Related Works

In [1], an enhanced GIS-based network analysis was performed and applied on the Greater Cairo road network. The focus was on finding the best route between two locations on the road network and finding the nearest healthcare service providers to an incident location based on the travel time. The proposed method has integrated historical traffic data to be used in the analysis. The authors have used The Dijkstra's routing algorithm built into the ArcGIS Network Analyst Extension for implementing the network analysis. The proposed method has improved the travel time with 20% to 22%, depending on the travel distances. The authors did not consider the other factors that impose a delay in travelling through the road network.

In [2], the authors tried to solve the problem of finding a specialized hospital and its shortest path to reach in Aurangabad city, Maharashtra State, India. They used the ArcGIS software and Dijkstra's algorithm that provide the shortest path from one location to another for finding the nearest location of the hospitals from user's location. The calculations of the shortest path were based on road distances; traffic congestion and state of the roads were not considered.

In [3], the authors developed a GIS based application for healthcare emergency response system services to manage healthcare in the ALMOKATAM Zone in the south of Cairo, Egypt. The optimal route was modeled based on the distance to the closest healthcare service providers. The system integrated data acquisition from databases and plotted the location-based features of satellite image through a web base interface which gives access to all different tasks by different end users to be a decision maker or policy makers in system management. They didn't consider any factor other than the distance.

In [6], the authors have used the ArcGIS software and Dijkstra's algorithm to solve the problem of finding the shortest path to reach a specialized hospital in Aurangabad city, Maharashtra State, India. The calculations of the shortest path were based on road distances; traffic congestion and state of the roads were not considered.

In [7], the authors have developed a desktop-based emergency response management system based on GIS in Delhi, India. In this system, a detailed transportation network was maintained and integrated with real-time traffic data provided by NAVTEQ in India, which was used in analyzing the best routes to an incident location. Various analyses were performed in this system using GIS capabilities, such as network analysis, Origin–Destination (OD) cost matrix, proximity analysis, and buffer analysis.

III. System Methodology

a) Graph Theory and Network Analysis

There are classical problems presented as graphs such as shortest path, longest path, travelling salesman problem. From the view of an emergency response system, it is an important issue to reduce the transmission time through the network by analyzing the spatial network with search procedure. Finding the shortest path from rescue sites to accident point through a road network is crucial for emergency services. In order to take prompt actions on a serious accident, it is important to construct an appropriate transportation network. The graph theory is used intensively in operations research, discrete mathematics, combinatorial optimization and network analysis [9]. Graphs provide a powerful tool to model objects and relationships among objects. Graphs are defined by a set of vertices and a set of edges, where each edge connects two of its vertices. Graphs are further classified into directed and undirected graphs, depending on whether the edges are directed [10]. A graph structure can be extended by assigning a weight to each edge of the graph. Graphs with weights, or weighted graphs, are used to represent structures in which pair wise connections have some numerical values. For example if a graph represents a road network, the weights could represent the length of each road [11]. A graph G consists of a set V of vertices and a set E of edges such that each edge in E joins a pair of vertices in V. Graphs can be finite and infinite, when V and E are finite then G is also finite.

Network analysis has many practical applications, for example, to model and analyze traffic networks. A traffic network represented by a directed graph consisting of a finite set of nodes and a finite set of path which is connected to each other. Each path in the traffic network has an associated generalized cost which could be a combination of travel time, direct cost and travel distance. The length of a path is the sum of the weights of the edges on the path. The shortest path is a classical and main problem in network analysis and it is mandatory for GIS. It has multiple realizations and is highly dependent on the nature of transportation network and the distance between origin and destination.

GIS are designed to capture, analyze, represent spatial data in a way that user can easily understand. The graphs in GIS are geographically referenced, and each vertex has a well defined absolute coordinates related to earth. Network analysis problems are modeled as graph problems based on the underlying graph model of networks. Since there can be more than one path between two vertices, there is then the

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problem of finding a path with the minimum cost between these two specified vertices. The optimal path in the networks is an optimization problem that finds the optimal minimum value path among many alternatives.

b) Dijkstra's Algorithm

Dijkstra's Algorithm is based on graph search, the edge and vertex, gives the shortest path between two vertex. For a given source vertex (node) the graph, the algorithm finds the path with lowest cost (i.e. the shortest path) between that vertex and every other vertex. It can also be used for finding costs of shortest paths from a single vertex to a single destination vertex by stopping the algorithm once the shortest path to the destination vertex has been determined [5].

The algorithm is represented in brief as below:

$$G = (V, E)$$

Where, V is a set of vertices and E is a set of edges.

Dijkstra's algorithm keeps two sets of vertices:

S = the set of vertices whose shortest paths from the source have already been determined.

V-S = the remaining vertices.

The other data structures needed are:

D = array of best estimates of shortest path to each vertex

Pi = an array of predecessors for each vertex

The basic mode of operation is:

1. Initial is d and pi,
2. Set S to empty,
3. While there are still vertices in V-S,
   a. Sort the vertices in V-S according to the current best estimate of their distance from the source,
   b. Add u, the closest vertex in V-S, to S,
   c. relax all the vertices still in V-S connected to u

Pseudo code for Dijkstra's Algorithm:

Distance [s] ←0 (distance to source vertex is zero)

for all v ∈V–{s}

do distance [v] ←∞ (set all other distances to infinity)

S←∅ (S, the set of visited vertices is initially empty)

Q←V (Q, the queue initially contains all vertices)

while Q ≠ ∅ (while the queue is not empty)

do u ← min distance (Q, distance) (select the element of Q with the min. distance)

S ← S ∪ {u} (add u to list of visited vertices)

for all v ∈ neighbors[u]

do if distance [v] > distance [u] + w(u, v) (if new shortest path found)

then d[v] ← d[u] + w(u, v) (set new value of shortest path)

(if desired, add trace back code) return dist

IV. Experimental Result

a) Proposed Approach

The flow chart of the proposed system is as shown in figure 1. Data such as street network, recuse sites is collected from Open Street Map (OSM), offices, etc. The resulted data is preprocessed to discover whatever errors in the data and correcting them in order to get good analysis and results. And then, the shortest route between the incident location and recuse sites can be searched by applying Dijkstra's algorithm within Mandalay city network.

Fig. 1: Flowchart for Proposed System

The following figure 2 shows the detailed process for finding shortest path and closet facilities.

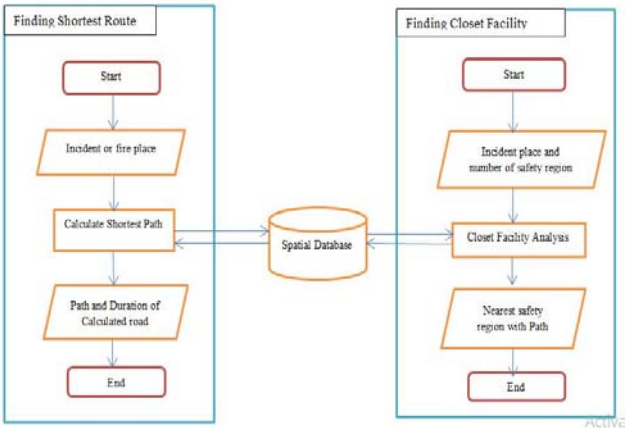

Fig. 2: Detailed process for proposed system

b) Study Area

The study area, Mandalay city is the second largest city and former royal capital in Myanmar. It is economic, industrial, transportation, and educational center It is located in the central part of the Myanmar with Latitude and longitude coordinates: N21.954510, E96.093292. It is bounded by Sagaing, Shan, Kayin, Bago, Naypyitaw and Magway. The population is around one and a quarter million people. Total area covers 29,686km^2, and consists of 28 townships. 29% of the population lives in urban areas, and the remaining

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71% in rural areas[4]. Figure 3 represents the map of the current study area.

Fig. 3: Study Area

c) Data Preparation

This phase includes collecting the study area base map, preparing the road network data, specifying safety area regions. The base map of Mandalay was downloaded from open Street Map (OSM). OSM can be accessed as an Arc GIS Online Service that provides free read-only access to Open Street Map as a base map for GIS work in ESRI products such as Arc GIS Desktop. The road network data are created with attributes such as name to store name of each road segment, meters for length of each road segment, direction for each segment direction and TF_Minutes & FT_Minutes for time required to travel over each road segment in both directions. Safety area data are with attributes such as name to store for name of each safety region and another attribute type to store the type of this safety region. Figure 4 and figure 5 shows the base map and road network of Mandalay region. The last step in the data preparation phase is the preparation of the road network traffic data. Traffic data can be stored using two different models: historical and live traffic. In this paper, traffic data were stored as historical traffic data. It is used to model the time dependent speeds of travelling on roads. And, it creates a series of costs (traffic speeds at different times of the day) for each edge. To perform analysis with this traffic, daily profiles table and street-daily profiles table are created.

Fig. 4: Base Map of Mandalay (from OSM)

Fig. 5: Mandalay Roads Network

d) Creation of Geo-database

A geo-database is an alternate way to store GIS information in one large file, which can contain multiple point, polygon, and/or polyline layers. It can organize data than having multiple shape files[14]. In this system, using the Mandalay City Map as the base map, vectorization of roads and other surface features are done. In the next step, the vector files of main features and roads are generated and geo-database is established including feature dataset and many feature classes (including road network data, safety region and traffic tables) with spatial and non-spatial data. The line feature classes represent streets, which must be stored in a feature dataset. The speed profiles are stored in one table, and the relationships between the streets and speed profiles are stored in the other table. Each record in this table has a unique identifier and several fields for storing the free-flow scale factor at different time of the day. The time of the day are split into time interval or time slices, which must be equal duration and thus split a 24 hour into equal interval as 1 hour interval. In daily profiles table, Free-flow scale factor is calculated as

$$\text{Speed} = \frac{Distance}{Time} \quad \text{and}$$

$$\text{Free-flow speed} = \frac{speed}{Defined\ \ speed\ \ for\ \ each\ road}$$

The distance and time for each road are collected from google map for different time intervals. In street-daily profiles table, it identifies street features, their free-flow travel speeds and their related traffic profiles for each day of the week. Each street feature has a unique identifier: the Object ID value. This table relates streets to their various traffic profiles through the unique identifier. Figure 6 shows the relation of graphical data and attribute data and the information of the location of each recuse site and street name. And also figure 7 and 8 describe daily profiles table and street-daily profiles table respectively.

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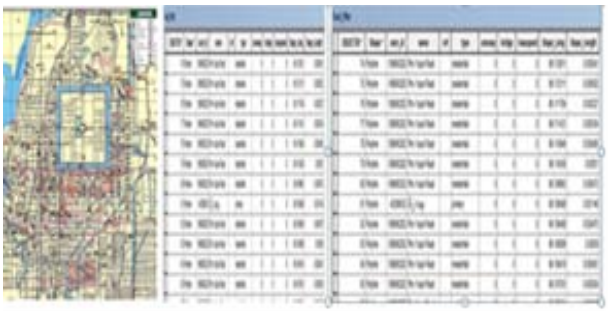

Fig. 6: Relationship between Graphic Data and Attribute Data

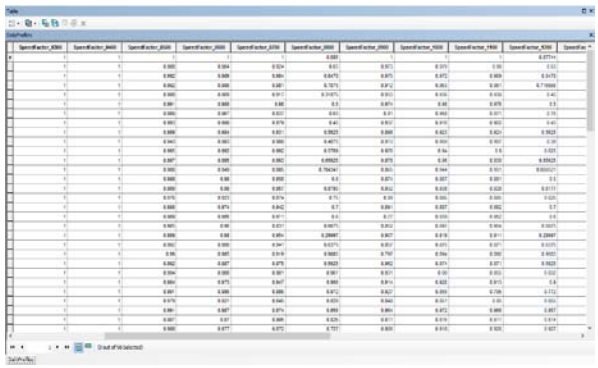

Fig. 7: Daily Profiles Table

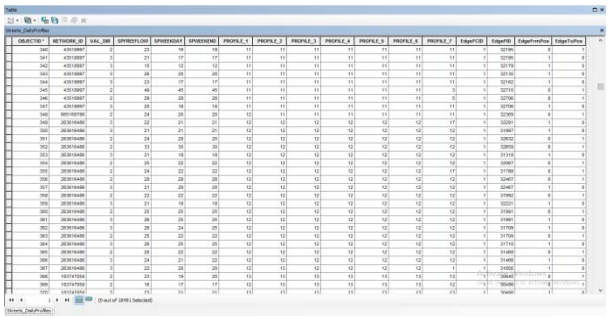

Fig. 8: Street-Daily Profiles Table

e) Building Network Dataset

A Network dataset is a GIS dataset that is designed to support network analysis. When creating a network dataset or edit an existing network dataset, it must be built. Building is a process of creating network elements, establishing connectivity, and assigning values to the defined attributes[13]. After creating geo-database that contains a line feature class and safety regions and two traffic tables, network dataset is built and then that is ready for using in the network analysis. In this system, geo-database network dataset is created with attributes such as hierarchy, meters, minutes, one way, road class, travel time and so on. As a result, figure 9 shows the network dataset of study region with 11613 junctions and 34314 edges for 17157 road segments.

Fig. 9: Network Dataset Results

f) Performing Network Analysis

The network analysis is performed by using network analyst solvers within the ArcGIS network analyst extension namely the Route, Closet Facility, and OD Cost Matrix solvers that are based on the well known Dijkstra's algorithm for finding shortest paths. The classic Dijkstra's algorithm solves a shortest path problem on an undirected, nonnegative weighted graph. To use it within the context of real-world transportation data, user settings such as one-way restrictions, turn restrictions, junction impedance, barriers, and slide-of-street constraints can be modified while minimizing a user specified cost attribute. Based on this well known Dijkstra's algorithm, there are two types of network analysis: best route analysis and closet facilities analysis.

Best route analysis generates best route based on travel time which depends on the traffic conditions with parameters such as travel time, start time of travelling, road directions, etc. GIS can be used to address the objectives of finding the optimal route between the given origin and destination. It can be used to find out the routes involving shortest distances as well as shortest travel time. To find optimal route between two given points, either the shortest path between them or the route having minimum travel time is to be selected[12]. The following figure 10 and figure 11 illustrate the best route between the ambulance location (Yi Yi store as the origin) and the nearest fire station(central fire station as the destination). This result is generated by processing suitable landmarks (i.e. identifiable buildings, round turns, road junctions etc.) that have been identified and located along each road in order to specifically reach the accident spot.

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Fig. 10: The Best Route Analysis Result

Fig. 11: The Best Route Direction Result

As a direction result, from the origin, it must first go north on 31 st street and then toward to 81 st street. Then, it find the central fire station as the destination. It's total distance is 2.5 miles and total time takes 3 minutes.

Closet Facilities Analysis The closet facilities analysis is performed with parameters such as impedance factor, start time, period to reach closet facilities, number of facilities to find, direction of travel. To perform closet facilities analysis, it is required to make a closet facility analysis layer and its analysis properties. This layer is useful in determining the closet facility or facilities to an accident based on a specified network cost. The safety regions layer (especially fire stations, hospitals, schools) as the closet facilities for this system can be seen in the following figure 12.

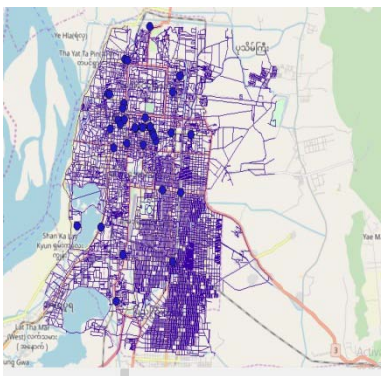

Fig. 12: Map of hospital and fire-station locations as closet facilities

It finds the closet facilities that can be reached in a specific period from an incident location based on travel time and distance information available. This helps in emergency situations to know the closest facilities that can be reached from the incident location, which in turn reduces time, effort, resources and saving people life [8]. The following figures demonstrate finding the closet facilities within 5 minutes for incident location (at the corner of 27*83). As a result, the three closet facilities as Aye chin Tar hospital, Mandalar clinic, and central fire station can be found within two, three, four minutes with their corresponding mile values. This can be seen detail in Figure 13 and 14.

Fig. 13: The Closet Facilities Analysis Result

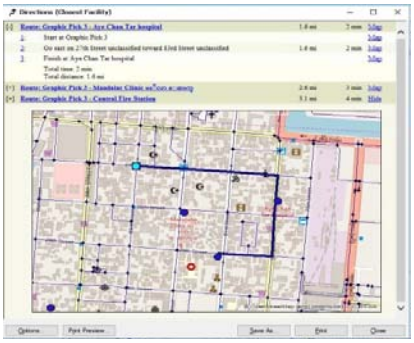

Fig. 14: The Closet Facilities Directions Result

The following figures (incident occurs on 33 street, near 76) show the difference between the results of using traffic data or not to reach closest recuse site. Without considering traffic data, it can go Gangaw hospital with 5 minutes as in figure 15 but with considering traffic, different route driving direction is produced with less time (4 minutes). It can be seen in figure 16.

Fig. 15: The Best Route Direction Result without traffic

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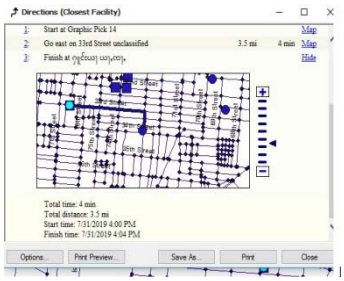

Fig. 16: The Best Route Direction Result with traffic

V. Conclusion & Future Works

In this paper, GIS-based network analysis was implemented and applied to the Mandalay road network. It focuses on finding the best route between two locations on the road network and finding the nearest healthcare service providers and fire stations to an incident location based on the traffic conditions. Also, the proposed method Dijkstra best routing algorithm built is the best method for the network analysis, especially in the crowded city such as Mandalay. In the future work, this system can be applied in other cities rather than Mandalay.

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Utilisation Des TIC Et Performance Des IMF Au Cameroun

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Abstract- The objective of this study is to analyze the effect of the adoption of ICT on the MFI performance in Cameroon. To achieve this objective, we used a hypothetic-deductive method. A questionnaire carried out amongst a sample of 107 MFI in Cameroon has permitted to collect data which were analyzed using SPSS 20 software. The results of ANOVA tests firstly show that MFI performance depends on their level of adoption of ICT, and secondly that the performance of MFI increases even more when the adoption of ICT is accompanied with organizational changes such as the training of employee on the use of ICT and the restructuring of the enterprise after adopting ICT.

Keywords: *performance - degree of adoption – ICT - MFI.*

GJCST-H Classification: *J.1*

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Utilisation Des TIC Et Performance Des IMF Au Cameroun

Lemadjio Marlyse [α] & Imele Tsafack Stephanie Julienne [σ]

Abstract- The objective of this study is to analyze the effect of the adoption of ICT on the MFI performance in Cameroon. To achieve this objective, we used a hypothetic-deductive method. A questionnaire carried out amongst a sample of 107 MFI in Cameroon has permitted to collect data which were analyzed using SPSS 20 software. The results of ANOVA tests firstly show that MFI performance depends on their level of adoption of ICT, and secondly that the performance of MFI increases even more when the adoption of ICT is accompanied with organizational changes such as the training of employee on the use of ICT and the restructuring of the enterprise after adopting ICT.

Keywords: performance - degree of adoption – ICT - MFI.

Résumé- L'objectif de cette étude est d'analyser l'effet de l'adoption des TIC sur la performance des IMF au Cameroun. Pour ce faire, une démarche hypothético-déductive a été empruntée. Une enquête par questionnaire menée auprès d'un échantillon de 107 IMF au Cameroun a permis de collecter des données qui ont été analysées avec le logiciel SPSS 20. Les résultats des tests de l'ANOVA montrentpremièrement que la performance des IMF dépend de leur niveau d'adoption des TIC et deuxièmement, que la performance des IMF s'améliore lorsque l'adoption des TIC est accompagnée des changements organisationnels tels que la formation des employés à l'usage des TIC et la restructuration de l'entreprise après adoption d'une TIC.

Motsclés: performance - niveau d'adoption – TIC - IMF.

I. Introduction

Dès le début du XXI[ème] siècle, l'accélération et la généralisation d'adoption des TIC[1] va être l'un des faits marquants les plus impressionnants. Précédemment désignées par le vocable NTIC[2], les TIC constituent l'ensemble des techniques utilisées dans le traitement et la transmission des informations, principalement de l'audiovisuel, de l'informatique, et des télécommunications (Poullard, 2000). Dans les pays développés ainsi que dans les pays émergents et en voie de développement, ces outils se sont imposées comme l'un des principaux vecteurs de l'activité économique et sociale en donnant la possibilité à un nombre croissant de personnes d'être connectées. À ce sujet, le rapport de l'UIT[3] de fin 2012, révèle que les nouvelles technologies au cours de ces dernières années ont continué à se développer de manière constante à travers le monde, comme en témoigne la progression de tous les indicateurs clés.Ces indicateurs clés sont: le nombre de foyers ayant accès à l'Internet, le nombre d'abonnés à large bande mobile et fixe, nombre d'abonnés à la téléphonie fixe et mobile, etc. Bien que le développement des TIC soit réel dans tous les secteurs d'activité, leur utilisation reste inégale entre pays développés et pays en développement (Abdenour et Matouk, 2014). Comme le montre le rapport de l'UIT (2012)[4], dans de nombreux pays, notamment ceux en voie de développement, on assiste encore à la persistance d'inégalités d'usages des TIC. À titre illustratif, dans les pays en voie de développementle nombre d'abonnés à la large bande fixe (Internet haut débit) est de 5 pour 100 habitants tandis celui des pays développés est de 25 pour 100 habitants[5]. En dépit des inégalités d'utilisation des TIC entre pays développés et pays en développement, tous les secteurs de l'économie ont connu des changements importants dans les processus de production et de distribution des biens et services par suite de l'adoption croissante de ces nouvelles technologies. Cependant, selon l'OCDE (2003), le secteur des services financiers est le secteur le plus susceptible d'utiliser les technologies de réseau et aussi celui le plus susceptible d'utiliser les combinaisons de différentes technologies de réseau. Cela montre que les entreprises de ce secteur à l'instar des Institutions de Microfinance (IMF ou EMF pour la suite) sont de gros consommateurs d'informations et qu'ils sont donc potentiellement les plus à même de tirer parti des profits générés par l'utilisation des TIC (Maliranta et Rouviren, 2004).

L'utilisation des TIC dans les transactions financières pour améliorer les performances est un fait réel pour l'ensemble des opérateurs du secteur de la

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[1] TIC signifie Technologies de l'Information et de la Communication.
[2] NTIC signifie Nouvelles Technologies de l'Information et de la Communication.
[3] L'Union Internationale de Télécommunications a pour objectifs d'établir des données concernant le secteur des télécommunications dans le monde. Il est considérée comme la principale source d'informations sur la normalisation, la réglementation et la technologie des télécommunications (voir UIT, « Une société de l'information pour tous – le rôle de la statistique dans la réalisation de cet objectif, 2003).
[4] Voir UIT(2012) "Mesurer la société de l'information".
[5] Ces chiffres proviennent du rapport de l'UIT (2012).

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microfinance. En effet, le recours aux TIC par les établissements financiers leurs permet de réaliser efficacement et rapidement plusieurs tâches tels que le traitement centralisé des transactions effectuées par les succursales, le traitement des demandes d'emprunt, l'exploitation des guichets automatiques et la gestion des transferts de fonds électroniques. Le CGAP (2004) précise également que les TIC peuvent aider les EMF à améliorer leur efficacité, avoir plus d'exactitude dans les opérations financières, augmenter la transparence et atteindre de nouveaux clients. Dans un tel contexte, l'intégration des microfinances dans ce vaste réseau devient une solution pour réduire et surpasser les difficultés dont ils font face dans leurs activités quotidiennes, et par conséquent améliorer leurs performances (CGAP, 2004).

Compte tenu de l'importance de l'utilisation des TIC dans les transactions financières,il importe dans la présente étude de s'interroger sur l'effet de l'adoption de ces outils sur la performance des IMF au Cameroun.Missaoui (2011) entend par "adoption des TIC", l'acquisition, l'implantation réussie et l'utilisation de ces outils par l'entreprise. Pour nous, le terme «adoption des TIC» est employé pour désigner *la décision d'utiliser une TIC* et son achat subséquent. De ce fait, nous considérons les termes «adoption des TIC » et «utilisation des TIC» comme synonymes dans ce développement. Les termes «TIC», ou «NTIC», considérés comme des synonymes dans ce développement désignent les technologies dites de première génération (téléphone fixe) ou celles dites de nouvelles génération (téléphone mobile, ordinateur, intranet, Internet, etc.). Cette précision faite sur les trois concepts principaux de notre étude éviterait toute confusion ou autres débats scientifiques liés à ces termes principaux: adoption, utilisation, et TIC.

La question du lien entre les TIC et la performance des entreprises n'est pas nouvelle car ellea longtemps fait l'objet de plusieurs débats mitigés. Ce questionnement a été vulgarisé par le paradoxe de productivité des TIC énoncé par Solow (1987): «On voit les ordinateurs partout sauf dans les statistiques de la productivité»[6]. En effet en ce qui concerne le lien entre les TIC et la performance d'entreprise, plusieursétudes, réalisées aussi bien dans les pays développés (Brynjolfsson et Hitt, 2000; Balwin et Sabourin, 2002; Baldwin et al., 2004; Leforestier, 2006; Becalli 2007, etc.) que ceux en voie de développement (Massaoui, 2011; Gnansounou, 2010; Aubert et al., 2009) soulignent un effet positif alors que d'autres se basent sur le concept de paradoxe de productivité et soulignent l'effet négatif de l'adoption des TIC sur la performance. A cause de ces résultats contradictoires et toujours pas généralisables, le paradoxe de la productivité est encore présent dans les esprits, du moins, en ce qui concerne les PED (Pilat, 2004). Au Cameroun, une telle étude dans le domaine des EMF est presque inexistante.Nous avons donc souhaité, après avoir effectué une revue de la littérature approfondie sur ce sujet, réaliser une étude empirique pour examiner l'effet de l'utilisation des TIC sur la performancedes EMF camerounaises. C'est pour cette raison quedans le contexte d'un PED,nous tentons de nous positionner dans le débat de la relation TIC et performance en dépassantla posture de lien direct entre les TICet la performance pour prendre également en compte les variables intermédiaires qui jouent un grand rôle lors de l'adoption d'un TIC. Pour cela, ce travail est structuré en trois sections. La première section est consacrée à la revue de la littérature théorique et empirique sur les points de vue contrastés des deux courants de pensée sur la relation adoption des TIC et performance de l'entreprisse. La deuxième présente le design de recherche utilisée et les résultats sont discutés dans la section trois.

II. Revue de la Litterature sur L'adoption Des tic Dans les Entreprises

L'analyse de la relation entre adoption des TIC et performance des entreprises a fait l'objet de nombreux travaux scientifiques (Follaci, 2005) et cela à tous les niveaux: macro, méso et microéconomique. Afin de ressortir les éléments de littérature sur ces travaux scientifiques, nous allons d'abord dans le premier point de cette section nous consacrer à une présentation des principales approches d'évaluation de la contribution des TIC à la performance des entreprises. Ensuite, la revue de la littérature sera centrée sur les débats scientifiques qui se sont intéressés à la relation TIC et performance des entreprises.

a) L'ancrage théorique

Dans la littérature, divers travaux analysent le lien entre TIC et performance d'entreprise, qui est un sujet de recherche complexe récurrent dans le domaine des SI. Cette complexité apparaît à travers la diversité des cadres théoriques mobilisés dans les différentes contributions. De manière plus précise, trois principaux modèles ou courants ont étudiés tous les trois la relation entre les investissements en TIC et la performance de l'entreprise. Il s'agit des modèles de causalités, des modèles processuels, et des modèles intégrateurs.

i. *Les modèles de causalité*

Les premiers travaux portant sur l'étude du lien entre les TIC et la performance des entreprises relèvent des modèles causals, impliquant un lien direct entre les TIC et la performance. Le modèle causal cherche à

[6] Il s'agit de l'idée largement répandue aux USA et dans les autres pays développés au cours des années 1980 et 1990; idée selon laquelle des investissements accrus dans les TIC ne se traduisaient pas par une amélioration de la productivité (Pilat, 2004).

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étudier la relation de cause à effet entre les variables indépendantes (telles que les investissements en TIC ou encore les budgets informatiques) et des variables dépendantes (telle que la performance). Ainsi, à la seconde moitié des années quatre-vingt et des années quatre-vingt-dix, plusieurs chercheurs étudient le lien entre les investissements en TIC et la performance opérationnelle ou financière. La performance est mesurée de manière quantitative avec par exemple le retour sur investissement, la part de marché ou la productivité (Strassman, 1985). Les résultats de ces études s'avèrent très divers et parfois même contradictoires. C'est ce que l'on appelle « paradoxe de la productivité » ou « paradoxe de Solow », en référence à Solow qui a fait la remarque suivante: *« On voit des ordinateurs partout, sauf dans les statistiques de productivité»* [7]. En effet, les études de Robert Solow (1987) ont mis en évidence une corrélation inverse entre les investissements informatiques et la productivité du travail aux États-Unis entre 1973 et 1995. D'une manière générale, les recherches ont par la suite montré qu'il existait une corrélation globalement positive entre les investissements en TIC et la productivité, et malgré les interrogations sur la mesure de la rentabilité, on peut aujourd'hui soutenir que les TIC contribuent tant à la croissance du PIB qu'à l'accroissement de la productivité du travail. C'est la fin du paradoxe de Solow. Dès lors, plusieurs chercheurs, adoptant différentes théories, mettent en œuvre le modèle causal: il s'agit principalement de théorie économique de production, de la théorie économique de l'information et de la la décision,de la théorie de l'avantage compétitif, et de la théorie du consommateur.

Pour la théorie économique de production, l'investissement en TIC est considéré comme un « *input* » de la fonction de production de l'entreprise (Raymond, 2002).Cette théorie permet de répondre à la question suivante: la productivité des entreprises peut-elle croitre suite à des investissements en TIC? Cette théorie suppose que pour un niveau donné d'*output*, l'accroissement des bénéfices sous forme de réduction des coûts de production peut être engendré par la baisse des prix des TIC (Brynjolfson et Hitt, 1996).Il s'agit des travaux qui ont suivi le paradoxe de Solow. L'objet principal de ces travaux est donc d'expliquer les variations dans l'*output* en trouvant la forme de fonction économique qui convient le mieux aux TIC en tant qu'*input.* Dans la recherche en système d'information où il s'agit de relier statistiquement un ensemble de mesures de l'investissement de l'entreprise en TIC à un autre ensemble de mesure de la performance de l'entreprise, ce modèle est très utilisé (Missaoui, 2009). Cependant, pour cette théorie, la performance se limite à l'analyse de la productivité de l'entreprise suite aux investissements en TIC.Selon le type de fonction de production [8] choisi, les données collectées et la définition retenue de la productivité, ces travaux ont abouti à des résultats difficiles à généraliser (Missaoui, 2009).

En intégrant des variables intermédiaires telles que le taux de roulement des stocks, et la mise sur le marché de nouveaux produits, les partisans de la théorie économique de l'information et de la décision examinent le processus par lesquels l'investissement en TIC se transforme en performance. Dans ce cas, plusieurs niveaux d'analyse (l'individu, le groupe, le secteur de l'entreprise, etc.) et différentes dimensions (performance relationnelle, concurrentielle, etc.) permettent d'étudier la performance.La démarche de cette approche consiste en la recherche d'identification d'une forme de la fonction économique qui convient le mieux à expliquer la variance de l'output induit par l'adoption des TIC et ceci à travers l'analyse de la relation entre la productivité et l'investissement réalisé en TIC. L'existence d'une relation positive entre l'amélioration de la productivité et l'investissement réalisé en TIC a été vérifiée dans les résultats de quelques études empiriques (voirBrynjolfsson et Hitt, 1996). Cependant, d'autres travaux empiriques, à l'instar de (Loveman, 1994; Mahmood, 1994; Morrison et Berndt 1990), ont généralement rejeté l'existence d'une telle relation ou du moins, ils ont mis en cause sa robustesse. En effet, pour ces auteurs, la réponse à la question « est ce que les bénéfices attendus en TIC ont été réalisés? » dépend de la capacité de mise en place d'un modèle orienté processus pour comprendre les impacts des TIC, ainsi d'une approche scientifique pour mesurer les conséquences économiques de l'investissement dans les TIC.Autrement dit, les auteurs qui penchent leurs réflexions sur la relation investissement en TIC - performance obéissent strictement à la rationalité économique qui est déterminée par les coûts d'investissement.Toutefois, les études de ces chercheurs présentent quelques limites. Selon Mebarki (2013), deux critiques profondes suffisent pour contester cette approche et justifier sa révision. La première, n'accepte pas les mesures qu'elle utilise pour la performance qui sont de nature agrégée et n'arrivent pas à cerner clairement les effets médiateurs, plus qualitatifs, comme l'amélioration de la qualité des produits, l'amélioration des processus et l'augmentation de la flexibilité. La deuxième approche a trait au fait qu'elle n'accorde que peu d'attention sur ce dont les utilisateurs doivent faire comme déterminant potentiel de succès des TIC dans l'organisation. Cette approche est touchée fondamentalement par ces deux critiques qui s'enracinent dans la spécificité des TIC.

[7] You can see the computer age everywhere but in the productivity statistics », Robert Solow, 1987.Voir annexe1 pour plus de details.

[8] La fonction de production est la formule qui permet de calculer la production en fonction des ressources utilisées de l'entreprise traditionnellement le capital et le travail.

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La théorie du consommateur s'insère dans le cadre de l'approche microéconomique. Elle vise à analyser l'impact des TIC sur la performance globale de l'économie à travers les impacts positifs sur la consommation (identification des surplus consommateurs). De ce fait, elle évalue le bénéfice total apporté par les achats du consommateur. Dans le cas spécifique des TIC, des bénéfices nets pour les consommateurs (ménages ou entreprises) sont engendrés grâce à la baisse du coût des ordinateurspar différents ordres de grandeur (Missaoui 2009). De manière plus claire, en situation d'équilibre entre l'offre et la demande dans un marché, une baisse du prix de l'*input* (dépenses en TIC) peut entrainer une hausse des dépenses dans cet *input* et par conséquent une augmentation du surplus du consommateur sans que celui-ci n'augmente pour autant le montant total de ses dépenses. Ainsi, l'hypothèse qui émane de cette théorie stipule qu'au fur et à mesure que le prix des TIC baisse, le surplus du consommateur crée par les TIC est positif et augmente dans le temps.

Des arguments aux termes desquels les investissements en TIC avaient un impact significatif sur l'*output* des entreprises sont mis en avant par Brynjolfson et Hitt (1996). Au final, en utilisant l'approche en termes de surplus du consommateur, Brynjolfson et Hitt (1996) estiment que le bénéfice total pour le consommateur est substantiel. Il est nécessaire de prendre en compte le fait que ces résultats s'appliquent à un concept abstrait qui n'a de réelle signification dans l'économie réelle: « l'entreprise moyenne». Une multitude d'entreprises ont sans aucun doute effectuées des investissements non productifs en TIC alors que ces dernières apparaissent comme ayant été productives pour cette « l'entreprise moyenne». Parallèlement, alors qu'il n'y avait pas une contribution discernable aux profits effectués par « l'entreprise moyenne»,le niveau élevé d'erreurs standards concernant les estimations suggèrent que certaines entreprises parvenaient à obtenir des avantages compétitifs substantiels tandis que d'autres non.

Les résultats des chercheurs qui analysent le lien direct entre les TIC et la performance de l'entreprise sont dans l'ensemble positifs. Cependant, ils présentent quelques limites: Premièrement, la performance est comprise au sens quantitatif de productivité. Deuxièmement, l'unité d'analyse agrégée est l'organisation. Pour pallier à ces limites, la deuxième approche utilisée pour contrer le « paradoxe de la productivité » est introduite. Cette approche, qui s'attache à analyser le lien indirect entre les investissements en TIC et la performance à travers l'amélioration des processus organisationnels relève des modèles processuels qui seront présentés ci-après.

ii. *Les modèles processuels*

Plutôt que de se baser sur les déterminants exogènes (variables indépendantes), le modèle processuel se propose d'analyser le processus par lequel les TIC contribuent à la performance de l'entreprise. Les partisans du modèle processuel examinent les événements qui, suite à l'introduction d'une technologie ont permis de contribuer à la performance de l'entreprise, pour expliquer la performance. Les modèles processuels de recherche ont conduit à des travaux pouvant recouvrir:

- *Divers impacts intermédiaires:* ces impacts sont des variables qui, selon Barua et ali (1995)[9] peuvent être quantitatives (Exemple: le taux de roulement des stocks, le prix relatif et la qualité des produits) ou encore qualitatives comme dans les travaux de Vandenbosh et Huff (1997)[10] qui étudient comment l'utilisation des TIC améliore le processus de veille stratégique du dirigeant, pour, in fine, impacter la performance organisationnelle.

- *Diverses mesures de la performance:* comme pour les variables intermédiaires, la mesure de la performance pourra être quantitative et/ou qualitative. Précisons que cette mesure de la performance va généralement au-delà de la seule productivité et prend en compte plusieurs dimensions.

- *Divers niveaux d'analyse:* l'individu, le groupe, l'organisation, l'industrie voire le pays sont les différentes unités d'analyse considérées par les modèles processuels. Ces derniers ont la possibilité de travailler sur des unités d'analyse mixte. Ceci est avantageux dans la mesure où la mise en place d'une technologie à un endroit de la chaîne logistique, peut générer de la valeur à un autre endroit et à des niveaux distincts (par exemple au niveau individuel et au niveau organisationnel).

- *Diverses méthodologies de recherche:* l'étude de cas, les enquêtes, les études longitudinales ou encore les études à base de données secondaires permettent d'appréhender la dynamique des modèles processuels. Plusieurs chercheurs (Giddens, 1984; Wernerfelt, 1984; Barney, 1991 et Raymond, 2002, etc.) prônent l'utilisation des modèles processuels bien qu'ils ne soient pas très répandu dans la recherche en système d'information. En fait, la fidélité empirique vis-à-vis des processus de l'entreprise est caractérisée par ces modèles. Les investissements en TIC vont alors être transformés en performance grâce à ces processus de l'entreprise (Raymond, 2002). Les courants de pensées basés sur ce modèle sont principalement: le courant sociotechnique,le courant structurationniste,l'approche des ressources, l'approche des capacités dynamiques etl'approche des cœurs de compétence « corecompetence».

[9] Barua et ali (1995) cités par Missaoui, 2011.
[10] Vandenbosh et Huff (1997)[10]cités par Folacci, 2005.

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Le courant sociotechnique considère que, dans un contexte organisationnel donné, l'organisation comme un ensemble de sous-systèmes en interaction, où le sous-système technologique et le sous-système social sont inter-reliés (Kéfi et Kalika, 2004). Plusieurs travaux de l'évaluation des systèmes d'information ont beaucoup mobilisé ce courant. Parmi les principaux apports de ce courant, on note:

- l'établissement d'une démarche d'évaluation des TIC basée sur l'examen de la relation entre l'acteur et la technologie.
- L'introduction de la notion d'adéquation (alignement au fit) entre les sous-systèmes de l'entreprise, notamment entre le sous-système technique et le sous-système social (Missaoui, 2009).

Ainsi, le grand mérite de ce courant est d'avoir pu réconcilier l'objet technique et le sujet individuel. Cependant, le fait de ne pas avoir clairement défini les mécanismes d'interaction entre la technologie et l'acteur constitue l'une de ses limites (Kéfi et Kalika, 2004).

L'apport majeur du courant structurationniste aux travaux relatifs à l'évaluation des TIC, porte sur l'analyse approfondie des mécanismes d'interaction entre la technologie et l'acteur. Basé sur la théorie sociale de la structuration de Giddens (1984), ce courant se propose d'apporter un éclairage sur le dualisme entre la structure et l'acteur pour établir une nouvelle relation de dualité où l'acteur et la structure se trouvent dans une relation d'interdépendance réciproque. À cet effet, dans la notion de structure Giddens (1984) distingue deux différentes dimensions lesquelles sont d'une part d'ordre matériel et observable et d'autre part d'ordre virtuel de modes de structuration engagés de façon récursive dans la reproduction de pratiques situées dans le temps et dans l'espace. Cette définition de Giddens (1984) présente donc deux notions indissociables qui sont l'action et la structure. Même si Giddens (1984) insiste dans ses travaux, sur la construction sociale des propriétés structurelles, il ne néglige pas la dimension matérielle de ces structures qu'il présente comme des propriétés institutionnelles sous la forme de modèles régularisés et identifiables.

Les origines de l'approche basée sur les ressources (encore appelé Ressource-Based) se trouvent dans les bases du management stratégique avec les premiers travaux de Barnard (1938) et Chandler (1957) [11]. Ces travaux portaient sur les capacités de l'entreprise à utiliser ses ressources et sur la création de la performance économique. Cette approche apparaît comme une critique des travaux dominants de l'époque c'est-à-dire de l'approche « structure-comportement-performance» présentée par Porter (1980).En effet, dans l'approche de Porter, les ressources n'ont pas de valeur en elles-mêmes: leur valeur dépend de la manière dont elles s'insèrent dans la structure industrielle et de la manière dont elles vont contribuer positivement à la réussite d'une stratégie particulière. Les ressources dont disposent un concurrent et la manière de les combiner sont la cause qui l'empêche de pénétrer un marché et non pas un environnement, donc la performance de l'entreprise ne peut s'expliquer uniquement par les caractéristiques de son industrie (Wernerfelt, 1984).

Les travaux de Nelson et Winter(1982), Amit et Schoemaker (1993), puis Teece et al (1997) [12] ont permis de développer une analyse des caractéristiques clés des capacités dynamiques des entreprises à créer et à utiliser des ressources (Sanchez, 2000). Ainsi, Teece et al. (1997) [13] définissent les capacités dynamiques comme l'aptitude de l'entreprise à intégrer, construire et reconfigurer des compétences internes et externes faites de divers usages de ressources spécifiques à l'entreprise. En associant les concepts de ressources et de capacités dynamiques, Amit et Schoemaker (1993) [14] utilisent le terme d'actif stratégique pour désigner « *l'ensemble des ressources et capacités difficiles à échanger et à imiter, rares, appropriables et spécialisées qui confèrent un avantage compétitif de l'entreprise*». Nelson et Winter (1982) [15] supposent que les savoir-faire d'une entreprise sont inscrits dans les routines organisationnelles, définies comme les activités répétitives qu'elle développe lors de l'usage des ressources spécifiques.

L'application du concept du «corecompetence» introduit par Prahalad et Hamel en 1990 peut être considérée comme une nouvelle manière d'identifier les sources d'avantages concurrentiels (Missaoui, 2009). En effet, ces auteurs expliquent que *la compétence clé est un domaine d'expertise qui résulte de l'harmonisation de technologies et d'une activité professionnelle complexe*. Autrement dit, le « cœur de compétence» correspond au savoir-faire de l'entreprise, grâce auquel elle acquiert son avantage concurrentiel. Hamel et Heene (1994) [16] ont proposé une théorie plus intégrée du management stratégique, fondée sur la notion de compétence organisationnelle. Ils suggèrent que le concept de compétence puisse alimenter une nouvelle approche théorique susceptible de nous éclairer sur la manière dont le maintien et la constitution d'un avantage

[11] Barnard, C. (1938), The function of executive; Chandler, A. (1962), Stategic and structure, Cités par Barney (1991).

[12] Teece, D., Pisano, G. and Shuen, A. (1997), op cit; Amit, R. and Schoemaker, P(1993), Strategic assets and organizational rent, Strategic management journal et Nelson, R. and Winter, S. (1982), An evolution theory of economic change.Cités par Sanchez (2000).

[13] Teece, D., Pisano, G. and Shuen, A. (1997) Op. cit.

[14] Amit et Schoemaker (1993) Op. cit.

[15] Nelson, R. and Winter, S.(1982)Op.cit.

[16] Hamel, G. and Heene, A. (1994), Competence based competition, john wiley & sons, cité par Missaoui (2009).

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compétitif dépendent des capacités de l'entreprise à gérer la création et l'utilisation des ressources de savoir. Les approches par variables intermédiaires ont fait l'objet de nombreuses contributions tant dans le secteur industriel que dans celui des services (Barua et al., 1991). Cependant, si ces approches permettent de « mieux » localiser les effets des TIC sur la performance des firmes, elles ne permettent pas réellement de mettre en avant les mécanismes se déroulant à l'intérieur des entreprises. Elles substituent au concept de productivité s'effectuant à un niveau global, un périmètre d'évaluation de la performance de nature plus locale. Ainsi, comme le suggère Monod (2002), ce mécanisme d'influence des TIC sur la performance des entreprises peut être mis en évidence par une relation indirecte se situant à un niveau plus spécifique et qui intéresse plus particulièrement les sciences de gestion.

b) TIC et performance de l'entreprise: un débat toujours d'actualité

Un certain nombre d'études ont proposé une synthèse des premières publications sur les TIC, la productivité et les performances de l'entreprise (Pilat, 2004).Plusieurs de ces études ont trouvé que la productivité n'est pas influencée, ou alors elle est influencée négativement par les TIC. Les impacts limités des TIC observés dans ces premières études ont contribué à ce que l'on a appelé le « paradoxe de la productivité » (Voir annexe 1). Dès lors, ce fameux paradoxe de Solow (1987): «On voit les ordinateurs partout sauf dans les statistiques de la productivité» va susciter l'attention de plusieurs chercheurs qui, dans leurs nombreuses études se sont succédés pour tenter de démontrer l'existence d'un lien entre l'adoption des TIC et la performance de l'entreprise. La synthèse des résultats de ces recherches souligne des résultats mitigés et parfois, même, contradictoires. Comme le souligne (Reix, 2002, Missaoui, 2009). Ainsi, Brynjolfson (1993) dans sa revue de la littérature relative au paradoxe de la productivité, conclut qu'un manque de preuves ne suppose pas nécessairement une absence d'impact des investissements en TIC sur la productivité. Cette conclusion est d'autant plus pertinente puisqu'on relève dans la littérature quelques travaux qui ont confirmé le paradoxe de Solow et d'autres qui ont infirmé ledit paradoxe.

i. *Quelques travaux ayant confirmé le paradoxe de la productivité*

Au cours des années 90, aucune relation (ou une relation négative) entre les TIC et la performance a été trouvé dans plusieurs études. À titre d'exemple, Lucas dans son étude portant sur 165 succursales d'une banque californienne (1975), a trouvé que l'utilisation du système d'information n'était pas un facteur explicatif de la performance. Il découvre par contre une faible relation entre la performance et l'utilisation du SI quand il porte son analyse dans le secteur de l'habillement. Turner (1985) dans une étude sur 58 banques, conclut que «de manière inattendue, aucune relation n'a été trouvée entre la performance organisationnelle et la proportion de ressources allouées au traitement de l'information». Strassman (1985) au cours de la même année fait une étude sur le secteur des services et ne trouve aucune relation significative entre les entreprises ayant une performance élevée et les investissements en TIC. Cette conclusion est renchérie par Baiely (1986) qui a argumenté que la corrélation entre la productivité et l'investissement dans les ordinateurs est négative. En outre, il a montré que l'investissement dans les TIC n'a pas aidé à améliorer la productivité américaine entre les années 1970 et 1993.Cette conclusion est partagée également par Roach (1987) qui, de son côté, a noté que l'utilisation des ordinateurs a augmenté dans le secteur bancaire d'une façon considérable mais n'a pas mené à l'amélioration de la productivité des travailleurs. Roach (1988) prolonge son travail au niveau macroéconomique sur le secteur des services et arrive à la conclusion que la productivité nationale au cours des années 1980 aux États-Unis n'a pas été améliorée par les investissements massifs en TIC.

L'impact des TIC sur la productivité dans le secteur industriel est étudié par Loveman (1994). Il parvient à conclure que les investissements marginaux auraient bien fait de ne pas être dépensé dans les TIC. Berndt et Morisson (1995) ont affirmé que cet investissement a un effet très négligeable sur la productivité. Dans ce sens, Markus et Soh (1993) ont trouvé que la majorité des banques américaines n'ont pas réalisé des bénéfices financiers suite à l'investissement dans les TIC pendant les années 80. Ils ont ajouté que les banques (de petite taille) ne montrent aucune relation significative entre l'investissement dans les TIC et la performance. Quant aux grandes banques, elles ont enregistré des rendements négatifs après leur investissement dans les TIC. Au même son de cloche, Greenan et Horty (2002) ont menés leurs études sur un échantillon d'entreprises industrielles françaises, et sont arrivés à la conclusion que lorsque l'informatisation n'est pas complétée par des changements organisationnels, alors, son impact sur la performance des entreprises est négatif. Les résultats des travaux de Monod (2002) épousent cette conclusion dans l'étude la relation entre les applications Internet, la croissance et le profit des PME. En effet, les résultats de ce chercheur montrent l'absence d'impact direct des applications Internet sur la performance de l'entreprise. Cependant, à travers une utilisation spécifique d'Internet par des PME industrielles, fournisseur spécialisé et de haute technologie, une influence indirecte des TIC est mise en évidence.

Parallèlement à ces études qui semblent montrer que l'investissement en TIC, bien que probablement nécessaire, n'est pas une source de

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performance pour les entreprises, d'autres études ont été en mesure d'identifier une influence positive des investissements en TIC.

ii. *Quelques travaux ayant infirmé le paradoxe de la productivité*

Ici nous allons nous attarder sur deux approches qui ont tous les deux validées l'existence d'un lien positif entre les TIC et la performance.

a. Lien direct entre les TIC etlaperformance

S'inscrivant majoritairement dans le cadre de la littérature de nature déterministe, les approches directes de la relation TIC/performance sont quantitativement majoritaires.Au niveau de l'entreprise, des études récentes (Gnansounou, 2010; aubert et al; 2009; Brynjolfsson et Hitt, 2004, etc.) apportent des éléments de conclusion qui montrent que l'adoption des TIC peut avoir une incidence positive sur la performance de l'entreprise OCDE (2003). Les conclusions de ces études varient. De leur part, Brynjolfsson et Hitt (2000), ont exploité la relation entre l'investissement dans les ordinateurs et l'amélioration de productivité de l'entreprise. Ils ont utilisé des techniques comptables sur un échantillon de 600 grandes entreprises américaines pour la période allant de 1987 à 1994. Ils ont abouti aux résultats suivants: D'une part l'investissement dans les ordinateurs a une relation positive et significative avec la productivité (en utilisant un modèle de différence d'une année). D'autre part, les rendements des ordinateurs sont deux à cinq fois meilleurs à travers les sept ans pris en considération.

Dans un travail plus récent, Brynjolfsson et Hitt (2003) ont estimé une fonction de production sur un panel de 600 grandes entreprises américaines. Ils ont détecté un effet positif de l'investissement dans les TI sur la croissance de la productivité. Ils ont alors spécifié que cet investissement mène à l'augmentation de la productivité. Même si des différences méthodologiques existent entre ces différentes études, elles ont présenté des informations très compatibles concernant l'accélération de la croissance suite à l'investissement dans les TIC. Dans ce contexte, Bresnahan et al. (2003) ont abouti à une corrélation positive entre l'investissement dans les TIC et la productivité.Cette affirmation est la conclusion la plus vulgaire de la plupart des études réalisées au niveau de l'entreprise, montrant que la productivité des entreprises qui utilisent les TIC est meilleure que celle des entreprises qui ne les utilisent pas (Brynjolfsson et Hitt, 2000; Balwin et Sabourin, 2002; Baldwin et al., 2004; Leforestier, 2006; Becalli 2007). De plus, entre 1988 et 1997, l'écart entre les entreprises utilisatrices des technologies et celle ne les utilisant pas s'est accentué, une croissance relative plus élevée des premières ayant été enregistré que les autres (OCDE, 2003).

L'OCDE (2003) montre aussi que certaines technologies de l'information et des communications sont plus importantes que d'autres pour améliorer la productivité, notamment les technologies des réseaux de communication.Ces résultats sont confirmés par Baldwin et al. (2004) qui ont trouvé des éléments convaincants indiquant qu'au Canada, l'adoption ou l'utilisation des TIC par les entreprises leur permet d'atteindre de meilleures performances. Ceci dit, une croissance plus forte de la productivité du travail durant les années 90 est liée à l'utilisation accrue des TIC de pointe. Baldwin et Sabourin (2002) dans une autre étude concernant le Canada, ont observé qu'une proportion considérable des parts de marché avait été transférée des entreprises en déclin vers les entreprises en croissance au cours de la décennie. Dans le même temps, les entreprises en croissance augmentaient leur productivité, contrairement aux entreprises en déclin. Les entreprises utilisatrices des TIC ou combinant plusieurs technologies de différentes catégories étaient celles dont la productivité relative augmentait le plus, et les gains ainsi enregistrés se traduisaient par des progressions de parts de marché. De façon convaincante, Maliranta et Rouvinen (2004) dans une étude concernant la Finlande ont montré que les TIC ont une incidence sur la productivité. Il en ressort le gain de productivité pour le personnel équipé de TIC varie de 8 % à 18% (ce qui correspond à une élasticité de 5 à 6 % du capital de TIC) lorsque les effets liés à la branche et à la période, les spécificités de l'entreprise et des travailleurs utilisant les TIC sont pris en compte. Cet effet est plus important dans les entreprises nouvellement crées et dans le secteur de producteurs de TIC, notamment dans les services producteurs de TIC (Pilat, 2004).

Les TIC sont généralement plus utilisés dans certaines branches des services que dans l'industrie manufacturière (OCDE, 2003). En plus, les mêmes technologies ne sont pas utilisées dans tous les secteurs. En réalité, ce sont les services financiers qui utilisent le plus les TIC dans de nombreux pays. Des données concernant le Royaume-Uni donnent à penser que le secteur le plus susceptible d'utiliser des technologies de réseau est celui de l'intermédiation financière (OCDE, 2003). C'est également ce secteur qui est le plus susceptible d'utiliser des combinaisons de différentes technologies de réseau. Cela montre que ce secteur est un gros consommateur d'informations et qu'il est donc potentiellement le plus à même de tirer parti des profits générés par l'utilisation des TIC.

Avec un même point de vue, Maliranta et Rouviren (2004) montrent que dans le secteur des services financiers, le gain de productivité du travail induit par les TIC semble plus marqué que dans l'activité manufacturière. Leforestier (2006) a montré, à partir d'une analyse micro-économétrique fondée sur l'estimation d'une relation technologique, que la productivité des entreprises françaises avait été meilleure sur la période 2002-2004 suite à l'utilisation

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accrue des TIC par ces derniers. Dans le même sens Becalli (2007) a trouvé un lien positif entre l'investissement total en TIC et la performance, et ceci à travers une étude faite sur le secteur bancaire européen. Il démontre également l'influence positive de l'investissement dans les services technologiques sur les profits bancaires. Dans un travail plus récent, Gnansounou (2010) montre que l'utilisation intensive des TIC peut accentuer également les effets de réseau tels que la réduction des coûts de transaction et l'accélération de l'innovation. D'où une amélioration de la productivité multifactorielle. Kossai et Piget (2012) précisent dans leur étude que « quel que soit le modèle utilisé: régression linéaire à variables muettes puis causalité au sens de Granger, test de Kruskal-Wallis et test de Welch; la rentabilité économique nette moyenne dépend du niveau de TIC ».

En somme, plusieurs études au niveau de l'entreprise ont confirmé que l'utilisation des TIC a un impact positif sur la performance et la productivité (Brynjolfsson et Hitt, 2000; Balwin et Sabourin, 2002; Baldwin et al.,2004; Leforestier, 2006; Becalli 2007; Gnansounou, 2010; Kossai et Piget, 2012, etc.). Toutefois les données d'autres études suggèrent que le lien entre TIC et productivité existe, mais qu'il n'est pas direct: les gains se produisent principalement lorsque cette adoption est accompagnée d'autres changements et investissements complémentaires.

b. Les analyses en termes de variables intermédiaires

Malgré le nombre d'études et de preuves empiriques présentées sur l'incidence des TIC sur la performance ces dernières années, l'importance relative des différents canaux par lesquels les TIC influent sur la productivité laisse encore plusieurs questions à débattre notamment sur l'importance du rôle joué par les facteurs complémentaires dans l'explication des contributions des TIC dans la performance. Dans l'ensemble, la littérature sur la performance et l'investissement dans les TIC nous permet de conclure quelques faits essentiels. Tout d'abord, la plupart des études montrent un impact positif, important et significatif des investissements dans les TIC sur la performance. Cependant, il est important de mentionner que cette littérature se réfère dans la plupart des cas à des moyennes et grandes entreprises. Deuxièmement, la littérature comprend également d'autres facteurs qui peuvent amplifier l'impact des investissements en TIC ou qui peuvent être complémentaires. En effet, les études empiriques montrent que, bien qu'il soit possible d'envisager une incidence positive de l'investissement en TIC, cet impact est lié aux complémentarités avec le capital humain, les changements organisationnels et les innovations. À cet effet, certains auteurs ont souligné que pour avoir un impact sur la performance des entreprises, les investissements dans les TIC doivent être combinés avec des investissements complémentaires dans les pratiques de travail, le capital humain et la restructuration des entreprises (Missaoui, 2009; Crespi et al., 2007; Brynjolfsson et Hitt, 2003).

En s'inscrivant dans cette volonté d'analyse globale et de compréhension du lien entre TIC et productivité en entreprise, Stratopoulos et Dehning (2000) trouvent que les entreprises qui investissent dans les TIC et qui maitrisent l'utilisation des TIC performent mieux financièrement. Dans cette même posture, Askenazy (2000) a montré l'existence d'un impact négatif des TIC sur les performances des entreprises lorsqu'il n'y a pas de changement organisationnel qui accompagne l'adoption des TIC.Au même son de cloche (Gollac et al, 2000) concluent dans leur étude que dans les entreprises où l'adoption des TIC s'est accompagnée de changements organisationnels et d'amélioration des niveaux de qualification des travailleurs, l'effet de ces dernières sur la productivité est plus marqué. Les conclusions de Hempell et al. (2002) sont similaires et montrent que les entreprises ayant une expérience innovante sont particulièrement bien préparées à faire un usage productif des TIC en introduisant des innovations complémentaires appropriées.

L'OCDE (2003) approuve également ces conclusions en montrant que les incidences des TIC se concrétisent principalement ou uniquement quand l'investissement dans les TIC s'accompagne d'autres changements et investissements tels que les qualifications, les effets sur la concurrence, le facteur temps, les facteurs liés à l'organisation, l'innovation, la taille et l'âge de l'entreprise. Brynjolfsson et Hitt (2003) renchérissent ces conclusions en démontrant que le rendement de l'investissement dans les TIC ne se produit pas immédiatement, mais avec un décalage de temps important. Bertschek et Kaiser (2004) ont montré que les TIC ont des effets indirects sur la productivité en permettant la réorganisation du travail et le changement organisationnel, en insistant sur de fortes complémentarités entre ces investissements. L'étude de Kalika (2006) montre que les entreprises pour lesquelles l'introduction des TIC a été accompagnée de changements d'organisation et de stratégie sont celles qui fournissent les scores d'amélioration des performances les plus forts. Cela signifie donc que les sources de performance se trouvent dans les changements de stratégie et d'organisation résultant des TIC. Ko et Osei-Bryson (2006) en étudiant les conditions sous lesquelles l'effet des TIC peut créer de la valeur pour l'entreprise concluent qu'en investissant dans les TIC, il faut également investir dans le capital physique et dans le capital humain pour maximiser le rendement sur l'investissement. Atzeni et Carboni (2006), évoquent également l'engagement de l'entreprise envers les investissements complémentaires en capital physique, en formation continue de la main-

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d'œuvre et en processus d'affaires comme condition nécessaire à la matérialisation des bénéfices potentiels associés aux TIC. En adoptant aussi une posture intermédiaire, Aubert et al. (2009) affirment qu'il semble que l'effet des TIC sur la performance ne puisse se faire sentir qu'en présence d'investissements complémentaires (notamment en capital humain et en réorganisation du savoir et des processus) malgré leur potentiel évident de création de valeur".

Après avoir observé les différents débats autour du paradoxe de Solow, nous constatons que les conclusions sont mitigés: certaines études ne voient aucune corrélation entre les TIC et la performance de l'entreprise (Greenan et Horty, 2002; Loveman, 1994; Roach, 1988, etc.), d'autres études trouvent l'existence d'un lien positif entre les TIC et la performance (Kossai et Piget, 2012; Gnansounou, 2010; Becalli, 2007; Leforestier, 2006; Maliranta et Rouviren , 2004; etc.) et d'autres études nuancent ces résultats en montrant que le lien entre TIC et productivité existe, mais qu'il n'est pas direct : les gains se produisent principalement lorsque l'adoption des TIC est accompagnée d'autres changements et investissements tels que la formation de la main d'œuvre et d'autres changements organisationnels ((Aubert et al. 2009; Missaoui, 2009; Atzeni et Carboni 2006; Brynjolfsson et Hitt, 2003; OCDE, 2003; Gollac et al, 2000; Askenazy, 2000, etc.). Malgré tout, on observe d'une part que la plus part des études recensées identifient une relation positive entre les TIC et la performance de l'entreprise et d'autre part que malgré le potentiel évident de création de valeur des technologies de l'information, il semble que leur effet ne puisse se faire sentir qu'en présence d'investissements complémentaires, notamment en capital humain et en réorganisation du savoir et des processus. Ces conclusions nous amène à formuler les hypothèses suivantes:

III. Design de la Recherche

À travers cette section, nous présentons les données de cette étude, le choix des variables et le modèle économétrique utilisé.

a) Données

Les données utilisées dans ce travail sont issues d'une enquête conduite auprès d'un échantillon d'EMF dont les directions générales sont localisées au Cameroun. Les entreprises visées par cette enquête sont les EMF indépendants du Cameroun[17]. Ils sont choisis délibérément en fonction de critères préalablement définis. Les données sont collectées entre Juillet 2016 et Mars 2018 au moyen d'un questionnaire. Le taux de réponse a atteint 80%, soit un échantillon de 107 EMF. Le questionnaire est construit sur la base des questionnaires élaborés par des organisations de microfinance, institutions internationales et des enquêtes portant sur les mêmes thèmes (Missaoui, 2011; Gnansounou, 2010; Follaci, 2005).

b) Spécifications des variables d'étude

Nous voulons dans cette étude étudier le lien entre les TIC et la performance. De ce fait, la performance *(PERF)* représente la variable dépendante et leniveau d'utilisation des TIC *(NATIC)* la variable indépendante. L'introduction des variables médiatrices (formation des employés et restructuration de l'entreprise après adoption d'un TIC) nous permettra de vérifier l'existence d'un lien indirect entre les TIC et la performance.

i. *Spécification de la variable endogène: La performance*

Comme nous l'avons dit précédemment, la principale variable endogène est la performance (*PERF*).

Plusieurs auteurs sont d'accord qu'aucune approche n'est supérieure à l'autre et ses auteurs soutiennent l'intérêt de l'adoption d'une approche subjective pour mesurer la performance (Missaoui, 2009). De ce fait, pour analyser l'influence du niveau d'utilisation des TIC sur la performance des EMF, nous avons utilisé une approche subjective pour mesurer la performance de l'EMF. Ce choix s'explique par la difficulté d'obtenir habituellement les informations comptables et financières, notamment dans les pays sous-développés où les entreprises du secteur financier communiquent très difficilement leurs chiffres.

Le nombre d'indicateurs de performance que nous avons choisi reflète la double identité financière et sociale des EMF et la catégorisation de la performance de Raymond (2002). Chemin faisant, nous avons emprunté aux travaux de Microrate & Inter American Development Bank (2003) et de Gauzente (2000), le résultat net et la part de marché comme indicateurs de la performance financière. Nous nous sommes également appuyées sur l'étude de Ktat (2004) et de Messomo (2017) pour choisir la qualité de service offert aux clients, le nombre de client et la durée de traitement des données comme indicateurs de la performance sociale.

ii. *Choix des variables explicatives*

La variable explicative de cette étude est le niveau d'utilisation des TIC. Comme Gnansounou (2010) et Fambeu (2015), nous avons élaboré une typologie des outils TIC utilisés dans les EMF. Cette typologie nous a permis de classer les entreprises de notre échantillon en six catégories en fonction de leur niveau d'utilisation des TIC:

[17] Les EMF indépendants sont ceux qui appartiennent à la 1ère, 2ième, ou 3ième catégorie et ne sont pas regroupés en réseau.

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$y_{i=}$ {
NATIC=0 si pas d'usage des TIC (aucune utilisation)
NATIC=1 si un type d'usage des TIC (niveau très faible)
NATIC=2 si deux types d'usage des TIC (niveau faible)
NATIC=3 si trois types d'usage des TIC (niveau moyen)
NATIC=4 si quatre types d'usage des TIC (niveau élevé)

Les types d'usage des TIC pour l'échange des informations sont: la messagerie téléphonique, l'Internet, l'Intranet, l'Extranet et le site web[18].

iii. *Choix des variables médiatrices*

La revue de la littérature révèle que, plusieurs études empiriques montrent que bien qu'il soit possible d'envisager un impact positif de l'utilisation des TIC, cet impact est lié aux complémentarités avec le capital humain, les changements organisationnels et les innovations. Dans ce sens certains auteurs ont souligné que pour avoir un impact sur la performance des entreprises, l'utilisation des TIC doit être combiné avec des investissements complémentaires dans les pratiques de travail, le capital humain et la restructuration des entreprises (Missaoui, 2009; Crespi et al., 2007; Brynjolfsson et Hitt, 2003). Au regard des points de vue de ces auteurs, nous relevons deux variables médiatrices dont nous utilisons pour déterminer leurs effets sur la relation utilisation des TIC et performance. Ces variables sont: la restructuration de l'entreprise et la formation des employés à l'utilisation des TIC.

L'ensemble des différentes variables utilisées sont résumées dans le tableau ci- après:

Tableau 1: Résumé des variables de notre étude

Variables		Définition	Mesure
Explicative:	NATIC	Scores du niveau d'utilisation des TIC	0= pas d'usage; 1=un type d'usage 2=deux types d'usage ; 3=trois types d'usage; 4=quatre types d'usage ; 5=cinq types d'usage
Expliquée: La performance, mesurée par plusieurs variables	AUGCLI	Nombre de client	1=En baisse2= Stable3= En hausse
	QUALSERCLI	Qualité de services rendus aux clients	1=En baisse2= Stable3= En hausse
	REDUCTEM	Réduction du temps de traitement des données	1=En baisse2= Stable3= En hausse
	RESULNET	Résultat net	1=En baisse2= Stable3= En hausse
	PARMAR	Part de marché	1=En baisse2= Stable3= En hausse
Médiatrices: Nouvelles pratiques organisationnelles	FOREMP	Formation des employés à l'utilisation des TIC	0= non 1= oui
	RESTEN	Restructuration de l'entreprise après acquisition d'un outil TIC	0= non 1= oui

Source: Construction des auteurs

c) *Méthode d'estimation: Régression catégorielle avec le test de l'ANOVA*

S'agissant de la démarche analytique de ce travail, notre attention s'est portée sur la régression catégorielleavec le test de l'ANOVA. Le choix de la régression catégorielle s'explique par la nature de nos variables. La variable explicative (NATIC) est une variable qualitative multinomiale ordonnée et les composantes de la variable expliquée (PERF) sont des variables qualitatives d'échelle.La deuxième est attribuable à la distribution de nos variables. Compte tenu de la taille de notre échantillon qui est supérieur à 30, nous pouvons conclure que nos variables sont approximativement normalement distribuées. Or d'un point de vue strictement méthodologique, le test de l'ANOVA se fonde sur l'hypothèse que les différents échantillons à comparer suivent la même distribution ou qu'ils ont des distributions avec la même médiane.

[18] L'ordinateur est une technologie de base et comme tel, il est considéré comme un acquis dans les EMF car l'utilisation d'internet, intranet, site web ne peut être .possible que s'il y'a présence d'un ordinateur.

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IV. Résultats

Après la présentation de la méthodologie retenue pour notre recherche dans la section précédente, il est question dans cette section de montrer les résultats issus de notre investigation sur le terrain. Compte tenu du fait que toutes les variables de cette étude ne sont pas de même nature, nous avons mené des analyses de normalité des variables dépendantes et de comparabilité des sous échantillons avant de procéder aux tests des hypothèses. À la suite de ces analyses préalables, nous nous sommes intéressés aux hypothèses de liens entre chaque composante de la performance et le niveau d'utilisation des TIC en passant d'abord par une approche causale et ensuite par celle de l'approche par les variables intermédiaires.

a) Analyses préalables

Pour faire une bonne interprétation des résultats des tests statistiques, il est toujours nécessaire de passer par des études préalables telles que: l'étude de la normalité des distributions et des tableaux de corrélation.

Le tableau du test de normalité de Kolmogorov montre que toutes nos variables ne sont pas normalement distribuées. Mais compte tenu de la taille de notre échantillon qui est supérieur à 30, nous pouvons conclure que nos variables sont approximativement normalement distribuées.

La littérature a montré que la majorité des études recensées (Kossai et Piget, 2012; Gnansounou, 2010; Becalli, 2007; Leforestier, 2006;Maliranta et Rouviren, 2004 ; etc) identifient une relation positive entre l'utilisation des TIC et la performance de l'entreprise. Afin de vérifier l'existence d'un tel lien dans le cas des IMF camerounaises, nous nous sommes appropriés d'une première technique qui est celle de l'étude de corrélations entre les variables. Le tableau 2 ci-dessous présente la matrice de corrélation entre les différentes variables de l'étude.

Tableau 2: Matrice de corrélations de Spearman

Variables	NATIC	AUGCLI	REDUCTEM	QUALSERCLI	RESULNET	PARMAR	FOREMP	RESTEN
NATIC	1	0,711*	-0,043	0,609 **	0,547**	0,639**	0,325	0,283
AUGCLI	0711* 0,264	1	- 0,354	0,174	0,284	0,156	0,281**	
REDUCTEM	0,043 0, 056	- 0,354	1	-0,147*	- 0,531	-0,185	-0,078	-
QUALSERCLI	0,609 ** 0,311	0,174*	-0,147*	1	0,713***	0,216	0,172**	
RESULNET	0,547 ** 0, 034 **	0,284	-0,531	0,713***	1	0,128	0,214	
PARMAR	0,639**	0,156	-0,1850, 216	0,128	1	0,583 ***	0,191	
FOREMP	0,325	0,281**	-0,0780,172**	0,214	0,583***	1	0,383	
RESTEN	0,283	0,264	- 0, 0560,311	0, 034**	0,191	0,383	1	

*(***, ** et * signifient que la corrélation est significative au seuil de 1%, 5%, et 10%)*

À la lecture de ce tableau, on constate des corrélations entre les variables relatives à la performance des IMF et l'adoption des TIC. On remarque que le nombre de client, laqualité des services rendus aux clients, le résultat net et la part de marché ont un lien significatif avec le niveau d'adoption des TIC. Par ailleurs, le temps de traitement des données a plutôt un lien non significatif avec le niveau d'adoption des TIC. Au regard de l'existence de corrélations entre toutes nos variables, nous rejetons l'hypothèse nulle d'absence de relation entre le niveau d'utilisation des TIC et les autres variables. Ensuite, nous acceptons l'hypothèse alternative d'existence de liens significativement positifs entre NATIC et le nombre de client, la part de marché, le résultat net et la qualité de service offert aux clients.

Pour ce qui est de l'auto corrélation entre les différentes variables explicatives, les coefficients de corrélation entre les variables doivent être au préalable étudiés afin de s'assurer que les variables entrant dans le modèle ne sont pas colinéaires. Le tableau ci-dessus présente les inter corrélations entre toutes les variables concernées par l'étude. Ce tableau montre que certaines variables sont fortement corrélées (AUGCLI, QUALSERCLI, RESULNET et PARMAR), d'autres moyennement corrélées (FOREMP, RESTEN) et d'autres faiblement corrélées (REDUCTEM) avec NATIC. Ces corrélations sont toutes inférieures au seuil de 0,80, valeur au-delà de laquelle la colinéarité est considérée comme problématique (Cerdin, Colle et Peretti, 2005). En outre, les corrélations entre les variables indépendantes ne dépassent jamais 0,8, ce qui est satisfaisant ; la condition d'indépendance entre les variables indépendantes est donc respectée.

Pour approfondir les résultats ci-dessus, il est nécessaire de procéder au test de l'ANOVA.

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b) Liens entre le niveau d'adoption des TIC et la performance: Résultats du test de l'ANOVA

Après avoir effectué des analyses préalables, nous avons testé plusieurs modèles sous SPSS 20avec le test d'ANOVA. Les différentes équations donnent des estimations statistiquement significatives et conformes à la majorité de nos hypothèses.

i. *Liens directs entre le niveau d'utilisation des TIC et la performance*

Les données du tableau 3 ci-dessous présentent les résultats des tests relatifs à la première hypothèse: *La performance des EMF dépend de leur degré d'utilisation des TIC.*

Tableau 3: Résultats du test de l'ANOVA de liens directs entre le niveau d'utilisation des TIC et la performance

	Libellé	Coefficients standardisés		D	Prob.
		Bêta	Ecart type		
NATIC	NATIC et variation du nombre de client	**0,099**	0,195	10,256	**0,005**
	NATIC et variation de la qualité de service rendue aux clients	**0,161**	0,175	0,845	**0,040**
	NATIC et variation de la durée du temps de traitement des données	**-0,260**	0,133	3,828	**0,053**
	NATIC et variation du résultat net	0,111	0,179	2,386	**0,043**
	NATIC et variation de la part de marché	**0,057**	0,216	1,071	**0,041**

Les résultats de ce tableau nous permettent de conclure que:

- qu'à un seuil de signification de 1% (p=0,005), il existe une relation significative entre le niveau d'utilisation des TIC et le nombre de client. Le coefficient de NATIC est positif, on en déduit donc que la relation entre le niveau d'utilisation des TIC et le nombre de client est positive. Ceci nous amène à affirmer que *Plus les EMF utilisent les TIC, plus leur nombre de client augmente*. De ce fait, une augmentation du niveau d'utilisation des TIC d'une unité pour toutes choses restant égales par ailleurs contribuera de 0,099 à la variation du nombre de client.
- qu'à un seuil de signification de 5% (p=0,040), il existe une relation significative entre le niveau d'utilisation des TIC et la qualité de service rendue aux clients. Le coefficient de NATIC est positif (0,161), ce qui signifie que la relation entre le niveau d'utilisation des TIC et la qualité de service rendue aux clients est positive. Ceci nous amène à affirmer que *Plus les EMF utilisent les TIC, plus bonne est la qualité de service rendue aux clients*.
- qu'il n'existe pas une relation significative entre le niveau d'utilisation des TIC et la durée du temps de traitement des données (P=0,053>0, 05). Ceci ne nous permet pas de conclure que le niveau d'utilisation des TIC a une influence sur la durée de traitement des données.
- qu'il existe une relation significative et positive entre le niveau d'utilisation des TIC et la variation du résultat net (P=0,043 et coef=0,111). Ainsi, une augmentation du niveau d'utilisation des TIC d'une unité, toute chose égale par ailleurs, contribuera à la variation du résultat net de 0,111. Nous pouvons donc dire que *plus les EMF utilisent les TIC, plus leur résultat net s'améliore*.
- qu'il existe une relation significative et positive entre le niveau d'utilisation des TIC et la variation de la part de marché (P=0,041 et coef=0,057).En effet, un niveau d'utilisation élevé des TIC d'une unité, toute chose égale par ailleurs, contribuera à la variation de la part de marché de 0,057. Ceci nous permet d'affirmer que *Plus les EMF utilisent les TIC, plus leur part de marché s'accroît.*

En somme, le test de l'ANOVA montre que le niveau d'utilisation des TIC a une influence significative et positive sur la variation du nombre de client, de la qualité de service offerts aux clients, du résultat net et de la part de marché.À ce stade de validation empirique, nous pouvons déjà conclure que l'utilisation des TIC augmente le nombre de client, améliore la qualité de service offert aux clients, le résultat net, la part de marché, et donc la performance de l'IMF. Ce résultat corrobore les travaux de plusieurs auteurs qui ont infirmés le paradoxe de productivité. Nous faisons référence plus principalement aux travaux de Gnansounou (2010), Aubert et al (2009), Brynjolfsson et Hitt (2004) qui ont montré dans leurs résultats que l'utilisation des TIC a un impact positif sur la performance de l'entreprise. Ce résultat concorde aussi avec les études de Kossai et Piget (2012) qui précisent que « quel que soit le modèle utilisé: régression linéaire à variables muettes puis causalité au sens de Granger, test de Kruskal-Wallis et test de Welch ; la rentabilité économique nette moyenne dépend du niveau de TIC ».

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ii. *Liens entre le niveau d'utilisation des TIC et la performance: prise en compte des variables intermédiaires*

Ici, nous voulons voir si les variables médiatrices (formation des employés et restructuration de l'entreprise) ont un effet significatif sur le lien niveau d'utilisation des TIC et performance. Pour cela, nous introduisons ces variables dans les équations des différents modèles effectués précédemment. Les résultats de ces estimations nous semblent très pertinents. Les données du tableau 4 et 5 ci-dessous présentent les résultats de ces tests relatifs à la seconde hypothèse: *L'effet des TIC sur la performance s'améliore lorsque son utilisation s'accompagne de nouvelles pratiques organisationnelles.*

a. Effet du médiateur « formation des employés » sur la relation niveau d'utilisation des TIC - performance

L'introduction de la variable médiatrice « formation des employés » dans la relation directe utilisation des TIC et performance, nous conduit à des résultats plus significatifs présentés dans les tableaux 4 ci-dessous.

Tableau 4: Liens entre le niveau d'utilisation des TIC et la performance: prise en compte de la variable « formation des employés »

Libellé		Coefficients Standardisés		D	Prob.
		Bêta	Ecart type		
Effet de 'formation des employés' sur la relation NATICetnombre de client	FOREMP	0,091	0,134	0,458	0,500
	NATIC	0,597	0,178	11,191	0,001
Effet de 'formation des employés' sur le lien NATIC et qualité de service rendue aux clients	FOREMP	0,079	0,133	1,353	0,054
	NATIC	0,649	0,203	10,267	0,002
Effet de 'formation des employés' sur le lien NATIC et durée du temps de traitement des données	FOREMP	-0,222	0,125	3,137	0,079
	NATIC	0,500	0,079	40,234	0,000
Effet de 'formation des employés' sur la relation NATIC et résultat net	FOREMP	0,078	0,134	0,341	0,561
	NATIC	0,449	0,124	13,077	0,000
Effet de 'formation des employés' sur la relation NATIC et part de marché	FOREMP	0,080	0,157	1,259	0,083
	NATIC	0,412	0,258	2,544	0,040

La prise en compte de la variable médiatrice « formation des employés » dans les résultats des tests d'ANOVA sur la relation directe utilisation des TIC et performancenous montre qu'hormis la variable « durée du temps de traitement des données », la formation des employés à l'utilisation des TIC a un effet positif et significatif sur la relation niveau d'utilisation des TIC et les autres variables de la performance (nombre de client, qualité de service offerts aux clients, résultat net et part de marché). En effet,à travers le tableau 4 on constate d'abord que la significativité des modèles a augmenté (Probpasse de 0,005 à 0,001, de 0,040 à 0,002, de 0,043 à 0,000 et de 0,057 à 0, 412 respectivement) ensuite, on remarque que le coefficient de NATIC a également augmenté (*Coef* NATIC passe de 0,099 à 0,597, de 0,161 à 0,649, de 0,111à 0,449 et de 0,057 à 0,412respectivement).Ce constat montre bien que le lien entre utilisation des TIC et le nombre de clients, la qualité des services rendus aux clients, le résultat net et la part de marché augmente plus lorsque l'utilisation des TIC est accompagnée d'une formation continue des employés.

Les résultatsdu tableau 4 viennent confirmer les travaux de l'OCDE (2002) qui affirme que "les gains se produisent principalement ou uniquement, lorsque cette adoption est accompagnée d'autres changements et investissements tels que la formation de la main d'œuvre et d'autres changements organisationnels". Ces résultatssont aussi similaires avec ceux de Ko et Osei-Bryson (2006) qui, en étudiant les conditions sous lesquelles l'effet des TIC peuvent créer de la valeur pour l'entreprise, concluent qu'en investissant dans les TIC, il faut également investir dans le capital physique et dans le capital humain pour maximiser le rendement sur l'investissement. Enfin, ces résultats rejoignentceux d'Atzeni et Carboni (2006) qui soulignent que l'engagement de l'entreprise envers les investissements complémentaires en capital physique, en formation continue de la main-d'œuvre est nécessaire à la matérialisation des bénéfices potentiels associés aux TIC.

Après avoir étudié l'impact de la formation des employés sur la relation niveau d'utilisation des TIC-performance, nous passons à l'étude de l'effet de la variable médiatrice « restructuration de l'entreprise » sur la relation niveau d'utilisation des TIC – performance.

b. Effet du médiateur "Restructuration de l'entreprise" sur la relation niveau d'utilisation des TIC - performance

La prise en compte de la variable médiatrice "formation des employés" dans la relation utilisation des TIC et performance, nous conduit à des résultats pertinents présentés dans les tableaux 5 ci-dessous.

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Tableau 5: Liens entre le niveau d'utilisation des TIC et la performance: prise en compte de la variable « Restructuration de l'entreprise »

Libellé		Coefficients standardisés		D	Prob.
		Bêta	Ecart type		
Effet de 'restructurtion de l'entreprise' sur la relation NATICetnombre de client	RESTEN	0,028	0,096	0,088	0,767
	NATIC	0,648	0,178	13,239	0,000
Effet de 'restructurtion de l'entreprise' sur le lien NATIC et qualité de service rendue aux clients	RESTEN	0,079	0,133	1,353	0,054
	NATIC	0,649	0,203	10,267	0,002
Effet de 'restructurtion de l'entreprise' sur le lien NATIC et durée du temps de traitement des données	RESTEN	-0,190	0,118	2,602	0,079
	NATIC	0,418	0,119	12,254	0,000
Effet de 'restructurtion de l'entreprise' sur la relation NATIC et résultat net	RESTEN	0,018	0,138	0,017	0,896
	NATIC	0,537	0,091	34,439	0,000
Effet de 'restructurtion de l'entreprise' sur la relation NATIC et part de marché	RESTEN	0,063	0,123	0,262	0,054
	NATIC	0,591	0,104	32,165	0,000

Ce tableau nous présente des résultats similaires au tableau 4:

- La restructuration de l'entreprise a un impact positif et significatif sur la relation niveau d'utilisation des TIC et variation du nombre de client. En effet, l'introduction de la variable RESTEN dans le premier modèle augmente la significativité (Prob passe de 0,005 à 0,000) et le coefficient de NATIC qui passe de 0,099 à 0,648. Ceci, nous permet d'affirmer que le niveau d'utilisation des TIC a une influence positive et plus significative sur la variation du nombre de client lorsqu'il est accompagné par une restructuration de l'entreprise.
- L'ajout de la variable médiatrice RESTEN dans la relation niveau d'utilisation des TIC et variation de la qualité de service rendue aux clients nous donne des résultats plus significatifs. En effet, on constate d'abord que la significativité de ce modèle a augmenté (Prob passe de 0,040à 0,002), ensuite on remarque que le coefficient de NATIC a également augmenté (*Coef*[19] NATIC passe de 0,161 à 0,649. Ceci montre que la restructuration de l'entreprise après adoption des TIC a un impact positif et significatif sur la relation niveau d'utilisation des TIC et qualité de service rendue aux clients.
- La prise en compte de la variable médiatrice RESTEN dans la relation niveau d'utilisation des TIC et durée de traitement des donnéesne permet pas d'obtenir un modèle plus significatif (Prob=0,079>0,05) donc, la restructuration de l'entreprise n'a pas d'effet significatif sur le lien niveau d'utilisation des TIC et durée de traitement des données.
- Ce tableau nous montre que l'insertion de la variable RESTEN dans la relation niveau d'utilisation des TIC et résultat net permet d'obtenir une significativité plus élevée du modèle avec un coefficient plus élevé de NATIC (*Coef* NATIC passe de 0,111 à 0, 537, soit une augmentation de 0,426 unité). Ces résultats permettent de déduire que la restructuration de l'entreprise a un impact positif et plus significatif sur la relation niveau d'utilisation des TIC et part de marché.
- La restructuration de l'entreprise a un impact positif et significatif sur la relation niveau d'utilisation des TIC et part de marché. En effet, l'introduction de la variable RESTEN dans ce modèle augmente la significativité (Prob passe de 0,043 à 0,000) du modèle et le coefficient de NATIC qui passe de 0,057 à 0,591. Ceci, nous amène à affirmer que le niveau d'utilisation des TIC a une influence positive et plus significative sur la variation de la part de marché lorsqu'il est accompagné par une restructuration de l'entreprise.

De manière brève, les résultats des tests d'ANOVA sur les différents modèles nous indique que la restructuration de l'entreprise après adoption des TIC a un impact positif et significatif sur la relation niveau d'utilisation des TIC et nombre de client, qualité de service rendue aux clients, résultat net et part de marché, et par conséquent sur la performance. En d'autres termes, L'effet des TIC sur la performance augmente plus lorsque leur adoption est accompagnée d'une restructuration de l'entreprise. Ce résultat vient confirmer les travaux de (Missaoui, 2009; Crespi et al., 2007; Brynjolfsson et Hitt, 2003) qui soulignent que pour avoir un impact sur la performance des entreprises, les investissements dans les TIC doivent être combinés avec des investissements complémentaires dans les pratiques de travail, le capital humain et la restructuration des entreprises. Notre résultat épouse aussi le point de vu d'Aubert et al. (2009) qui affirment que, "malgré le potentiel évident de création de valeur des technologies de l'information, il semble que leur effet ne puisse se faire sentir qu'en présence

[19] Coefficient

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d'investissements complémentaires, notamment en capital humain et en réorganisation du savoir et des processus".

Globalement, les résultats dégagés de l'étude de la relation entre l'utilisation des TIC et la performance montrent bien que le niveau d'utilisation des TIC affectepositivement lenombre de client, la qualité de service rendue aux clients, le résultat net,la part de marché, et par conséquent la performance. Il est néanmoins nécessaire d'accompagner cette utilisation par des pratiques organisationnelles (formation des employés et restructuration de l'entreprise) pour bénéficier d'un effet plus significatif de l'utilisation de ces outils.

V. Conclusion

Cette étude réalisée auprès de 107 IMF camerounaises vise à examiner la relation entre l'utilisation des TIC et la performance des IMF camerounaises. Cette relation a été examinée à travers deux approches différentes à savoir: celle de la théorie du consommateur qui s'insère dans le cadre de l'approche causale (microéconomique) et qui vise à identifier l'impact des TIC sur la performance à travers les impacts positifs sur la consommation. Ensuite, nous nous sommes basés sur la théorie de la structuration de Giddens (1987) qui tient compte de la liberté des acteurs dans les organisations et de l'influence des structures sociales sur les acteurs.

Les résultats du test de l'ANOVA nous montrent l'importance du rôle joué par les TIC dans les IMF camerounaises. En effet, les résultats de notre recherche montrent que le niveau d'utilisation des TIC par les IMF a un effet positif sur leurs performances (nombre de client, qualité de service rendue aux clients, part de marché et résultat net). En outre, la prise en compte des pratiques organisationnelles de l'entreprise (formation des employés et restructuration de l'entreprise après adoption d'un TIC) améliore légèrement la relation entre ces deux variables. Ceci, nous amène à nous poser la question de savoir si l'approche processuelle explique mieux la relation entre les TIC et la performance. Compte tenu du fait que nous n'avons utilisé que deux variables des pratiques organisationnelles et une approche subjective pour mesurer la performance, il serait intéressant dans les recherches futures devoir si la prise en compte de plus de variables se rapportant aux pratiques organization nelles et l'utilisation d'une approche objective pour mesurer la performance de l'IMF permet d'aboutir aux mêmes conclusions que celles dégagées dans cette étude.

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Image Retrieval with Relational Semantic Indexing Color and Gray Images

By Dr. S. Sutha, Mr. C. A. Kandasamy & Mr. N. Prakash
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Abstract- Due to the development of digital technology large number of image is available in web and personal database and it take more time to classify and organize them. In AIA assigns label to image content with this image is automatically classified and desired image can be retrieved. Image retrieval is the one of the growing research area. To retrieve image Text and content based methods used. In recent research focus on annotation based retrieval. Image annotation represents assigning keywords to image based on its contents and it use machine learning techniques. Using image content with more relevant keywords leads fast indexing and retrieval of image from large collection of image database. Many techniques have been proposed for the last decades and it gives some improvement in retrieval performance. In this proposed work Relational Semantic Indexing (RSI) based LQT technique reduces the search time and increase the retrieval performance. This proposed method includes segmentation, feature extraction, classification, and RSI based annotation steps. This proposed method compared against IAIA, and LSH algorithms.

Keywords: image annotation, segmentation, gray intensity matrix, keywords, feature extraction, relational semantic indexing.

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IMAGERETRIEVALWITHRELATIONALSEMANTICINDEXINGCOLORANDGRAYIMAGES

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I. Introduction

Automatic Image retrieval is the one of the growing research area. The aim of the image retrieval is to search or find similar images from databases. Large number of image is available in web and personal database due to the development of digital technology. Advances in image acquisition and storage technology have led to tremendous growth in very large and detailed image databases. These images, if analyzed, can reveal useful information to the human users. Image mining deals with the extraction of implicit knowledge, image data relationship, or other patterns not explicitly stored in the images. Image mining handles with the hidden knowledge extraction, image data association and additional patterns which are not clearly accumulated in the images.

The traditional image retrieval approaches separated into two categories text based retrieval and content based retrieval. Text based image retrieval similar to document retrieval. It needs manual annotation. More expensive and time consuming. To overcome this content based image retrieval technique was used. It takes image low level features such as color, texture and shape. Retrieval performance is increased but accuracy is yet refined. Everything not derived from image features. There is a semantic gap. Smeulders define the semantic gap as "lack of coincidence between the information that one can extract from the visual data and the interpretation that the same data have for a user in a given situation" [18]. The aim of annotation based retrieval system is to bridging the semantic gap between image low level features and high level semantics. Semantic description of image content is associated with image. It will enable the user to retrieve the image with keywords or queries.

Nowadays annotation based retrieval is an interesting research area. It can be defined as Assigning keywords to the image based on its contents. Keyword describes the visual content of the image. Using image content with more relevant keywords leads to fast indexing.

In the proposed image retrieval system used to identify and retrieve the image. In training images previsiously annotated with keywords and with usage of machine learning techniques test image is automatically annotated with keywords. Image annotation models can be classified into two types. Namely Probabilistic model Discriminative model.

II. Literature Survey

Much research effort has been focused on content based and text based retrieval during recent years, resulting in remarkable achievements [1], [2] Among others, automatic image annotation technology, which associates images with labels or tags, has received much research interest [3]. This technique enables conversion of image retrieval into text matching Duygulu [19] proposed the translation model to treat AIA as a process of translation from a set of blob tokens, obtained by clustering image regions, to a set of keywords. Image annotation thus brings several benefits in image retrieval, such as high efficiency and accuracy in the field of Research area such as multimedia and computer vision, pattern recognition. Many research has been done in these area. Yang's proposed learning paradigm [1] and Carneiro a generative paradigm [2]. Latent Dirichlet Allocation (CorrLDA) [3] considers associations through a latent topic space in a generatively learned model. Carneiro [20] proposed supervised multi-class labeling (SML), which utilizes

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optimal principle of minimum probability of error and treats annotation as a multi-class classification problem.

A semi automatic framework for image annotation using Locality Sensitive Hashing improved the searching combination of keywords. With the application of LSH, though search effectiveness was improved, search time increased with different combination of image annotation [6]. Texture based approaches are efficient in dealing with complex background with dissimilar textual structure to the text regions. But the computational complexity restricts its applications in large databases. Han et al[6] proposed a system prototype for multimedia data mining capable of performing data summarization, comparison, classification, association mining and clustering. Metzler proposed a graph representation of joint queries [6], and cross-language LSI [7], offer means for linking the word-image occurrences, but still do not perform as well as the non-parametric mode.

Even though improved results have been reported by annotation based retrieval techniques it lacks a comparison with simple baseline measures across diverse image datasets. In the absence of such a comparison, it is hard to understand the gains and justify the need for complex models and training processes as required by most of the current annotation methods. Alnihoud has proposed a novel approach for CBIR using Fuzzy Color Histogram (FCH) and subtractive fuzzy clustering algorithm Similarity mining into a joint framework [7]. Yi Yang Propose a new inductive algorithm for image annotation by integrating label correlation mining.

Recent researchers have shown that the designing of manual tags are often insignificant and not reliable. Moreover, as many users select the most general and ambiguous tags for minimizing their involvement while selected more appropriate words, tags are considered to be noisy. To provide solution to this problem, tag completion in [12] filled the missing tags in an automatic manner and also corrected noisy tags for the images provided as input resulting in significant improvement but tag completion based on compressed sensing and matrix completion remain unaddressed.

A novel method was presented for graph indexing for better image retrieval using hyper graph which improved the scalability of images being retrieved. A structural learning algorithm was instantiated for implementing large-scale image classification. But the results, accuracy obtained for large scale classification was not precise. [14]

The rest of this paper is organized as follows. In Section 3, introduce image Pre-processing techniques section describes edge detections, Section 4,5 feature extraction and RSI based annotation algorithm associated with linear quad tree construction is presented for image annotation framework. Section 5, 6 provides an experimental evaluation with the detailed section 7 gives Result Analysis finally section 8 concludes with remarks.

III. Framework for Proposed System

The Four main tasks of the proposed system are:

1. Texture Feature Extraction (Haralick and Tamura).
2. Shape Feature Extraction (moment invariant)
3. Translating keywords and Classification.
4. Using Euclidean Distance Method Similarity of the query image and database images are retrieved.

a) Outline and Pre-processing

The sizes of the Input images are verified by its pixel range as 256*256. Image with noise leads to low accuracy of image retrieval. So smoothing filter [16]-technique used for noise removal. By using edge detection techniques edge of the images is identified image is spilited into 4*4 blocks. Features of all blocks can be derived. Semantic tag is automatically assigned by comparing training image feature vector. System works gray and binary image. 4 Haralick and 2 Tamura texture features and 7 Hu's moment invariant features extracted. The extracted features from the query image and database images are compared using the Euclidean distance.

For binary image segmented using threshold mean segmentation. The converted binary image contains all the essential information about the location and outline of the objects for segmenting the images with minimal time. The purpose of thresholding is to extract those pixels from some image which represent an object (either text or other line image data such as graphs, maps). Though the information is binary the pixels represent a range of intensities. Thus the objective of binarization is to mark pixels that belong to true foreground regions with a single intensity and background regions with different intensities. With the threshold mean value, the objects position and shape is identified. Madirakshi Das proposed segmentation approach to foreground segment detection. It is based on elimination of background. This is accomplished by combining a color-based background detection step with refinement of the segmentation using edge information. [18].In Fig 1 shows the segmentation carried by both approaches.

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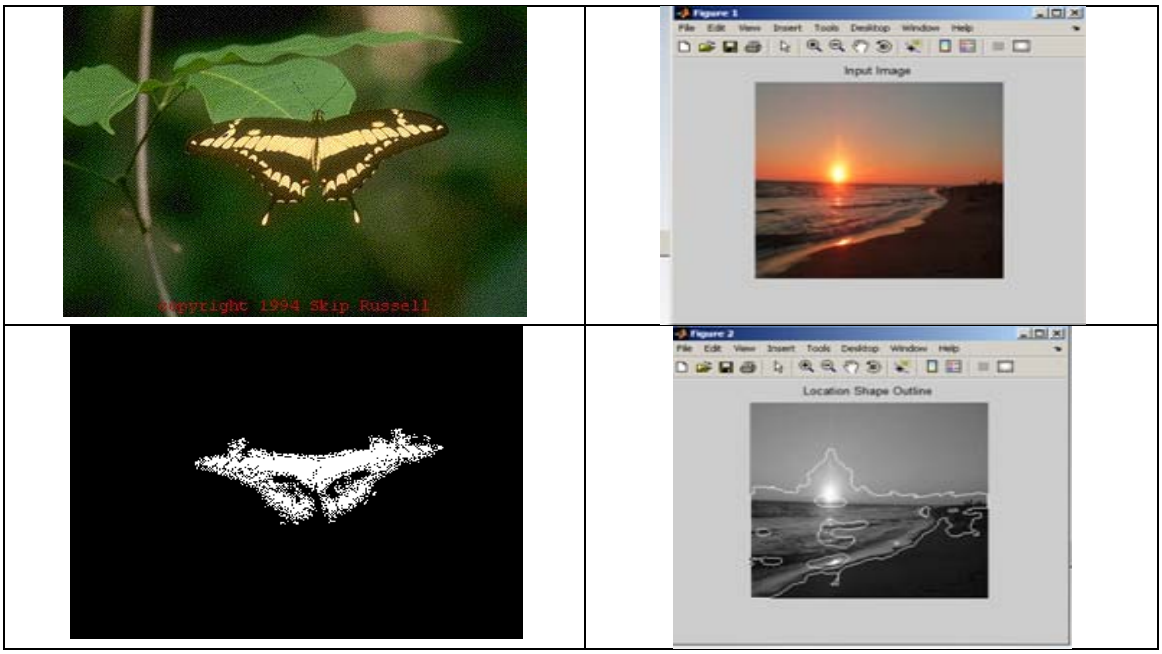

a. Background Elimination b. Threshold mean

Fig. 1: input image after segmentation

IV. Feature Extraction

Like color, the texture is a powerful feature for image search and retrieval applications. Texture descriptor provides measures of the properties such as smoothness, coarseness, and regularity.

V. Classification and Keyword Translation

The extracted features are provided as the input to the classification process in the image annotation framework. With the features being extracted, the RSI technique uses the minimum distance classification that contains different types of class centres such as, $C_i = 1,2 \ldots n$.

Relational indexing handles different combination of keywords with (x, y) pixel points for effectual quality of search. The combinatorial interpretation in RSI technique chooses 'n' semantic keywords and result with potentially high search result on larger database. This proposed model trained with small set of manually annotated images. This training set class used to assign a keyword to one or more classes. Using RSI technique the unknown image annotated by word translation model. For efficient image indexing and retrieval proposed system used RSI with quad tree. The main goal of Relational Semantic Indexing technique in the image annotation framework is to reduce the search time for different combinations of semantic keyword. The RSI technique also works to improve the quality of search by developing an entity relationship model.

VI. Evaluation and Measurement

Proposed system use translation model to translate semantic keyword from training image to test image. The retrieval performance is measured with precision and recall. It is the ratio of the number of relevant images retrieved to the total number of irrelevant and relevant images retrieved. Recall is the total number of relevant images that exist. Proposed system uses the mean of precisions and recalls for a given query set.

$$\text{Precision} = \frac{\text{No. relevant images retrieved}}{\text{Total No images retrieved}}$$

$$\text{Recall} = \frac{\text{No. relevant images retrieved}}{\text{Total No. relevant images in the collection}}$$

In otherwise precision evaluates the proportion of relevant images in the retrieval results, while recall calculates that of the relevant images in all of the relevant images contained in the database.

VII. Experiment and Result Analysis

Image Annotation Framework based on the Relational Semantic Indexing (RSI) technique performs the experimental work using MATLAB coding. RSI indexing is experimented using INIRA holidays dataset.RSI is compared against the Search based retrieval Inductive Algorithm for Image Annotation (IAIA) and Semi automatic framework with Locality Sensitive Hashing (LSH). In order to evaluate the proposed system INIRA Holidays database is used.

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In the database 800 images were taken for experiment. The data set contains 10 classes. 500 images for training and 300 images for testing are used for the experimental study. The Image Annotation framework based on the Relational Semantic Index (RSI) technique is compared against the existing inductive algorithm for image annotation [1] and Locality Sensitive Hashing [2] and Learning based retrieval algorithm. The simulation results using MATLAB are compared and analyzed

Table 1: Tabulation for recall

No. of test Images (MB)	Recall (%)		
	RSI	IAIA	LSH
500	67	56	60
600	68	58	61
700	67	59	61
800	68	62	62
900	69	63	63
1000	70	64	65
1100	68	64	66
1200	56	65	67

Query Image/Keyword-sea

Few Examples of predicted results using RSI with LQT

Figure 2: No. of test images versus precision

Table1, 2 provides a few statistics on precision and recall with respect to 800 test images for experimental purpose. Consequently, the results obtained using proposed RSI is compared with the existing IAIA [1] and LSH [2].Figure 3,4 provides comparison chart for precision and recall respectively.

It is observed that the search time using RSI is better as an entity relationship is developed to identify the relationships with different combination of semantic keywords by minimizing the search time. It is also observed that the performance of search time are affected using the existing IAIA [1] and LSH [2]. This improves the search time using RSI by 6 – 23 % when compared to IAIA. In addition, using RSI, the keyword retrieves all combination of objects from classified class and reduces the search time using the relational semantic indexing by 16 – 34 % when compared to LSH. The simulation shows that the recall rate is higher using the proposed RSI with Quad tree than when compared to the existing inductive algorithm for image annotation (IAIA) [1] and Locality Sensitive Hashing (LSH) This is because of the application of relational database for indexing different combination of semantic keywords which in turn increases the recall ratio in an optimal manner based on the number of test images by 2 – 8 % when compared to IAIA [13]. In a similar manner, with the application of linear quad tree, the two dimensional space is efficiently partitioned into four quadrant form that increases the recall ratio by 7 – 13 % when compared to LSH. But comparatively, the precision rate is higher using the RSI technique. This is because with the application of semantic keyword addition on image annotation framework therefore increases the precision rate by 7 – 10% when compared to IAIA. RSI technique fetches the user result with higher precision rate by 14 – 20 % when compared to LSH [13].

VIII. Conclusion

With the increasing need of multimedia applications over the Internet, the importance of image mining and image retrieval has also increased [17]. Currently, many new schemes are proposed in the field of Image Mining and Retrieval. The application of relational semantic indexing dramatically encapsulates the function for varying combination of keywords. In these experiments, RSI with quad tree framework has several advantages, such as efficiency and accuracy.

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Application of IOT and Countermeasure in Agriculture of Shandong Province, China

By LI Guangzhong
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Abstract- As a major agricultural province in China, Shandong Province has always played an important role. At the same time, it is also closely related to the strong support of agricultural science and technology. As a new technology, the Internet of things has made great contributions. In this paper, the application of Internet of things in the field of agriculture in Shandong Province is described from two practical cases, and discusses the countermeasures at the end of the paper.

Keywords: IOT, WSN, the quality and safety traceability system.

GJCST-H Classification: J.m

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I. Introduction

Agriculture, as the dominant industry in Shandong Province, plays an important role in China. A number of indicators of the agricultural industry have always been in the forefront of the country. The total output value of agriculture, forestry, animal husbandry and fishery, the added value of the first industry and the export of agricultural products have always been the first in the country. Grain ranks the third in the country, cotton and oil plants rank the second, and the total output of vegetables, fruits, meat, eggs and milk, and aquatic products rank the first. According to statistics, Shandong Province, with 6% of the country's arable land and 1% of the country's water resources, has produced 8% of the country's grain, 13% of the country's vegetables and 10% of the country's meat, eggs and milk, making a positive contribution to the country[1].

The strong joint force of agricultural science and technology innovation in the whole province plays a leading and supporting role in the development of agricultural industry. Applying the IOT technology to agricultural production will form the Agricultural Internet of things, The Agricultural IOT connects all links of agricultural production through the network to realize the real-time monitoring and effective control of the whole agricultural production process.

Here are two examples to illustrate the application of IOT in agricultural production in Shandong Province, China.

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II. Application of IOT in Bohai Granary Science and Technology Demonstration Project

a) Big data platform of Bohai granary science and technology project

In 2013, the "Bohai granary science and technology demonstration project" of the national major science and technology support plan was implemented. The project aims at the problems of 40 million mu of medium and low yield fields and 10 million mu of salt alkali wasteland in the low plain around the Bohai Sea, such as lack of fresh water resources, poor soil and salt alkali restricting grain production. It focuses on breaking through key technologies such as soil, fertilizer, water and seed, and establishes a grain production demonstration area in the local area. The goal is to increase grain by 3 billion kg by 2017 and 5 billion kg by 2020[2].

The big data platform is designed for this project. The platform system mainly includes four modules: data collection, mining analysis, monitoring and early warning, and decision-making service. Among them, the data acquisition module, through scientific assembly of various sensors such as meteorology, seedlings, soil and groundwater, forms a ground air integrated sensor cluster, constructs an intelligent sensing system for crop growth process environmental information, collects and transmits all kinds of data in real time, and provides all-weather and three-dimensional data support for subsequent data analysis, monitoring and early warning, and decision-making services [3].

The agricultural big data platform of Bohai granary has completed the functions of influencing factors analysis of grain production, data collection and transmission, data storage and partial data analysis and application. From bottom to top, the agricultural big data platform structure of Bohai granary can be divided into three layers: data acquisition layer, data storage layer and data application layer.

b) Wireless data acquisition system

There are many ways of data acquisition. The main way of data acquisition is on-site manual acquisition and Internet of things real-time acquisition. Using the self-developed real-time data acquisition base station of the Internet of things, the real-time and

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accurate acquisition of key factors of meteorological information(wind speed and direction, air temperature and humidity, light intensity, rainfall, evaporation), soil information (salt, soil pH value, water level, water salinity, soil temperature and humidity) and crop growth (Leaf area index, dry matter accumulation, nitrogen content, nitrogen accumulation and chlorophyll content) is realized[4].

After data acquisition, ZigBee wireless sensor network technology is used for data transmission. ZigBee sensor network node is composed of four modules: processor, radio frequency transmission, sensor and power supply. The relationship between the modules is shown in the figure. The processor module is used for equipment control, task scheduling, logical calculation, coordination function, etc. of the network node. The radio frequency transceiver module is used for data transmission, frequency selection, etc. of the network nodes. The sensor module is used for Sampling and conversion of external sensing signals; The power supply module provides the necessary power for the network sensor nodes to maintain the operation of the network. The relationship between node modules is shown in Figure 1.

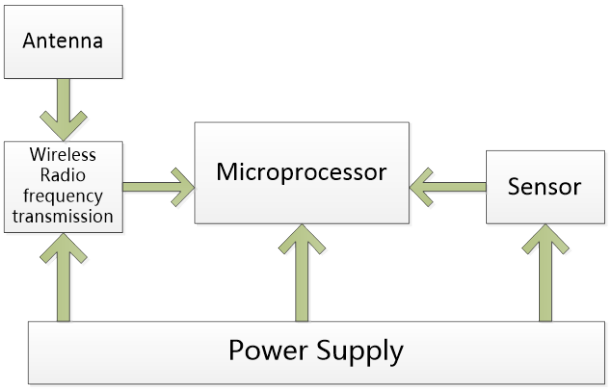

Fig. 1: Relationship between node modules

In the hardware design of ZigBee node, the CC2430 chip of TI company is used as the radio frequency transceiver module, and the MSP430 chip of TI company is used as the main control chip. Each ZigBee node is arranged in the monitoring area according to the requirements through ZigBee The whole ZigBee wireless network system collects and uploads the data in the monitoring area to the monitoring host, and the monitoring host analyzes and collects the data.

MSP430 adopts the master mode, CC2430 adopts the slave mode, and the connection is simple and convenient. Four pins of SFD, FIFO, fifop and CCA are used to receive and transmit data; the processor exchanges data and sends commands with CC2430 through SPI interface. The processor accesses CC2430 internal memory through SPI interface. During the access process, CC2430 is the slave device of SPI interface, which receives clock signal from the processor and performs input / output operation under the control of the processor.

c) Application results

There are three areas around Bohai Sea in the saline alkali land of Shandong Province. The platform has completed 72 data collection stations in three areas. The meteorological, seedling, soil and groundwater data of 27 demonstration sites in the Shandong project area of "Bohai granary" were collected, processed and analyzed, which effectively solved the problems of real-time data collection in the field of grain production. After research and development, testing, adjustment, optimization and demonstration application, the platform now has the characteristics of massive data source diversity, integration of historical and real-time data, multi factor comprehensive analysis and decision-making. It has been applied to the grain production management and decision-making process of typical plots in Shandong project area of Bohai granary, effectively guiding the grain production in the project area.

III. Application of IOT in the Safety Traceability of pig Industry Chain

Internet of things (IOT) is a kind of network that connects any object with the Internet through RFID, infrared sensor, global positioning system, laser scanner and other information sensing equipment to exchange and communicate information, so as to realize intelligent identification, positioning, tracking, monitoring and management.

The quality and safety traceability system of agricultural products is to realize digital management of the whole industrial chain of agricultural products from breeding, transportation, slaughtering, segmentation, storage, processing to marketing.

Achieve precise management of production process and supervision, prevent cross mixing of products from different sources, Keep complete and detailed personal information of products, keep complete data, test reports and relevant certificates, so as to facilitate downstream producers and consumers to query and check at any time, Especially in the case of food safety incidents, find out the cause of the accident quickly, make control decisions immediately, minimize the possible losses and hazards, and reduce unnecessary panic[5].

In this application, a famous and excellent product pig in a region is taken as the research object, and the Internet of things technology runs through the whole industrial chain of pig from breeding, slaughtering and processing, logistics, sales and consumption. The data related to food safety in the industrial chain is transmitted to the database server through GPRS by the mobile terminal to the consumer for traceability query. At

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the same time, the information multiple feedback mechanism is established to provide data support for pig breeding by using the information of breeding and slaughtering [6].

The whole industrial chain of pigs includes five links: breeding, breeding, slaughter division, logistics and sales, There are corresponding information management systems in each stage, which provide daily management for breeding plants, breeding plants, slaughterhouses, storage and logistics companies, and sales companies in different links, as well as write data to the database through the hardware collection terminal of the Internet of things, so as to provide data sources for the traceability of the whole industry chain. At the same time, in order to ensure the reliability and authenticity of the data source, the whole platform covers the supervision of the animal husbandry supervision department on the industrial chain information and the traceability query of consumers on the safety information related to meat products. The specific functions are shown in the figure2.

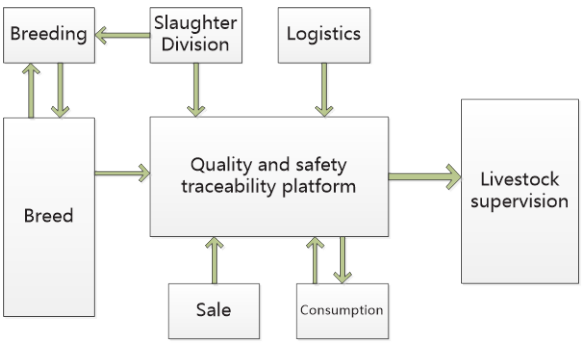

Fig. 2: Function division of pig whole industry chain traceability

The whole system adopts B / S architecture, which can be used through hardware platforms such as handheld devices and general PC, and is compatible with windows, Android, IOS and other operating systems, greatly facilitating the use of users, while reducing development costs and maintenance workload. After entering the pig traceability system information platform, They can directly input the traceability source code to query the traceability information of pigs.

The system is conducive to the real-time monitoring and control of the pig's growth environment by managers, convenient for consumers to query the information of all links from breeding to sales, and realize the tracking and traceability of pigs by consumers, governments and enterprises.

IV. Challenges in Implementing IOT in Rural Area

The new central document proposes to build agricultural and rural big data centers and accelerate the application of modern information technology in the agricultural field, including the Internet of things, big data and artificial intelligence[7].

The application of Internet of things in the field of agriculture is still in its infancy, and there are still some constraints and bottlenecks. The price of chips, processors and other hardware equipment is high, the development of related software and application systems is relatively lagging behind, and the awareness and application level of grass-roots farmers on the Agricultural Internet of things need to be improved. It is not only limited to the Internet of things technology, accelerating the application of science and technology in agriculture should focus on the following aspects: Government guidance, policy support, increasing the interest of growers, encouraging market capital investment, Agricultural technology application demonstration and improving the innovation enthusiasm of agricultural researchers. With the in-depth implementation of the strategy of rural revitalization, the construction of modern agriculture and even smart agriculture is speeding up. Through improving the model of demonstration and guidance, strengthening the development and application training of relevant software and hardware, the application of Internet of things in the field of agriculture will be increasingly extensive, effectively promoting the level of agricultural production and efficiency.

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Big Phish Little Phish

By Kyle Bynum
Marymount University

Introduction- A cyber-attack is "an attempt to gain illegal access to a computer or computer system for the purpose of causing damage or harm."In the cyber realm there are many ways hackers go about getting personal information in an unauthorized way. In this research project I will be focusing totally on Phishing, how it works, some examples and how we can reduce phishing incidents.

Phishing is a cyber security attack that uses email as a weapon. The process of phishing is when the email recipient believes that the message, they are sent is something they want or need. The attackers disguise themselves as a trusted entity of some kind making the recipient feel as if they are conversing with trustworthy person, or a company the victim might do business with. It's one of the oldest types of cyber attacks and it's still one of the most widespread and harmful. In my research I found that the F5 Lab of Artificial Threat Intelligence breaks down phishing into three distinct operations.

GJCST-H Classification: K.6.5

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Big Phish Little Phish

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Introduction

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1. Target selection - Finding suitable victims, notably, their email addresses and background information to find a psychological hot button that will lure them.
2. Social engineering - Baiting the hook with a suitable lure that would entice a victim to bite into the technical hook set to steal their credentials or plant malware. In the case of spear-phishing, this lure is customized to the targeted victim. At the end of the year, phishers will take advantage of fiscal year-end and holiday events as part of their masquerade.
3. Technical engineering - Devising the method to hack the victim, which can include building fake websites, crafting malware, and hiding the attack from security scanners.

In 2013, a Lithuanian citizen named Evaldas Rimasauskas allegedly hatched an elaborate scheme to defraud U.S. tech companies. The Justice Department shared that Rimasauskas forged email addresses, invoices, and corporate stamps in order to impersonate a large Asian-based manufacturer. The manufacturer was known for doing business with U.S. tech firms, so Rimasauskas used the opportunity to trick the companies into paying for computer supplies. The scheme worked until 2015, the corporate imposter convinced accounting departments at the two tech companies to make transfers worth tens of millions of dollars. By the time the firms figured out what was going on, Rimasauskas had coaxed out over $100 million in payments, which he promptly stashed in bank accounts across Eastern Europe. The companies that Rimasauskas defrauded was Facebook and Google. This incident is the Costliest phishing attack to date. According to the Federal Bureau of Investigation (FBI) this type of phishing is a Business E-mail Compromise (BEC)/E-mail Account Compromise (EAC). This scam targets both businesses and individuals performing wire transfer payments. The scam is frequently carried out when a subject compromises legitimate business e-mail accounts through social engineering or computer intrusion techniques to conduct unauthorized transfers of funds.BEC/EAC statistics were reported to the Internet Crime Complaint Center (IC3). Here is Data from the IC3, international law enforcement complaint data, and filings from financial institutions. The data below shows Domestic and international incidents and the dollar loss between October 2013 and May 2018.

Domestic and International Incidents:	78,617
Domestic and International exposed dollar loss:	$12,536,948,299

This data is the BEC/EAC statistics that were reported in victim complaints where a country was identified to the IC3 from October 2013 to May 2018.

Total U.S. Victims:	41,058
Total U.S. Victims:	$2,935,161,457
Total non-U.S. Victims:	2,565
Total non-U.S. Victims exposed dollar loss	$671,915,009

The FBI shared that the BEC/EAC scam continues to grow. Scammers are targeting small, medium, and large businesses. Between December 2016 and May 2018there was a 136% increase in identified global exposed losses. The scam has been

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reported in all 50 states and in 150 countries. Victims of the scam filed their information with the IC3. Financial sources indicate fraudulent transfers have been sent to 115 countries. Observing the statics above I was able to understand why phishing scams so successful. My researched led me to the schemers and the specific people they are targeting. The schemers are counting on employees of the company they are trying to scheme to respond to urgent emails that appear to come from their executives or vendors. As an employee of a corporation if I received an email from my executive or a vendor I always respond in a timely manner and do exactly what they ask me to do. The difference is I make sure that the email is legit and is coming from the actual source.

In the August 2006 Boulder County Business Report, there was a story about how the Boulder Police Department in Colorado was investigating several cases of identity theft and fraud from customers of the Elevations Credit Union which was formally known as the University of Colorado Federal Credit Union. Boulder Police had taken nearly 30 reports from victims who have had more than $39,000 taken from their accounts in early April of that year. The incidents caused the Boulder County Sheriff's Office and the University of Colorado Police Department to investigate eight other cases with loses exceeding $10,500. In this case It seems that the scammers might have got in by using the members passwords and credit card numbers to retrieve the money.

The last incident of phishing I researched was from the New Orleans City of Business Journal in 2004. The journal shared a story about a St. Tammany Parish resident Vicky Magas who received an E-mail in her home account about an offshore worker named Peter Magas. The E-mail stated that Peter and the rest of his family had died and together they left $3 million to his closest heirs. Vicky had never heard of a relative named Peter Magas. The E-mail then told Vicky that if she knew the where his heirs were to click the link provided and follow the instructions and then after she could to claim part of the money. Vicky didn't click the link because she had heard about these kinds of scams, so she sent the E-mail to Cynthia Albert at the New Orleans Better Business Bureau. Albert confirmed her suspicion and stated that this type of phishing is referred to as the "Nigerian Letter Scam."The Nigerian Letter scam focuses on urging consumers or businesses by E-mail or phone to hand over their financial information in return for a promised payoff or shipment of money overseas. The Nigerian scams originate from several countries like Africa, New Zealand, Brazil and Great Britain and are typically signed by someone who allegedly represents the country's ministry of commerce or finance. This type of phishing has been around since the Internet's early ages and is focused on urging consumers or businesses by E-mail or phone to hand over their financial information in return for a promised payoff or shipment of money overseas.

No matter how large or small a company, business, or person is eliminating and minimizing phishing should be a topic of discussion. Conducting my research I was able to find several ways to fight and overcome phishing.

1. *Require Verification Through Other Official Channels*

Reach out to colleagues by using methods like contacting the person directly from company directory, contacting their assistant, or just walk down the hall to speak with the alleged requester face to face

2. *Implement New Processes to Increase Cyber Defenses*

Another way companies can avoid phishing attacks is if they had account verification and safeguard processes in place. This could entail requiring employees to follow set processes like performing account verification with 2 step factor authentications, via phone, or email. Lastly, have signatures from the sender and receiver before any transfers over a set amount is sent.

3. *Implement New Processes to Increase Cyber Defenses Cont*

Have a system like Pass Marks put in to place to increase security. Pass Marks directly addresses the "phishing" e-mail scams. The software protects financial institutions, e-commerce sites and enterprises against Internet phishing attacks.

4. *Implement Employee Cyber Awareness Training*

Offer cyber security awareness training for employees. This will education and train employees to identify and appropriately respond to phishing emails. In addition, these trainings will help strengthen your organization's human firewall. Cyber security awareness training can be offered as a new hire and once each work quarter face to face or online. Periodic phishing testing should be performed to determine the success of the training or to identify areas to focus on in future trainings.

5. *Use Email Signing Certificates*

E-mail signing certificates enable executives and other employees to digitally sign their emails so their recipients can easily verify that they are who they say they are. These certificates are issued by industry-trusted certificate authorities. With E-mail signing certificates mandatory someone in the finance or accounting department can easily verify the identity of the email sender. In addition, these certificates can also be used to send secure emails using asymmetric encryption. This enables you to send an encrypted email to a recipient who has the matching private key, which protects the integrity of your data.

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In closing, my research brought me to investigate the large and small incidents of phishing. The investigation led to my discovery of how much of a problem phishing is globally. Personal information and were always at loss during the attacks. Throughout my research with the information provided I was also able to come up with ways to try to overcome phishing and protect company's and individual's integrity.

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A Comparative Study between a Simulation of Machine Learning and Extreme Learning Machine Techniques on Breast Cancer Diagnosis

By Rahul Reddy Nadikattu
University of the Cumberlands

Abstract- Breast Cancer is a developing and most normal disease among ladies around the globe. Breast malignancy is an uncontrolled and exorbitant development of abnormal cells in the Breast because of hereditary, hormonal, and way of life factors. During the starting stages, the tumor is restricted to the Breast, and in the latter part, it can spread to lymph hubs in the armpit and different organs like the liver, bones, lungs, and cerebrum. At the point when the bosom disease spreads to different pieces of the body, it is going to metastasize. The sickness is repairable in the beginning periods, yet it is identified in later stages, which is the fundamental driver for the passing of such a large number of ladies in this entire world. Clinical tests led in medical clinics for deciding the malady are a lot of costly, just as tedious as well.

Keywords: extreme learning machine (ELM), random forest (RF), decision tree (DT), support vector machine (SVM), and KNN.

GJCST-H Classification: I.2.m

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Keywords: extreme learning machine (ELM), random forest (RF), decision tree (DT), support vector machine (SVM), and KNN.

I. Introduction

Breast Cancer has become the principal explanation for the passing of many ladies worldwide. The principle explanation behind the passing of ladies by this infection is the procedure by which is analyzed. The innovation has become a significant part of our ways of life; we are still missing behind diagnosing this essential ailment in early stages[2]. As the ailment isn't analyzed in beginning times, along these lines, the mammography rate has expanded for a specific age gathering of concerned women[3].

Breast Cancer is reparable, and life could be spared on the off-chance, and it would analyze in beginning times. Various causes have been analyzed for this dreadful malady, specifically, hormonal awkwardness, family ancestries, corpulence, radiation treatments, and some more. Many AI and profound learning calculations were applied to diagnose this ailment.

Machine learning algorithms follow the following steps during classification problems[1]:

- Data Collection
- Appropriate Model selection
- Modeler is trained
- Testing and prediction of results

In this paper, we analyzed different Machine Learning calculations and a neural system (ELM) to discover which calculation gives the best outcome as far as precision and preparing time. Different AI calculations examined here are Support Vector Machine (SVM), K-Nearest Neighbor (KNN), Decision Tree (DT), and Random Forest (RF). The neural system talked about here is the Extreme Learning Machine (ELM).

II. Literature Review

In this section, some of the previous work done by different researchers on different breast cancer Datasets had discussed.

In [4], the dataset was taken from the Iranian center of breast cancer, and the performance of the decision tree, support vector machine, and artificial neural network was compared. The support vector machine was proven to be the best followed by an artificial neural network, and then the decision tree classification model.

In [5], two datasets were taken for performing comparison among different machine learning models. The datasets were WPBC(Wisconsin Prognostic Breast Cancer) and Wisconsin breast cancer dataset. The comparison was between the decision tree classification model, Naïve Bayes model, neural network, and support

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vector machine with different kernels. Results showed that the neural network was best for the Wisconsin breast cancer dataset and support vector machine with radial basis function (RBF) and was best for the WPBC dataset.

In [6], an ANN (Artificial neural network) with Principal Component Analysis (PCA) is used to distinguish between malign and benign tumor cells.

In [7], the WPBC dataset is used for comparing the performance of different machine learning algorithms. The result showed that the support vector machine and decision tree were among the best predictors of results.

In [8], a multi-layer perceptron with backpropagation neural network and support vector machine uses for the classification dataset. Support Vector machine found to be the best result giving algorithm.

In [9], a signal-to-noise ratio technique is used with different classification models: k-nearest neighbor, SVM, and PNN, which is a probabilistic neural network. SVM with a radial basis function, that is RBF kernel concluded to give the best result.

In [10], a comparative study was done on the random forest classification model, Naïve Bayes model, and Support Vector Machine model to analyze the Wisconsin breast cancer dataset on the parameters of precision, accuracy, and specificity.

In [11], a new approach was provided, based on the neural network with a feed forward BP algorithm. Wisconsin breast cancer dataset used from the UCI repository. A 7 hidden unit neural network used to obtain the results.

In [12], the relevance vector machine (RVM) compares with other machine learning techniques. Linear Discriminant Analysis (LDA) method was used for dimension reduction. RVM gave the best results in their experiment on the WBC dataset.

III. Machine Learning Classification Models used

a) Support Vector Machine Classification

It is the directed AI arrangement method that separates the dataset into classes utilizing an appropriate maximal edge hyperplane, for example, the upgraded choice boundary[1]. The methods utilized in numerous fields, such as infection acknowledgment, penmanship acknowledgment, discourse acknowledgment, and numerous different fields, of example, acknowledgment. This strategy builds the gap between the classes, which it makes in figure1.

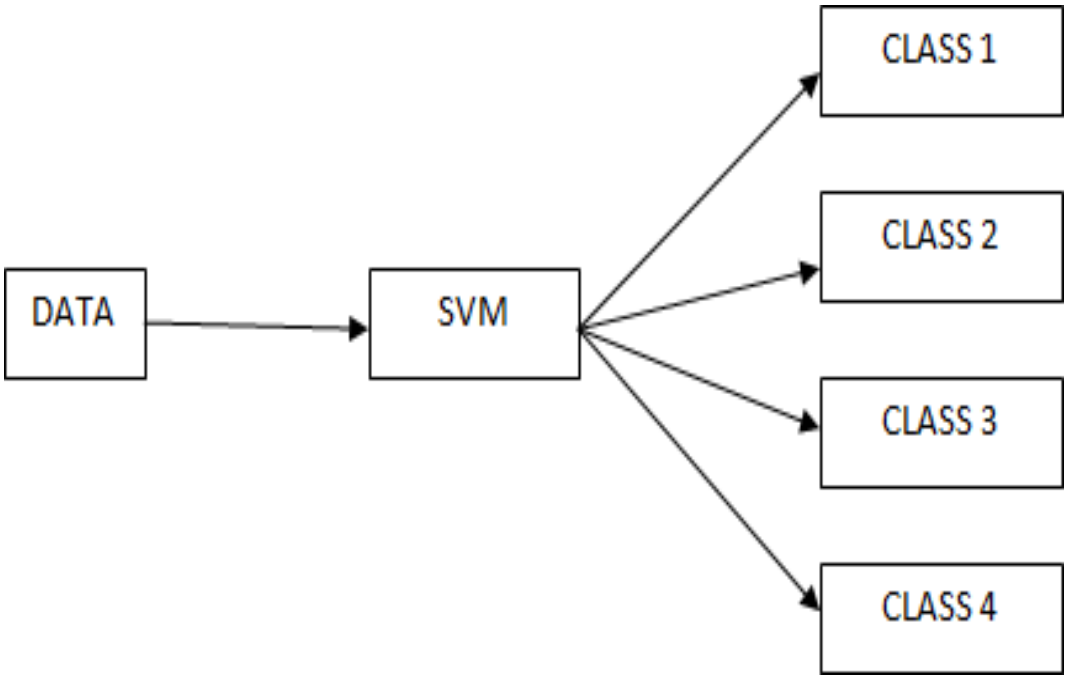

Figure 1: Different Classes via SVM

An SVM model which utilizes part as a "Sigmoid" bit can be considered as a two-layer neural system. SVM can be utilized with various pieces like "direct", "poly", "spiral premise work (RBF)" etc[13]. SVM is a regulated AI calculation that utilizes both characterization and regression[14]. In this, every datum point is plotted in n-dimensional space, and afterward, a hyperplane or line dictates by grouping. Figure2 wonderfully recognizes the two classes as the focuses on the left half of the line are in green circle class, and information focuses on the right side of line fall in red circle class. As SVM is a multi-dimensional space in this way, each point turns into a vector here.

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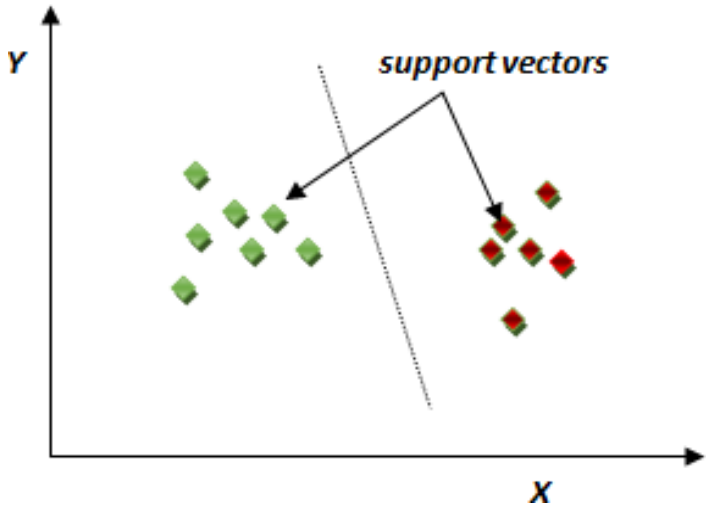

Figure 2: Support Vector Machine Classification

b) K-Nearest Neighbor Classification

KNN classification is an advantageous and straightforward classification method that can be implemented very quickly. The ideology is to find K's most similar samples from feature samples[15]. KNN is measured by finding the distance between eigenvalues, which is also known as Euclidean distance, as in figure3. The number of K neighbors is predetermined. Firstly, the default value taken for K is usually 5. Then, K nearest neighbors of a new data points are taken. Among these K neighbors, data points are counted in each category, and the new data point is assigned to the category for which you counted the most neighbors.

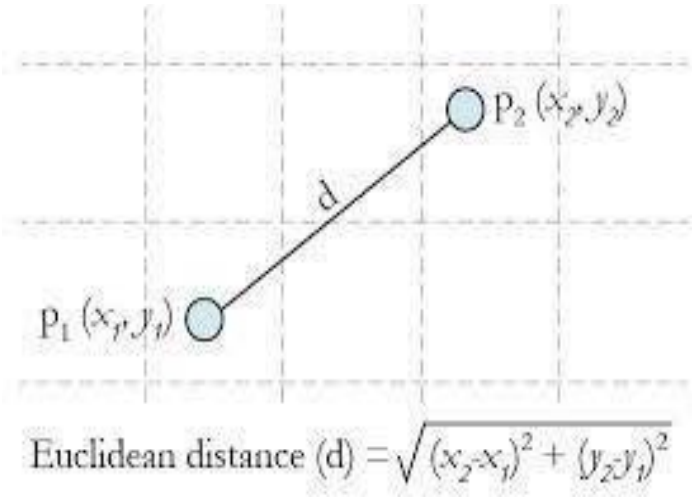

Figure 3: K-Nearest neighbour classification The Euclidean distance is calculated as below:

$$5h555\ (5_0, 5_0)\ 55555555555\ 55\ 555\ 55555\ 55^2\ 5\ (5_1, 5_1)^2 55555555555\ 55\ 55h55\ 55555.$$

c) Decision Tree Classification

Decision trees are also called a choice tree. The choice tree is a stream diagram in which the dataset is a part of the way with the goal that each part area has the most extreme number of information focuses, as in figure 4. Choice trees parcel the info space into cells where every cell has a place with one class[16]. Dividing is finished by the tests performed on the dataset. Every hub brings forth two streets, either a specific condition or a bogus one. It is a prescient model that could be viewed as a tree. Leaves of this tree speak to divided datasets. In this calculation, the best information point is root. In this calculation, we started with a pull for depicting the class of a record. In this information point's qualities are contrasted, and inward hubs of the choice tree will arrive at the leaf hub with the anticipated class.

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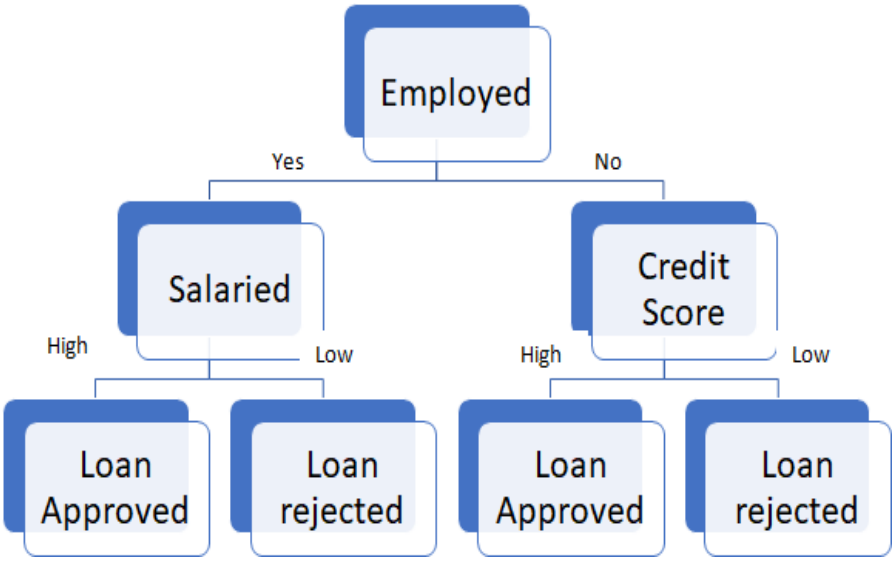

Figure 4: Decision Tree Classification

d) Random Forest Classification

Random forest is a version of ensemble learning, and it follows a bagging technique, as in figure 5. The base model used in the random forest is the decision tree. This algorithm selects data points randomly and creates multiple trees or forests. In this, random K data points are selected from the data set, and decision trees are built for these data points.

Samples were taken with a replacement, but trees are related in such a manner, so that the correlation between classifiers could be reduced. As it is an ensemble learning algorithm, it provides the best results with accuracy and in very less processing time. Fig 5. of Random Forest Classification diagram is shown below

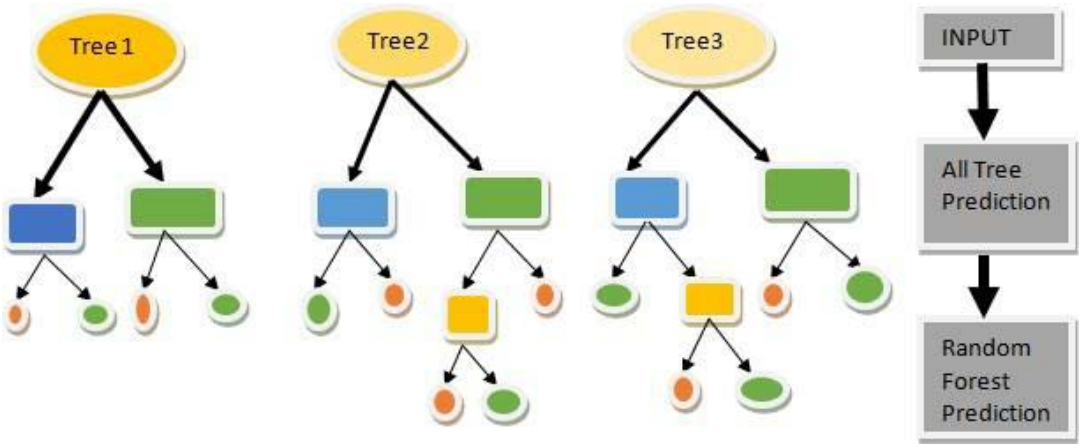

Figure 5: Random Forest Classification

e) Extreme Learning Machine

Extreme Learning Machine (ELM) is a technique that is used for a single hidden layer feed forward neural network that randomly chooses hidden nodes and determines the output weights[17] as in figure6. This method only has one input layer, one hidden layer, and one output layer. It is a bit different from traditional Back propagation algorithms.ELM sets the number of hidden neurons, and randomly weights are assigned between the input layer and hidden layers with the bias value of hidden units, then the output layer is calculated by using the Moore Penrose pseudo inverse method[18]. This algorithm provides an exceptional fast processing speed and great accuracy. When ELM compares with traditional neural network techniques, it found to be more convincing as it overcomes the overfitting problems[19]. Figure 6 is an ELM consisting of n input layer neurons, l hidden neurons, and m output layer neurons. The algorithm for ELM is as follow:

The training sample is [X,Y] = {xi, yi} (i= 1,2,……Q) and X and Y matrices can be described as

$$X = \begin{bmatrix} x_{11} & x_{12} & \cdots & x_{1Q} \\ x_{21} & x_{22} & \cdots & x_{2Q} \\ \vdots & \vdots & \ddots & \vdots \\ x_{n1} & x_{n2} & \cdots & x_{nQ} \end{bmatrix}$$

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$$Y = \begin{bmatrix} y_{11} & y_{12} & \cdots & y_{1Q} \\ y_{21} & y_{22} & \cdots & y_{2Q} \\ \vdots & \vdots & \ddots & \vdots \\ y_{m1} & y_{m2} & \cdots & y_{mQ} \end{bmatrix}$$

ELM generate the weights matrix for the input layer as

$$W = \begin{bmatrix} w_{11} & w_{12} & \cdots & w_{1n} \\ w_{21} & w_{22} & \cdots & w_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ w_{l1} & w_{l2} & \cdots & w_{ln} \end{bmatrix}$$

Biases are assumed between the hidden layer and output layer as:

$$\beta = \begin{bmatrix} \beta_{11} & \beta_{12} & \cdots & \beta_{1m} \\ \beta_{21} & \beta_{22} & \cdots & \beta_{2m} \\ \vdots & \vdots & \ddots & \vdots \\ \beta_{l1} & \beta_{l2} & \cdots & \beta_{lm} \end{bmatrix}$$

Bias is randomly set for hidden layer neurons as:

$$B = [b_1 b_2 \ldots b_n]^T$$

An activation function is chosen and according to figure 6 the output matrix can be expressed as

$$T = [t_1 t_2 \ldots t_Q]_{mxQ}$$

Calculate the Moore-Penrose pseudo inverse of the matrix.

Calculate the output weight matrix H as:

$$H\beta = T',$$

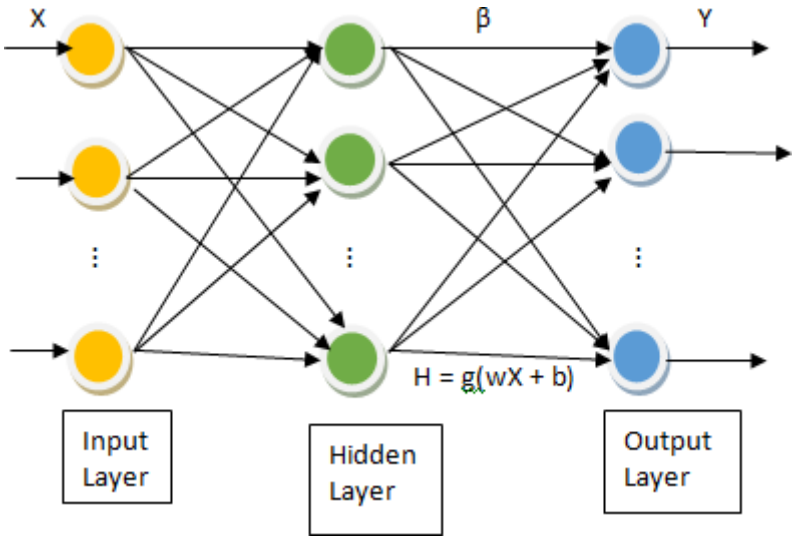

Figure 6: ELM Neural Network

IV. Methodology

We applied various algorithms, as mentioned above, on the Wisconsin Breast Cancer dataset taken from the UCI repository. We used Anaconda Spyder as a platform for coding with Python version 3.7. The methodology includes various techniques like Support Vector Machine (SVM), K-Nearest Neighbors (KNN), Decision tree (DT), Random Forest (RF), and Extreme Learning Machine (ELM) with dimension reduction techniques that is Principal Component Analysis (PCA).

In this paper, after reading the dataset, the preprocessing of data is done by splitting the dataset into a training set and testing set. The ratio used for splitting the dataset is 75:25. Python API Scikit-learn is used to perform different tasks. After splitting of data, feature scaling would be done. It helps normalize the data within a range so that the algorithm speed can increase. After normalization of data, dimensions are reduced. In this paper, PCA is used for this purpose, and the process had explained below.

a) Dimension Reduction

The process of reducing independent variables to principal variables is known as dimension reduction[14]. This process reduces the dimensions of the dataset so that data can be better viewed and utilized better. It is explained in figure7 below. It comprises of the below method[1]:

Feature Selection: Finding a subset of original features by applying different methods according to the information provided is the process of finding a subset

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of original features. It is a transformation in which data was compressed using linear algebra. PCA is used to reduce the dimensions of the dataset and improve the accuracy of the machine learning algorithm. The PCA algorithm, as in the figure, illustrates the entire working principle. The steps are as follows:

Step 1: the breast cancer dataset is prepared in a matrix form with all the features.
Step 2: Features are scaled or normalised by subtracting average from each dimension to form a data which has no mean at all.
Step 3: Covariance matrix is computed which describes the variance of data and

$$Cov(X,Y) = \frac{\sum_{i=1}^{n}(X_i - \bar{X})(Y_i - \bar{Y})}{(n-1)}$$

Step 4: Using above covariance, Eigenvalues and vectors are calculated which are useful in providing information about our data.
Step 5: Eigenvalues are arranged in non-increasing order. The feature with the largest Eigenvalue becomes the principal component of the dataset.
Step 6: A new vector forms which comprise all the principal components of the dataset.

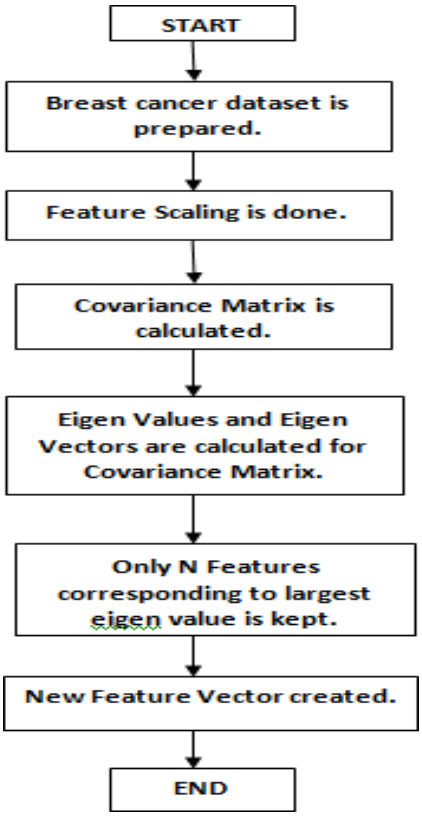

Figure 7: Principal Component Analysis Algorithm Once dimensions are reduced, model is selected for evaluating the results

b) Model Selection

It is the most exciting phase, as in this machine learning algorithm is selected. Machine learning algorithms are categorized into two groups, namely: Supervised and Unsupervised learning algorithms. In the supervised algorithm, the machine is trained on labeled data. Supervised learning algorithms are divided into regression and classification techniques. An unsupervised learning algorithm is a method in which unlabeled information is provided to the machine, and this information is analyzed without any direction. In this dataset, Y is a dependent variable, which is having values either malign (1) or benign (0)[14]. Here classification techniques are applied. In this paper, five algorithms have been chosen namely (already discussed above),

1. K-Nearest Neighbour
2. Support Vector Machine
3. Decision Tree
4. Random Forest
5. Extreme Learning Machine

V. Results

Below is a tabular format which gives results of the experiments performed on the above- discussed dataset by using various techniques. Different techniques used here are being compared based on training and testing accuracies and based on training and testing time taken on the dataset. The results clearly

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show that the Extreme Learning Machine is the best among others as it gives 99% accuracy and less time.

Table 1: Performance Comparison

MODEL	ACCURACY		TIME	
	Training (%)	Testing (%)	Training (ms)	Testing (ms)
Decision Tree(DT)	83	88	0.046875	0.015625
K-Nearest Neighbour(KNN)	88	89	0.359375	0.328125
Support Vector Machine(SVM)	90	90	0.0625	0.015625
Random Forest(RF)	93	93	0.15625	0.140625
Extreme Learning Machine(ELM)	94	99	0.046875	0.015625

The below figure 8 shows a bar chart comparison for all the models on the basis of accuracy and time.

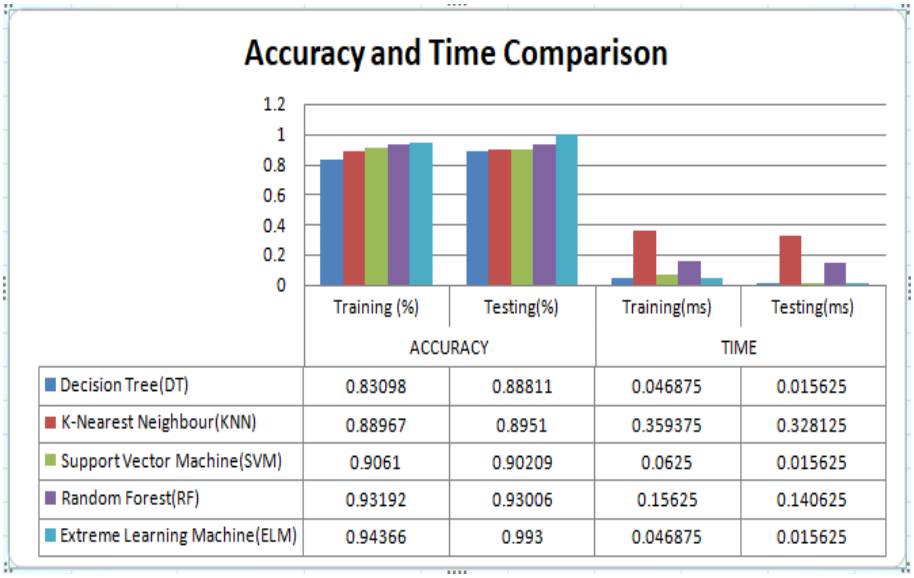

Figure 8: Accuracy and Time Comparison

VI. Conclusion

Extreme Learning Machine (ELM) will be utilized to foresee Breast malignancy with a rough 99% precision rate after 50 ages. This exactness is given with the choice instrument of PCA alongside ELM. This component can be utilized in the future to distinguish the amiable and dangerous cells in beginning periods and can be executed as an application in mammography procedures. There is consistently an opportunity to get better. This research study helps researchers working in the same field.

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Authors can submit papers and articles in an acceptable file format: MS Word (doc, docx), LaTeX (.tex, .zip or .rar including all of your files), Adobe PDF (.pdf), rich text format (.rtf), simple text document (.txt), Open Document Text (.odt), and Apple Pages (.pages). Our professional layout editors will format the entire paper according to our official guidelines. This is one of the highlights of publishing with Global Journals—authors should not be concerned about the formatting of their paper. Global Journals accepts articles and manuscripts in every major language, be it Spanish, Chinese, Japanese, Portuguese, Russian, French, German, Dutch, Italian, Greek, or any other national language, but the title, subtitle, and abstract should be in English. This will facilitate indexing and the pre-peer review process.

The following is the official style and template developed for publication of a research paper. Authors are not required to follow this style during the submission of the paper. It is just for reference purposes.

Manuscript Style Instruction (Optional)

- Microsoft Word Document Setting Instructions.
- Font type of all text should be Swis721 Lt BT.
- Page size: 8.27" x 11'", left margin: 0.65, right margin: 0.65, bottom margin: 0.75.
- Paper title should be in one column of font size 24.
- Author name in font size of 11 in one column.
- Abstract: font size 9 with the word "Abstract" in bold italics.
- Main text: font size 10 with two justified columns.
- Two columns with equal column width of 3.38 and spacing of 0.2.
- First character must be three lines drop-capped.
- The paragraph before spacing of 1 pt and after of 0 pt.
- Line spacing of 1 pt.
- Large images must be in one column.
- The names of first main headings (Heading 1) must be in Roman font, capital letters, and font size of 10.
- The names of second main headings (Heading 2) must not include numbers and must be in italics with a font size of 10.

Structure and Format of Manuscript

The recommended size of an original research paper is under 15,000 words and review papers under 7,000 words. Research articles should be less than 10,000 words. Research papers are usually longer than review papers. Review papers are reports of significant research (typically less than 7,000 words, including tables, figures, and references)

A research paper must include:

a) A title which should be relevant to the theme of the paper.
b) A summary, known as an abstract (less than 150 words), containing the major results and conclusions.
c) Up to 10 keywords that precisely identify the paper's subject, purpose, and focus.
d) An introduction, giving fundamental background objectives.
e) Resources and techniques with sufficient complete experimental details (wherever possible by reference) to permit repetition, sources of information must be given, and numerical methods must be specified by reference.
f) Results which should be presented concisely by well-designed tables and figures.
g) Suitable statistical data should also be given.
h) All data must have been gathered with attention to numerical detail in the planning stage.

Design has been recognized to be essential to experiments for a considerable time, and the editor has decided that any paper that appears not to have adequate numerical treatments of the data will be returned unrefereed.

i) Discussion should cover implications and consequences and not just recapitulate the results; conclusions should also be summarized.
j) There should be brief acknowledgments.
k) There ought to be references in the conventional format. Global Journals recommends APA format.

Authors should carefully consider the preparation of papers to ensure that they communicate effectively. Papers are much more likely to be accepted if they are carefully designed and laid out, contain few or no errors, are summarizing, and follow instructions. They will also be published with much fewer delays than those that require much technical and editorial correction.

The Editorial Board reserves the right to make literary corrections and suggestions to improve brevity.

Format Structure

It is necessary that authors take care in submitting a manuscript that is written in simple language and adheres to published guidelines.

All manuscripts submitted to Global Journals should include:

Title

The title page must carry an informative title that reflects the content, a running title (less than 45 characters together with spaces), names of the authors and co-authors, and the place(s) where the work was carried out.

Author details

The full postal address of any related author(s) must be specified.

Abstract

The abstract is the foundation of the research paper. It should be clear and concise and must contain the objective of the paper and inferences drawn. It is advised to not include big mathematical equations or complicated jargon.

Many researchers searching for information online will use search engines such as Google, Yahoo or others. By optimizing your paper for search engines, you will amplify the chance of someone finding it. In turn, this will make it more likely to be viewed and cited in further works. Global Journals has compiled these guidelines to facilitate you to maximize the web-friendliness of the most public part of your paper.

Keywords

A major lynchpin of research work for the writing of research papers is the keyword search, which one will employ to find both library and internet resources. Up to eleven keywords or very brief phrases have to be given to help data retrieval, mining, and indexing.

One must be persistent and creative in using keywords. An effective keyword search requires a strategy: planning of a list of possible keywords and phrases to try.

Choice of the main keywords is the first tool of writing a research paper. Research paper writing is an art. Keyword search should be as strategic as possible.

One should start brainstorming lists of potential keywords before even beginning searching. Think about the most important concepts related to research work. Ask, “What words would a source have to include to be truly valuable in a research paper?” Then consider synonyms for the important words.

It may take the discovery of only one important paper to steer in the right keyword direction because, in most databases, the keywords under which a research paper is abstracted are listed with the paper.

Numerical Methods

Numerical methods used should be transparent and, where appropriate, supported by references.

Abbreviations

Authors must list all the abbreviations used in the paper at the end of the paper or in a separate table before using them.

Formulas and equations

Authors are advised to submit any mathematical equation using either MathJax, KaTeX, or LaTeX, or in a very high-quality image.

Tables, Figures, and Figure Legends

Tables: Tables should be cautiously designed, uncrowned, and include only essential data. Each must have an Arabic number, e.g., Table 4, a self-explanatory caption, and be on a separate sheet. Authors must submit tables in an editable format and not as images. References to these tables (if any) must be mentioned accurately.

Figures

Figures are supposed to be submitted as separate files. Always include a citation in the text for each figure using Arabic numbers, e.g., Fig. 4. Artwork must be submitted online in vector electronic form or by emailing it.

Preparation of Eletronic Figures for Publication

Although low-quality images are sufficient for review purposes, print publication requires high-quality images to prevent the final product being blurred or fuzzy. Submit (possibly by e-mail) EPS (line art) or TIFF (halftone/ photographs) files only. MS PowerPoint and Word Graphics are unsuitable for printed pictures. Avoid using pixel-oriented software. Scans (TIFF only) should have a resolution of at least 350 dpi (halftone) or 700 to 1100 dpi (line drawings). Please give the data for figures in black and white or submit a Color Work Agreement form. EPS files must be saved with fonts embedded (and with a TIFF preview, if possible).

For scanned images, the scanning resolution at final image size ought to be as follows to ensure good reproduction: line art: >650 dpi; halftones (including gel photographs): >350 dpi; figures containing both halftone and line images: >650 dpi.

Color charges: Authors are advised to pay the full cost for the reproduction of their color artwork. Hence, please note that if there is color artwork in your manuscript when it is accepted for publication, we would require you to complete and return a Color Work Agreement form before your paper can be published. Also, you can email your editor to remove the color fee after acceptance of the paper.

Tips for writing a good quality Computer Science Research Paper

Techniques for writing a good quality computer science research paper:

1. Choosing the topic: In most cases, the topic is selected by the interests of the author, but it can also be suggested by the guides. You can have several topics, and then judge which you are most comfortable with. This may be done by asking several questions of yourself, like "Will I be able to carry out a search in this area? Will I find all necessary resources to accomplish the search? Will I be able to find all information in this field area?" If the answer to this type of question is "yes," then you ought to choose that topic. In most cases, you may have to conduct surveys and visit several places. Also, you might have to do a lot of work to find all the rises and falls of the various data on that subject. Sometimes, detailed information plays a vital role, instead of short information. Evaluators are human: The first thing to remember is that evaluators are also human beings. They are not only meant for rejecting a paper. They are here to evaluate your paper. So present your best aspect.

2. Think like evaluators: If you are in confusion or getting demotivated because your paper may not be accepted by the evaluators, then think, and try to evaluate your paper like an evaluator. Try to understand what an evaluator wants in your research paper, and you will automatically have your answer. Make blueprints of paper: The outline is the plan or framework that will help you to arrange your thoughts. It will make your paper logical. But remember that all points of your outline must be related to the topic you have chosen.

3. Ask your guides: If you are having any difficulty with your research, then do not hesitate to share your difficulty with your guide (if you have one). They will surely help you out and resolve your doubts. If you can't clarify what exactly you require for your work, then ask your supervisor to help you with an alternative. He or she might also provide you with a list of essential readings.

4. Use of computer is recommended: As you are doing research in the field of computer science then this point is quite obvious. Use right software: Always use good quality software packages. If you are not capable of judging good software, then you can lose the quality of your paper unknowingly. There are various programs available to help you which you can get through the internet.

5. Use the internet for help: An excellent start for your paper is using Google. It is a wondrous search engine, where you can have your doubts resolved. You may also read some answers for the frequent question of how to write your research paper or find a model research paper. You can download books from the internet. If you have all the required books, place importance on reading, selecting, and analyzing the specified information. Then sketch out your research paper. Use big pictures: You may use encyclopedias like Wikipedia to get pictures with the best resolution. At Global Journals, you should strictly follow here.

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6. Bookmarks are useful: When you read any book or magazine, you generally use bookmarks, right? It is a good habit which helps to not lose your continuity. You should always use bookmarks while searching on the internet also, which will make your search easier.

7. Revise what you wrote: When you write anything, always read it, summarize it, and then finalize it.

8. Make every effort: Make every effort to mention what you are going to write in your paper. That means always have a good start. Try to mention everything in the introduction—what is the need for a particular research paper. Polish your work with good writing skills and always give an evaluator what he wants. Make backups: When you are going to do any important thing like making a research paper, you should always have backup copies of it either on your computer or on paper. This protects you from losing any portion of your important data.

9. Produce good diagrams of your own: Always try to include good charts or diagrams in your paper to improve quality. Using several unnecessary diagrams will degrade the quality of your paper by creating a hodgepodge. So always try to include diagrams which were made by you to improve the readability of your paper. Use of direct quotes: When you do research relevant to literature, history, or current affairs, then use of quotes becomes essential, but if the study is relevant to science, use of quotes is not preferable.

10.Use proper verb tense: Use proper verb tenses in your paper. Use past tense to present those events that have happened. Use present tense to indicate events that are going on. Use future tense to indicate events that will happen in the future. Use of wrong tenses will confuse the evaluator. Avoid sentences that are incomplete.

11. Pick a good study spot: Always try to pick a spot for your research which is quiet. Not every spot is good for studying.

12. Know what you know: Always try to know what you know by making objectives, otherwise you will be confused and unable to achieve your target.

13. Use good grammar: Always use good grammar and words that will have a positive impact on the evaluator; use of good vocabulary does not mean using tough words which the evaluator has to find in a dictionary. Do not fragment sentences. Eliminate one-word sentences. Do not ever use a big word when a smaller one would suffice.

Verbs have to be in agreement with their subjects. In a research paper, do not start sentences with conjunctions or finish them with prepositions. When writing formally, it is advisable to never split an infinitive because someone will (wrongly) complain. Avoid clichés like a disease. Always shun irritating alliteration. Use language which is simple and straightforward. Put together a neat summary.

14. Arrangement of information: Each section of the main body should start with an opening sentence, and there should be a changeover at the end of the section. Give only valid and powerful arguments for your topic. You may also maintain your arguments with records.

15. Never start at the last minute: Always allow enough time for research work. Leaving everything to the last minute will degrade your paper and spoil your work.

16. Multitasking in research is not good: Doing several things at the same time is a bad habit in the case of research activity. Research is an area where everything has a particular time slot. Divide your research work into parts, and do a particular part in a particular time slot.

17. Never copy others' work: Never copy others' work and give it your name because if the evaluator has seen it anywhere, you will be in trouble. Take proper rest and food: No matter how many hours you spend on your research activity, if you are not taking care of your health, then all your efforts will have been in vain. For quality research, take proper rest and food.

18. Go to seminars: Attend seminars if the topic is relevant to your research area. Utilize all your resources.

19. Refresh your mind after intervals: Try to give your mind a rest by listening to soft music or sleeping in intervals. This will also improve your memory. Acquire colleagues: Always try to acquire colleagues. No matter how sharp you are, if you acquire colleagues, they can give you ideas which will be helpful to your research.

20. Think technically: Always think technically. If anything happens, search for its reasons, benefits, and demerits. Think and then print: When you go to print your paper, check that tables are not split, headings are not detached from their descriptions, and page sequence is maintained.

21. Adding unnecessary information: Do not add unnecessary information like "I have used MS Excel to draw graphs." Irrelevant and inappropriate material is superfluous. Foreign terminology and phrases are not apropos. One should never take a broad view. Analogy is like feathers on a snake. Use words properly, regardless of how others use them. Remove quotations. Puns are for kids, not grunt readers. Never oversimplify: When adding material to your research paper, never go for oversimplification; this will definitely irritate the evaluator. Be specific. Never use rhythmic redundancies. Contractions shouldn't be used in a research paper. Comparisons are as terrible as clichés. Give up ampersands, abbreviations, and so on. Remove commas that are not necessary. Parenthetical words should be between brackets or commas. Understatement is always the best way to put forward earth-shaking thoughts. Give a detailed literary review.

22. Report concluded results: Use concluded results. From raw data, filter the results, and then conclude your studies based on measurements and observations taken. An appropriate number of decimal places should be used. Parenthetical remarks are prohibited here. Proofread carefully at the final stage. At the end, give an outline to your arguments. Spot perspectives of further study of the subject. Justify your conclusion at the bottom sufficiently, which will probably include examples.

23. Upon conclusion: Once you have concluded your research, the next most important step is to present your findings. Presentation is extremely important as it is the definite medium though which your research is going to be in print for the rest of the crowd. Care should be taken to categorize your thoughts well and present them in a logical and neat manner. A good quality research paper format is essential because it serves to highlight your research paper and bring to light all necessary aspects of your research.

Informal Guidelines of Research Paper Writing

Key points to remember:

- Submit all work in its final form.
- Write your paper in the form which is presented in the guidelines using the template.
- Please note the criteria peer reviewers will use for grading the final paper.

Final points:

One purpose of organizing a research paper is to let people interpret your efforts selectively. The journal requires the following sections, submitted in the order listed, with each section starting on a new page:

The introduction: This will be compiled from reference matter and reflect the design processes or outline of basis that directed you to make a study. As you carry out the process of study, the method and process section will be constructed like that. The results segment will show related statistics in nearly sequential order and direct reviewers to similar intellectual paths throughout the data that you gathered to carry out your study.

The discussion section:

This will provide understanding of the data and projections as to the implications of the results. The use of good quality references throughout the paper will give the effort trustworthiness by representing an alertness to prior workings.

Writing a research paper is not an easy job, no matter how trouble-free the actual research or concept. Practice, excellent preparation, and controlled record-keeping are the only means to make straightforward progression.

General style:

Specific editorial column necessities for compliance of a manuscript will always take over from directions in these general guidelines.

To make a paper clear: Adhere to recommended page limits.

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Mistakes to avoid:

- Insertion of a title at the foot of a page with subsequent text on the next page.
- Separating a table, chart, or figure—confine each to a single page.
- Submitting a manuscript with pages out of sequence.
- In every section of your document, use standard writing style, including articles ("a" and "the").
- Keep paying attention to the topic of the paper.
- Use paragraphs to split each significant point (excluding the abstract).
- Align the primary line of each section.
- Present your points in sound order.
- Use present tense to report well-accepted matters.
- Use past tense to describe specific results.
- Do not use familiar wording; don't address the reviewer directly. Don't use slang or superlatives.
- Avoid use of extra pictures—include only those figures essential to presenting results.

Title page:

Choose a revealing title. It should be short and include the name(s) and address(es) of all authors. It should not have acronyms or abbreviations or exceed two printed lines.

Abstract: This summary should be two hundred words or less. It should clearly and briefly explain the key findings reported in the manuscript and must have precise statistics. It should not have acronyms or abbreviations. It should be logical in itself. Do not cite references at this point.

An abstract is a brief, distinct paragraph summary of finished work or work in development. In a minute or less, a reviewer can be taught the foundation behind the study, common approaches to the problem, relevant results, and significant conclusions or new questions.

Write your summary when your paper is completed because how can you write the summary of anything which is not yet written? Wealth of terminology is very essential in abstract. Use comprehensive sentences, and do not sacrifice readability for brevity; you can maintain it succinctly by phrasing sentences so that they provide more than a lone rationale. The author can at this moment go straight to shortening the outcome. Sum up the study with the subsequent elements in any summary. Try to limit the initial two items to no more than one line each.

Reason for writing the article—theory, overall issue, purpose.

- Fundamental goal.
- To-the-point depiction of the research.
- Consequences, including definite statistics—if the consequences are quantitative in nature, account for this; results of any numerical analysis should be reported. Significant conclusions or questions that emerge from the research.

Approach:

- Single section and succinct.
- An outline of the job done is always written in past tense.
- Concentrate on shortening results—limit background information to a verdict or two.
- Exact spelling, clarity of sentences and phrases, and appropriate reporting of quantities (proper units, important statistics) are just as significant in an abstract as they are anywhere else.

Introduction:

The introduction should "introduce" the manuscript. The reviewer should be presented with sufficient background information to be capable of comprehending and calculating the purpose of your study without having to refer to other works. The basis for the study should be offered. Give the most important references, but avoid making a comprehensive appraisal of the topic. Describe the problem visibly. If the problem is not acknowledged in a logical, reasonable way, the reviewer will give no attention to your results. Speak in common terms about techniques used to explain the problem, if needed, but do not present any particulars about the protocols here.

The following approach can create a valuable beginning:

- Explain the value (significance) of the study.
- Defend the model—why did you employ this particular system or method? What is its compensation? Remark upon its appropriateness from an abstract point of view as well as pointing out sensible reasons for using it.
- Present a justification. State your particular theory(-ies) or aim(s), and describe the logic that led you to choose them.
- Briefly explain the study's tentative purpose and how it meets the declared objectives.

Approach:

Use past tense except for when referring to recognized facts. After all, the manuscript will be submitted after the entire job is done. Sort out your thoughts; manufacture one key point for every section. If you make the four points listed above, you will need at least four paragraphs. Present surrounding information only when it is necessary to support a situation. The reviewer does not desire to read everything you know about a topic. Shape the theory specifically—do not take a broad view.

As always, give awareness to spelling, simplicity, and correctness of sentences and phrases.

Procedures (methods and materials):

This part is supposed to be the easiest to carve if you have good skills. A soundly written procedures segment allows a capable scientist to replicate your results. Present precise information about your supplies. The suppliers and clarity of reagents can be helpful bits of information. Present methods in sequential order, but linked methodologies can be grouped as a segment. Be concise when relating the protocols. Attempt to give the least amount of information that would permit another capable scientist to replicate your outcome, but be cautious that vital information is integrated. The use of subheadings is suggested and ought to be synchronized with the results section.

When a technique is used that has been well-described in another section, mention the specific item describing the way, but draw the basic principle while stating the situation. The purpose is to show all particular resources and broad procedures so that another person may use some or all of the methods in one more study or referee the scientific value of your work. It is not to be a step-by-step report of the whole thing you did, nor is a methods section a set of orders.

Materials:

Materials may be reported in part of a section or else they may be recognized along with your measures.

Methods:

- Report the method and not the particulars of each process that engaged the same methodology.
- Describe the method entirely.
- To be succinct, present methods under headings dedicated to specific dealings or groups of measures.
- Simplify—detail how procedures were completed, not how they were performed on a particular day.
- If well-known procedures were used, account for the procedure by name, possibly with a reference, and that's all.

Approach:

It is embarrassing to use vigorous voice when documenting methods without using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result, when writing up the methods, most authors use third person passive voice.

Use standard style in this and every other part of the paper—avoid familiar lists, and use full sentences.

What to keep away from:

- Resources and methods are not a set of information.
- Skip all descriptive information and surroundings—save it for the argument.
- Leave out information that is immaterial to a third party.

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Results:

The principle of a results segment is to present and demonstrate your conclusion. Create this part as entirely objective details of the outcome, and save all understanding for the discussion.

The page length of this segment is set by the sum and types of data to be reported. Use statistics and tables, if suitable, to present consequences most efficiently.

You must clearly differentiate material which would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matters should not be submitted at all except if requested by the instructor.

Content:

- Sum up your conclusions in text and demonstrate them, if suitable, with figures and tables.
- In the manuscript, explain each of your consequences, and point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation of an exacting study.
- Explain results of control experiments and give remarks that are not accessible in a prescribed figure or table, if appropriate.
- Examine your data, then prepare the analyzed (transformed) data in the form of a figure (graph), table, or manuscript.

What to stay away from:

- Do not discuss or infer your outcome, report surrounding information, or try to explain anything.
- Do not include raw data or intermediate calculations in a research manuscript.
- Do not present similar data more than once.
- A manuscript should complement any figures or tables, not duplicate information.
- Never confuse figures with tables—there is a difference.

Approach:

As always, use past tense when you submit your results, and put the whole thing in a reasonable order.

Put figures and tables, appropriately numbered, in order at the end of the report.

If you desire, you may place your figures and tables properly within the text of your results section.

Figures and tables:

If you put figures and tables at the end of some details, make certain that they are visibly distinguished from any attached appendix materials, such as raw facts. Whatever the position, each table must be titled, numbered one after the other, and include a heading. All figures and tables must be divided from the text.

Discussion:

The discussion is expected to be the trickiest segment to write. A lot of papers submitted to the journal are discarded based on problems with the discussion. There is no rule for how long an argument should be.

Position your understanding of the outcome visibly to lead the reviewer through your conclusions, and then finish the paper with a summing up of the implications of the study. The purpose here is to offer an understanding of your results and support all of your conclusions, using facts from your research and generally accepted information, if suitable. The implication of results should be fully described.

Infer your data in the conversation in suitable depth. This means that when you clarify an observable fact, you must explain mechanisms that may account for the observation. If your results vary from your prospect, make clear why that may have happened. If your results agree, then explain the theory that the proof supported. It is never suitable to just state that the data approved the prospect, and let it drop at that. Make a decision as to whether each premise is supported or discarded or if you cannot make a conclusion with assurance. Do not just dismiss a study or part of a study as "uncertain."

Research papers are not acknowledged if the work is imperfect. Draw what conclusions you can based upon the results that you have, and take care of the study as a finished work.

- You may propose future guidelines, such as how an experiment might be personalized to accomplish a new idea.
- Give details of all of your remarks as much as possible, focusing on mechanisms.
- Make a decision as to whether the tentative design sufficiently addressed the theory and whether or not it was correctly restricted. Try to present substitute explanations if they are sensible alternatives.
- One piece of research will not counter an overall question, so maintain the large picture in mind. Where do you go next? The best studies unlock new avenues of study. What questions remain?
- Recommendations for detailed papers will offer supplementary suggestions.

Approach:

When you refer to information, differentiate data generated by your own studies from other available information. Present work done by specific persons (including you) in past tense.

Describe generally acknowledged facts and main beliefs in present tense.

The Administration Rules

Administration Rules to Be Strictly Followed before Submitting Your Research Paper to Global Journals Inc.

Please read the following rules and regulations carefully before submitting your research paper to Global Journals Inc. to avoid rejection.

Segment draft and final research paper: You have to strictly follow the template of a research paper, failing which your paper may get rejected. You are expected to write each part of the paper wholly on your own. The peer reviewers need to identify your own perspective of the concepts in your own terms. Please do not extract straight from any other source, and do not rephrase someone else's analysis. Do not allow anyone else to proofread your manuscript.

Written material: You may discuss this with your guides and key sources. Do not copy anyone else's paper, even if this is only imitation, otherwise it will be rejected on the grounds of plagiarism, which is illegal. Various methods to avoid plagiarism are strictly applied by us to every paper, and, if found guilty, you may be blacklisted, which could affect your career adversely. To guard yourself and others from possible illegal use, please do not permit anyone to use or even read your paper and file.

Criterion for Grading a Research Paper (Compilation) by Global Journals Inc. (US)

Please note that following table is only a Grading of "Paper Compilation" and not on "Performed/Stated Research" whose grading solely depends on Individual Assigned Peer Reviewer and Editorial Board Member. These can be available only on request and after decision of Paper. This report will be the property of Global Journals Inc. (US).

Topics	Grades		
	A-B	**C-D**	**E-F**
Abstract	Clear and concise with appropriate content, Correct format. 200 words or below	Unclear summary and no specific data, Incorrect form Above 200 words	No specific data with ambiguous information Above 250 words
Introduction	Containing all background details with clear goal and appropriate details, flow specification, no grammar and spelling mistake, well organized sentence and paragraph, reference cited	Unclear and confusing data, appropriate format, grammar and spelling errors with unorganized matter	Out of place depth and content, hazy format
Methods and Procedures	Clear and to the point with well arranged paragraph, precision and accuracy of facts and figures, well organized subheads	Difficult to comprehend with embarrassed text, too much explanation but completed	Incorrect and unorganized structure with hazy meaning
Result	Well organized, Clear and specific, Correct units with precision, correct data, well structuring of paragraph, no grammar and spelling mistake	Complete and embarrassed text, difficult to comprehend	Irregular format with wrong facts and figures
Discussion	Well organized, meaningful specification, sound conclusion, logical and concise explanation, highly structured paragraph reference cited	Wordy, unclear conclusion, spurious	Conclusion is not cited, unorganized, difficult to comprehend
References	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring

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