Online ISSN : 0975-4172
Print ISSN : 0975-4350

Global Journal of Computer Science and Technology : D
Neural and AI

DISCOVERING THOUGHTS AND INVENTING FUTURE

Highlights

- Artificial Neural Network
- Estimation of Global Solar
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Volume 12 | Issue 11 | Version 1.0 ENG

Global Journal of Computer Science and Technology: D
Neural & Artificial Intelligence

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Volume 12 Issue 11 (Ver. 1.0)

Open Association of Research Society

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Employer Identification Number (EIN):
USA Tax ID: 98-0673427

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USA Toll Free: +001-888-839-7392

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Offset Typesetting

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Global Journal of Computer Science and Technology
Neural & Artificial Intelligence
Volume 12 Issue 11 Version 1.0 Year 2012
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals Inc. (USA)
Online ISSN: 0975-4172 & Print ISSN: 0975-4350

Recognition of Similar Shaped Handwritten Marathi Characters Using Artificial Neural Network

By Mrs. Archana P.Jane & Mukesh. A.Pund
Ram Meghe Institute of Research & Technology, Badnera

Abstract - The growing need have handwritten Marathi character recognition in Indian offices such as passport, railways etc has made it vital area of a research. Similar shape characters are more prone to misclassification. In this paper a novel method is provided to recognize handwritten Marathi characters based on their features extraction and adaptive smoothing technique. Feature selections methods avoid unnecessary patterns in an image whereas adaptive smoothing technique form smooth shape of charecters. Combination of both these approaches leads to the better results. Previous study shows that, no one technique achieves 100% accuracy in handwritten character recognition area. This approach of combining both adaptive smoothing & feature extraction gives better results (approximately 75-100) and expected outcomes.

Keywords : *Character recognition, features Extraction, adaptive Smoothing, Image segmentation, pattern matching, Image Pixel Rating.*

GJCST-E Classification: *I.5.2*

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Mrs. Archana P.Jane [α] & Mukesh. A.Pund [σ]

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Keywords : Character recognition, features Extraction, adaptive Smoothing, Image segmentation, pattern matching, Image Pixel Rating.

I. Introduction

In recent years, handwritten Marathi character recognition has grabbed a lot of attention as Marathi being primary official language in Maharashtra has wide application in areas like passport, railways, postal address reading etc. Handwritten character recognition [4] consist of six main steps.

i. Handwritten drawn of character
ii. Training on handwritten characters.
iii. Testing on handwritten characters.

- Pixel rating an Image
- Image smoothing
- Features extraction.
- Image segmentation.
- Patterns matching
- Result display as per their % of pattern matched.

Earlier, traditional classifiers such as Nearest Neighbor (NN), Hidden Markov Models (HMM) etc. were adopted for character recognition, however they exhibit certain limitations. Machine learning (ML) algorithms [6] provide a promising alternative in character recognition based on the feature set given to them. Each character image sample can be expressed in terms of some 26 Computer Science & Information Technology (CS & IT) quantifiable attributes called features. A variety of features can be extracted such as primitives, profiles etc. Multi Layer (ML) algorithm is then trained with this list of measured features, so that it maps these input features onto a class among certain predefined classes [1, 2]. Then the classifier can be used to determine the class of unknown samples used for testing.

II. Literature Survey

Character recognition task has been attempted through many different approaches like template matching, statistical techniques like NN, HMM, Quadratic Discriminant function (QDF) etc. Template matching works effectively for recognition of standard fonts, but gives poor performance with handwritten characters and when the size of dataset grows. It is not an effective technique if there is font discrepancy [4]. HMM models achieved great success in the field of speech recognition in past decades, however developing a 2-D HMM model for character recognition is found difficult and complex [5]. NN is found very computationally expensive in recognition purpose [6]. N. Araki et al. [7] applied Bayesian filters based on Bayes Theorem for handwritten character recognition. Later, discriminative classifiers such as Artificial Neural Network (ANN) and Support Vector Machine (SVM) grabbed a lot of attention. In [3] G. Vamvakas et al. compared the performance of three classifiers: Naive Bayes, K-NN and SVM and attained best performance with SVM. However SVM suffers from limitation of selection of kernel. ANNs can adapt to changes in the data and learn the characteristics of input signal [8].Also, ANNs consume less storage and computation than SVMs [9]. Mostly used classifiers based on ANN are MLP and RBFN. B.K. Verma [10] presented a system for HCR using MLP and RBFN networks in the task of handwritten Hindi character recognition. The error back propagation algorithm was used to train the MLP networks. J. Sutha et al. in [11] showed the effectiveness of MLP for Tamil HCR using the Fourier descriptor features. R. Gheroie et al. in [12] proposed handwritten Farsi character recognition using MLP trained with error back propagation algorithm. Computer Science & Information Technology (CS & IT) 27 similar

Author α : M.E (Scholar), Prof.Ram Meghe Institute of Research & Technology, Badnera. E-mail : apjane@rediffmail.com
Author σ : Associate Prof. Prof. Ram Meghe Institute of Research & Technology, Bandera. E-mail : pundmukesh@rediffmail.com

shaped characters are difficult to differentiate because of very minor variations in their structures. In [13] T. Wakabayashi et al. proposed an F-Ratio (Fisher Ratio) based feature extraction method to improve results of similar shaped characters. They considered pairs of similar shaped characters of different scripts like English, Arabic/Persian, Devnagri, etc. and used QDF for recognition purpose. QDF suffers from limitation of minimum required size of dataset. F. Yang et al. in [14] proposed a method that combines both structural and statistical features of characters for similar handwritten Chinese character recognition. As it can be seen that various feature extraction methods and classifiers have been used for character recognition by researchers that are suitable for their work, we propose a novel feature set that is expected to perform well for this application. In this paper, the features are extracted on the basis of character geometry, which are then fed to each of the selected ML algorithms for recognition of SSHMC.

III. Proposed Method

In this paper, we proposed a novel method based on combinations on pixel rating an image, feature extractions and Image pattern matching. Proposed method gives considerable expected outputs than previous proposed character recognition algorithms like HMM, NN, ML etc. Proposed method consists of following phases.

a) Training

In this proposed work, Training on images consists of listing all handwritten images with respect to its standard Marathi character images. See the training set data in the following figure.

Handwritten Images	Standard Marathi Character Images
अ	अ
आ	आ
इ	इ
ई	ई
उ	उ
स,	स,
क	क
र	र
न	न
म	म
द	द
प	प

In Training phase, we are having 51 Marathi characters and we Trained 20 handwritten characters with respect to each corresponding standard Marathi character images. The no. Of images in Training affects turnaround time of entire process execution.

$$Ti \propto N \text{ ----------Eq.3.1.1}$$

Where
T_i=Turnaround time.
N=No. of Training images.

An accuracy of result depends on the no. of trained handwritten images per standard Marathi character image.

$$Ac \propto \frac{Him}{Sim} \text{----------Eq.2.1.2}$$

Where
A_c= Accuracy of character Recognition
H_{im}=No. of handwritten patterns.
S_{im}= Standard Marathi image=1

b) Testing

Testing is a phase where no. of Marathi handwritten character image is tested against training set handwritten images.

Testing consists of following phases:

c) RGB-to-Binary image conversion

As we maintained Training images as a binary images, there is need to convert testing image into binary image. Binary image avoids unnecessary image segmentation and features extraction.

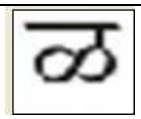
	
Input handwritten image	Input binary image

Table 3.2.2.1

d) Pixel rate an image

	
Input binary image	Pixel Rate Image

Table 3.2.2.2

Pixel rate an image used to identify an image pixel value either on or off. We set pixels height and width equal to 10 of which we got result shown in above table 3.2.2.2. Height, Width of an pixel rate image should be proportionate to size of an binary image.

From the table 3.2.2.2, it is observed that having pixels size 10 x 10 leads to loss of pixels which are represented with an equation

$$Pl = \int_1^{n} Pnhw(\log_2 n)$$----------Eq.3.2.1

Where
P_l= No. of Pixels loss
P_{nhw}= Pixels new height, width.
n=No. of off pixels in binary image.

e) Image edge smoothing

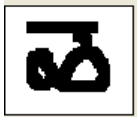
From literature review, it is observed that patterns in handwritten characters have large deviation factor with respect to its standard image pattern. Deviation factor is a mod difference value between no. of pixels patterns in training and testing images and represented with

$$Df = |Tr - Ts|$$-----eq.3.3.1

Where
D_f= Deviation factor.
T_r= No. of segments of training image.
T_s= No. of segments of testing image.

$$Tr = Ts = \sum_1^s \max_{1 \le hw \le 100} d\left(\frac{s}{\le n}\right)$$--------Eq.3.3.2

Where
S= size of an image.
hw= new height, width of segment.
D_n = new segment size

	
Input binary image	**Image After Edge Smoothing**

Average searching time for character recognition of test image uses best-fit search approach with training set images.

$$O(t) = O(N)$$-------eq.3.3.3

Where
O (t) =Average searching time.

f) Image segmentation

To recognize character, segmentation is done based on their patterns of size 2x2 as per equation 3.3.2.

g) Pattern Matching

We form fuzzy pattern match of pixels value (Equivalent decimal value) of segmented image based on which we match an object array patterns with following fuzzy rules:

$$Ptm = \sum_{i=1}^{\frac{s}{4}} Tsi \; v \left(Tri \; v \, Tri + 1 \, v \ldots\ldots v \, \frac{Trs}{4}\right)$$----eq3.5.1

Where
P_{tm}= fuzzy pattern match.
S= size of training image=size of testing image.

h) Experiment result

Sr No	Test Image	Recognize Image 1	Recognize Image 2	Recognize Image 3	Recognize Image 4	Recognize Image 5	Recognize Image 6	Recognize Image 7	Recognize Image 8	Recognize Image 9
1	प	प	व	ब	फ	म	क	ष	भ	य
Std.marathi char.		प	व	ब	फ	म	क	ष	भ	य
Deviation Factor		0.0000	0.1923	0.2345	0.2378	0.3124	0.3564	0.4219	0.5638	0.5698
Recognize Character								प		
Sr No	Test Image	Recognize Image 1	Recognize Image 2	Recognize Image 3	Recognize Image 4	Recognize Image 5	Recognize Image 6	Recognize Image 7	Recognize Image 8	Recognize Image 9
2	म	म	प	भ	फ	ष	स	य	क	न
Std.marathi char.		म	प	भ	फ	ष	स	य	क	न
Deviation Factor		0.0000	0.1276	0.2234	0.2567	0.3015	0.3567	0.4216	0.5216	0.5767
Recognize Character								म		
Sr no	Test Image	Recognize Image 1	Recognize Image 2	Recognize Image 3	Recognize Image 4	Recognize Image 5	Recognize Image 6	Recognize Image 7	Recognize Image 8	Recognize Image 9
3	फ	फ	प	व	क	अ	स	ष	थ	घ
Std.marathi char.		फ	प	व	क	अ	स	ष	थ	घ
Deviation Factor		0.0000	0.1435	0.24545	0.2535	0.25467	0.258965	0.46556	0.525464	0.58967
Recognize Character								फ		

Experiment Result 1

Sr.no.	No. of Training Images / standard Marathi characters	Type of Images	% Loss of Pixels/Image in Pixel rating Image	Average % Accuracy
1	10	JPG	33%	70%-80%
2	20	JPG	33%	80%-85%
3	30	JPG	33%	85%-90%
4	50	JPG	33%	90%-98%

Experiment Result 2

IV. Conclusion

From the study of Literature survey and proposed method, we conclude that, proposed method gives considerable and expected accuracy than previous character recognitions techniques like HMM, ML, NBP etc. Experiment results shows that, proposed method achieved an accuracy nearer to 98%provided no. of training samples per standard Marathi images should be maximum as possible as.

V. Future Work

In the process of recognizing handwritten character, human brains may fails that's why to keep an expectations to achieve 100% accuracy is not expectable. A future work is needed to correctly analyze segments patterns and fuzzy rules mentioned in an equation 3.5.1 to achieve better accuracy which should be independent of no. of training set images.

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Global Journal of Computer Science and Technology
Neural & Artificial Intelligence
Volume 12 Issue 11 Version 1.0 Year 2012
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals Inc. (USA)
Online ISSN: 0975-4172 & Print ISSN: 0975-4350

Comparison of Angstrom-Prescott, Multiple Regression and Artificial Neural Network Models for the Estimation of Global Solar Radiation in Warri, Nigeria

By Ibeh G.F, Agbo G.A, Oboma D.N, Ekpe J.E & Odoh S
Ebonyi State University, Abakaliki

Abstract - In this paper, the application of artificial neural network, Angstrom-Prescott and multiple regressions models to study the estimation of global solar radiation in Warri, Nigeria for a time period of seventeen years were carried out. Our study based on Multi-Layer Perceptron (MLP) of artificial neural network was trained and tested using seventeen years (1991-2007) meteorological data. The error results and statistical analysis shows that MLP network has the minimum forecasting error and can be considered as a better model to estimate global solar radiation in Warri compare to the estimation from multiple regressions and Angstrom-Prescott models.

Keywords : Artificial neural networks, multiple regression, Angstrom-Prescott, prediction, troposphere, Multi-layer perceptron.

GJCST-E Classification : I.2.6

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Ibeh G.F [α], Agbo G.A [α], Oboma D.N [α], Ekpe J.E [α], & Odoh S [σ]

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Keywords : Artificial neural networks, multiple regression, Angstrom-Prescott, prediction, troposphere, Multi-layer perceptron.

I. Introduction

The troposphere is the lower layer of the Earth's atmosphere. Most of the weather phenomena, systems, convection, turbulence and clouds occur in this layer, although some may extend into the lower portion of the stratosphere. The troposphere contains almost all the atmospheric water vapour. It contains about 70 to 80 percent of the total mass of the earth's atmosphere and 99 per cent of the water vapour. Temperature and water vapour content in the troposphere decrease rapidly with altitude and thus most of the water vapour in the troposphere is concentrated in the lower, warmer zone. Water vapor concentrations vary with latitude. The condition of the atmosphere as dictated by the sun is very dynamic both in space and time scales. The resulting solar interactions on the atmosphere leads to changes in weather as well as the so called climate change.

The objective of this study is to model the relevant data provided by the Nigerian Meteorological Agency, Federal Ministry of Aviation, Oshodi, Lagos, Nigeria as shown in Table 1 and the global solar radiation data collected from Renewable Energy for Rural Industrialization and Development in Nigeria using the Angstrom-Prescott, statistical technique (multiple regression model) and the artificial neural networks (ANN), and then comparing the results of these three models along with the measured solar radiation data. The table below (Table1) shows the atmospheric parameters in preparation of the prediction.

Table 1 : Meteorological Data for Warri

Month	$\bar{n}$ Hour	T_m °C	$\bar{H}_M$ (MJm^2day^{-1})
JAN	4.72	33.00	12.52
FEB	4.80	33.68	14.26
MAR	4.61	33.45	15.64.
APR	4.92	32.86	18.11
MAY	4.89	31.93	12.84
JUN	3.86	30.53	13.99
JUL	2.27	28.77	14.67
AUG	2.31	28.89	13.85
SEPT	2.57	29.99	15.40
OCT	4.15	31.28	16.55
NOV	5.23	32.74	15.81
DEC	5.66	32.66	18.16

Author α : Department of Industrial Physics, Ebonyi state University, Abakaliki Nigeria. E-mail : ibehgabriel@ymail.com

Author σ : Nigeria Turkish International College, Kano.

II. Methods and Procedures Multiple Regressions

Regression method is one of the most widely used statistical techniques Mendenhall and Beaver (1994) and Sharda, and Patil (1990). Multiple regression analysis is a multivariate statistical technique used to examine the relationship between a single dependent variable and a set of independent variables. The objective of the multiple regression analysis is to use independent variables whose values are known to predict the single dependent variable (Olaniyi, 2011). The effect of independent variables on the response is expressed mathematically by the regression or response function f:

$$y = f(x_1, x_2, \ldots, x_n; \beta_1, \beta_2, \ldots, \beta_n) \quad (1)$$

where y is the dependent variable.

$\beta_1, \beta_2, \ldots, \beta_n$ in the regression parameters which will be determined

The regression model for the observed response variable is written as

$$z = y + \varepsilon = f(x_1, x_2, \ldots, x_n; \beta_1, \beta_2, \ldots \beta_n) + \varepsilon \quad (2)$$

Where ε is the error in observed value z (Olaniyi, 2011).

To find *unknown regression parameters* $\{\beta_1, \beta_2, \ldots \beta_n\}$, *the method of least squares* (Beenstock, 1992) can be applied:

$$E(\beta_1, \beta_2, \ldots \beta_n) = \sum_{j=i}^{n} (z_j - y_j)^2 = \sum (z_j - f(x_1 x_2, \ldots, x_n; \beta_1, \beta_2, \ldots \beta_n))^2 \quad (3)$$

Where $E(\beta_1, \beta_2, \ldots \beta_n)$ is the error function or sum of squares of the deviations.

To estimate $\beta_1, \beta_2, \ldots n$ we minimize, E, by solving the system of equations:

$$\frac{\partial E}{\partial \beta_1} = 0, i = 1,2, \ldots, n \quad (4)$$

a) Model Specification and Analysis

The regression model to consider in this study takes the maximum temperature (Tm) and sunshine hour ($\bar{n}$) as the explanatory variables and measured values (H_m) as dependent variable. This is used to obtain a reliable parameter estimates in the regression. The model to be used can be specified as

$$H_M = f(T_M, \bar{n}) \quad (5)$$

More precisely;

$$H_M = \beta_0 + \beta_1 T_M + \beta_2 \bar{n} \quad (6)$$

$\beta_0, \beta_1, \beta_2 > 0$

III. Angstrom-Prescott Model

There are several types of empirical formulae for predicting the monthly mean daily global solar radiation as a function of readily measured climatic data (Iqbal, 1977; and Klien, 1977). Among the existing correlations, the one used in this paper is the Angstrom–Prescott regression equation, which relates the monthly mean daily global solar radiation to the number of hours of bright sunshine as follows

$$\frac{\bar{H}_M}{\bar{H}_O} = a + b\frac{\bar{n}}{\bar{N}} \quad (7)$$

Where,

$\bar{H}_M$ = measured monthly mean daily global solar radiation on a horizontal sunshine.

$\bar{n}$ = monthly mean daily bright sunshine hour, $\bar{N}$ = Maximum possible monthly mean daily sunshine,

a and b = regression constant.

The monthly mean daily extraterrestrial radiation $\bar{H}_o$ and monthly mean day length $\bar{N}$ was derived from the formulae:

$$\bar{H}_O = \frac{24}{\pi} I_{SC} E_O [W_S \sin\Phi \sin\Phi + \cos\Phi \cos\delta \cos W_S] \quad (8)$$

$$\overline{N} = \frac{2}{25} \text{COS-1 (- tan } \Phi \text{ tan } \delta) \quad (9)$$

$$\delta = 23.45 \sin\left[\frac{N+284}{365}\right] \quad (10)$$

$$W_S = \text{COS -1 (- tan } \Phi \text{ tan } \delta) \quad (11)$$

I_{SC} = solar constant (4.921 MJM^{-2} day^{-1})

N = characteristic day number

Φ = latitude angle

δ = angle of declination

$$a = -0.110 + 0.235 \cos\Phi + 0.323 \text{ (n/N)} \quad (12)$$

$$b = 1.449 - 0.553 \text{ Cos } \Phi - 0.694 \text{ (n/N)} \quad (13)$$

IV. Artificial Neural Network Model

Artificial neural network models are based on the neural structure of the brain (Ibeh et al, 2012). The brain learns from experience and so do artificial neural networks. Previous research has shown that artificial neural networks are suitable for pattern recognition, prediction and pattern classification tasks due to their nonlinear nonparametric adaptive-learning properties. As a useful analytical tool, ANN is widely applied in analyzing the data stored in database or data warehouse nowadays (Massie, 2001). One critical step in neural network application is network training. Generally, meteorological data is selected and refined to form training data sets. Artificial Neural Network is widely used in various branches of engineering and science and their unique proper of being able to approximate complex and nonlinear equations makes it a useful tool in quantitative analysis (Olaniyi, 2011).

The true power and advantage of neural networks lies in their ability to represent both linear and

non-linear relationships and in their being modeled. Traditional linear models are simply inadequate when it comes to modeling data that contains non-linear characteristics. In this paper, one model of neural network is selected among the main network architectures used. The basis of the model is neural structure as shown in Fig. 1. These neurons act like parallel processing units.

a) Multi-Layer Perception

The most popular network architecture in use today is perhaps the Multilayer Perceptron network and it uses supervised network (Hair and Tatham, 1998). This type of neural network is known as a supervised network because it requires a desired output in order to learn. The goal of this type of network is to create a model that correctly maps the input to the output using historical data so that the model can then be used to produce the output when the desired output is unknown. Figure 1 show the block diagram of a double hidden layer multiplayer perceptron (MLP).

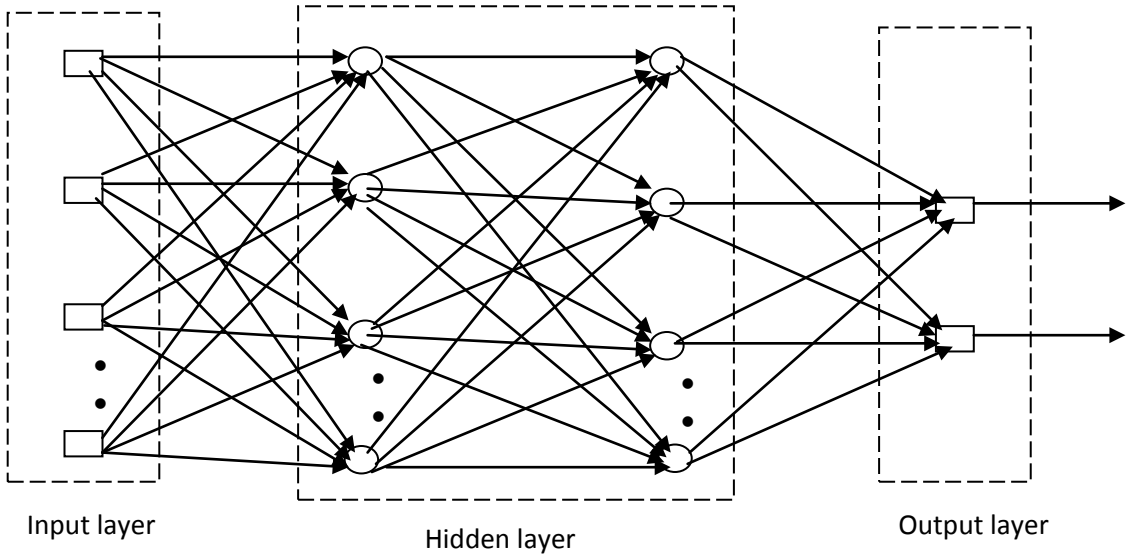

Figure 1: Structure of the artificial neural network with Double hidden layer

The inputs are fed into the input layer and get multiplied by interconnection weights as they are passed from the input layer to the hidden layer. Within the hidden layer, they get summed then processed by a nonlinear function (usually the hyperbolic tangent).

If more than a single hidden layer exists then, as the processed data leaves the first hidden layer, again it gets multiplied by interconnection weights, then summed and processed by the second hidden layer and so on. Finally the data is multiplied by interconnection weights then processed one last time within the output layer to produce the neural network output.

An artificial neuron is a unit that performs a simple mathematical operation on its inputs and imitates the function of biological neurons and their unique process of learning (Ibeh and Agbo, 2012). The weighted sum of the inputs are calculate using the following equation,

$$v_k = \sum_{j=1}^{m} x_j w_{kj} + b_k \qquad (7)$$

Where v_k is the weight sum from the *k*th hidden node, w_{kj} is the weight on connection from the *j*th to the *k*th node; x_j is an input data from input node; m is the total number of input (N=17); and b_k denotes a bias on the *k*th hidden node.

The mathematical structure of the normal method is as shown in fig.2

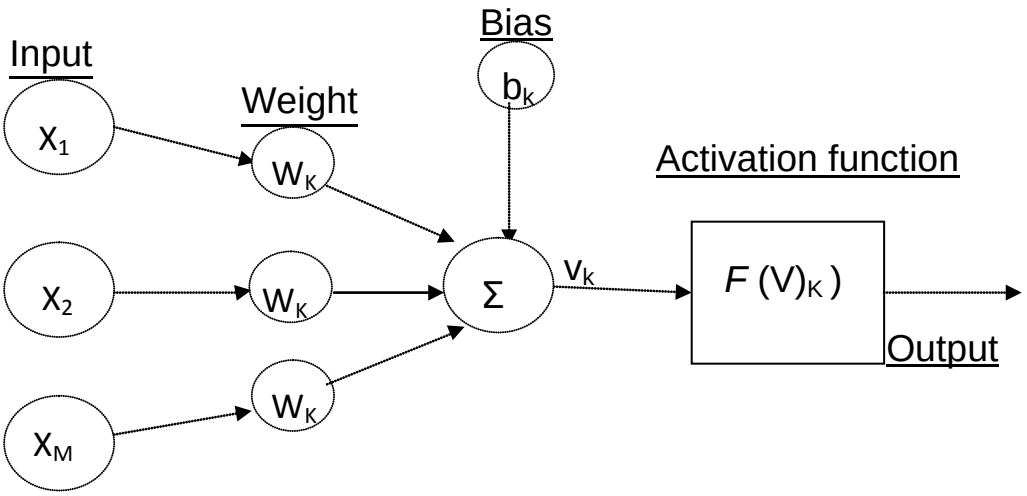

Fig. 2 : Mathematical structure of ANN (Ibeh et al, 2012)

V. Results and Discussions

Table 2 is obtained from the SPSS output for the analysis of the multiple linear regressions relating the measured values of global solar radiation as a function of the maximum temperature (Tm) and the sunshine hour (n). The standard error for each of the variables is indicated in the table 3. From figure 1, the highest value of solar radiation is 18.16 and 18.11MJ/M^2/Day respectively. These results suggest that there is peak dry season in Warri during December and April when the solar radiation is high. Again, the low values of solar radiation occur from May to August, which indicates peak rainfall Warri when the sky is cloudy and solar radiation is low.

Table 2 : Standard error of the models

Variable	Coefficient Std.	Std. Error	*t*-statistic	Prob.
Tm	-0.362	0.656	-0.461	0.785
$\bar{n}$	0.966	0.428	0.830	0.617
Constant	22.591	0.301	1.098	0.000

ERROR	ANN	REGRESSION	ANGSTROM-PRESCOTT
MBE	0.0085	0.2490	0.0352
RMSE	0.0004	0.0104	0.0251
MPE	-1.2580	-2.2116	-1.6230

Table 3 : Summary of error of the two models

VI. Conclusion

In this paper, three techniques for modeling and forecasting the solar radiation of Warri Nigeria: Neural Network, Angstrom-Prescott and Statistical Technique. The forecasting ability of these models is accessed on the basis of MBE, RMSE and MPE. We have discovered the fact that Neural Networks output perform better in forecasting from table 2 and 3 compare to other two models. Thus, ANN should be used for prediction of global solar radiation of the location and other location that has similar condition.

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Global Journal of Computer Science and Technology (D) Volume XII Issue XI Version I Year 2012
12

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Global Journal of Computer Science and Technology
Neural & Artificial Intelligence
Volume 12 Issue 11 Version 1.0 Year 2012
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals Inc. (USA)
Online ISSN: 0975-4172 & Print ISSN: 0975-4350

Mobile Robot for Object Detection Using Image Processing

By Himanshu Borse, Amol Dumbare, Rohit Gaikwad & Nikhil Lende
Pune University

Abstract - This paper describes a robotic application that tracks a moving object by utilizing a mobile robot with sensors and image processing. The robotic platform uses a visual camera to sense the movement of the desired object and a range sensor to help the robot detect and then avoid obstacles in real time while continuing to detect and follow the desired object. In terms of real-time obstacle avoidance capacity, this paper also presents an algorithm for this robotic application specifically. Experimental results show that the robotic and intelligent system can fulfill the requirements for detecting an object and avoiding obstacles simultaneously.

GJCST-E Classification : I.5.m

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Mobile Robot for Object Detection Using Image Processing

Himanshu Borse [α], Amol Dumbare [σ], Rohit Gaikwad [ρ] & Nikhil Lende [ω]

Abstract - This paper describes a robotic application that tracks a moving object by utilizing a mobile robot with sensors and image processing. The robotic platform uses a visual camera to sense the movement of the desired object and a range sensor to help the robot detect and then avoid obstacles in real time while continuing to detect and follow the desired object. In terms of real-time obstacle avoidance capacity, this paper also presents an algorithm for this robotic application specifically. Experimental results show that the robotic and intelligent system can fulfill the requirements for detecting an object and avoiding obstacles simultaneously.

I. Introduction

Video tracking, surveillance systems, and robotic platforms are fields that have been well studied in the past decade. However, in the majority of surveillance and video tracking systems, the sensors are stationary. The stationary systems require the desired object to stay within the surveillance range of the system. If the object goes beyond this range.

It no longer becomes tractable. One solution to this problem is to design the system as a mobile system that uses a infrared range sensor, and a visual-spectrum camera, to track the object and avoid obstacles . This research topic has been partially studied in several different areas. Studies made by the automotive industry in this area develop systems that assist a human driver for safety and comfort . NASA has applied this to help astronauts to carry more equipment while walking on the moon . These systems are primarily concerned with object tracking, and the obstacle avoidance problem.

The contributions of this paper are to present a mobile robotic system which can simultaneously detect an object and avoid obstacles in real-time. We first introduce the system architecture, then present strategy for object detection, obstacle detection, obstacle avoidance mechanism and robot control. Finally, the experiment and conclusion will be addressed.

II. System Architecture

In general, the overall system consists of five main phases: image input, object detection, obstacle detection, obstacle avoidance and robot mobility phase. If no obstacles are detected, then system skips the obstacle avoidance phase, and only uses four phases. The following sections explain how each phase works individually, and how the various phases work in conjunction with each other.

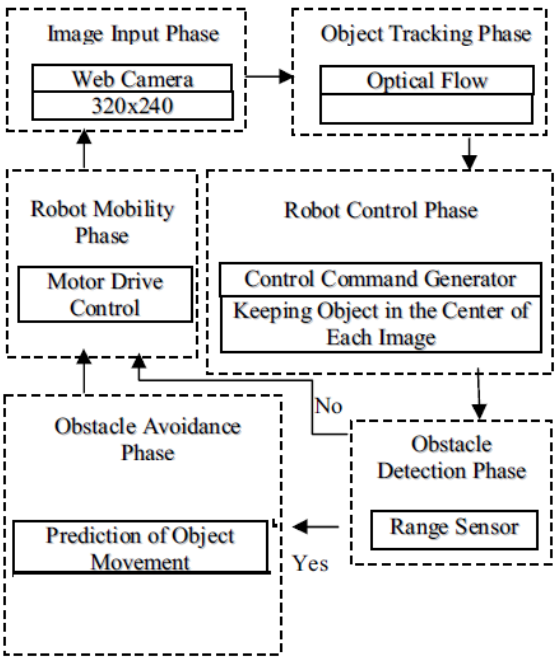

Figure 1 : This block diagram shows the overall system

a) Image Input Phase

The Logitech Web Camera has a fixed view and is attached to the robotic platform. It is used to acquire color 640x420 images. The camera is tasked to capture the object image.

b) Object Detection

In this system we have one webcam which is placed on the robot platform. Webcam captures the image and stores it on hard disk. In computer system preprocessing is done on the image to convert it into gray scale image. After this we find region for an object. On the basis of this region we compare the image with previously stored image. If the image matches with the one stored on the hard disk then robot moves in forward direction towards the object. If images doesn't match robot rotates using castroy wheel and repeats the process. First convert an image to gray scale, find gradient, boost the image. Then develop histogram from gray scaled image to find the region desired region of object.

E-mail α : hp2451@gmail.com
E-mail σ : amoldumbare12@gmail.com
E-mail ρ : rohitgai208@gmail.com
E-mail ω : nikhillende52@gmail.com

c) Robot Control Phase

If captured image matches with the image of an object then character "V" is sent indicating that required object has found & robot moves towards the object. If there is no match between captured image and destination image then character "A" is sent indicating that required object was not found. In such case robot takes a left turn. It keeps capturing and comparing the images until the captured image matches with the destination image.

d) Obstacle Detection Phase

IR sensor is mounted on the robot for obstacle detection . Whenever an IR sensor detects an obstacle, LED on IR sensor glows. Corresponding data is sent to microcontroller due to this robot moves backwards and then takes a left turn so that it can avoid the obstacle and find a new path.

e) Obstacle Avoidance Phase

Whenever an IR sensor detects an obstacle, LED on IR sensor glows. Corresponding data is sent to microcontroller due to this robot moves backwards and then takes a left turn so that it can avoid the obstacle and find a new path.

III. Platform

Figure shows the entire system including the web camera, IR sensor and robotic platform. Robot mobility is achieved through two wheels at back and one castroy wheel at front. Motion can be controlled directly by a computer system sending motion commands to the motors via RF module signal. Web Camera IR Sensor RF Module Computer.

a) Board

PIC16F877A microcontroller is used for robot computing system. Interfacing of microcontroller and LCD is done for validation purpose. The code to control is developed using MPLAB C. This software is retargeted specifically for PIC16F877A microcontroller.

b) Wireless Transmission

Wireless transmission is done through RF module CC2500 which is interfaced with microcontroller and connected to computer system.

c) Motor Driver System

Motor driver system consists of two DC motors and L239D motor driver IC.

d) Power Supply

Rechargeble batteries are used for power supply. Batteries provide clean reliable power supply and can be recharged. 12V power supply is required for robot to work and 9V is required for RF module to work. So we are using 12V and 9V batteries.

IV. Conclusion

Thus we have implemented Robotic Application which will detect the objects and avoid the obstacles. The application we have developed is a Desktop Application in that the user gives a command to capture image .This image is stored as destination image. After that user gives command to start the robot which will capture the image. This newly captured image will be compared with the destination image.Comparison will give a conclusion wheather the captured image matches with the destination image or not. This system compares the images using regionwise comparison. The system is implemented using J2EE, Java Swing and proteus technologies.

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Global Journal of Computer Science and Technology
Neural & Artificial Intelligence
Volume 12 Issue 11 Version 1.0 Year 2012
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals Inc. (USA)
Online ISSN: 0975-4172 & Print ISSN: 0975-4350

Review on Financial Forecasting using Neural Network and Data Mining Technique

By Mehzabin Shaikh & Mrs. Gyankamal J. Chhajed
Faculty of Information Technology Polytechnic University of Tirana Tirana, Albania

Abstract - The rise of economic globalization and evolution of information technology, financial data are being generated and accumulated at an extraordinary speed. As a result, there has been a critical need for automated approaches to effective and efficient utilization of massive amount of financial data to support companies and individuals in strategic planning and investment decision-making. The competitive advantages achieved by data mining include increased revenue, reduced cost, and much improved marketplace responsiveness and awareness. There has been a large body of research and practice focusing on exploring data mining techniques to solve financial problems. This paper describes data mining in the context of financial application from both technical and application perspective by comparing different data mining techniques.

Keywords : *Data mining in Financial Forecasting, Data Mining Algorithm, Technical Indicators, BP neural network.*

GJCST-E Classification: *F.1.1*

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Review on Financial Forecasting using Neural Network and Data Mining Technique

Mehzabin Shaikh [α] & Mrs. Gyankamal J. Chhajed [σ]

Abstract - The rise of economic globalization and evolution of information technology, financial data are being generated and accumulated at an extraordinary speed. As a result, there has been a critical need for automated approaches to effective and efficient utilization of massive amount of financial data to support companies and individuals in strategic planning and investment decision-making. The competitive advantages achieved by data mining include increased revenue, reduced cost, and much improved marketplace responsiveness and awareness. There has been a large body of research and practice focusing on exploring data mining techniques to solve financial problems. This paper describes data mining in the context of financial application from both technical and application perspective by comparing different data mining techniques.

Keywords : Data mining in Financial Forecasting, Data Mining Algorithm, Technical Indicators, BP neural network.

I. Introduction

Data mining techniques have been used to uncover hidden patterns and predict future trends and behaviours in financial markets. The competitive advantages achieved by data mining include increased revenue, reduced cost, and much improved marketplace responsiveness and awareness. Data mining has been applied to a number of financial applications, including development of trading models, investment selection, loan assessment, portfolio optimization, fraud detection, bankruptcy prediction, real-estate assessment, and so on.

II. Literature Survey

a) *Classification and Issues of Data Mining in Financial Application*

Data mining aims to discover hidden knowledge, unknown patterns, and new rules from large databases that are potentially useful and ultimately understandable for making crucial decisions.

Based on the type of knowledge that is mined, data mining can be mainly classified into the following categories:

1) ***Association rule mining*** uncovers interesting correlation patterns among a large set of data items by showing attribute- value conditions that occur together frequently. A typical example is market basket analysis, which analyzes purchasing habits of customers by finding associations between different items in customers' —shopping baskets.‖

2) ***Classification and prediction*** is the process of identifying a set of common features and models that describe and distinguish data classes or concepts. The models are used to predict the class of objects whose class label is unknown. A bank, for example, may classify a loan application as either a fraud or a potential business using models based on characteristics of the applicant. A large number of classification models have been developed for predicting future trends of stock market indices and foreign exchange rates.

3) ***Clustering analysis*** segments a large set of data into subsets or clusters. Each cluster is a collection of data objects that are similar to one another within the same cluster but dissimilar to objects in other clusters. In other words, objects are clustered based on the principle of maximizing the intra-class similarity while minimizing the inter-class similarity.

4) ***Sequential pattern and time-series mining*** example, clustering techniques can be used to identify stable dependencies for risk management and investment management. looks for patterns where one event (or value) leads to another later event (or value). One example is that after the inflation rate increases, the stock market is likely to go down.

First, data mining needs to take ultimate applications into account. For example, credit card fraud detection and stock market prediction may require different data mining techniques.

Second, data mining is dependent upon the features of data. For example, if the data are of time series, data mining techniques should reflect the features of time sequence.

Third, data mining should take advantage of domain models. In finance, there are many well-developed models that provide insight into attributes that are important for specific applications. Many applications combine data mining techniques with various finance and accounting models (e.g., capital asset pricing model and the Kareken–Wallace model) [1].

Author α : M.E. student Department of Computer Engg, VPCOE, Baramati. E-mail : mehzabin.shaikh@gmail.com
Author σ : Asst. Professor and Head of Computer Engg, VPCOE, Baramati. E-mail : gjchhajed @gmail.com

b) Existing Data Mining Techniques

i. *Overview of Data Mining Techniques*

1. Neural Networks : Artificial neural networks are computer models built to emulate the human pattern recognition function through a similar parallel processing structure of multiple inputs. A neural network consists of a set of fundamental processing elements (also called neurons) that are distributed in a few hierarchical layers. Most neural networks contain three types of layers: input, hidden, and output.

2. Genetic Algorithms : The basic idea of genetic algorithms is that given a problem, the genetic pool of a specific population potentially contains the solution, or a better solution. Based on genetic and evolutionary principles, the genetic algorithm repeatedly modifies a population of artificial structures through the application of initialization, selection, crossover, and mutation operators in order to obtain an evolved solution.

3. Statistical Inference : Statistics provides a solid theoretical foundation for the problem of data analysis. Through hypothesis validation and/or exploratory data analysis, statistical techniques give asymptotic results that can be used to describe the likelihood in large samples. The basic statistical exploratory methods include such techniques as examining distribution of variables, reviewing large correlation matrices for coefficients that meet certain thresholds, and examining multidimensional frequency tables.

4. Rule Induction : Rule induction models belong to the logical, pattern distillation based approaches of data mining. Based on data sets, these techniques produce a set of if-then rules to represent significant patterns and create prediction models. Such models are fully transparent and provide complete explanations of their predictions. One commonly used and well-known type of rule induction is the family of algorithms that produce decision trees.

5. Data Visualization*—"Seeing" the Data:* Data are difficult to interpret due to its overwhelming size and complexity. In order to achieve effective data mining, it is important to include people in the data exploration process and combine the flexibility, creativity, and general knowledge of people with the enormous storage capacity and computational power of today's computers. Data visualization is the process of analyzing and converting data into graphics, thus taking advantage of human visual systems. large number of variables while still presenting useful information.

c) Applications of Data Mining In Finance

i. *Prediction of the Stock Market*

Investors in the market want to maximize their returns by buying or selling their investments at an appropriate time. Since stock market data are highly time-variant and are normally in a nonlinear pattern, predicting the future trend (i.e., rise, decrease, or remain steady) of a stock is a challenging problem. The dominant data mining technique used in stock market prediction so far is neural network modeling, including back-propagation (BP) networks, probabilistic neural networks, and recurrent neural networks The basic assumption is that similar input time series should produce similar output time series while ignoring intra-day fluctuations compared to regression models with a back-propagation network using the same data for stock prediction. Results showed that back-propagation network was a better predictor.

ii. *Portfolio Management*

Portfolio management is a major issue in investment. It concerns how individuals decide which securities to hold in investment portfolios and how funds should be allocated among broader asset classes, such as stocks versus bonds, and domestic securities versus foreign securities. The primary goal is to choose a set of risk assets to create a portfolio in order to maximize the return under certain risk or to minimize the risk for obtaining a specific return.

iii. *Bankruptcy Prediction*

Predicting bankruptcy is of great benefit to those who have some relations to a firm concerned, for bankruptcy is a final state of corporate failure. In the 21st Century, corporate bankruptcy in the world has reached an unprecedented level. It results in huge economic losses to companies, stockholders, employees, and customers, together with tremendous social and economical cost to the nation.

iv. *Foreign Exchange Market*

"Foreign Exchange" is the simultaneous buying of one currency and selling of another. The foreign exchange market is the largest financial market in the world, with a daily average turnover of over US$1 trillion. Data mining has been applied to identifying such technical trading rules. The neural networks were trained using more than 21 years of data to predict 1-day future spot rates for several nominal exchange rates, and achieved 58% accuracy for trading the British Pound and 57% accuracy for trading the German Mark.

v. *Fraud Detection*

Credit card transactions continue to grow, taking an ever larger share of the U.S. payment system and leading to a higher rate of stolen account numbers and subsequent losses by banks. According to Meridian Research, financial institutions lost more than US$1 billion in credit and debit card fraud in 2001. Therefore, fraud detection is becoming a central application area of data mining, which aims at searching for patterns indicative of fraud. Improving fraud detection is essential

to reducing the loss and maintaining the viability of the payment system.

vi. *Data Mining in Other Financial Applications*

In addition to the above applications that are discussed, above data mining techniques have also been applied to other financial applications such as loan risk analysis and payment prediction, mortgage scoring and real estate services. Data mining systems can determine whether or not a customer will be able to pay off their loans based on his/her income, age, and historical credit information, etc. Neural networks have been used for providing recommendations to grant or deny a loan based on financial ratios, past credit ratings, and loan records.

III. BP Neural Network

Artificial neural network is a large broad network with a number of processing units (neurons) connected. It is an abstract, simplified and simulation to human brain, and reflects the basic characteristics of the human brain. Generally, the neural network is the multi-layered network topology, including the input layer, hidden layer and output layer. In dozens of neural network models that were put forward, researchers often use the Hopfield network, BP network [2].

Hopfield network is the most typical feedback network model, it is one of the models which are most commonly studied now. The Hopfield network is the monolayer constituted by the same neuron, and is also a symmetrically connected associative network without learning function. It can implement the restriction optimization and associative memory BP network is the back-propagation network. It is a multi-layer forward network, learning by minimum mean square error. It is one of the most widely used networks. It can be used in the field of language integration, identification and adaptive control, etc.

BP network is semi supervised learning. First of all, artificial neural network needs to learn a certain learning criteria, and then it can work. Guidelines for e-learning (Electronic Learning) can be listed as below. If the result yielded by network is wrong, then the network should reduce the possibility of making the same mistake next time through learning.

Back propagation network with the following indicator can be used to develop the system which can be used for financial forecasting.

a) Economic indicator used as input to the BP neural network

i. *Moving average (MA)*

Moving average line is a statistical mean, which sums up stock price of certain days and gives out an average, and then connects them into a line to observe the price trend. The function of moving average is obtaining the average cost during a certain period, and we can use the average cost curve and the movement of daily closing price changes in the line analysis of the change of bull and bear to study and to determine possible changes in stock.

ii. *Random indicator (KDJ)*

There are a total of three lines standing for random indicators in the stock, namely K line, D line and the J line. Random indicator not only considers the highest price, the lowest price in the calculation period, but also takes into account of the random amplitude in the course of the fluctuation of stock price. Therefore, researchers always think that random indicator can more truly reflect the volatility of stock price, and it plays an important role in prompting.

$$K=2Kt\text{-}1 / 3+RSV/3$$

$$D=2\ Dt\text{-}1 /3+ K/3$$

$$RSV=100(Cn\text{-}Ln)(Hn\text{-}Ln)$$

In the formula: C represents the daily closing price means the lowest price that day; H stands for the highest price that day.

$$J = 3K - 2D$$

iii. *Moving Average Convergence/Divergence (MACD)*

The principle of MACD is to use the functions of the signs for aggregation and separation of fast moving average and slow moving average, in addition to double smoothing operation in order to study and determine the timing of buy and sell.

iv. *Relative Strength Index (RSI)*

Relative Strength Index is an indicator comparing the average of closing high and the average of closing low .We can use it to analyze the market and strength in order to forecast the future of the market trend.

RSI = [average of increase / (average of increase + average of decline)] *100

v. *On Balance Volume (OBV)*

OBV is the degree of the active investors in the stock market. If there are a lot of buyers and sellers, the stock prices and the volume of trade will rise, the atmosphere of the stock market is warm, commonly known as the bull market; if there are a few of buyers and sellers, the stock prices and the volume of trade will decline. It can be seen that the impact of the rise and fall of stock prices and the volume of trade is the OBV of stock. The volume of shares and stock price can also reflect the degree of the rise and fall of popularity of stock.

vi. *BIAS*

BIAS is the ratio between the application index and the moving average. Base on BIAS, it is possible to observe the degree which the stock price deviate from the moving average price to decide to buy or sell.

RSI = [average of increase / (average of increase +average of decline)] *100

vii. *Increase scope*

Increase scope= (the stock market closing price of today the stock market opening price of today) / the stock market opening price of today.

In order to avoid the situation that the dimensions of larger data have larger influence in the results than that of smaller data normalized the original data.

The formula of Normalization is as follows:

$$A\ ij\text{-}Min\ (Aj) / Max\ (Aj)\text{-}Min\ (Aj)$$

The data were normalized to between 0 and 1.

IV. Analysis

Even though different exiting techniques can be used for financial forecasting, but BP neural network will be the best to develop a software tool that can be used for financial forecasting.

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Global Journal of Computer Science and Technology
Neural & Artificial Intelligence
Volume 12 Issue 11 Version 1.0 Year 2012
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals Inc. (USA)
Online ISSN: 0975-4172 & Print ISSN: 0975-4350

Intelligent Intrusion Detection in Computer Networks Using Fuzzy Systems

By Amin Einipour
Islamic Azad University, Andimeshk, Iran

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In this paper, we have focused on intrusion detection in computer networks by combination of fuzzy systems and Particle Swarm Optimization (PSO) algorithm. Fuzzy rules are desirable because of their interpretability by human experts. PSO algorithm is employed as meta-heuristic algorithm to optimize the obtained set of fuzzy rules. Results on intrusion detection dataset from KDD-Cup99 show that the proposed approach would be capable of classifying instances with high accuracy rate in addition to adequate interpretability of extracted rules.

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GJCST-E Classification: *C.2.0*

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Intelligent Intrusion Detection in Computer Networks Using Fuzzy Systems

Amin Einipour

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I. Introduction

Data mining usually means the methodologies and tools for the efficient new knowledge discovery from databases. It is also a form of knowledge discovery essential for solving problems in a specific domain.

An intrusion is defined as any set of actions that attempt to compromise the integrity, confidentiality, or availability of a resource [1]. An Intrusion Detection System (IDS) monitors and restricts user access to the computer system by applying certain rules. These rules are based on expert knowledge extracted from skilled administrators, who construct attack scenarios and apply them to find system exploits. The system identifies all intrusions by users and takes or recommends necessary action to stop an attack on the database.

Two approaches to intrusion detection are currently used. The first one, called misuse detection, is based on attack signatures, i.e., on a detailed description of the sequence of actions performed by the attacker. This approach allows the detection of intrusions matching perfectly the signatures, so that new attacks performed by slight modification of known attacks cannot be detected. The second approach is based on statistical knowledge about the normal activity of the computer system, i.e., a statistical profile of what constitutes the legitimate traffic in the network. In this case, intrusions correspond to anomalous network activity, i.e. to traffic whose statistical profile deviates significantly from the normal one [2, 3].

Earlier studies, the statistical related techniques were most commonly used data mining approaches to construct classification models. However, as the intrusion detection classification problem is highly nonlinear in nature, it is hard to develop a comprehensive model taking into account all the independent variables using conventional statistical modeling techniques. Furthermore, traditional ad hoc mixtures of statistical techniques and data management tools are no longer adequate for analyzing the vast collection of data. For the needs of improving the prediction accuracy in intrusion detection, more and more researchers have tried to apply artificial intelligence related approaches for intrusion detection in computer networks [4, 5].

A good computerized detection tool should possess two characteristics. First, the tool must attain the highest possible performance. Moreover, it would be highly desirable to be in possession of a so-called degree of confidence: the system not only provides a crisp detection, but also outputs a numeric value that represents the degree to which the system is confident about its response. Second, it would be highly beneficial for such a detection system to be human-friendly, exhibiting so-called interpretability. This means that the experts in computer networks is not faced with a black box that simply spouts answers (albeit correct) with no explanation; rather, we would like for the system to provide some insight as to how it derives its outputs.

Some experimental studies reported that success of artificial neural networks in intrusion detection [6-8], but there is a major drawback in building and using a model in which the user cannot readily comprehend the final rules that neural networks models acquire. In other words, the results of training a neural network are internal weights distributed throughout the network. These weights provide no more insight into why the solution is valid than asking many human experts why a particular decision is the right decision. For example, the weights are not readily understandable although, increasingly, sophisticated techniques for probing into neural networks help provide some explanation. It is also some recently studies used

Author : Department of Computer, Andimeshk Branch, Islamic Azad University, Andimeshk, Iran. E-mail : a.einipour@gmail.com

meta-heuristic and K-NN approaches to intrusion detection which interpretability of these approaches higher than of neural networks [9-12, 21].

In this paper we combine two methodologies—fuzzy systems and meta-heuristic algorithm—so as to automatically produce systems for intrusion detection in computer networks. The major advantage of fuzzy systems is that they favor interpretability; however, finding good fuzzy systems can be quite an arduous task. This is where PSO algorithm step in, enabling the automatic production of fuzzy systems, based on a database of training cases. Our fuzzy-PSO approach produces systems exhibiting two prime characteristics: first, they attain high classification performance, with the possibility of attributing a confidence measure to the output detection; second, the resulting systems involve a few simple rules, and are therefore (human-) interpretable.

We believe the development of PSO algorithm for data mining is a promising research area, due to the following rationale.

This paper is organized as follows. In Section 2 we describe the Intrusion detection problem and KDD99 dataset, which is the focus of our interest in this paper. The third section describes the fuzzy systems based classification. Section 4 describes our particular PSO-Fuzzy approach to the intrusion detection problem. The fifth section reports on computational results evaluating the performance of the proposed system. Finally, the sixth section concludes the paper.

II. The Intrusion Detection Problem and KDD Cup 99 Dataset

The first major work in the area of intrusion detection was discussed by J.P Anderson in [13]. Anderson introduced the concept that certain types of threats to the security of computer systems could be identified through a review of information contained in the system‘s audit trail. Many types of operating systems, particularly the various ―flavors‖ of UNIX, automatically create a report which details the activity occurring on the system. Anderson identified three threats which could be identified from a concentrated review of the audit data:

1. External Penetrations - Unauthorized users of the system.
2. Internal Penetrations - Authorized system users who utilize the system in an unauthorized manner.
3. Misfeasors - Authorized user who mislead their access privileges.

Anderson indicated that a particular class of external attackers, known as clandestine users, were particularly dangerous to the system resources. Clandestine users are those who evade both system access controls and auditing mechanisms through the manipulation of system privileges or by operating at a level that is lower than what is regularly monitored by the audit trail. Anderson suggested that clandestine users could be detected by lowering the level which is monitored by the audit trail, monitoring the functions that turn off the audit systems, or through a comparison of defined ―normal‖ usage patterns of system resource usage with those levels which are currently observed.

While the concept of manually reviewing operating system audit records for indications of intrusions was recognized as an extremely inefficient method of securing a computer system, Anderson‘s article served to initiate research into the area of intrusion detection. Subsequent research involved the development of automated techniques for the review of audit record data. Until recently, most intrusion detection mechanisms were based on an automated approach to Anderson's concepts. However, the recent development of new intrusion detection approaches and, more significantly, the necessary application of intrusion detection technologies to networked environments, is changing the focus of intrusion detection research.

Dr. Dorothy Denning proposed an intrusion detection model in 1987 which became a landmark in the research in this area [14]. The model which she proposed forms the fundamental core of most intrusion detection methodologies in use today. Because of the applicability of these concepts to most accepted intrusion detection systems, an overview of the primary concepts of the model are presented here to provide a basis of understanding the core technology.

Any statistical intrusion detection methodology requires the use of a set of definable metrics. These indices are the elements upon which all of the tool's statistical analysis is based. These metrics characterize the utilization of a variety of system resources. The resources which would be used in the definition of the metrics are required to be system characteristics which can be statistically based, (i.e., CPU usage, number of files accessed, number of login attempts).

These metrics are usually one of three different types. Event counters identify the occurrences of a specific action over a period of time. These metrics may include the number of login attempts, the number of times that a file has been accessed, or a measure of the number of incorrect passwords that are entered.

The second metric, time intervals, identify the time interval between two related events. Each time interval compares the delay in occurrence of the same or similar event An example of a time interval metric is the periods of time between a user‘s logins.

Finally, resource measurement is the concept of quantifying the amount of resources used by the system over a given period of time. Resource measurement incorporates individual event counters and time interval metrics to quantify the system. Examples of resource measurements include the expenditure of CPU time,

number of records written to a database, or the number of files transmitted over the network.

While not normally considered with the "traditional" intrusion detection metrics, keystroke dynamics is another method of quantifying a user's activities which offers an effective measure of user identification. The concept involves the development of an electronic signature of a user based on their individual typing characteristics. These characteristics usually include typing speed, intervals in typing, number of errors, and the user's typing rhythm. These characteristics may be verified on login and/or monitored throughout a session. Complete intrusion detection mechanisms have been developed exclusively around the use of keystroke dynamics techniques. [15]

In 1998, DARPA in concert with Lincoln Laboratory at MIT launched the DARPA 1998 dataset for evaluating IDS [16]. The DARPA 1998 dataset contains seven weeks of training and also two weeks of testing data. In total, there are 38 attacks in training data as well as in testing data. The refined version of DARPA dataset which contains only network data (i.e. Tcpdump data) is termed as KDD dataset [17]. The Third International Knowledge Discovery and Data Mining Tools Competition were held in colligation with KDD-99, the Fifth International Conference on Knowledge Discovery and Data Mining. KDD dataset is a dataset employed for this Third International Knowledge Discovery and Data Mining Tools Competition. KDD training dataset consists of relatively 4,900,000 single connection vectors where each single connection vectors consists of 41 features and is marked as either normal or an attack, with exactly one particular attack type [18]. These features had all forms of continuous and symbolic with extensively varying ranges falling in four categories:

- In a connection, the first category consists of the intrinsic features which comprises of the fundamental features of each individual TCP connections. Some of the features for each individual TCP connections are duration of the connection, the type of the protocol (TCP, UDP, etc.) and network service (http, telnet, etc.).
- The content features suggested by domain knowledge are used to assess the payload of the original TCP packets, such as the number of failed login attempts.
- Within a connection, the same host features observe the recognized connections that have the same destination host as present connection in past two seconds and the statistics related to the protocol behavior, service, etc are estimated.
- The similar same service features scrutinize the connections that have the same service as the current connection in past two seconds.

A variety of attacks incorporated in the dataset fall into following four major categories:

Denial of Service Attacks (DOS): A denial of service attack is an attack where the attacker constructs some computing or memory resource fully occupied or unavailable to manage legitimate requirements, or reject legitimate users right to use a machine.

User to Root Attacks(U2R): User to Root exploits are a category of exploits where the attacker initiate by accessing a normal user account on the system (possibly achieved by tracking down the passwords, a dictionary attack, or social engineering) and take advantage of some susceptibility to achieve root access to the system.

Remote to User Attacks (R2L): A Remote to User attack takes place when an attacker who has the capability to send packets to a machine over a network but does not have an account on that machine, makes use of some vulnerability to achieve local access as a user of that machine.

Probes (PRB): Probing is a category of attacks where an attacker examines a network to collect information or discover well-known vulnerabilities. These network investigations are reasonably valuable for an attacker who is staging an attack in future. An attacker who has a record, of which machines and services are accessible on a given network, can make use of this information to look for fragile points.

Table1 illustrates a number of attacks falling into four major categories and table 2 presents a complete listing of a set of features characterized for the connection records.

Table 1 : Various types of attacks described in four major categories

Denial of Service Attacks(DOS)	Back, land, neptune, pod, smurf, teardrop
User to Root Attacks(U2R)	Buffer _overflow, loadmodule, perl, rootkit,
Remote to Local Attacks(R2L)	Ftp_write, guess_passwd, imap, multihop, phf, spy, warezclient, warezmaster
Probes(PRB)	Satan, ipsweep, nmap, portsweep

Table 2 : A complete list of features given in KDD cup 99 dataset

Feature index	feature name	description	Type
1	duration	length (number of seconds) of the connection	Continuous
2	Protocol_type	type of the protocol, e.g. tcp, udp, etc.	Symbolic
3	service	network service on the destination, e.g., http, telnet,etc.	Symbolic
4	flag	normal or error status of the connection	Symbolic
5	Src_Bytes	number of data bytes from destination to source	Continuous
6	Dst_Bytes	number of data bytes from destination to source	Continuous
7	Land	1 if connection is from/to the same host/port; 0 otherwise	Symbolic
8	wrong_fragment	number of ``wrong'' fragments	Continuous
9	Urgent	number of urgent packets	Continuous
10	hot	number of ``hot'' indicators	Continuous
11	num_failed_logins	number of failed login attempts	Continuous
12	logged_in	1 if successfully logged in; 0 otherwise	Symbolic
13	num_compromised	number of ``compromised'' conditions	Continuous
14	root_shell	1 if root shell is obtained; 0 otherwise	Continuous
15	su_attempted	1 if ``su root'' command attempted; 0 otherwise	Continuous
16	num_root	number of ``root'' accesses	Continuous
17	num_file_creations	number of file creation operations	Continuous
18	num_shells	number of shell prompts	Continuous
19	num_access_files	number of operations on access control files	Continuous
20	num_outbound_cmds	number of outbound commands in an ftp session	Continuous
21	is_hot_login	1 if the login belongs to the ``hot'' list; 0 otherwise	Symbolic
22	is_guest_login	1 if the login is a ``guest'' login; 0 otherwise	Symbolic
23	Count	number of connections to the same host as the current connection in the past two seconds	Continuous
24	Srv_count	number of connections to the same service as the current connection in the past two seconds	Continuous
25	serror_rate	% of connections that have ``SYN'' errors	Continuous
26	srv_serror_rate	% of connections that have ``SYN'' errors	Continuous
27	rerror_rate	% of connections that have ``REJ'' errors	Continuous
28	srv_rerror_rate	% of connections that have ``REJ'' errors	Continuous
29	same_srv_rate	% of connections to the same service	Continuous
30	diff_srv_rate	% of connections to different services	Continuous
31	srv_diff_host_rate	% of connections to different hosts	Continuous
32	dst_host_count	count for destination host	Continuous
33	dst_host_srv_count	srv_count for destination host	Continuous
34	dst_host_same_srv_rate	same_srv_rate for destination host	Continuous
35	dst_host_diff_srv_rate	diff_srv_rate for destination host	Continuous
36	dst_host_same_src_port_rate	same_src_port_rate for destination host	Continuous
37	dst_host_srv_diff_host_rate	diff_host_rate for destination host	Continuous
38	dst_host_serror_rate	serror_rate for destination host	Continuous
39	dst_host_srv_serror_rate	srv_serror_rate for destination host	Continuous
40	dst_host_rerror_rate	rerror_rate for destination host	Continuous
41	dst_host_srv_rerror_rate	srv_serror_rate for destination host	Continuous

III. Fuzzy System Based Classification

Let us assume that our pattern classification problem is a c -class problem in the $n-$dimensional pattern space with continuous attributes. We also assume that m real vectors $x_p = (x_{p1}, x_{p2}, ..., x_{pn}), p = 1, 2, ..., m,$ are given as training patterns from the c classes ($c \ll m$).

Because the pattern space is $[0,1]^n$, attribute values of each pattern are $x_{pi} \in [0,1]$ for $p = 1, 2, ..., m$ and $i = 1, 2, ..., n$. In computer simulations of this paper, we normalize all attribute values of each data set into the unit interval [0, 1].

In the presented fuzzy classifier system, we use fuzzy if-then rules of the following form:

Rule R_j : If x_1 is A_{j1} and … and x_n is A_{jn} , then Class C_j with $CF = CF_j$.

where R_j is the label of the *jth* fuzzy if–then rule, $A_{j1}, ..., A_{jn}$ are antecedent fuzzy sets on the unit interval [0,1] , C_j is the consequent class (i.e., one of the given c classes), and CF_j is the grade of certainty of the fuzzy if–then rule R_j . In computer simulations, we use a typical set of linguistic values in Fig. 1 as antecedent fuzzy sets. The membership function of each linguistic value in Fig. 1 is specified by homogeneously partitioning the domain of each attribute into symmetric triangular fuzzy sets. We use such a simple specification in computer simulations to show the high performance of our fuzzy classifier system, even if the membership function of each antecedent fuzzy set is not tailored. However, we can use any tailored membership functions in our fuzzy classifier system for a particular pattern classification problem.

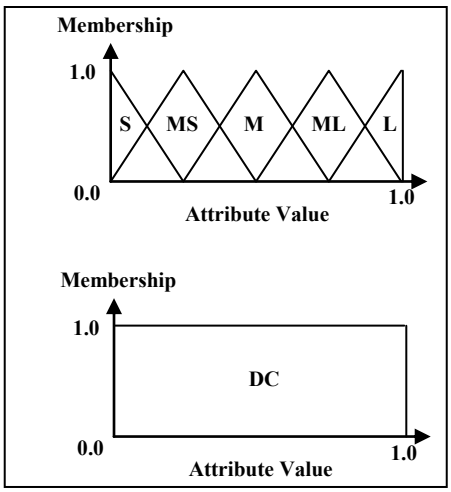

Fig. 1 : The used antecedent fuzzy sets in this paper. 1: Small, 2: medium small, 3: medium, 4: medium large, 5: large, and 6: don't care

The total number of fuzzy if–then rules is in the case of the -dimensional pattern classification problem. It is impossible to use all the fuzzy if– then rules in a single fuzzy rule base when the number of attributes (i.e.) is large (e.g., intrusion detection problem which n = 41). 6n n 6n n

Our fuzzy classifier system searches for a relatively small number of fuzzy if–then rules with high classification ability. Since the consequent class and the certainty grade of each fuzzy if–then rule can be determined from training patterns by a simple heuristic procedure [19], the task of our fuzzy classifier system is to generate combinations of antecedent fuzzy sets for a set of fuzzy if–then rules. While this task seems to be simple at first glance, in fact it is very difficult for high-dimensional pattern classification problems, since the search space involves combinations. 6n

In our fuzzy classifier system, the consequent Class and the grade of certainty of each fuzzy if– then rule are determined by a modified version of the heuristic procedure which is discussed in [18][19]. j C j CF

IV. Proposed Pso-Based Fuzzy System Approach

Swarm intelligence describes the collective behavior of decentralized, self organized natural or artificial systems. Swam intelligence model were employed in artificial intelligence. The expression was introduced in the year 1989 by Jing wang and Gerardo Beni in cellular robotic systems. Swarm Intelligence (SI) was a innovative pattern for solving optimizing problems. SI systems are typically made up of populations of simple agents interacting locally with one another and with their environment. The agent follows simple rules and the interactions between agents lead to the emergence of *"intelligent"* global behavior, unknown to the individual agents. Examples of SI include ant colonies, bird flocking, animal herding, bacterial growth and fish schooling.

The example algorithms of Swarm Intelligence are i) Ant Colony Optimization ii) Particle Swarm Optimization iii) Gravitational Search Algorithm iv) Stochastic diffusion search. Particle Swarm Optimization belongs to the class of swarm intelligence techniques that are used to resolve the optimization problems.

Particle Swarm Optimization (PSO) works with a population-based heuristic inspired by the social behavior of bird flocking aiming to find food [20]. In Particle Swarm Optimization the system initializes with a set of solutions and searches for optima by updating generations. The set of possible solutions is a set of particles, called swarm, which moves in the search space, in a cooperative search procedure. These moves are performed by an operator called velocity of a particle and moves it through an n-dimensional space based on the best positions of their leader (social component) and on their own best position (local component).

The main strength of PSO is its fast convergence, which compares with many global optimization algorithms like Genetic algorithms, Simulated Annealing and other global optimization algorithms. Particle Swarm Optimization shares many similarities with evolutionary computation techniques such as Genetic Algorithms. The system is initialized with a population of random solutions and searches for optima by updating generations. PSO has no evolution operators such as cross over and mutation. In PSO, the potential solutions called particles fly through the problem space by following the current optimum particles. PSO is a global optimization algorithm for dealing with problems in which a best solution can be represented as a point or surface search in n-dimensional space.

Hypotheses are plotted in this space and seeded with an initial velocity as well as a communication channel between the particles. Particles then move through the solution space and are evaluated according to some fitness criterion following each time step. The particles were accelerated in the direction of communication grouping which have better fitness values. The main advantage of such approach great global minimization strategies such as simulated annealing is that the large number of members that make up the particle swarm formulate the technique impressively flexible to the problem of local minima.

Each particle keeps track of its coordinates in the problem space which are associated with the best solution it has achieved so far. This value is called pbest. Another best value that is tracked by the particle swarm optimizer is the best value, obtained so far by any particle in the neighbors of the particle. This location is called lbest. When a particle takes all the population

as its topological neighbors, the best value is a global best and is called gbest.

The basic idea of combining PSO with data mining is simple. To extract this knowledge, a database may be considered as a large search space and a mining algorithm as a search strategy. PSO makes use of particles moving in an n-dimensional space to search for solutions for an n-variable function optimization problem. The datasets are the sample space to search and each attribute is a dimension for the PSO-miner.

The pseudo-code of the PSO-Based Search algorithm is presented in figure 2. Note that the input of this algorithm is a fuzzy rule and the output is an improved version of that fuzzy rule.

```
For each particle
Initialize particle
End For
Do
For each particle
Calculate fitness value of the particle fp
/*updating particle's best fitness value so far)*/
If fp is better than pBest
set current value as the new pBest
End For
/*updating population's best fitness value so far)*/
Set gBest to the best fitness value of all particles
For each particle
Calculate particle velocity according equation (1)
Update particle position according equation (2)
End For
While maximum iterations OR minimum error criteria
is not attained
```

Fig. 2 : Pseudo-code for the PSO-Based Search algorithm

a) Proposed Fuzzy-PSO Approach for Intrusion Detection in Computer Networks

Outline of the proposed approach for intrusion detection follows in figure 3.

A fuzzy inference system is a rule-based system that uses fuzzy logic, rather than Boolean logic, to reason about data [23]. Its basic structure includes four main components, as depicted in Fig. 3: (1) a fuzzifier, which translates crisp (real-valued) inputs into fuzzy values; (2) an inference engine that applies a fuzzy reasoning mechanism to obtain a fuzzy output; (3) a defuzzifier, which translates this latter output into a crisp value; and (4) a knowledge base, which contains both an ensemble of fuzzy rules, known as the rule base, and an ensemble of membership functions, known as the database.

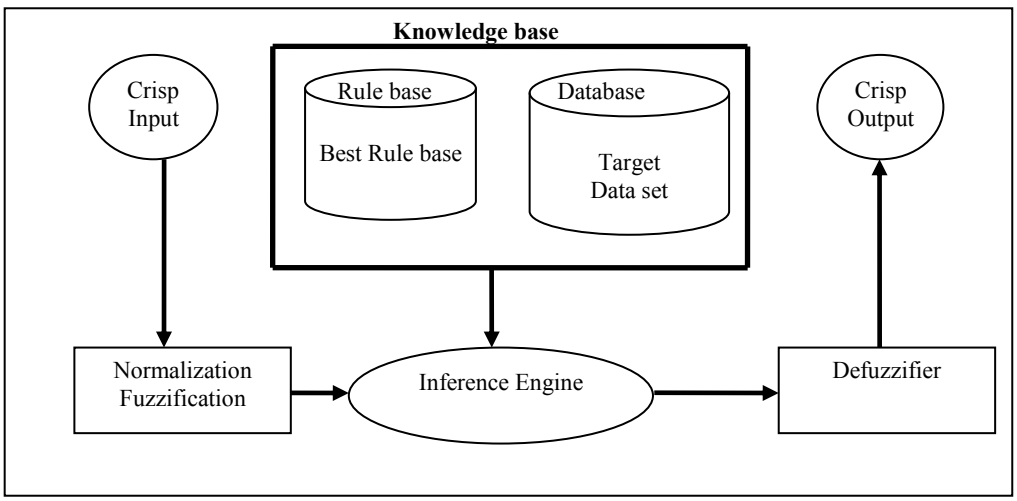

Fig. 3 : Basic structure of a fuzzy inference system for intrusion detection

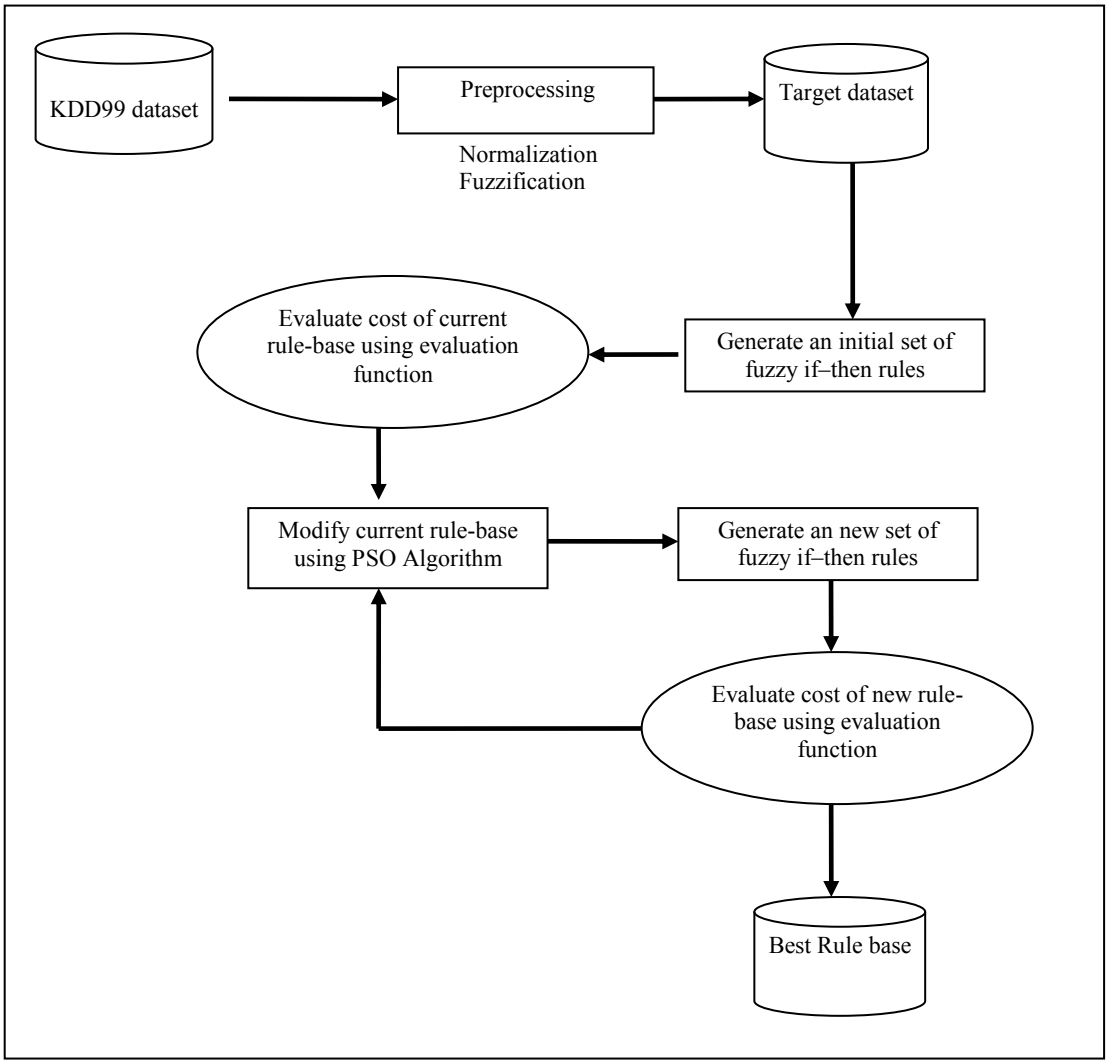

Fig. 4 : Generate Best Knowledge base Using PSO

The decision-making process is performed by the inference engine using the rules contained in the rule base. These fuzzy rules define the connection between input and output fuzzy variables.

Fuzzy modeling is the task of identifying the parameters of a fuzzy inference system so that a desired behavior is attained [24]. With the direct approach a fuzzy model is constructed using knowledge from a human expert. This task becomes difficult when the available knowledge is incompleteor when the problem space is very large, thus motivating the use of automatic approaches to fuzzy modeling.

There are several approaches to fuzzy modeling, based on neural networks [25, 26, 27], genetic algorithms [28, 29], and hybrid methods [9].

In this paper we use Particle Swarm Optimization (PSO) as automatic approach to produce knowledge base which indicated in figure 4.

In the next subsection we describe some steps of the proposed approach which presented in figure 3, 4.

i. *Generate initial rule-base*

There are different method for generate initial rule-base. One of the methods is that we assigned one of the symbols in figure 1 randomly. One method is that we increase probability of don't care fuzzy term. One innovative method is that we generate fuzzy if-then rules directly using training set. First, compatible fuzzy if-then rule is created; then antecedent part of some rules is replaced with don't care term.

The proposed evolutionary fuzzy system (EFS) is considered for each of the classes of the classification problem separately. One of the important benefits of this separation is that the learning system can focus on each of the classes of the classification problem. According to this fact, the mentioned random pattern is extracted according to the patterns of the training dataset, which their consequent class is the same as the class that the algorithm works on. Next, for this random pattern, we determine the most compatible combination of antecedent fuzzy sets using only the five linguistic

values (Figure. 1). The compatibility of antecedent fuzzy rules with the random pattern is calculated by equation (1).

$$\mu_j(x_p) = \mu_{j1}(x_{p1}) \times \ldots \times \mu_{jn}(x_{pn}) \qquad p = 1,2,\ldots,m \qquad (1)$$

Where $\mu_{A_{ji}}(.)$ is the membership function of Aji.

After generating each fuzzy if-then rule, the consequent class of this rule is determined according to (2).

$$\beta_{Class\ h}(R_j) = \sum_{x_p \in Class\ h} \mu_{R_j}(x_p) \qquad ,h = 1,2,\ldots,c \quad (2)$$

Where,

$$\beta_{Class\ C_j}(R_j) = \max\{\beta_{Class\ 1}(R_j),\ldots,\beta_{Class\ c}(R_j)\}. \quad (3)$$

Where β Class h (R j) is the sum of the compatibility grades of the training patterns in Class h with the fuzzy if–then rule Rj and N Class h is the number of training patterns which their corresponding class is Class h . Each of the fuzzy rules in the final classification has a certainty grade, which denotes the strength of that fuzzy rule. This number is calculated according to (4).

$$CF_j = \frac{\beta_{Class\ C_j}(R_j) - \overline{\beta}}{\sum_{h=1}^{c} \beta_{Class\ h}(R_j)} \qquad (4)$$

Where,

$$\overline{\beta} = \frac{\sum_{h \neq C_j} \beta_{Class\ h}(R_j)}{c-1} \qquad (5)$$

ii. *Evaluate rule-base*

The generation of each fuzzy rule is accepted only if its consequent class is the same as its corresponding random pattern class. Otherwise, the generated fuzzy rule is rejected and the rule generation process is repeated. After generation of N pop fuzzy if-then rules, the fitness value of each rule is evaluated by classifying all the given training patterns using the set of fuzzy if–then rules in the current population. The fitness value of the fuzzy if–then rule is evaluated by the following fitness function:

$$fitness(R_j) = NCP(R_j) \qquad (6)$$

Where $NCP(R_j)$ denotes the number of correctly classified training patterns by rule R_j .

iii. *PSO-based rule set update and optimization*

As we have mentioned in the previous subsections, initial rule-base is generated randomly, so that accuracy of the initial rule-base is low. For optimize initial rule-base, we use an PSO algorithm.

Input of this algorithm is a fuzzy rule and the output is an improved version of that fuzzy rule. The improvement is accomplished by some modifications (local search) to the current (input) fuzzy rule. The algorithm is capable of searching for the best modification according to the lifetime of the current fuzzy rule. in each step the algorithm performs one changes to the current (input) fuzzy rule. For each one value, a complete PSO process is done.

In PSO there are many fitness functions. By exploring Pareto dominance concepts, it is possible to obtain results with specific properties. Based on this concept each particle of the swarm could have different leaders, but only one may be selected to update the velocity. This set of leaders is stored in a repository, which contains the best non-dominated solutions found. The PSO components are defined as follows [22].

Each particle pi, at a time step t, has a position x (t) ϵ R^n, that represents a possible solution. The position of the particle, at time t +1, is obtained by adding its velocity, v (t) ϵ R^n, to x (t):

$$x(t+1) = x(t) + v(t+1) \qquad (9)$$

The velocity of a particle pi is based on the best position already fetched by the particle, pbest(t), and the best position already fetched by the set of neighbors of pi, Rh(t), that is a leader from the repository. The velocity update function, in time step t +1 is defined as follows:

$$v(t+1) = \varpi * v(t) + (c_1 * \phi_1) * (p_{best}(t) - x(t)) + (c_2 * \phi_2) * (R_h(t) - x(t)) \qquad (10)$$

The variables ϕ1and ϕ2, in Equation 10, are coefficients that determine the influence of the particle's positions. The constants c_1 and c_2 indicates how much each component influences on the velocity. The coefficient ϖ is the particle inertia and controls how much the previous velocity affects the current one R_h is a particle from the repository, chosen as a guide of p_i. There are many ways to make this choice. At the end of the algorithm, the solutions in the repository are the final output.

V. Experimental Result

Experiments were carried out on a subset of the database created by DARPA in the framework of the 1998 Intrusion Detection Evaluation Program [16]. We used the subset that was pre-processed by the Columbia University and distributed as part of the UCI KDD Archive [17]**Error! Reference source not found.** The available database is made up of a large number of network connections related to normal and malicious traffic. Each connection is represented with a 41-dimensional feature vector which presented in table 2. Connections are also labeled as belonging to one out of

five classes. One of these classes is the normal class and the rest indicates four different intrusion classes: PRB, DOS, U2R, and R2L which presented in table 1. These intrusion classes are a classification of 22 different types of attacks in a computer network.

This approach is implemented by using C++ programming language. We use 10-CV technique for evaluate proposed approach. In this technique, KDD99 dataset divided to 10 parties, nine parties for train set and one party for test set.

Table 3 is the confusion matrix of Proposed approach. The top-left entry of Table 3 shows that 3194 instances of the actual PRB test set were detected to be PRB; the last column indicates that 76.66% of the actual PRB samples were detected correctly. In the same way, for R2L, 1971 instances of the actual _attack' test set were correctly detected. The last column indicates that 12.17% of the actual R2L samples were detected correctly. The bottom row shows that 83.48% of the test set classified, as R2L indeed belongs to R2L. The bottom-right entry of the table 3 shows that 93.70% of all patterns in the test set are correctly classified.

Table 4 represents the cost matrix that defines the cost for each type of misclassification.

We aim at minimizing that cost function. Given the confusion and cost matrixes, we calculated the cost of our simulated annealing based fuzzy intrusion detection system as shown in table 5. The bottom-right entry of the table 5 shows that the classification cost of our algorithm is 0.1872.

Proposed approach is compared with some algorithms, such as C4.5, *k*-NN, Naïve Bayes, SVM, MLP. Result of comparison is indexed in table 6.

Table 3 : Confusion Matrix for the Proposed Approach

Real Class	Detected Class				
	PRB	DOS	U2R	R2L	%
PRB	3194	306	0	0	76.66
DOS	576	226388	10	0	98.49
U2R	116	0	37	11	16.22
R2L	77	3447	8	1971	12.17
%	76.66	98.33	46.83	83.48	**93.70**

Table 4 : Cost Matrix Used To Evaluate the Confusion of Proposed Approach

Real Class	Detected Class			
	PRB	DOS	U2R	R2L
PRB	0	2	2	2
DOS	1	0	2	2
U2R	2	2	0	2
R2L	2	2	2	0

Table 5 : Cost-Based Scoring of the Proposed Approach

Real Class	Detected Class				
	PRB	DOS	U2R	R2L	
PRB	0	612	0	0	
DOS	576	0	20	0	
U2R	232	0	0	22	
R2L	154	6894	16	0	
					0.1872

Table 6 : Recall, Precision, and F-measure For Different Classifier. The Best Values are Bold

Class	Algorithm	C4.5	5-NN Error! Reference source not found.	SVM Error! Reference source not found.	Winner Entry	Proposed Approach
PRB	Recall	81.88	81.61	**86.27**	83.30	76.66
	Precision	52.20	55. 6	77.72	64.81	**76.66**
	F-measure	63.76	66.05	81.77	72.90	**86.2**
DOS	Recall	96.99	97.00	97.65	97.10	**99.20**
	Precision	99.69	99.42	99.86	**99.88**	98.39
	F-measure	98.32	98.19	98.70	98.47	**98.79**
U2R	Recall	14.47	14.91	10.09	13.20	**16.23**
	Precision	9.35	5.47	53.49	**71.43**	32.46
	F-measure	11.36	8.00	16.97	**22.28**	21.64
R2L	Recall	1.45	6.90	3.55	8.40	**12.65**
	Precision	30.32	66.97	62.39	**98.84**	90.26
	F-measure	2.77	12.51	6.71	15.48	**22.19**

VI. Conclusions

In this paper, we focused on intrusion detection in computer networks by combination of fuzzy systems and PSO algorithm. The proposed method performs the classification task and extracts required knowledge using fuzzy rule based systems which consists of fuzzy if-then rules. Particle Swarm Optimization algorithm is employed to optimize the obtained set of fuzzy rules. The proposed system has two main features of data mining techniques which are high reliability and adequate interpretability, and is comparable with several well-known algorithms. Results on *intrusion detection* data set from KDD cup-99 repository show that the proposed approach would be capable of classifying intrusion instances with high accuracy rate in addition to adequate interpretability of extracted rules.

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21. 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 to your topic. You may also maintain your arguments with records.

22. Never start in last minute: Always start at right time and give enough time to research work. Leaving everything to the last minute will degrade your paper and spoil your work.

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

24. Never copy others' work: Never copy others' work and give it your name because if evaluator has seen it anywhere you will be in trouble.

25. Take proper rest and food: No matter how many hours you spend for your research activity, if you are not taking care of your health then all your efforts will be in vain. For a quality research, study is must, and this can be done by taking proper rest and food.

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

27. Refresh your mind after intervals: Try to give rest to your mind by listening to soft music or by sleeping in intervals. This will also improve your memory.

28. Make colleagues: Always try to make colleagues. No matter how sharper or intelligent you are, if you make colleagues you can have several ideas, which will be helpful for your research.

29. **Think technically:** Always think technically. If anything happens, then search its reasons, its benefits, and demerits.

30. Think and then print: When you will go to print your paper, notice that tables are not be split, headings are not detached from their descriptions, and page sequence is maintained.

31. Adding unnecessary information: Do not add unnecessary information, like, I have used MS Excel to draw graph. Do not add irrelevant and inappropriate material. These all will create superfluous. Foreign terminology and phrases are not apropos. One should NEVER take a broad view. Analogy in script is like feathers on a snake. Not at all use a large word when a very small one would be

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33. Report concluded results: Use concluded results. From raw data, filter the results and then conclude your studies based on measurements and observations taken. Significant figures and appropriate number of decimal places should be used. Parenthetical remarks are prohibitive. Proofread carefully at final stage. In the end give outline to your arguments. Spot out perspectives of further study of this subject. Justify your conclusion by at the bottom of them with sufficient justifications and examples.

34. After 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 to 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 in 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 criterion for grading the final paper by peer-reviewers.

Final Points:

A purpose of organizing a research paper is to let people to interpret your effort selectively. The journal requires the following sections, submitted in the order listed, each section to start on a new page.

The introduction will be compiled from reference matter and will reflect the design processes or outline of basis that direct you to make study. As you will carry out the process of study, the method and process section will be constructed as like that. The result segment will show related statistics in nearly sequential order and will direct the reviewers next to the similar intellectual paths throughout the data that you took to carry out your study. The discussion section will provide understanding of the data and projections as to the implication of the results. The use of good quality references all through the paper will give the effort trustworthiness by representing an alertness of prior workings.

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General style:

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To make a paper clear

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Mistakes to evade

- Insertion a title at the foot of a page with the subsequent text on the next page

- Separating a table/chart or figure - impound each figure/table to a single page
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· Keep on paying attention on the research topic of the paper

· Use paragraphs to split each significant point (excluding for the abstract)

· Align the primary line of each section

· Present your points in sound order

· Use present tense to report well accepted

· Use past tense to describe specific results

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· Shun use of extra pictures - include only those figures essential to presenting results

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The summary should be two hundred words or less. It should briefly and clearly explain the key findings reported in the manuscript--must have precise statistics. It should not have abnormal acronyms or abbreviations. It should be logical in itself. Shun citing 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 approach 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. Yet, use comprehensive sentences and do not let go readability for briefness. You can maintain it succinct by phrasing sentences so that they provide more than 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 maintain the initial two items to no more than one ruling each.

- Reason of the study - 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 quantitative data; results of any numerical analysis should be reported
- Significant conclusions or questions that track from the research(es)

Approach:

- Single section, and succinct
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- A conceptual should situate on its own, and not submit to any other part of the paper such as a form or table
- Center on shortening results - bound background information to a verdict or two, if completely necessary
- What you account in an conceptual must be regular with what you reported in the manuscript
- Exact spelling, clearness 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

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The **Introduction** should "introduce" the manuscript. The reviewer should be presented with sufficient background information to be capable to comprehend and calculate the purpose of your study without having to submit to other works. The basis for the study should be offered. Give most important references but shun difficult to make a comprehensive appraisal of the topic. In the introduction, describe the problem visibly. If the problem is not acknowledged in a logical, reasonable way, the reviewer will have no attention in your result. Speak in common terms about techniques used to explain the problem, if needed, but do not present any particulars about the protocols here. Following approach can create a valuable beginning:

- Explain the value (significance) of the study
- Shield the model - why did you employ this particular system or method? What is its compensation? You strength remark on its appropriateness from a abstract point of vision as well as point out sensible reasons for using it.
- Present a justification. Status your particular theory (es) or aim(s), and describe the logic that led you to choose them.
- Very for a short time explain the tentative propose and how it skilled the declared objectives.

Approach:

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- Explain materials individually only if the study is so complex that it saves liberty this way.
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- Do not take in frequently found.
- If use of a definite type of tools.
- Materials may be reported in a part section or else they may be recognized along with your measures.

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- Report the method (not particulars of each process that engaged the same methodology)
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- Simplify - details how procedures were completed not how they were exclusively performed on a particular day.
- If well known procedures were used, account the procedure by name, possibly with reference, and that's all.

Approach:

- It is embarrassed or not possible to use vigorous voice when documenting methods with no using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result when script up the methods most authors use third person passive voice.
- Use standard style in this and in 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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The principle of a results segment is to present and demonstrate your conclusion. Create this part a 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. Carry on to be to the point, by means of statistics and tables, if suitable, to present consequences most efficiently.You must obviously differentiate material that would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matter should not be submitted at all except requested by the instructor.

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- Present a background, such as by describing the question that was addressed by creation an exacting study.
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- Never confuse figures with tables - there is a difference.

Approach

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

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- Give details all of your remarks as much as possible, focus on mechanisms.
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- Try to present substitute explanations if sensible alternatives be present.
- One 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 available information
- Submit to work done by specific persons (including you) in past tense.
- Submit to generally acknowledged facts and main beliefs in present tense.

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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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ISSN 9754350