Online ISSN : 2249-4596
Print ISSN : 0975-5861

Global Journal

of Researches in Engineering: J

General Engineering

Stationary Wavelet Transform

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Discovering Thoughts, Inventing Future

VOLUME 14 ISSUE 6 VERSION 1.0

Global Journal of Researches in Engineering: J
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General Engineering
Volume 14 Issue 6 (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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Contents of the Issue

Global Journal of Researches in Engineering: J
General Engineering
Volume 14 Issue 6 Version 1.0 Year 2014
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals Inc. (USA)
Online ISSN: 2249-4596 & Print ISSN: 0975-5861

A Novel Approach for Saliency Detection by using Stationary Wavelet Transform Low Level Features

By Mulagundla Mahalaxmi, Mr K. Durga Prasad, Dr. K. Manjunathachari & Dr. M.N. Giri Prasad

Vardhaman College of Engineering, India

Abstract- The ability of the Human Visual System (HVS) to detect an object in an image is extremely fast and reliable but how can a machine vision system detects the salient regions? many algorithms have been proposed to solve this problem by extracting features in either spatial or spectral domain, in this paper, A novel saliency detection model is introduced by utilizing low level features obtained from Stationary Wavelet Transform domain. Here Stationary Wavelet Transform (SWT) is preferred as the wavelet transform than Discrete Wavelet Transform (DWT), Since DWT is not a time-invariant transform. So to make it translation invariant SWT is introduced. And also unlike the other wavelet transforms SWT does not require down sampling, So image size is same as original even after decomposition, thus there is no information loss in respective sub bands. Experimental results demonstrate that proposed model produces better performance by using SWT than by using DWT with the overall F-Measure value being high.

Keywords: human visual system (HVS), saliency detection, stationary wavelet transform, feature map, saliency map.

GJRE-J Classification : FOR Code: 091599

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A Novel Approach for Saliency Detection by using Stationary Wavelet Transform Low Level Features

Mulagundla Mahalaxmi [α], Mr K. Durga Prasad [σ], Dr. K. Manjunathachari [ρ] & Dr. M.N. Giri Prasad [ω]

Abstract- The ability of the Human Visual System (HVS) to detect an object in an image is extremely fast and reliable but how can a machine vision system detects the salient regions? many algorithms have been proposed to solve this problem by extracting features in either spatial or spectral domain, in this paper, A novel saliency detection model is introduced by utilizing low level features obtained from Stationary Wavelet Transform domain. Here Stationary Wavelet Transform (SWT) is preferred as the wavelet transform than Discrete Wavelet Transform (DWT), Since DWT is not a time-invariant transform. So to make it translation invariant SWT is introduced. And also unlike the other wavelet transforms SWT does not require down sampling, So image size is same as original even after decomposition, thus there is no information loss in respective sub bands. Experimental results demonstrate that proposed model produces better performance by using SWT than by using DWT with the overall F-Measure value being high.

Keywords: human visual system (HVS), saliency detection, stationary wavelet transform, feature map, saliency map.

I. Introduction

The first step in recognition of an object is object detection. Object detection is nothing but extracting an object from its background. Human visual system (HVS) can easily identifies the important and compact information from the natural scenes [1]. But for the machine vision systems it is a challenging task. Many traditional models have been introduced to detect the salient regions by utilizing the low level features such as intensity, color, contrast.

There are two types of visual attention mechanism: top-down and bottom-up approaches. The top-down approach is goal-driven, consists of high level data processing and requires prior knowledge to support the tasks such as target detection, object recognition etc [2],[3]. Bottom-up approach is task independent and obtained from early features [4],[5]. Both the computational models are used to generate the salient regions for the images. In this paper bottom-up visual attention mechanism is used.

Most visual attention models computes the saliency maps by extracting low level features from the image. These models consists of the following three steps. First step is feature extraction in which multiple low level features such as such as color, intensity, orientation, texture and motion are extracted from the image at various scales[6],[7].

The second step is saliency computation, it is computed by self information [6] and center-surround operation [7] and last step is few key locations on saliency map are identified by applying non linear operations. Recent studies have tried to obtain saliency map for images in different domains namely, Spatial, Fourier Transform, Wavelet Transform domains. One of the earliest computational models of visual attention is proposed by Itti et.al [3], [7]. He used low level features to calculate saliency map, however local information loss is unavoidable in this algorithm since the saliency map is calculated in coarser scales. problems. By using Fourier Transform, a signal in frequency domain can be decomposed in to amplitude spectrum and phase spectrum. Oliva et al [8], [9]. proposed an algorithm by using Fourier Transform (FT), amplitude spectrum gives the shape and position of the object and the phase spectrum gives global information of the image that contributes to overall scene. Hou et al. [10] extracted the spectral residual of an image by analyzing the log spectrum of an image in spectral domain and saliency map is computed by transforming the spectral domain to spatial domain by applying inverse Fourier Transform. However in this model global irregularities are more dominant than local irregularities and another disadvantage is it requires high down-sampling rate. And main disadvantage of Fourier Transform is, it cannot be applied to non- stationary signals and gives better results with only periodic or stationary signals.

Recently Wavelet Transform [11], [12] has begun to draw the much attention in visual attention modeling because of its advantage of being applicable to non-stationary signals. Wavelet Transforms are used to provide time-frequency representation [12]. It is capable of providing the time and frequency information simultaneously. In this paper Stationary Wavelet Transform (SWT) is used to decompose the image into sub-bands. Feature maps are created by applying Inverse SWT on the multi-level decomposition.

Rest of this paper is organized as follows: section II gives the brief view of existing mode land wavelet decomposition, section III presents the

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proposed model in detail, experimental results are given in section IV and conclusions are given in final section.

II. Conventional Model

Nevrez Imamoglu et al. [13] proposed an algorithm by utilizing low-level features obtained from the discrete wavelet Transform domain. DWT decomposes the input image and generates four sub-bands of the image [12],[13] namely approximation, horizontal, vertical, diagonal representing details of the image are shown in fig.1. Then feature maps are generated by applying IDWT and then global and local saliency maps are computed separately from these features to form a final saliency map.

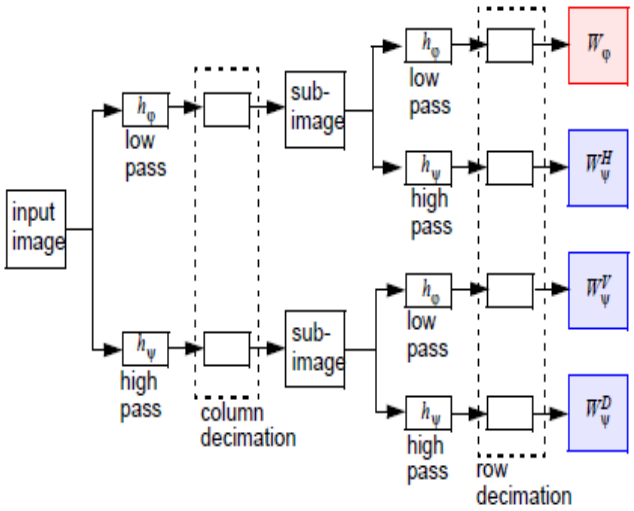


Fig. 1 : Two dimensional DWT decomposition scheme

This model is aimed to modulate local contrast at a location with its global saliency computed based on likelihood of the features and also considered local center-surround differences and global contrast in the final saliency map. But Discrete wavelet Transform (DWT)'s drawback is that it is not translation invariant and includes down sampling steps so image size will be reduced in the decomposition levels, in order to overcome this and to get more complete characteristic of the input image the un decimated WT i.e Stationary Wavelet Transform (SWT) is proposed.

III. Proposed Saliency Detection Model

a) Stationary wavelet Transform (SWT)

It is also called Un-decimated Wavelet Transform or the Invariant Wavelet Transform or the redundant Wavelet Transform [14]. The key point is that it gives better approximation than the DWT since it is redundant, linear and shift invariant. SWT is very useful algorithm for analyzing a linear system. Stationary Wavelet Transform is preferred as the Wavelet Transform since unlike the other Wavelet Transforms, the SWT procedure does not include any down sampling steps as it can be seen in fig.2. Normally Discrete Wavelet Transform (DWT) is used to decompose an input image into different sub band images i.e approximation, horizontal, vertical and diagonal. Three high frequency sub bands (LH,HL,HH) contain the high frequency components of an input image and LL band, which is a low frequency band gives the approximation of the input image. Down sampling in each of the DWT sub bands causes information loss in respective sub bands that is why SWT is used to minimize this loss. As no decimation steps are involved in SWT, it produces more precise information for the frequency localization [15],[16],[17].

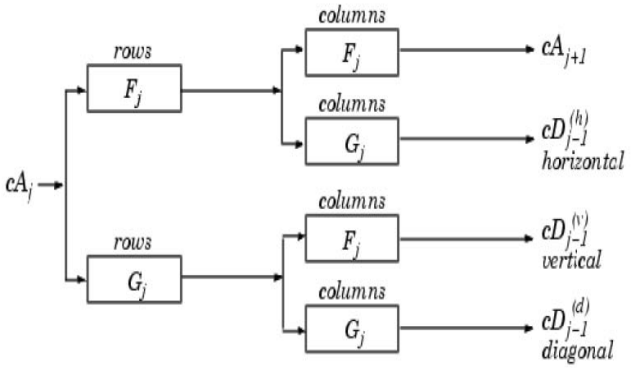


Fig. 2 : Stationary Wavelet Transform decomposition scheme

b) Over view of the proposed model

Proposed model is same as saliency detection model using wavelet transform proposed by Nevrez Imamoglu et al [13]. except one difference here SWT is used instead of DWT because in SWT no decimation steps are there, therefore sub bands of image size is same as original image even after decomposition for number of levels thus there is no loss of Information in the sub bands, Thus SWT gives better saliency detection than DWT. The framework of the proposed model is shown in fig. 3, first of all, rgb image is converted into CIE Lab color space since lab color space is similar to human perception ,with a luminance and two chromatic channels (RG and BY) and another advantage is it is device independent . To remove noise an mxm 2D Gaussian low-pass filter is applied to the input color image g^c.

$$g^{IC} = g^{c} * I_{m\times m} \quad (1)$$

Where I is the mxm 2-D filter, g^{IC} is noise removed version of g^c, here a small filter size m=3 is selected for noise reduction.

SWT is based on the idea of no decimation. It does not include down sampling in the forward and up sampling in the inverse transform. The sub-bands of the image is formed by applying SWT for number of levels

representing approximation, horizontal, vertical and diagonal coefficients of the image. H, V, D coefficients are saved and approximation is used for next level, thus the decomposition is done until the coarsest resolution is possible. Here as no decimation and interpolation process are involved the size of the sub-bands of the image do not diminish from level to level, thus there will be no information loss, thus the number of pixels involved in computing a given coefficients grows slower and so the relation between the frequency and spatial information is more precise.

$$[A_N^c, H_s^c, V_s^c, D_s^c] = SWT_N(g^{IC}) \quad (1)$$

Where N is the maximum number of scaling for decomposition process. i.e resolution.

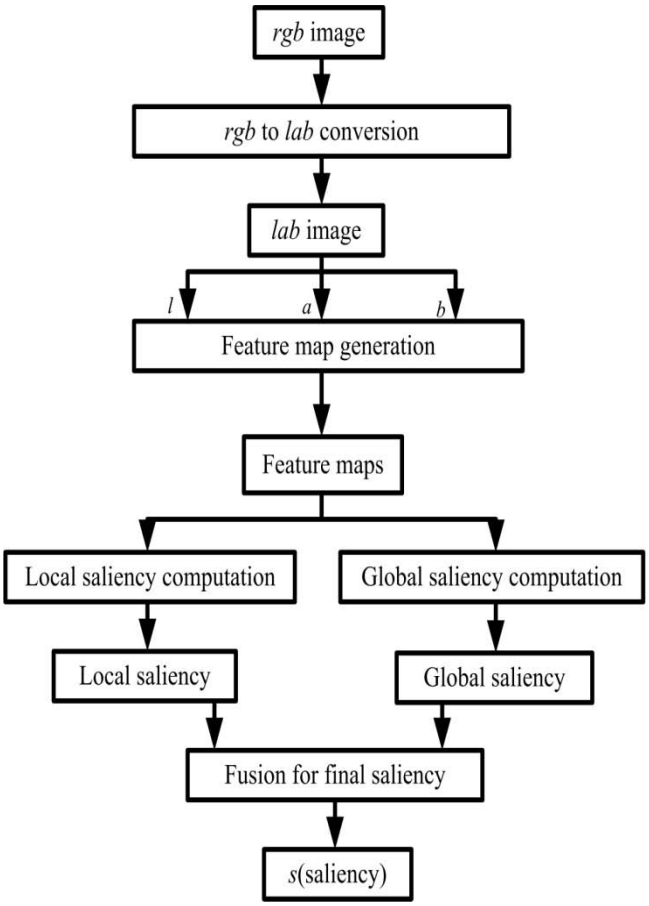


Fig. 3 : The frame work of proposed saliency detection model

index s $\epsilon\{1,....N\}$. C is the channels of g^{IC} as C $\epsilon\{L,a,b\}$. A_N^c is the approximation output at the coarsest resolution for each channel, H_s^c, V_s^c, D_s^c are wavelet coefficients of Horizontal, Vertical and diagonal details of the given image.

Several feature maps are created by applying inverse SWT to the horizontal, vertical and diagonal details of the image by neglecting approximation during IWT process

$$f_s^c(x,y) = \frac{(ISWT_s(H_s^c, V_s^c, D_s^c))^2}{\eta} \quad (3)$$

here $f_s^c(x,y)$ is the feature map generated for the s^{th} level decomposition for each image sub-band c, η is the scaling factor to limit the feature maps. Since the range of Lab input image for each channel is [0, 255], there will be higher range for feature values, here $\eta = 10^4$ is chosen. Thus eqn (3) creates 3xN feature maps for an input color image and each feature maps resolution is equal to the size of the input image. Once the feature maps are generated, the next step is to calculate the global distribution of the local features to obtain the global saliency map. From $f_s^c(x,y)$ in (3), a location (x,y) is selected which represents the feature vector f(x,y) with a length of 3xN from all feature maps. The likelihood of the features of a given location can be defined by applying probability density function (PDF) [8], [18]. By using PDF global saliency map can be computed as shown below.

$$s_G(x,y) = (\log(p(f(x,y))^{-1}))^{1/2} * I_{k\times k} \quad (4)$$

where kxk 2-D Gaussian low pass filter is used to obtain a smooth map, the global saliency map is generated with small salient regions and causes some loss in local saliency information thus it can be seen that global distribution on the saliency map is much higher due to the content or structure of the scene. After obtaining global saliency map, the next step is to compute local saliency, local saliency is created by adding the feature maps at each level linearly without any normalization operation in [7], as the formula to be given in (5) below. This new map is computed by taking the maximum value between channels of the input image at each level

$$s_L(x,y) = \left(\sum_{s=1}^{N} \arg\max\left(f_s^L(x,y), f_s^a(x,y), f_s^b(x,y)\right)\right) * I_{k\times k} \quad (5)$$

where $f_s^L(x,y), f_s^a(x,y), f_s^b(x,y)$ are the feature maps for L, a and b channels respectively. The final saliency map is computed by combining global and local saliency maps

$$s'(x,y) = M(s'_L(x,y) \times e^{S'_G(x,y)}) * I_{k\times k} \quad (6)$$

where $s'(x,y)$ is the final saliency map, $s'_L(x,y)$ and S'_G(x,y) are the local and global saliency maps scaled to the range [0,1]. Final saliency map is enhanced with a similar fashion in [25]. As stated by Goferman et al. [18] the locations around the focus of attention (FoA) have to be more attentive than those away from the (FoA). Therefore saliency values are increased to enhance the performance of the saliency map.

Where s'(x',y') is the salient value of the most salient points at the location (x',y') extracted from the

saliency map in (6), s(x,y) is the saliency value at point (x,y) and $d_{cFoA}(x,y)$ is the distance between location (x,y) and its closest FoA at the location (x',y'). The proposed final saliency map is better than the global an local saliency maps.

IV. Experimental Results

For experimental results, the quantitative performance of the proposed model and conventional model is evaluated based on overall precision P, recall R, and F-Measure Fα [19] as defined below.

$$precision(p) = \frac{\sum_x \sum_y (t(x,y) \times s(x,y))}{\sum_x \sum_y s(x,y)}$$

$$recall(R) = \frac{\sum_x \sum_y (t(x,y) \times s(x,y))}{\sum_x \sum_y t(x,y)}$$

$$F-measure(F_\alpha) = \frac{(1+\alpha) \times P \times R}{\alpha \times P + R}$$

where s(x,y) is the saliency map from the computational model , t(x,y) is the ground truth map and α is a positive parameter to decide the importance of the precision over the recall. Precision is related to the saliency detection performance of the proposed model. Recall is the ratio of correct detection of salient regions to the ground truth map. F-measure is the harmonic mean of precision and recall [19]. Precision(P), recall(R), F-Measure (F_α) results for the proposed and conventional model are shown in table 1.

Table 1 : Performance comparison of conventional and proposed model

Parameters	Conventional model	Proposed model
Precision	0.0085	0.0943
Recall	0.3203	0.1140
F-measure	0.0166	0.1032

It can be seen that precision and F-Measure values of the computational model using DWT [13] are very low due to high recall value which causes more irrelevant salient regions occur and the proposed model has the better Precision and F-Measure values compared to conventional model. Therefore the overall performance of the proposed model is reliable and yields better results with respect to the relevant conventional model.

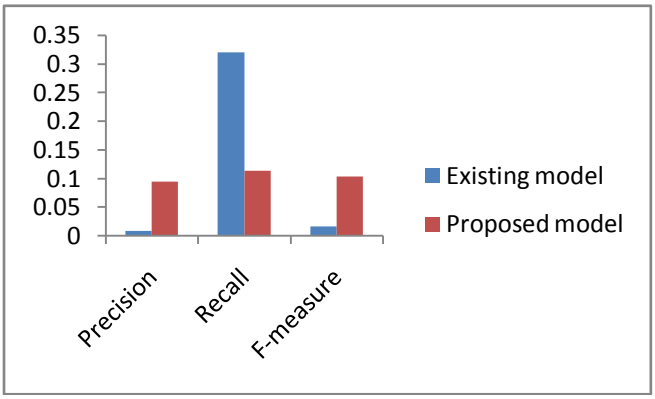
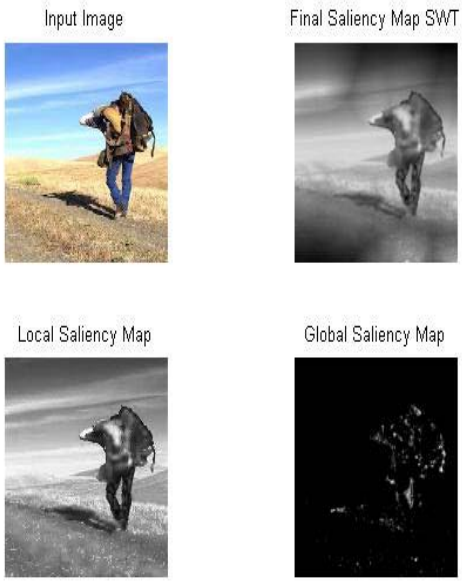


Fig. 4 : Comparison of conventional and proposed model

Microsoft public data base is used to evaluate the performance of the proposed model and is implemented by using MATLAB. The final saliency maps along with local and global saliency maps of DWT and SWT are shown in figs 5 and 6.

Fig. 5 : Local, Global and Final saliency map for a given image by using DWT

Fig. 6 : Local, Global and Final saliency map for a given image by using SWT



V. Conclutions

In this paper, a bottom up computational model of visual attention system based on wavelet coefficients is proposed to obtain the saliency map for images. Various feature maps are generated by applying ISWT to the band pass regions of images at various scales. Using these features, the local and global saliency maps are computed, by combining these maps final saliency map is formed. The performance of the proposed model based on precision, recall an F-Measure is evaluated. Experimental evaluation shows that performance of the proposed model is better than the conventional model.

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Global Journal of Researches in Engineering: J
General Engineering
Volume 14 Issue 6 Version 1.0 Year 2014
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals Inc. (USA)
Online ISSN: 2249-4596 & Print ISSN: 0975-5861

Advances of Space Technology in Geotechnical Studies

By Sefer Kurnaz, Bahar N. Aliyeva & Rustam B. Rustamov
Bahcheshehir University, Azerbaijan

Abstract- Geographical Information Systems (GIS) is the technology where geospatial data can be represented in the graphic form integrated into the geotechnical, geologic and hydrologic information routinely used by geotechnical engineers. A GIS makes available a wide of forms of spatial data to be integrated, selected and sorted with any number of physical, chemical or any possible environmental factors.

GJRE-J Classification : FOR Code: 091402p

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Advances of Space Technology in Geotechnical Studies

Sefer Kurnaz [α], Bahar N. Aliyeva [σ] & Rustam B. Rustamov [ρ]

Abstract- **Geographical Information Systems (GIS) is the technology where geospatial data can be represented in the graphic form integrated into the geotechnical, geologic and hydrologic information routinely used by geotechnical engineers. A GIS makes available a wide of forms of spatial data to be integrated, selected and sorted with any number of physical, chemical or any possible environmental factors.**

I. Introduction

There is no doubt that Remote Sensing method is the instrument for development of GIS. It is obvious that GIS technology developments need collection of initial data based on aero and space information. A Remotely Sensed information required for GIS technology applications needed to be processed depending of kind of problem necessary to be solved.

Major areas of space science and technology applications in study of soil are following:

- Geotechnical Investigations;
- Foundations;
- Earthquake;
- Landslide Studies;
- Application of remote sensing & GIS;
- Geological & Geophysical Investigation;
- Industrial waste & contaminated soil.

Some of the important areas in geotechnical investigations can be classified as [1]:

- Geotechnical instrumentation for performance evaluation;
- Mobile drilling rig for soil and rock exploration;
- Sub-surface profiling by Engineering Seismograph, Resistivity meter and Georadar;
- Total Station for surveying & monitoring;
- Computer controlled Triaxial and Consolidation Testing System;
- Computer controlled Laser Particle Size Analyzer;
- Petrological microscope;
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- Strong Motion instruments;
- Digital Image Processing and Geographical Information System;

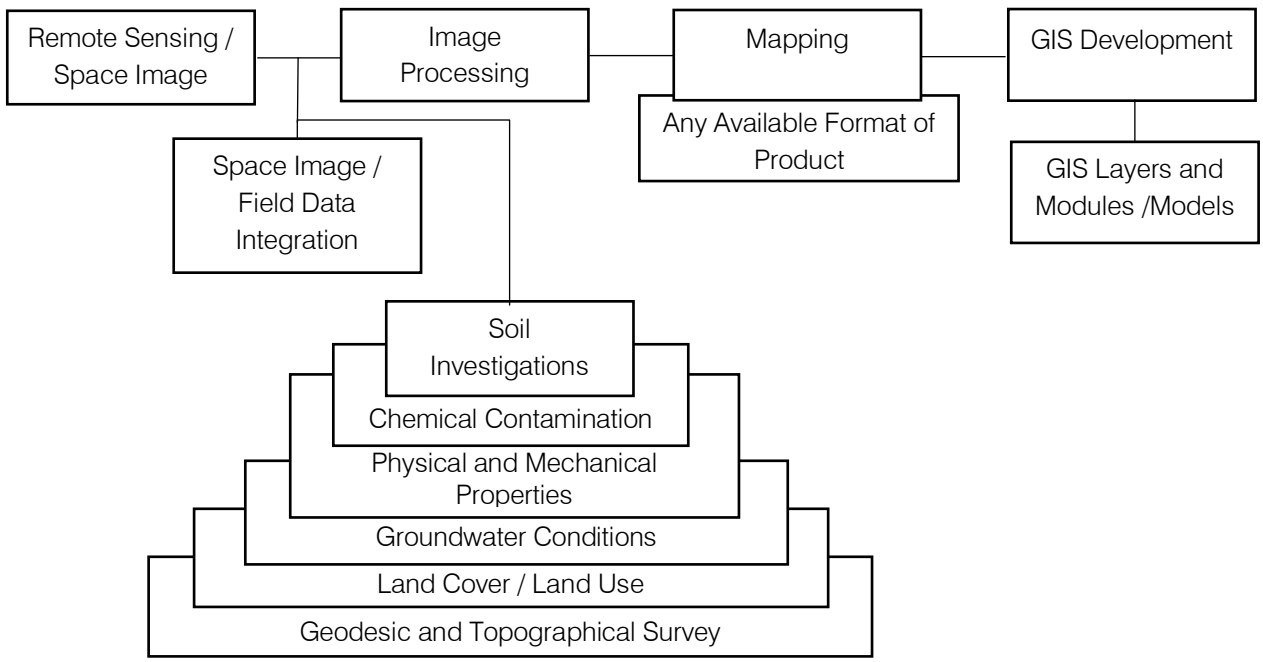

Figure 1 : A GIS development in geotechnical study

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II. Data Access in gis Developments

It is important stage of GIS developments to start from the segments of data collections based on Remote Sensing method use (Figure 1). A quality of final product in geotechnical investigations depends how correct and right Remote Sensing data shall be used for GIS technology application.

The fact is that the most expensive and time consuming component of GIS has been data access due to the lack of sufficient information in the area for the reason of limited store of geotechnical information in electronic format. There is number of problems even with available information which needed to be edited as some objects on older maps has to be corrected and specified. Some paper maps can be scanned electronically as raster images, which convert map lines to a series of points and digits. Many GIS were formulated to emphasize spatial relationships between mapped objects and such boundaries are usually represented by a line. The line may be a road, mapped boundary, or some sort of link between two other points of interest. Civil infrastructure elements, such as roads, may not be reflected accurately, in terms of absolute scale, but simply represented by a default line width(s) coded into the mapping software. This condition creates limitation in application mainly in GIS developments especially in dynamic change studies where necessary correct base information for correlation and comparison old and existing current situations.

III. Stage of Data Integration

GIS makes possible to mix or integrate information that would otherwise be difficult to associate through other means. These could be soil chemical contamination, physical-mechanical properties in the form of scanned, geo-referenced and sandwiched with other kinds of data, such as topographic and geologic maps.

IV. Data Structures

Digital geospatial data is collected and stored in many different formats. A GIS must be used to convert data from one type of structure to another. Satellite data can usually be "read" into the GIS in a raster format. Raster data files consist of rows of uniform cells coded according to data values. Raster files can be manipulated quickly by computer, but they are often less detailed and may be less visually appealing than vector data files. Vector digital data files have been captured as points, lines (a series of point coordinates) or areas (shapes bounded by lines). A typical vector file would be tax assessor's parcel maps [1, 2].

V. Data Modeling

GIS allows two and three-dimensional characteristics of the Earth's surface, subsurface or atmosphere from geospatial data. Some common examples of data modeling would be creating isohyets based on different initial information sources. These data models can then be combined with other types of information layers in the GIS [3,4]. Some common examples would be combining measured different information sources with elevation, or the thickness of a certain geologic formation (isopach) as compared to the depth to its upper surface (isopleth) where available.

VI. Outcomes

One of the important issue of GIS is its ability to produce pleasing graphics that convey analyses to decision makers and the public at-large. These analyses usually begin with entering any codified restrictions, such as structural setbacks. An attributes included can then be electronically combined and weighted according to arbitrary values set by the body ordering the analysis. Such kind of developed hybrid data in the form of maps frustrate many engineers because they can arbitrarily be weighted to restrict or even eliminate development from areas where the project's detractors reside on adjacent parcels with all the same attributes.

VII. Geotechnical Investigations

Filed measurements in geotechnical investigations are very important in development of GIS technology. It is considering number of implementations in the selected areas needed to be investigated.

a) Area selected for geotechnical investigations

It has been selected area of Sangachal district, Baku, capital of Azerbaijan located on the coast of the Caspian Sea 45 kilometres (28 mi) south of Baku, Azerbaijan. There is the Sangachal Terminal is an industrial complex consisting of a natural gas processing plant and oil production plan. It makes very attractive and vital to monitor of the area with contamination as more as possible information in point of environmental and ecological condition assessment. In this case geotechnical investigations can be play a significant place in collection and processing of data based on use of modern technology applications.

Remote Sensing method and GIS technology is key instrument in consideration of approaches of data collection for decision makers as well as suitable way in data storage for the future access.

Shah Deniz flare area is located adjacent to the Sangachal Terminal and lies within the Garadagh District, which includes Baku and then extends south along the Caspian coast to the south of Alyat. The Garadagh District was established in 1923 and comprises five city settlements including Lokbatan, which is the District's administrative center. The four communities in the immediate vicinity of the Terminal (Sangachal Town, Umid, Masiv3 and Azim Kend) are

likely to be the most directly affected by the socio-economic impacts of Shah Deniz flare project.

b) Field Geotechnical Works

i. *Drilling and sampling*

Drilling at the Shah Deniz flare area started immediately after realization of detailed geodetic and topographic investigation. During the drilling process, the samples were obtained and the whole information about the site, depth of boreholes, date and number of samples were recorded.

ii. *Standard penetration test (SPT)*

The SPT method covers the determination of the resistance to soils at the base of a borehole to the penetration of the split-barrel sampler when driven dynamically in a standard manner, and the obtaining of a disturbed sample for identification purposes.

iii. *Soil electrical resistivity test*

Soil resistivity is dependent on moisture content and temperature as well as on soil constituents, so that it can vary seasonally and progressively due to the hydrological trends such as changing water tables or continuous drainage.

Soil resistivity is generally measured by driving three equally spaced test spikes to a depth of up to 1m, the depth not exceeding 5% of their separation a. It's important to ensure that their resistance areas do not overlap. Current is passed between electrode X, the one being tested, and an auxiliary current electrode Y. The voltage drop between electrode X and a second auxiliary electrode Z is measured and the resistance of the electrode X is then the voltage between X and Z divided by the current flowing between X and Y. The source of current and the means of metering either the current and voltage or their ratio are often, but not necessarily, combined in one device.

VIII. Laboratory Tests

There is no doubt that collected field data for geotechnical investigation required to be processed in laboratory condition. The following tests have been conducted for soil samples collected from investigated area.

a) Moisture Content

The water content is determined by drying selected moist/wet soil material (the mass of moist soil material is not less than 30g) for at least 18 hours to a constant mass in a drying oven at 105°C up to 110°C. The difference in mass before and after drying is used as the mass of the water in the test material. The mass of material remaining after drying is used as the mass of the solid particles. The ratio of the mass of water to the measured mass of solid particles is the water content of the material.

b) Particle size analysis

Particle size analysis can be performed by means of sieving and/or hydrometer readings. Sieving is carried out for particles that would be retained on a 0.063mm sieve, while additional hydrometer readings may be carried out when a significant fraction of the material passes a 0.063mm sieve.

c) Bulk density

The bulk density of a soil, $\boldsymbol{\rho}$ is the mass per unit volume of the soil deposit including any water it contains. The dry density $\boldsymbol{\rho}_d$ is the mass of dry soil contained in a unit volume. Both are expressed in Mg/cm^3.

d) Atterberg limits

Atterberg limits are determined on soil specimens with a particle size of less that 0.425mm. If necessary, coarser material is removed by dry sieving. The Atterberg limits refer to arbitrarily defined boundaries between the liquid and plastic states (Liquid Limit, w_L), and between the plastic and brittle states (Plastic Limit, w_p) of fine-grained soils. They are expressed as water content, in percent.

e) Unconsolidated–undrainedtriaxial compression test

This test method covers determination of the strength and stress-strain relationship of a cylindrical specimen of either undisturbed or remolded cohesive soil. Specimens are subjected to a confining fluid pressure in a triaxial chamber. No drainage of the specimen is permitted during the test. The specimen is sheared in compression without drainage at a constant rate of axial deformation.

f) Direct shear test

The soil is dried and sieved with 5mm sieve, wetted and placed in the ring of the shear device. Key parameters that can be obtained from this test are angle of internal friction φ (grad) and cohesion C (kPa) determined from the plot $\tau = f(P)$ for three points.

g) One-dimensional consolidation properties of soils (Oedometer test)

The Oedometer test covers determination of the rate and magnitude of consolidation of a laterally restrained soil specimen, which is axially loaded in increments of constant stress until the excess pore water pressures have dissipated for each increment. The key parameters obtained from this test are voids ratio e, deformation modulus E, preconsolidation pressure and the compression index C_c.

h) Collapse potential of soils

This test method is used to determine the magnitude of potential collapse that may occur for a given vertical (axial) stress and an index for rating the potential for collapse.

The test method consists of placing a soil specimen at natural water content in a consolidometer, applying a predetermined applied vertical stress to the specimen with fluid to induce the potential collapse in the soil specimen. The fluid should be distilled water

when evaluating the collapse index, I_e. The fluid may simulate pore water of the specimen or other field condition as necessary when evaluating collapse potential I_c.

i) Determination of permeability of soils

The permeability of a soil is a measure of its capacity to allow the flow of water through the pore space between solid particles. The degree of permeability is determined by applying a hydraulic pressure gradient in a sample of saturated soil and measuring the consequent rate of flow. The coefficient of permeability is expressed as a velocity.

j) Maximum dry density and optimum water content (Proctor test)

An indication of the state of compaction of a cohesionless (free-draining) soil is obtained by relating its dry density to its maximum and minimum possible densities (the limiting densities). The tests described in this section enable these parameters to be determined for cohesionless soils.

k) Soil chemical analysis

Chemical analyses of soil is carried out to determine chloride, sulphate, calcium carbonate content, pH.

Soil pH is one of the most common measurements in soil laboratories. It reflects whether a soil is acid, neutral, basic or alkaline.

Depending on the amount of sulphate in contact with the concrete, it may be necessary to protect the concrete with a plastic liner, sulphate resistant concrete mix, or a protective adhesive coating.

IX. Data Processing Stage

Figure2 shows location of areas selected for geotechnical investigations. It reflects of points (red color) conducted measurements into the mapping system. The number of points required to be investigated on geotechnical parameters definitions depend of engineering task and scope of work reflected in the project requirements. This circumstance finds of accuracy of conducted engineering service. In some cases it become very expensive in conducting huge numbers of geotechnical investigations. It relates of the scale of area needed to be investigated and type of engineering facilities intended to be constructed.

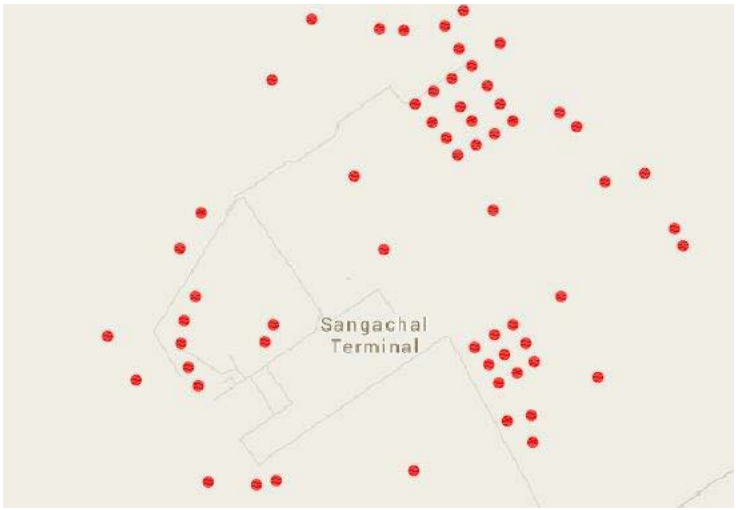

Figure 2 : Map of the selected area

In the map have been demonstrated sensitive area in point of view engineering importance of conducted geotechnical measurements. As it seeing from the Figure there are a big numbers of ground samples have been taken from the area.

It is highly important definition of the process of GIS development in geotechnical investigations. Figure 1 describes segments of data collection from different sources and that integration[7].

It has been considered to develop layers for GIS presentation following performance:

- Soil investigation data;
- Chemical contamination;
- Physical and mechanical properties of soil;
- Ground water condition of soil
- Land Use/Land Cover;
- Geodetic and topographic data.

It can be integrated into GIS layers a more geotechnical data depends of requirements of engineering solutions for the selected. The main available information is tied to various forms of georeferenced information. It is required accurate merging topographic map with space image for

selected area to achieve demanded cartographic corrections. Anexcellent advantage of GIS is its incorporate processing subroutines that can transform older data to modern coordinates if a sufficient number of georeferencing points can be co-located on both the old and new maps. These georeference points may be established and constructed benchmarks (state or installed), old structures, roads, or even above-ground power lines; anything that can be identified on both maps in the GIS.

In Figure 4is shown results of data imposed on the space image for selected area.In the figure has been used a space image with spatial resolution of 1m. It is enough high resolution which is more than enough for the case of geotechnical studies of selected area.

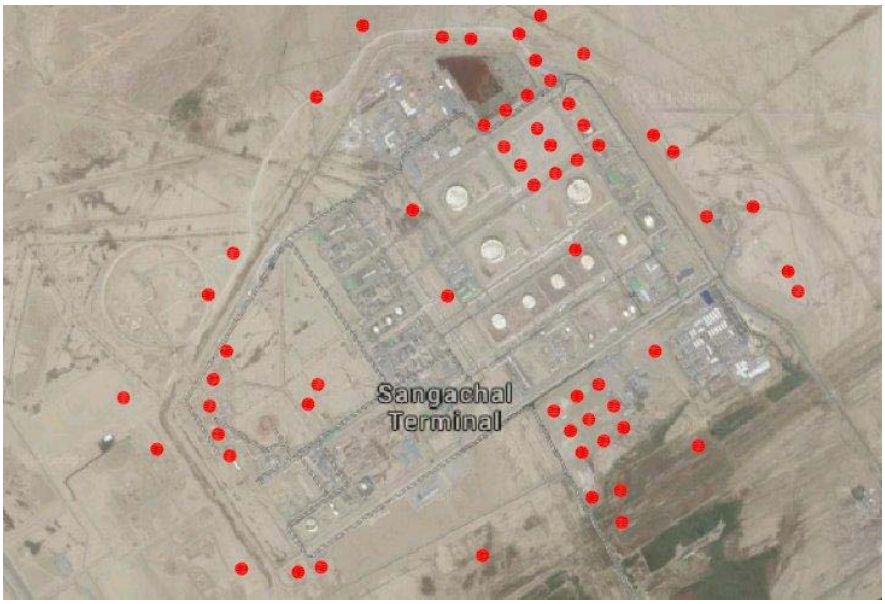

Figure 3 : Integration of geotechnical data and processed space image data

X. Conclusion

This paper describes geotechnical investigations of selected area in Absheron peninsula, Azerbaijan. It contents of measurements of geotechnical data such as standard penetration test, soil electrical resistivity test, laboratory processing of filed data, moisture content, particle size analysis, maximum dry density and optimum water content (proctor test), determination of maximum density of sands, determination of maximum density of gravelly soils, derivation of density index, bulk density, atterberg limits, unconsolidated–undrainedtriaxial compression test, direct shear test, one-dimensional consolidation properties of soils (oedometer test), collapse potential of soils, determination of permeability of soils. There is no doubt that it is an excellent source reflecting soil condition which can be used for engineering solution in any stage of implementation< tender package preparation, design and construction.

At the same time integration of geotechnical data into the GIS developed on the base of space data collected by method of remote sensing is an advantage of application of outcomes in a wide areas of engineering such as project coordination and management, construction, supervision where is required to use suitable and simplicity of data access. In the meantime the use of data integrated into GIS makes possible to link of existing information to the coordinate system which is very important in all stages of achievements.

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Global Journal of Researches in Engineering: J General Engineering
Volume 14 Issue 6 Version 1.0 Year 2014
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals Inc. (USA)
Online ISSN: 2249-4596 & Print ISSN: 0975-5861

A Secure Steganographic Technique for Embedding Text using Adaptive Pixel Pair Matching

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Abstract- Steganography is a method of hiding secret messages in a cover object while communication takes place between sender and receiver. Generally data embedding is achieved in text, image, audio, video, network for the purpose of secret communication. This paper proposes a secure method for hiding text based on adaptive pixel pair matching (APPM). The basic idea of Pixel Pair Matching (PPM) is to use the values of pixel pair as a reference coordinate, and search a coordinate in the neighborhood set of this pixel pair according to a given message digit. The pixel pair is then replaced by the searched coordinate to conceal the digit. APPM allows users to select digits in any notational system for data embedding, and thus achieves a better image quality. Compared with the optimal pixel adjustment process (OPAP) Method and diamond encoding (DE), the proposed method always has lower distortion for various payloads. This paper proposes an extension to conceal text into an image for conveying secret messages confidentially.

Keywords: steganography, least significant bit method, pixel pair matching, diamond encoding.

GJRE-J Classification : FOR Code: 291899

Strictly as per the compliance and regulations of:

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K Madhuri [α] & Ms C Padmini [σ]

Abstract- Steganography is a method of hiding secret messages in a cover object while communication takes place between sender and receiver. Generally data embedding is achieved in text, image, audio, video, network for the purpose of secret communication. This paper proposes a secure method for hiding text based on adaptive pixel pair matching (APPM). The basic idea of Pixel Pair Matching (PPM) is to use the values of pixel pair as a reference coordinate, and search a coordinate in the neighborhood set of this pixel pair according to a given message digit. The pixel pair is then replaced by the searched coordinate to conceal the digit. APPM allows users to select digits in any notational system for data embedding, and thus achieves a better image quality. Compared with the optimal pixel adjustment process (OPAP) Method and diamond encoding (DE), the proposed method always has lower distortion for various payloads. This paper proposes an extension to conceal text into an image for conveying secret messages confidentially.

Keywords: steganography, least significant bit method, pixel pair matching, diamond encoding.

I. Introduction

Today the growth in the information technology, especially in computer networks such as Internet, Mobile communication, and Digital Multimedia applications such as Digital camera, handset video etc. has opened new opportunities in scientific and commercial applications. But this progress has also led to many serious problems such as hacking, duplications and malevolent usage of digital information. Steganography finds its role in attempt to address these growing concerns [6]. Steganography is the art of hiding the fact that communication is taking place, by hiding information in other information. Many different carrier file formats can be used, but digital images are the most popular because of their frequency on the Internet. In image steganography, the aim is to hide information in to a given image called as cover image and the diagnosis of the hidden information will be probably difficult [10]. Every steganographic methods consist of a cover image and a stego image.

Many approaches of information hiding have been proposed for different applications, such as copyright protection, secret transmission, tampering detection, and image authentication.

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The most well-known data hiding scheme is the least significant bits (LSBs) substitution method [1], [13]. This method embeds fixed-length secret bits into the least significant bits of pixels by directly replacing the LSBs of cover image with the secret message bits. Although this method is simple, it generally effects noticeable distortion when the number of embedded bits for each pixel exceeds three [1]. Several methods have been proposed to reduce the distortion induced by LSBs substitution. OPAP scheme searches the minimal distortion value which LSBs equal the embedded bits and replaces stego-pixel value with it [12]. Another way of improving LSBs scheme is to reduce the amount of alterations necessary to be introduced into the cover image for data hiding when the number of secret bits is significantly less than that of available cover pixels.

Another method called optimal pixel adjustment process (OPAP) method [14] is introduced to reduce the distortion caused by LSB replacement. In LSB and OPAP methods one pixel is used as an embedding unit[11], and conceal data into the right-most LSBs. OPAP is conceptually defined as matching pixel to its optimal level. OPAP effectively reduces the image distortion compared with the traditional LSB method [12]. But in OPAP method, imbalanced embedding distortion emerges and is vulnerable to steganalysis. LSB and OPAP methods are not suitable for applications requiring high payload.

An efficient data hiding method is proposed for gray-scale images by utilizing the diamond encoding concept (DE). We first transform the secret data into a sequence of digits, and the cover image is partitioned into non-overlapping blocks of two consecutive pixels. The diamond encoding method produces a diamond characteristic value (DCV) of the pixel-pair block, and the DCV [3] is revised as the embedded secret digit after data embedding procedure. For each block, the diamond encoding technique addresses the minimal changes of two pixel values under the embedding parameter k. In other words, the difference between the cover-block and the stego-block is never more than k, and the embedding capacity of a block equals $\log_2(2k^2+2k+1)$. The payload of DE [2] is determined by the selected notational system, which is restricted by the parameter k; therefore, the notational

system cannot be arbitrarily selected. For example, when is 1, 2, and 3, then digits in a 5-ary, 13-ary, and 25-ary notational system are used to embed data, respectively. However, embedding digits in a 4-ary (i.e., 1 bit per pixel) or 16-ary (i.e., 2 bits per pixel) notational system are not supported in DE. Secondly, $\phi(x, y)$ in DE [1], [2], [4] is defined by a diamond shape, which may lead to some unnecessary distortion when k > 2. In fact, there exists a better $\phi(x, y)$ other than diamond shape resulting in a smaller embedding distortion.

a) Adaptive Pixel Pair Matching For Embedding Digits

The basic idea of the PPM-based data-hiding method is to use pixel pair (x, y) as the coordinate, and searching a coordinate (x', y') within a predefined neighborhood set Ø(x, y) such that $f(x', y') = S_B$, where *f* is the extraction function and S_B is the message digit in B-ary notational system to be concealed [1], [3]. Data embedding is done by replacing (x, y) with (x', y').

Suppose the cover image is of size $M \times M$, S is the message bits to be concealed and the size of S is $|S|$. First we calculate the minimum B such that all the message bits can be embedded. Then, message digits are sequentially concealed into pairs of pixels. First minimum B satisfying $|M \times M / 2| \geq |S_B|$ and convert S into a list of digits with a B-ary notational system S_B. The discrete optimization problem is solved to find c_B and $\phi(x, y)$. In the region defined by $\phi(x, y)$, record the coordinate (x', y') such that $f(x', y') = i, 0 \leq i \leq B-1$

Construct a non repeating random embedding sequence Q using a key K. To embed a message digit S_B, two pixels (x, y) in the cover image are selected according to the embedding sequence Q, and calculate the modulus distance $d = (S_B - f(x, y)) \bmod B$ between S_B and $f(x, y)$, then replace (x, y) with $(x + x', y + y')$.

The rest of the paper is organized as follows. Section II deals with proposed methodology. Embedding and extraction procedures of text are given in sections IV and section V concludes the paper.

II. Proposed Methodology

As APPM is proved to offer better security against detection and lower distortion, we can take forward APPM for hiding text in an image. This method is proposed to explore a better mechanism and provide better security and lower distortion for embedding text in images. The ascii values of all the characters in the given text are converted to binary values and then they are partitioned into groups of bits. Then the embedding process is performed for embedding them into an image.

Data embedding is done by replacing (x, y) with (x', y'). These are the reference coordinate and pixel value from the neighborhood set. The concept of a PPM-based steganographic method is that, let S_B be the message bit is to be concealed and the range of S_B is between 0 and $B-1$. And there should be a coordinate (x', y') has to be found such that $f(x', y') = S_B$. That is why the range of $f(x, y)$ must be within integers between 0 and $B-1$. [2] Also here each integer must occur at least once. In APPM, consider the compact neighborhood set for reducing the distortion. The the following three conditions should be satisfied by the best ppm based data hiding method.

a) There are exactly B number of coordinates in the neighborhood set $\phi(x, y)$.

b) These coordinates and the values of extraction function must be mutually exclusive.

c) The design aspects of neighborhood set $\phi(x, y)$ and the extraction function $f(x, y)$ should be capable of embedding the message bits in least notational system.

i. *Conversion of input text into appropriate form for embedding*

First the ASCII values of all characters in the secret data are converted into an array of eight bit binary numbers. Now the array of binary numbers is divided into groups containing each containing four number of bits. The decimal value of each group is embedded into pixel pairs of a cover image.

c_2	c_3	c_4	c_5	c_6	c_7	c_8	c_9	c_{10}	c_{11}	c_{12}	c_{13}	c_{14}	c_{15}	c_{16}	c_{17}	c_{18}
1	1	2	2	2	2	3	3	3	3	4	5	4	4	6	4	4
c_{19}	c_{20}	c_{21}	c_{22}	c_{23}	c_{24}	c_{25}	c_{26}	c_{27}	c_{28}	c_{29}	c_{30}	c_{31}	c_{32}	c_{33}	c_{34}	c_{35}
4	8	4	5	5	5	5	10	5	5	5	12	12	7	6	6	10
c_{36}	c_{37}	c_{38}	c_{39}	c_{40}	c_{41}	c_{42}	c_{43}	c_{44}	c_{45}	c_{46}	c_{47}	c_{48}	c_{49}	c_{50}	c_{51}	c_{52}
15	6	16	7	7	6	12	12	8	7	7	7	7	14	14	9	22
c_{53}	c_{54}	c_{55}	c_{56}	c_{57}	c_{58}	c_{59}	c_{60}	c_{61}	c_{62}	c_{63}	c_{64}					
8	12	21	16	24	22	9	8	8	8	14	14					

Fig. 1 : List of c_B for 2 ≤ B ≤ 16

ii. *Finding Neighborhood Set And Extraction Function*

In this module, the extraction function is explained. By using this method, we can get a simple extraction function and compact neighborhood set. Thus the proposed method enhances the embedding efficiency. The quality of image obtained by this method is much better than the other existing data hiding method such as OPAP and DE [1]. Another two advantages of this proposed method are higher payload capability and less detectability. Compact notional system is used for data embedding which gives increased performance.

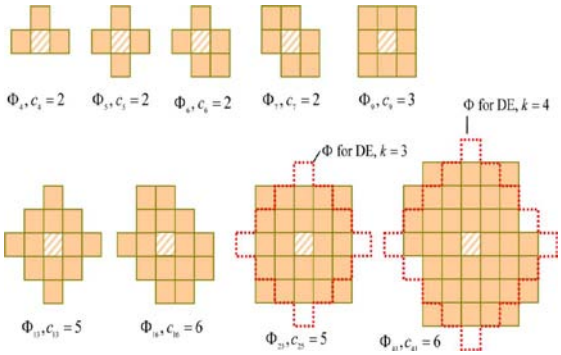

Fig. 2 : Neighborhood set for APPM

The stego image quality is significantly affected by both definitions of $\phi(x,y)$ and $f(x,y)$. All values of $f(x,y)$ in $\phi(x,y)$ must be mutually exclusive, and also the summation of the squared distances between all the coordinates present in $\phi(x,y)$ and (x,y) has to be the smallest. This is because, during embedding procedure the pixel value (x,y) is replaced by one of the pixel in the neighborhood set $\phi(x,y)$. If there is B number of coordinates in $\phi(x,y)$, then message bits a B-ary notational system are to be concealed. The averaged MSE can be calculated by averaging the summation of squared distance between the coordinates (x,y) and other coordinates in $\phi(x,y)$ the reference coordinate. Thus, MSE after embedding can be calculated the following equation by

$$\text{MSE}\,\phi(x,y) = \frac{1}{2B}\sum_{i=0}^{B-1}((\mathrm{x_i} - \mathrm{x})2 + (\mathrm{y_i} - \mathrm{y})2)$$

The adaptive pixel pair matching (APPM) data-hiding method is used to explore better $\phi(x,y)$ and $f(x,y)$. So that MSE is minimum compared with the other existing methods. In this method the extraction function is

$$f(x,y) = (x + c_B \times y) \bmod B$$

So the calculation of both neighborhood set $\phi(x,y)$ and the extraction function $f(x,y)$ can done by a discrete optimization problem. For this following conditions have to be considered.

Minimize to $\sum_{i=0}^{B-1}((\mathrm{x_i} - \mathrm{x})2 + (\mathrm{y_i} - \mathrm{y})2)$

Subject to : $f(x_i, y_i) \in \{0,1.....,B-1\}$

$$f(x_i, y_i) \neq f(x_j, y_j)$$

for $0 \le i, j \le B-1$

From figures (1) and (2) show some neighborhood sets $\phi_B(x,y)$ and their corresponding c_B values which satisfy the above condition. In the above figure 3 the shaded with lines represents the center of $\phi_B(x,y)$.

III. Data Embedding Procedure

Here the secret data has to be embedded into the given cover image. For this first we should calculate the image size and message size. If the message size exceeds size of the image, then the embedding procedure cannot be done. Consider the image size as M*M, For S message bits the size of secret message S is $|S|$. By using these, calculate the minimum B value such that all the message bits can be embedded. The message digits will be sequentially concealed into pairs of pixels.

The data embedding process is shown by a flowchart in fig 3 below. The detailed procedure is listed as follows.

a) First the ASCII values of all characters in the secret data are converted into an array of eight bit binary numbers.

b) Now the array of binary numbers is divided into groups containing each containing four number of bits.

c) The decimal value of each group is embedded into pixel pairs of a cover image.

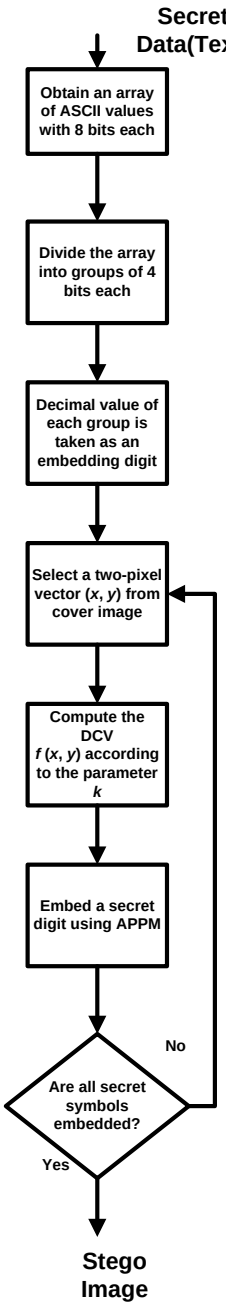

Fig. 3 : Data Embedding Process

d) Calculate the minimum B satisfying

e) $|M \times M / 2| \geq |S_B|$.

f) Convert the secret message S into the sequence of digits with a B -ary notational system.

g) Find c_B and $\phi_B(x, y)$ using the discrete optimization equations.

h) From the neighborhood region $\phi_B(0,0)$ find the coordinate positions (x_i, y_i) by satisfying the condition $f(x_i, y_i) = i, 0 \leq i \leq B-1$.

i) Create a non repeat random key Kr for embedding the secret message bits Q.

j) To embed a secret message bits B, find the two pixels (x, y) in the cover image and replace (x, y) with $(x + x_d, y + y_d)$ for the modulus distance $d = (S_B - f(x, y)) \bmod B$ between S_B and $f(x, y)$.

k) Repeat Step 6 and 7 until all the secret message bits are concealed.

IV. Data Extraction Procedure

To extract the embedded message digits, pixel pairs are scanned in the same order as done in the embedding procedure. The value of extraction function of a scanned pixel pair gives the embedded digit. Now the text input is retrieved from this output array of digits. The data extraction process is shown by a flowchart in fig 4 below.

a) Take two pixels positions (x', y') and calculate $f(x', y')$.

b) The value of $f(x', y')$ is the embedding digit.

c) The decimal value of these output digits are converted as an array of binary numbers, where each digit is represented with four bits.

d) Now the array of binary numbers is divided into groups of eight bits each.

e) The decimal value of each group of bits gives the ASCII value of the character.

f) After converting all the groups of bits into characters, we will get the input text as the output.

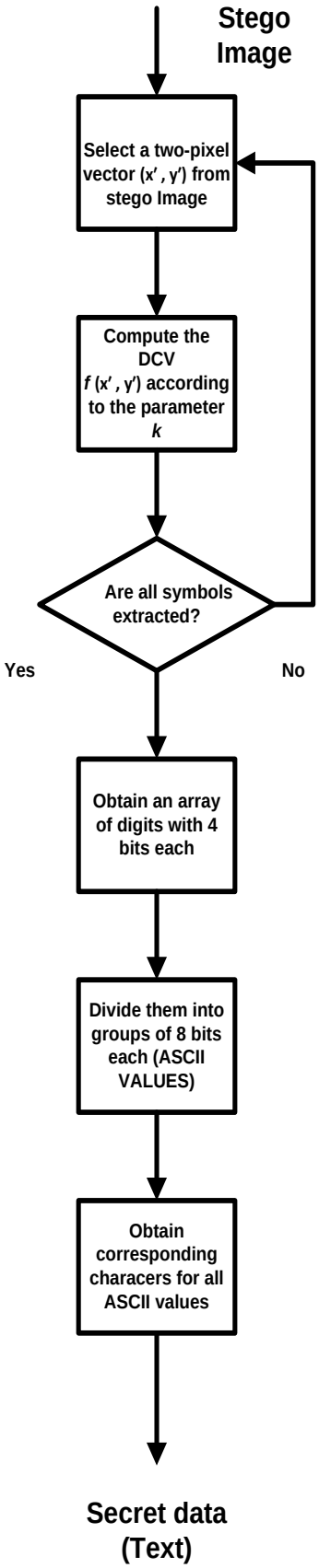

Fig. 4 : Data Extraction Process

V. Theoretical Analysis and Experimental Results

When data embed in an image, the pixel values in that image may modified and this process is known as image distortion or embedding distortion. MSE (Mean Square Error) is used to measure this distortion. MSE is calculated by the following equation

$$\frac{1}{M \times M} \sum_{i=0}^{M} \sum_{j=0}^{M} (p_{i,j} - p'_{i,j})^2$$

Where M×M is the image size, $p_{i,j}$ denotes the pixel values of original image and $p'_{i,j}$ denotes the pixel values of stego image. Here the mean square error between the cover image and stego image is represented by MSE.

Table 1 : Mean square error of APPM for embedding digits and text

Image	APPM(DIGITS) $c_B = 6$	APPM(TEXT) $c_B = 6$
Clock.tiff	0.8220	0.8167
Nature.png	0.2049	0.2041
Cartoon.png	0.2931	0.2754

The smaller MSE is for APPM which indicate the better image quality. APPM is flexible and gives less mean square error while embedding digits [1] and as well as embedding text also.

Fig. 5 : Cover Image

Fig. 6 : Stego Image

Cover image and stego image are shown above. Less detectability to the text hided in the image

is one of the desired aspect. Both the images are visually similar. Therefore the attacker cant determine whether the image is encoded or not.

VI. Conclutions

This paper proposed an efficient data embedding algorithm for hiding text in an image based on APPM. Here two pixel positions are scanned and are considered as a scanning unit. And a specially designed neighborhood set with smallest notational system is used for embedding text and hence a better image quality is achieved. The steganalysis results of stego images are similar to those of the cover images, which offer a secure communication under adjustable embedding capacity. It also contains additional features such as digital watermark and encryption of secret messages for the provision of more security. APPM technique can also be used for embedding data in audio and video also. All these various features made this APPM technique a straightforward and economical embedding method for the data hiding.

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Global Journal of Researches in Engineering: J
General Engineering
Volume 14 Issue 6 Version 1.0 Year 2014
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals Inc. (USA)
Online ISSN: 2249-4596 & Print ISSN: 0975-5861

Energy Efficient FMA for Embedded Multimedia Application

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Abstract- This article presents energy efficient fused multiplyadd for multimedia applications. Low cost, low power and high performance factors diddle the design of many microprocessors directed to the low-power figuring market. The floating point unit occupies a significant percentage of the silicon area in a microprocessor due to its wide data bandwidth and the area occupied by the multiply array. The fused floating-point multiply-add unit is utilitarian for digital signal processing (DSP) applications such as fast Fourier transform (FFT) and discrete cosine transform (DCT). The proposed designs are implemented for single precision and synthesized with a 45-nm standard cell library. To improve the performance of the fused floating point multiply-add unit, we are supervening upon leading zero anticipation with the novel leading zero detection, as the novel leading one detection algorithm allowing us to significantly reduce the anticipation failure rates.

Keywords: floating point, binary128, fused multiply add, simd, implementation, computer arithmetic.

GJRE-J Classification : FOR Code: 090607

Strictly as per the compliance and regulations of:

Energy Efficient FMA for Embedded Multimedia Application

Mandala Rakesh Raj [α] & Ms S. Sujana [σ]

Abstract- This article presents energy efficient fused multiply-add for multimedia applications. Low cost, low power and high performance factors diddle the design of many microprocessors directed to the low-power figuring market. The floating point unit occupies a significant percentage of the silicon area in a microprocessor due to its wide data bandwidth and the area occupied by the multiply array. The fused floating-point multiply-add unit is utilitarian for digital signal processing (DSP) applications such as fast Fourier transform (FFT) and discrete cosine transform (DCT). The proposed designs are implemented for single precision and synthesized with a 45-nm standard cell library. To improve the performance of the fused floating point multiply-add unit, we are supervening upon leading zero anticipation with the novel leading zero detection, as the novel leading one detection algorithm allowing us to significantly reduce the anticipation failure rates.

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I. Introduction

This paper presents energy efficient fused multiply-add unit for multimedia applications. In this, floating point can be implemented by using different precisions. As we have SP (Single Precision), DP (Double Precision), QP (Quadruple Precision). IEEE Binary 32 which is pertained as single precision and binary64 referred to as double precision. Floating-point operations have both gained widespread popularity in versatile multimedia and scientific applications, resulting in modern processors patronize both the precisions. Due to accumulation errors in computations they are becoming deficient for today large-scale applications. This precision problem can be overcome by one promising approach that is by using the binary 128 which is referred to as quadruple precision or QP format. The accuracy and numerical stability of many applications can be improved by introducing this format and is already specified in the new IEEE-754-2008 standard. Another approach to which we have to improve the performance is using the fused multiply add (FMA) operation which yields one rounding error for two operations [3]. The first FMA is introduced in the year 1990 by IBM RS/6000 [6], [7]. After FMA is implemented by several companies like HP, MIPS, ARM and Intel. Many algorithms are developed on floating-point fused multiply add unit to decrease its latency [2], [4]. As we can say it is a key feature of the floating-point unit because it greatly increases the floating-point performance and accuracy since rounding is performed only once for the result.

A Field Programmable Gate Array, FPGA provides a versatile and inexpensive way to implement and test VLSI designs. It is mostly used in low volume applications that cannot afford silicon fabrication or designs which require frequent changes or upgrades.

In FPGA's, the bottleneck for designing efficient floating-point units has mostly been area with advancement in FPGA architecture [3], there is a significant increase in FPGA densities so latency has been the main focus of attention in order to improve performance.

The main contribution and objective of our work is to implement the architecture which is proposed by Lang/Bruguera but with little change to facilitate the implementation.

In reminder of this paper is organized as follows. Proposed FMA unit section 2 backgrounds, section 3 proposed methods and section 4 describes its general architecture. Section 5 provides the evaluation results and Section 6 concludes this paper.

II. Background

In this paper, the floating-point fused multiply-add operation A x B + C is implemented for the IEEE floating- point format. In this format, a floating-point number X represents the value $X = (-1)^s \times f \times \beta^{e-p}$, Where s, f, β, e, and p are integers with s being the sign bit; f the normalized mantissa; β the radix, 2 for binary; e the biased exponent; and p the biased number.

The fused multiply-add unit gets the input operands A, B, and C with values $A = (-1)^{sa}.f_a.2^{ea}$, $B = (-1)^{sb}.f_b.2^{eb}$ and $C = (-1)^{sc}.f_c.2^{ec}$ and performs the fused multiply- add operation:

$$A \times B + C = rnd((-1)^{sa \oplus sb}.f_a f_b.2^{ea+eb} + (-1)^{sc}.f_c.2^{ec})$$

Where the computed fused multiply- add result is rounded and normalized. The FMA architecture proposed before implemented in several floating-point units of general-purpose processors is shown in Fig. 1. The steps in this implementation are:

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a) Multiplication and alignment shift

- Acquiring an intermediate carry-save product by multiplication of B and C.
- Inorder to reduce the latency, the bit inversion and alignment of the significand of A is done in parallel with the multiplication [2]. The bit inversion provides the one's implement of A for an effective subtraction.
- The shift amount of the alignment depends on the value of d = E_a – (E_b + E_c), where E_a, E_b, E_c are the exponents of the A, B, and C operands, respectively.
- When d ≥ 0 (i.e. E_a > (E_b + E_c)), in a conventional alignment, B x C would have to be aligned with a right shift of d bits.

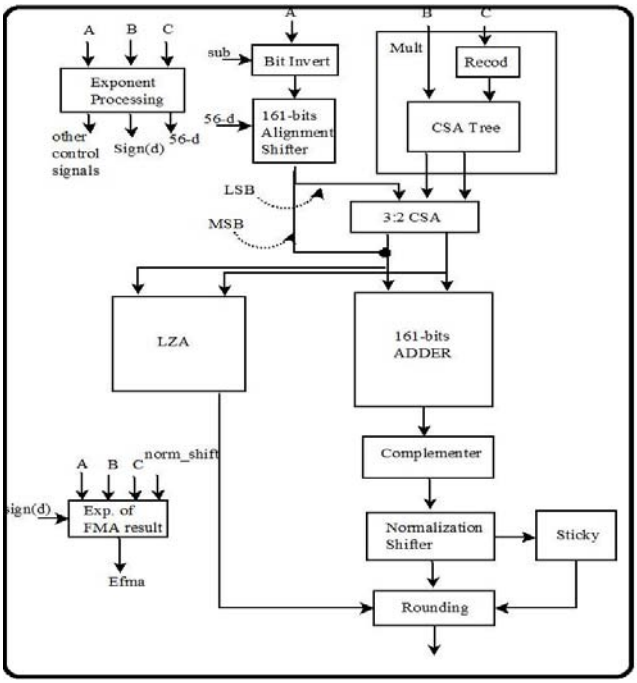

Fig. 1 : Basic architecture of FMA unit

- Instead, shift the addend A to the left to perform the alignment parallel with the multiplication. For double precision format the maximum left alignment shift would be 56 bits. When d ≥ 56, $B \times C$ is placed to the right of the least significant bit of A; in this case, B x C affects only the calculation of the sticky bit. Maximum left shift is obtained by observing that the guard (position 53) and the round (position 54) bits are 0 when the result signific and corresponding to the addend. Consequently two additional positions are included, resulting in the shift of 56 positions. When d < 0, the addend A would have to be aligned with a right shift of d bits. In this case the maximum alignment shift would be 105 bits for double precision formats.
- For shift amount larger than 105, d < -105, the operand A is placed to the right of the least-significant bit of $B \times C$, affecting only the calculation of the sticky bit.
- To avoid bidirectional shifter the alignment is implemented as a right shift by placing the addend A to the left of the most significant bit of the product B x C by 56 bits. Two extra bits are placed between the addend A and the product $B \times C$ to allow correct rounding when A is not shifted. For ≥d 0 with this implementation, A is right shifted (56- d) bits; then, the shift amount is shift amount = max {0, 56 – d}.
- For d < 0, A is right shifted 56-d bits, then shift amount = min {161, 56 – d}. By combining both cases, the shift amount is in the range [0:161], requiring a 161-bit right shifter. Moreover, the shift amount is computed as shift amount = 56-d.

b) The multiplier produce 106-bit sum and carry vectors that are reduced together with the aligned A using 3:2 CSA, because the product has only 106 bits. The 55 most-significant bits will be sign extension bits, for theses 55 most significant bits, we use two multiplexers, one to select between A and inverted A as a sum vector and the second one to select between zeros and A as a carry vector by Xor-ing sign extension bits then the outputs of the two multiplexers are concatenated at the output of the CSA to obtain the 161-bit sum and carry words.

c) The next step is the addition of the carry and sum words and the determination of the shift amount for normalization.

- The carry and sum words, obtained at the output of the CSA, are added in a 161-bit one's complement adder (with end around carry adjustment for effective subtraction). As the result can be negative, a complementer is required at the output of the adder.
- In parallel with the significands addition, the normalization shift is determined. The LZA (Leading Zero Anticipator) [12] produces the amount of the shift directly from the operands.

d) Once the result of the addition is obtained, the normalization shift can be performed since the shift amount has been already determined. A normalization shift is required to place the most-significant bit of the result at bit 0; as a consequence, normalization is performed to compensate for the cancellation produced in subtraction as well as to compensate for the way the alignment is performed.

e) The last step is the rounding of the result

With this scheme, the delay of the FMA operation is determined by the sum of the delays of the

following components: multiplier, 3-2 CSA, 161-bit adder plus complementer, normalization, and rounding. On the other hand, the main hardware components are: multiplier, alignment shifter, 3:2 CSA, LZA, 161-bit adder, normalization shifter, and rounder.

III. Proposed Architecture

We now describe the proposed FMA architecture. Since the unit is quite complex, we present this description in a single step. In this section, we give an overview of the scheme, with just enough detail to make it understandable and believable. Here we use Fig. 2 to illustrate the description.

The objective of the proposed FMA architecture is to reduce the overall delay, and Power. Since, in floating-point addition and multiplication, one of the approaches to reduce latency has been to combine addition with rounding [5], [10], [12], [13], we follow the same approach. For this approach, in floating-point addition and multiplication, the order of normalization and rounding is interchanged. This seems impractical to do for FMA because, before the normalization, the rounding position is not known. The solution we explore is to perform the normalization before the addition.

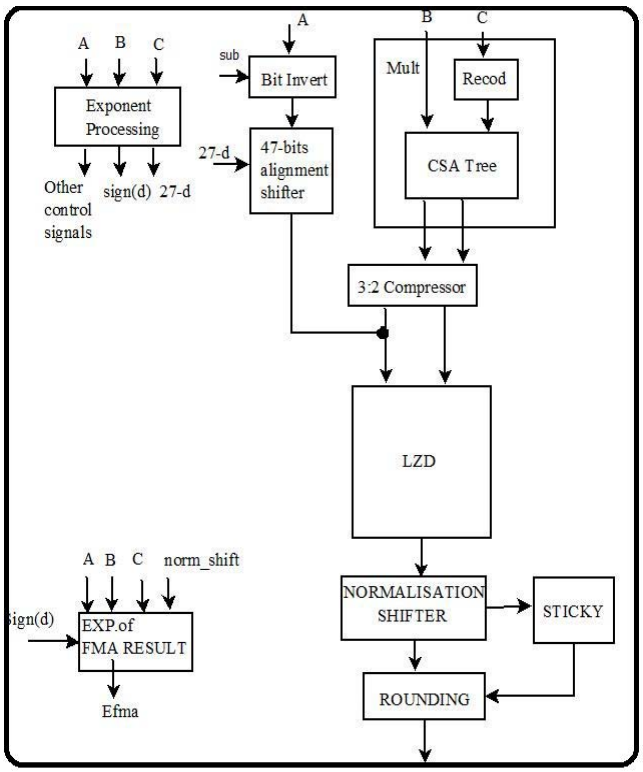

Fig. 2 : Block diagram of the proposed FMA Architecture

To improve the performance of the fused floating point multiply-add unit, we are supervening upon leading zero anticipation with the novel leading zero detection, as the novel leading one detection algorithm allowing us to significantly reduce the anticipation failure rates. The proposed leading digit is worked using tree structure, where inputs of n bits are divided into n/2 pairs of bits.

For each pair of bits a two bit count is generated and another counter is triggered to calculate the depth of the tree. For example a four digit can be paired into two pairs and a counter is used to find the one/ zero in pair *i and i+1* and the second counter is used to find the value of required bit in which pair and at which level. This method is continued of $log_2 (n)$ levels. To boost this tree structure we use a structure method which speed's up by a 4 bit or even 8bit to reduce the hierarchy of the tree structure.

IV. Detailed Description of some Modules of the Architecture

a) 3:2 CSA

The multiplier produce 106-bit sum and carry vector that are reduced together with the aligned A using 3:2 CSA. Although the output of the multiplier must be positive number because we multiply two positive numbers (sign and magnitude representation), one of the two output vectors of the multiplier may be negative because of using booth algorithm which use negative sets {-1,-2} which convert a positive number with sign and magnitude representation to a negative number with two's complement representation. The addition of sum and carry vectors must be a positive number but one of them, not both, may be negative.

Instead of using 161-bit CSA, only the 106 least-significant bits of the aligned A are needed as input to the 3:2 CSA, because the product of sum and carry vectors has only 106 bits and The 55 most-significant bits will be sign extension bits which have two cases {0, 0} if both sum and carry vectors are positive or {0, 1} if one of them is negative. For the 55 most-significant bits, we use two multiplexers, one to select between A and inverted A as a sum vector and the second one to select between zeros and A as a carry vector by Xor-ing sign extension bits then the outputs of the two multiplexers are concatenated at the output of the CSA to obtain the 161-bit sum and carry words.

b) Leading zero Anticipator

The leading zero anticipator (LZA) has two main parts: the encoding of the leading-one position i.e. detection module and the correction of this position i.e. correction module. The detection module are divided into two parts the first one is called LZA and it determines the number of leading zeros i.e. the position of the leading one. By producing a string of zeros and ones where the position of the most significant 1 is the position of the leading one. The second part, called leading zero detectors (LZD), counts the number of zero digits from the left-most position until the first nonzero digit is reached i.e. leading one position. Since the detection is done from most significant bit to least

significant bit regardless of the carry that may come from the least significant bit, the detection of leading one position may be off by one bit. The LZA logic takes two input strings and uses a set of logical equations given below.

After LZA logic LZD is used to drive the normalization shifter [11] by encoding the position of leading one to its weighted binary representation.

$$f_i = t_{i+1} \times (g_i.z_{i+1} + z_i.\bar{g}_{i+1}) \oplus \bar{t}_{i+1}(z_i.\bar{z}_{i+1} + g_i.\bar{g}_{i+1}), i > 0$$

$$f_0 = \bar{t}_0.t_1$$

Where $t_i = a_i \oplus b_i$

$$g_i = a_i.b_i$$

$$z_i = \bar{a}_i.\bar{b}_i$$

The LZD unit assumes n bits as input and produces $\log_2$ n bits of the leading one position

Pattern	Position	Valid
1x	0	Yes
01	1	Yes
00	X	No

Table (I) shows the truth table of 2-bits LZD. By using two 2-bits LZD's we can get 4-bit LZD is shown in Figure (a). Following the same concept we can get LZD with higher number of output using hierarchical structure.

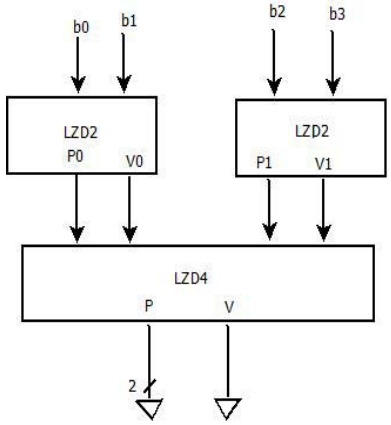

Fig. 3 : Using 2-input LZD

c) Normalization

The IEEE 754 binary floating-point standard defines a set of normalized numbers and four sets of special numbers. Of the four types of special numbers, three do not require computation for arithmetic operations. These include Not-a-Numbers (NaN), infinities, and zeros. De-normalized numbers, also known as subnormal or denormals are the fourth type of special number and do require computation.

Normalized numbers can be described by the following:

$$X = (-1)^{xs} \times 1 \times f \times 2^{xe-bias}$$

Where X is the value of the normalized number, X_s is the sign bit, $X_{f\ is}$ the fractional part of the significand, Xe is the exponent, and *bias* is the bias of the format which corresponds to 127, 1,023, and 16,383, for single, double, and quad, respectively.

Denormalized numbers can be described by the following:

$$X = (-1)^{xs} \times 0 \times f \times 2^{1-bias}, X_e = i \times f \neq 0$$

The denormal format differs from a normal number in that there is no implied bit and the exponent is not equal to X_e – *bias*, but , instead, is forced up by 1 to E_{min} which is equal to -126, -1,022, and -16,382, depending on the format.

Using the results from the LZD, the result from the adder is shifted left to normalize the result. That means now the first bit is 1.

The normalize is mostly a large shifter. The shifter has more than one stage. The stages are organized from the coarsest to the finest. The last stage performs a shift by one or two due to correction signal. This should have a negligible effect on the delay of the last stage.

d) Rounding

The IEEE 754 floating-point standard has been widely adopted since its introduction in 1985. The standard requires that all arithmetic operations are rounded so as to maintain as high a degree of accuracy and uniformity across different computing platforms as possible. The rounding decision is taken by knowing also sticky and round bits. The sticky bit is calculated from the result by OR-ing all least significant bits after the round bit. Rounding operations were originally viewed as a final separate step in most arithmetic circuit implementations. This has been merged with the carry-propagate addition in floating-point adders by delaying normalization until after rounding. Four different rounding modes are laid down by the IEEE floating-point standard [8], [9]: rounding toward 0, rounding to nearest (even), and rounding to $\pm\infty$. Rounding to nearest (even) is the standard's default mode; rounding toward zero is helpful in many DSP applications; and rounding to $\pm\infty$ is used in interval arithmetic, which affords bounds to be specified on the accuracy of a number.

V. Simulations Results

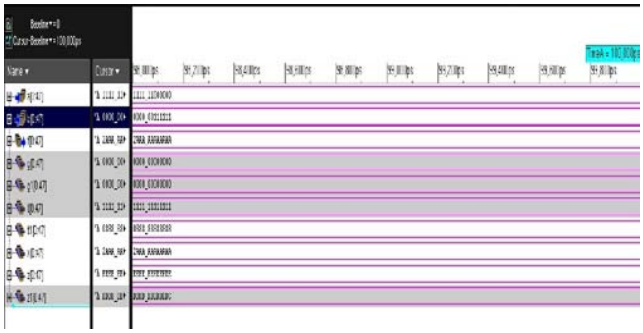

Fig. 4 : Simulation result of Leading Zero Anticipatior

Fig. 5 : Simulation result of Leading zero detector

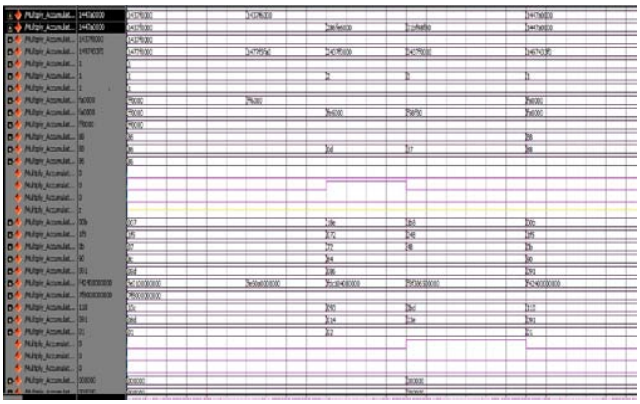

Fig. 6 : Top Module of Fused Multiply Add

a) Delay

The delay of both architectures is measured in the proposed architecture is less delay. Which is represented through the graph which is shown in the Fig the red line in the graph shows the actual FMA and the blue line represents the modified FMA.

b) Power

The power is the important aspect of the any architecture as the power decreases the power consumption of the entire processor decreases. In this project the power of the both proposed and the previous architecture are calculated using Cadence RC complier in different TSMC standard libraries. The proposed architecture is efficient in terms of power.

Table II : Summary report of Area and Power

Methods Using- nm	Area (μm^2)	Power (mW)
Existing Method(90nm)	87,908	19
Proposed Method (45nm)	6,984	6.35

VI. Conclutions

Architecture for a floating-point Multiply-Add-Fused (FMA) unit that reduces the latency of the traditional FMA units has been proposed. The proposed FMA is based on the combination of the final addition and the rounding, by using proposed LZD. This novel leading one detection algorithm allowing us to significantly reduce the anticipation failure rates. We embedded the proposed technique in Fused floating point multiply and Accumulation unit and its silicon area and performance with other existing solution. This approach has been used previously to reduce the latency of the floating-point addition and multiplication. However, it can be used only if the normalization is performed after the rounding and this is not possible for the FMA operation because the rounding position is not known until the normalization has been performed. To overcome this difficulty, we propose that the normalization be carried out before the addition. This required a careful design of some other parts of the FMA, the leading-zeros-detector (LZD).

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Global Journal of Researches in Engineering: J General Engineering
Volume 14 Issue 6 Version 1.0 Year 2014
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals Inc. (USA)
Online ISSN: 2249-4596 & Print ISSN: 0975-5861

Appraisal of Sediment Load in Rainfed Areas of Pothwar Region in Pakistan

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Keywords: *sediment, watershed, pothwar.*

GJRE-J Classification : *FOR Code: 091599*

Strictly as per the compliance and regulations of:

Appraisal of Sediment Load in Rainfed Areas of Pothwar Region in Pakistan

Zakaullah [α], Muhammad Ashraf [σ], Muhammad Afzal [ρ], Muhammad Yaseen [ω] & Khalida Khan [¥]

Abstract- Inadequate watershed management, natural, and man induced erosion of soils in the barani areas have threatened the sustainability of soil and water resources. In this study, sediment loads in the main streams passing through rainfed areas of the Pothwar region has been estimated for verifying the impacts of projects being implemented for agricultural development in the regions, especially the construction of small dams. The study has been carried out in three major basins namely Soan, Kanshi and Haro of Pothwar region. The daily discharge, sediment and rainfall data for the period 1982-2004 were analyzed and correlated accordingly. The sediment load has increased with the increase of river flow and vice versa. The unit rate of sediment yield decreased as the drainage area increased. Moreover, the observed sediment concentrations were low in low rainfall areas (Dhok Pathan) and high in areas fall under high rainfall zone (Chirah and Rawalpindi). Generally, the sediment concentration waslow during January to June (low rainfall) and high during months of October to December (high rainfall). The study concluded that sediment load beyond sustainable limits can affect the land and water resources negatively which can be identified by exploring basin hydrology and predicting sediment load as well as mitigating potential threats through application of computer simulation model.

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I. Introduction

Water is a very important resource for any country, especially for an agrarian one like Pakistan. It is a resource, which cannot be generated but can be preserved. Every country is doing its best to manage the water resources for the fulfillment of its needs. Water resources are affected by many natural hazards like sedimentation, earthquakes, floods etc. It has been documented that World's 13 large rivers carry 5.8 billion tons of sediments to the reservoirs every year (Nasir et al., 2006). Poor management of erosion prone areas has resulted in flooding and rapid filling of water reservoirs (Butt et al. 2010; Bradley et al. 2005; Nasir et al. 2006).

The Indus River is one of the world's largest rivers in term of water discharge and sediment loads, and the backbone of Pakistan's economy for agriculture and hydropower (Ali, 2004). Much of Indus River flow originates in the mountains of the Himalayas, Karakoram and Hindu Kush. Indus basin carries about 350,000 acre feet (AF) of suspended sediment per year, perhaps one of the greatest sediment load in the world, and about 200,000 AF of these sediments is deposited in the reservoirs and canals (Belaud *et al.*, 1998).

It is estimated that the Indus and its tributaries carry about 0.35 MAF of sediment load annually, almost 60% (0.2 MAF) of which deposits in the reservoirs, canals and irrigation fields (Kahlown et.al., 2002). Annual silt removal practices are undertaken in the canal systems to remove the deposited silt. Costa (1994) made the experiment on sediment of yield of two rivers i.e. South Fork Toutle River and Muddy River. Under the drastic change of sediment yield from 1980 to 1993 in these rivers, it was concluded that suspended sediment yields in all monitored streams have decreased since 1980, and fluctuate in response to annual runoff. Revegetation and natural armoring of channels and floodplains have reduced sediment yields at all sites. Freshwater resources are tremendously limited as 2.79 percent of the total water resources on the earth, of which only 0.03 per cent are available for human uses (Khalid, 2010).

Inadequate watershed management, natural, and man induced erosion of the barani soils has resulted in the depletion of the soil and water resources. The high runoff in these areas is associated with the erosion and sediment transport. A huge amount of soil is being transported which is being deposited in the reservoirs. For a slope of 1-10%, soil is being lost at a rate of 17-41 Tons/ha under fallow conditions and at a rate of 9-26 tons/ha under vegetative cover in the Fateh Jang Watershed (Ahmed et al., 1990). The high rate of soil erosion in these areas is due to the desire of bringing more land under cultivation that has led to the degradation of virgin lands.

Pothwar plateau, located in the northern part of Punjab province in Pakistan, is characterized by a high but irregular amount of precipitation has been developed as rainfed agricultural land mainly for wheat cultivation. This area is mostly covered with loess soils which are highly erosive. The natural conditions of this land may be suitable for crop production provided that rainfall is stable and soil erosion is well controlled. However, highly erratic climatic conditions for a long period of time and inadequate land management in addition to the existence of highly erosive soils have

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resulted in the expansion of severely eroded and degraded land in this area. Out of total 1.8 Mha of Pothwar region, about 0.77 Mha (43%) are cultivated and the remaining is mostly grazing land. While of the cultivated area only 4 percent is irrigated, while remaining (96%) is under rain-fed agriculture (Khan 2002). About 60% of the land area has been highly eroded leaving the rest as a flat land which constitutes the main cultivated area.

Using traditional techniques in Pothwar plateau soil loss of 3.0-4.5 tons/ha/year has been observed in cropped fields (Ahmed, 2002). Soil erosion is responsible for silting up of small dams and contamination of surface and groundwater. Soil erosion may contain chemicals that may be toxic to plants and animals. More importantly, small dams in Pothwar region are subject to silt problems as the average annual sediment yield of various catchments of Soan and Haro (excluding Chirah) is 3.83 AF/mile^2 (NESPAK, 1991). Another study shows that for a slope of 1-10%, soil is being lost at the rate of 17-41 tons/ha under fallow conditions and of 9-26 tons/ha under vegetative covers in the Fateh Jang watershed (Ahmad *et al.*, 1990). Out of 1.82 Mha of Pothwar Plateau only 0.61 are cultivated and the remaining 1.21 Mha are affected by gully erosion (Ahmad *et al.*, 1990). The high rate of soil erosion in these areas is due to the horizontal expansion of agricultural activities. However, inadequate watershed management and natural as well as man induced erosion of the fragile barani soils led to the depletion of the soil and water resources. The vegetative growth in the dams' lakes indicates that top fertile soil from the catchment is being brought into these reservoirs, thus converting the productive land into non-productive (Ashraf, *et al.*, 2000).Thus developments of efficient soil erosion management technologies are required to preserve valuable natural resources for human development and environmental protection.

The protection and management of this element is of crucial importance for sustainable agriculture development in Pothwar region. Appropriate activities must be carried out to reduce the soil erosion and to conserve soil moisture for enhancing the agricultural productivity of the soils. The Government started various projects for watershed development in the upstream of storage reservoirs such as Watershed Management Programme by Pakistan Water and Power Development Authority (WAPDA). Similarly, soil and water conservation activities have also been carried out in Pothwar region for erosion control and land development through series of Barani Areas Development Projects. The projects though contributed in the agricultural development of the areas, the actual appraisal of these projects with reference to sediment control, have not been made so far.

It is estimated that approximately 1% of the storage volume of the world's reservoir is lost annually due to sediment deposition (Fan and Morris, 1998). In some developing countries like Pakistan, there is rapid reduction in reservoir storage due to improper watershed management. Water shed management is the best option to reduce the sedimentation rate.

Viewing the scenario, there is a need to find the sediment yield of the streams and rivers located in the upstream catchments, particularly Pothwar region. This would help to assess the effectiveness of the watershed management activities carried out by various agencies and would further help to suggest innovative soil and water conservation techniques. The overall objective of this study is to assess the sediment load in the main streams/rivers passing through rainfed areas of the Pothwar region for sustainability of land and water resources.

II. Materials and Methods

a) Location of the study area

The study was carried out in the Pothwar region comprising of three major basins: Soan, Kanshi and Haro as shown in Fig.1. The total area of Pothwar is 1.8 Mha (4.45 million acres). The project area falls under the administrative control of Attock, Rawalpindi, Islamabad, Jhelum, Chakwal and some part of Khushab Districts. The study area lies in semi-arid to sub-humid zone of climatic region with hot summers and cold winters except Murree which falls in humid zone. The average annual rainfall in the area varies from 250 mm to 1,675 mm, the maximum being in the north. The average annual rainfall at Murree in the north-eastern part of the area is about 1,685 mm. whereas the average annual rainfall in the western part of the area is at Tamman, about 290 mm. About 40% of total annual precipitation occurs in spring and winter seasons and the rest in the monsoon season. The Pothwar has a complex geologic history of mountain building, alluvial and loessial deposition and erosional cycles. The result is a varied landscape of mountains, stony plateau, level alluvial plains and rolling sand plains and intricately dissected uplands.

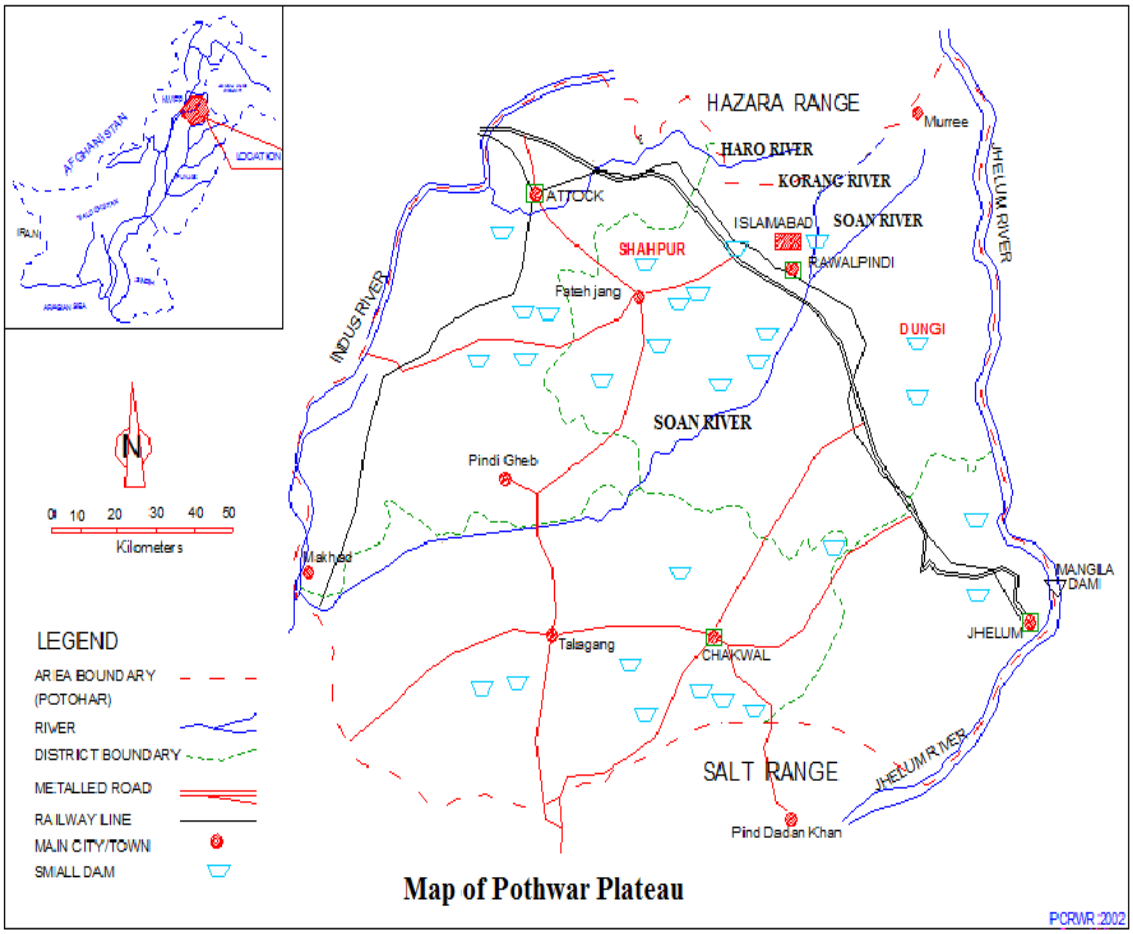

Fig. 1 : Location of study area

III. Data Collection

The daily discharge, sediment load and rainfall data of Soan, Haro and Kanshi River basins were collected from Surface Water Hydrology Project (SWHP), WAPDA. The collected data sets were analyzed and average annual discharge and sediment load were calculated to monitor the detailed trend of each basin.

IV. Results and Discussion

a) Status of sediment load at Soan basin

There are three major river basins in the Pothwar region: Soan, Haro and Kanshi basins comprising of many small tributaries. The Soan River basin is the major hydrological unit of Pothwar Plateau. The drainable area of this basin is about 11,085 km^2. The Soan Basin forms the central part of Pothwar Plateau. The sediment load from Soan basin was analyzed at different reaches of Soan River i.e. Chirah, Rawalpindi and Dhoke Pathan, covering about 60% basin area. The overall average annual sediment yields of the Soan basin were ranged from 0.02 to 0.38 million tons per year as shown in Table 1.

Table 1 : Summary of sediment yield in sub catchment of Soan basin

Sub Catchment	Drainage area (km^2)	Years of record	Average sediment yield (million tons/year)	Unit sediment yield (tons/km^2/year)
Chirah	323	1982-2006	0.02	61.92
Rawalpindi	1,342	1982-2006	0.11	66.00
DhokPathan	4,736	1982-2006	0.38	59.36

The unit rate of sediment yield is inversely proportional to the drainage area because there is an association between the rate of sediment production and size of catchment area as the total runoff yield is dependent upon the aerial extent of the watershed. The unit sediment yield of Chirah is 33%, while 35% and 32% for Rawalpindi and Dhok Pathan, respectively. It is clear that the drainage area of the Chirah is 5% of the total draining area of the Soan basin from Chirah to DhokPathan but the unit sediment yield is 33% whereas the Dhok Pathan having 74% and Rawalpindi 21% drainage area accumulates 32% and 35% sediment yield respectively.

The sediment yield from Soan basin is highly temporal and spatial because the rainfall and runoff are highly variable. Theaverage annual sediment yield rate may not provide sufficient information to interpret causes and effects of proper land management. The annual sediment yield, however, provides a general basis of comparison between the sub catchments. Hydrologic, geomorphic and watershed characteristics influence the sediment yield. The peak flow decreases as the area increases while the period of surface runoff increases with the more area because the catchment of larger area has greater time of concentration showing that more time is available to the water for leaching into the soil, ultimately there is reduction in runoff and soil loss or sediment yield. Barnson et al. (1981) also presented a graph illustrating the relationship between sediment yields and draining area based on the research work. In general, the unit rate of sediment yield decreases as drainage area increases (Fig.2).

The relationship in average monthly discharge and sediment concentration of Chirah, Rawalpindi and Dhok Pathan are plotted in Figures 3-5. The sediment concentration increases from July-September with peak in August i.e. monsoon season at Chirah which is due to high rainfall this period but the sediment concentration is very low during January-June and October-December due to low rainfall during these months (Fig.6).

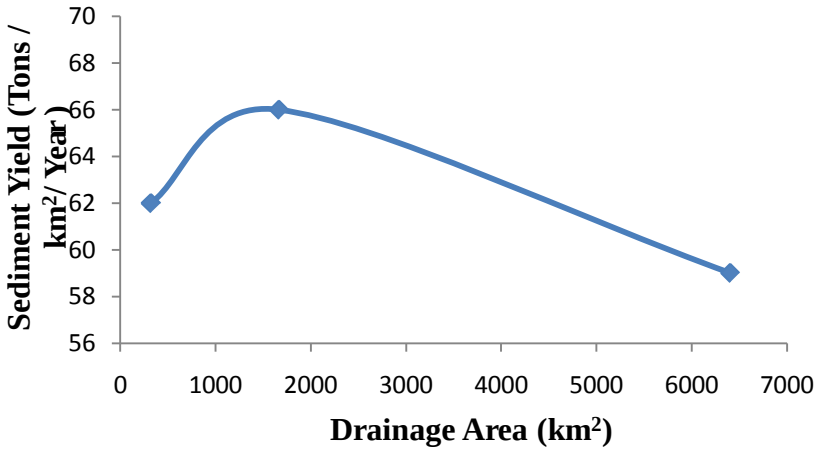

Fig. 2 : Relationship between drainage area and sediment yield

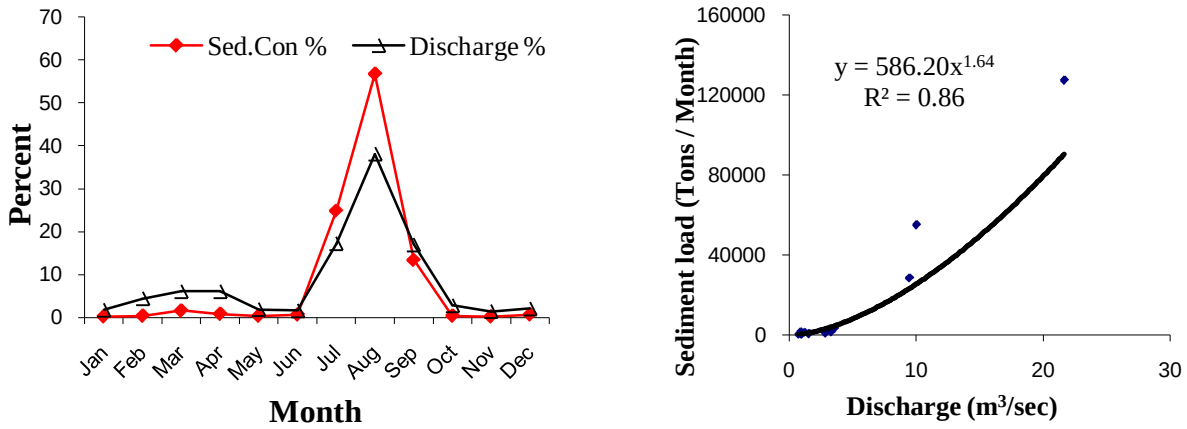

Fig. 3 : Relationship between discharge and sediment concentration at Chirah

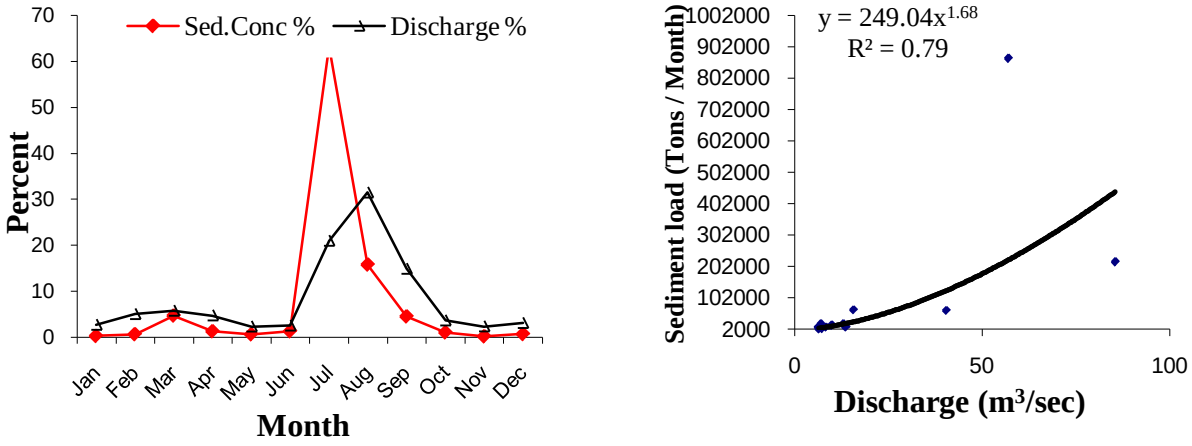

Fig. 4 : Relationship between discharge and sediment concentration at Rawalpindi

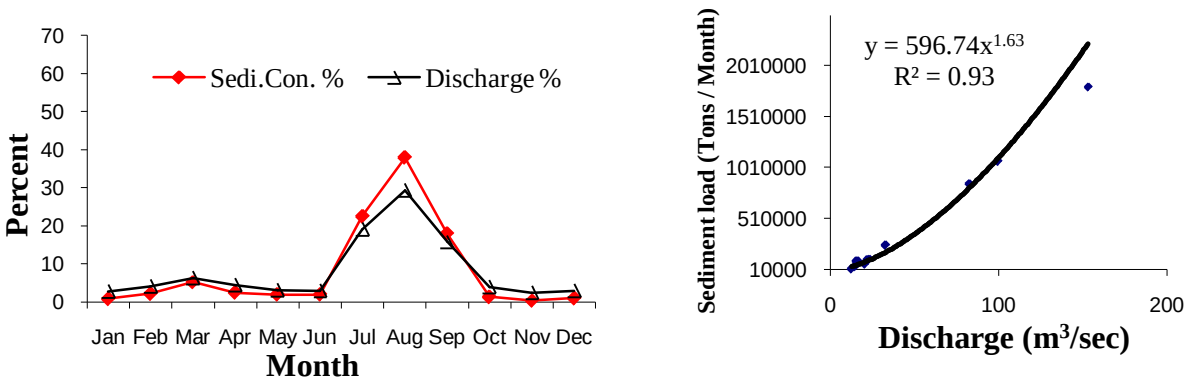

Fig. 5 : Relationship between discharge and sediment concentration at Dhok Pathan

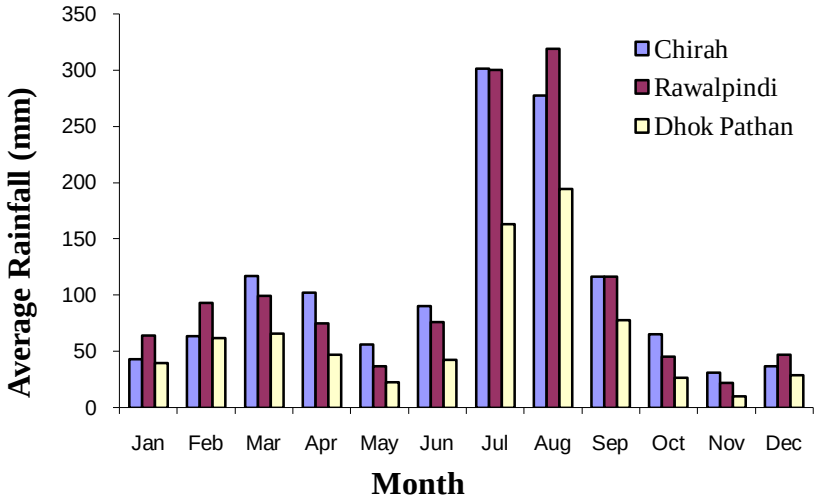

Fig. 6 : Average monthly rainfall trend (1982-2006) of Soan River Basin

The discharge at Chirah is comparatively low as compared to Rawalpindi and Dhok Pathan as Chirah is located at upstream of the Soan River. The R^2 (coefficient of determination) value was 0.86 at Chirah and 0.79 at Rawalpindi, whereas 0.93 at Dhok Pathan. The Dhok Pathan station has greater sediment-discharge correlation as compared to other stations.

Whereas, there was sudden increase in sediment concentration during July due to high intensity rainfall but the discharge was maximum during August due to high rainfall at Rawalpindi. At Dhok Pathan, the sediment concentration was high from July-September with peak in August and discharge was also maximumduring August.

There is good correlation between the discharge and the sediment concentration. The best fit rating curve between the discharge and the sediment is power function. Also other empirical relationships were applied but most commonly used relationship is the power function. The same results were reported by Walling, 1977; Holubová, 1998; Asselman, 1999; Bhutiyani, 2000 and Rondeau, 2000.

$$C = aQ^b$$

Where C is the suspended sediment concentration in mg/l.

Q is the water discharge in m^3/sec.

a and b are empirically derived regression coefficients.

The percentage of sediment concentration at Chirah ranged from 13-57% and at Rawalpindi were 5-63% during the monsoon season (July-August) due to high intensity rainfall in this season but the sediment concentration at Dhok Pathan were 17-38%. As Dhok Pathan is lying in low rainfall area the sediment concentration was relatively low at this point whereas Chirah and Rawalpindi falls at high rainfall zone and accordingly high sediment concentration. Most importantly, the sediment concentration at all points is low during January-June and October-December due to low rainfall.

b) Status of sediment load at Haro river basin

The sediment load from HaroRiver basin was analyzed at Garrialawhich islocated at the end of the basin, covering about 100% basin area.

c) Haroriver basin at Garriala

The maximum sediment load was observed during the months of July and September which also has correlation with the monthly flow pattern (Fig. 7). The high intensity and short duration rainfall during monsoon period has direct influence to erode the soil particles. Further, the long term yearly pattern of sediment load at Gurriala were indicating an increase in sediment load with increase in discharge(Fig.8).

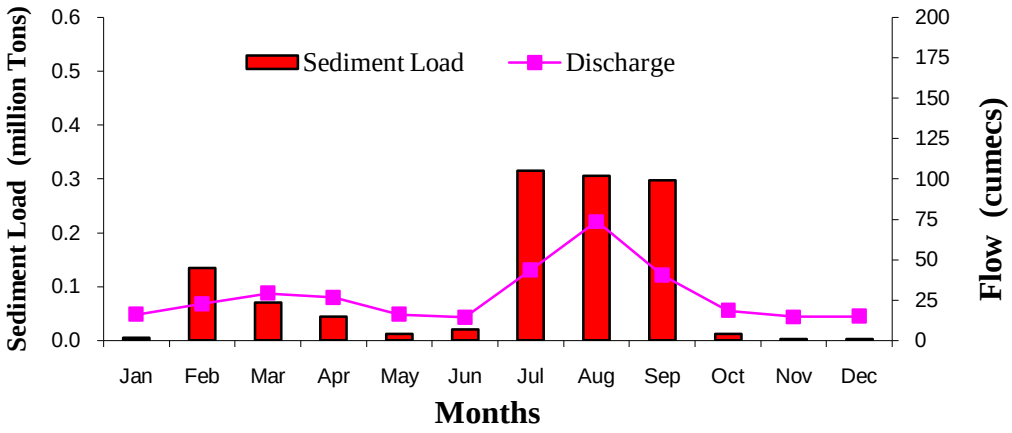

Fig. 7 : Monthly sediment load of Haro basin at Gurriala

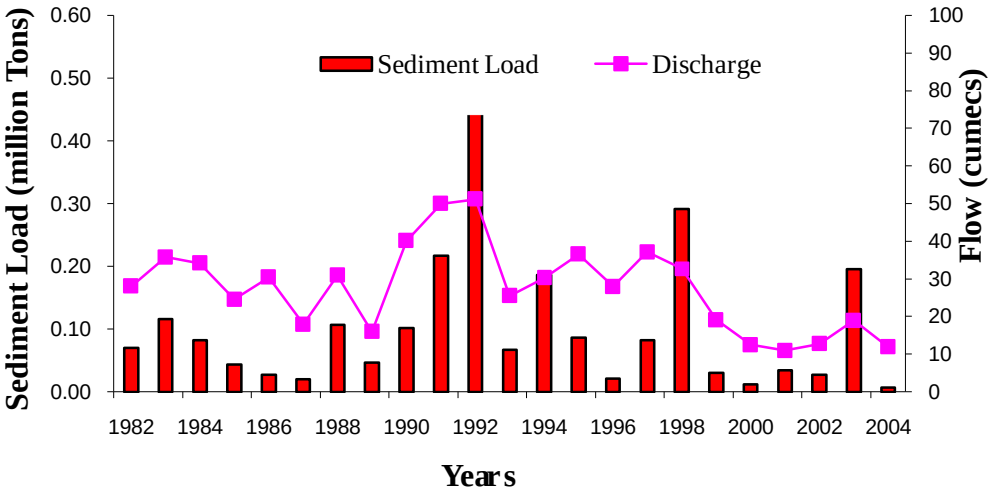

Fig. 8 : Annual sediment load of Haro basin at Gurriala.

d) Status of sediment load at Kanshiriver basin

The Kanshi river basin is adjacent to Soan basin and located with Jhelum River in Pothwar Plateau with drainable area of about 1,300 square kilometers (km^2). The area lies in semi-arid zone of climatic region with hot summers and cold winters. The sediment load from Kanshi basin was analyzed at Palote covering about 85% basin area.

e) Kanshiriver basin at Palote

The analysis of long term data of suspended sediment load at Palote indicating that the monsoon period i.e. months of July and August have maximum sediment load which also has correlation with the monthly flow pattern (Fig. 9). The rainfall during monsoon period was associated with high intensity and short duration which has direct influence to erode the soil particles. Almost the same pattern was observed when long term yearly data of sediment load and discharge were plotted (Fig. 10).

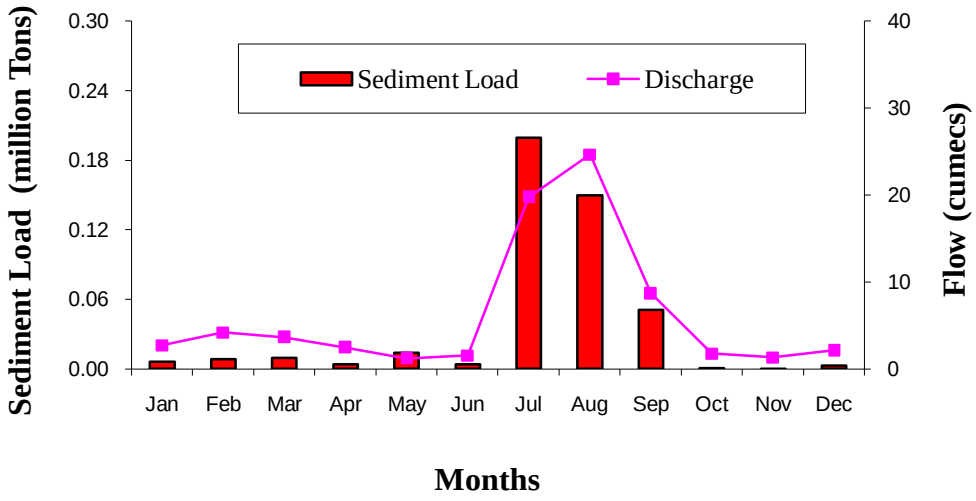

Fig. 9 : Monthly pattern of sediment load of Kanshi River basin at Palote

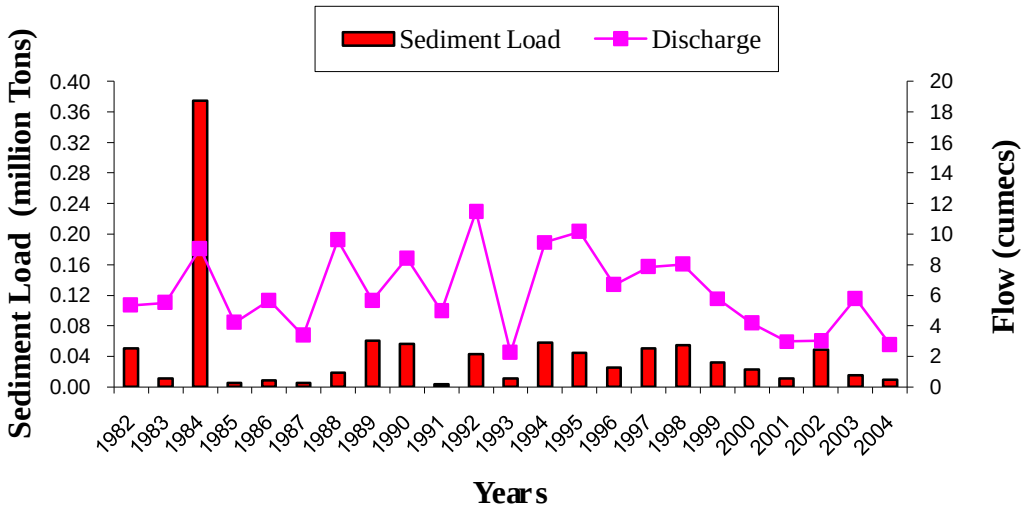

Fig. 10 : Average annual of sediment load of Kanshi River basin at Palote

V. Status of Total Sediment Load

Resultantly, the total sediment load of Soan Basin at Dhoke Pathaninstigating that this basin was relatively producing more load as compared to the other two basins. However, the maximum load is gradually decreased from 1990 to 2001 (Fig. 11). As compared to Soan Basin, total sediment load at Harrow rive basin is low and fluctuating periodically from 1990 to 2001. Moreover, the total sediment load at Kanshi Basin is also comparatively low like the Haro Basin.

VI. Conclusions

The study indicates that sediment load increases as the river flows towards down stream. In high flow season, the sediment load was high and vice versa. However, the sediment load may increase during low flow periods because of some earthen work e.g. cutting of trees, construction of dams etc. It was further observed that abrupt change in flow increased the sediment load which is normally observed at the start of pre-monsoon i.e. in the months of June and July. The observed sediment load was comparatively high at uplands as compare to flat land. The total sediment load from Soan Basin is relatively high as compared to Haro and Kanshi Basin. Given the spatial variability of basin characteristics (topography, land use and cover, geology, soils etc.), applying a computer simulation model can better capture basin hydrology subject to good quality data. The appraisal of this study can be further proceeded for exploring basin hydrology and predicting sediments loadings to identify the critical sub-basins as well as studying land use management scenarios to mitigate potential threats by conservational and watershed management techniques to the precious land and water resources.

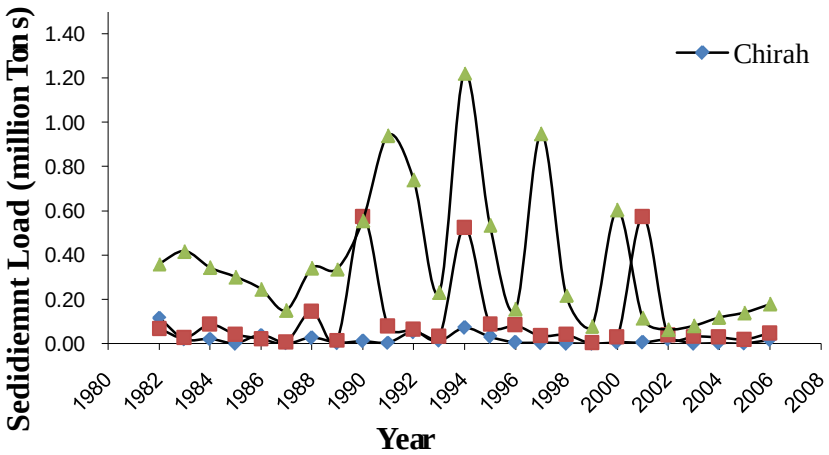

Fig. 11 : Annual sediment load at different sites

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Global Journal of Researches in Engineering: J
General Engineering
Volume 14 Issue 6 Version 1.0 Year 2014
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals Inc. (USA)
Online ISSN: 2249-4596 & Print ISSN: 0975-5861

Multiple Object Tracking using Support Vector Machine

By G. Ramya & Mrs. Srilatha
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Abstract- This paper presents an accurate and flexible method for robust recognition and tracking of multiple objects in video sequence. Object tracking is the process of separating the moving object from the video sequences. Tracking is essentially a matching problem in object tracking. In order to avoid this matching problem, object recognition is done on the tracked object. Background separation algorithm separate moving object from the background based on white and black pixels. Support Vector Machines classifier is used to recognize the tracked object. SVM classifier are supervised learning that associates with machine learning algorithm that analyse and recognize the data used for classification. SVM uses Kalman filter which makes the system more robust by tracking and reduce the noise introduced by inaccurate detections.

Keywords: *object tracking, background subtraction, SVM, kalman filter, fuzzy.*

GJRE-J Classification : *FOR Code: 091599*

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Multiple Object Tracking using Support Vector Machine

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Abstract- This paper presents an accurate and flexible method for robust recognition and tracking of multiple objects in video sequence. Object tracking is the process of separating the moving object from the video sequences. Tracking is essentially a matching problem in object tracking. In order to avoid this matching problem, object recognition is done on the tracked object. Background separation algorithm separate moving object from the background based on white and black pixels. Support Vector Machines classifier is used to recognize the tracked object. SVM classifier are supervised learning that associates with machine learning algorithm that analyse and recognize the data used for classification. SVM uses Kalman filter which makes the system more robust by tracking and reduce the noise introduced by inaccurate detections.

Keywords: object tracking, background subtraction, SVM, kalman filter, fuzzy.

I. Introduction

Normally all working environments need security. Security can be implemented [1] in many ways, sometimes audio, video or by any other means. Video surveillance systems are most common today. Intelligent video surveillance systems deal with the real-time monitoring of persistent and transient objects within a specific environment. This type of video surveillances can be applied not only to various security systems, but also for environmental surveillance. This surveillance can be used for many other purposes like event detection, [2] visual surveillance and robotics. A normal object detection algorithm can be applied for this purpose, but it may be difficult to detect unknown objects with significant changes in color, shape and texture. So most surveillance systems use static cameras which make the object detection much more easy. In such cases a background model is trained with data obtained from empty scenes and foreground regions are identified using the dissimilarity between the trained model and new observations. This method is normally used in all static cameras. Difficulties in tracking objects can arise due to abrupt object motion,[3] changing appearance patterns of both the object and the scene, non-rigid object structures, object-to-object and object-to-scene occlusions, and camera motion. Tracking is usually performed in the context of higher level applications that require the location and/or shape of the object in every frame.

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The rest of this paper is organized as follows. Section II is a brief review of existing method. The proposed method is given in section III. Simulation results are given in section IV. Section V includes conclusion.

II. Existing Method

A In the literature, many features are used for the detection of moving objects. In the case of color features, [4]some authors make the foreground detection in each dimension independently and then aggregate the corresponding foreground mask using the binary operator (OR). The disadvantage is that a false positive in one dimension generate false positive in the final result.

We propose thus to use a fuzzy operator i.e. the Choquet integral to aggregate the results obtained in each dimension to avoid crisp decision. fuzzy aggregation is the most promising, as it considers the correlation[5] existing among the features by fuzzy measure. Fuzzy Logic is a problem-solving control system methodology that lends itself to implementation in systems ranging from simple, small, embedded micro-controllers to large, networked, multi-channel PC or workstation-based data acquisition and control systems.

Fuzzy technique can be used to perform the accurate segmentation of the foreground object. fuzzy logic system, which fuses multiple sources of information together for decision making. In fuzzy technique the following are the drawbacks Using [6] more quantization levels increases the co-occurrence matrix size, thereby increasing computational complexity. Using less number of levels results in losing the information content in the frame. Thresholds were chosen empirically for all the competing [7] approaches so that their best results are used for comparison. High value of threshold results in more pixels getting falsely classified as foreground and vice versa.

III. Proposed Method

The capability of multiple objects tracking [8] is essential for most surveillance systems. One major challenge of this requirement is to detect multiple objects with occlusion. In this paper, the tracking algorithm combines feature matching model and Kalman filter framework to resolve this problem.

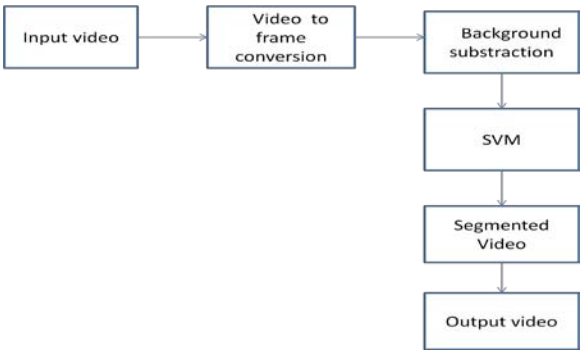


Fig. 1 : The architecture of the proposed method

The real-time visual surveillance system detects and tracks multiple people and monitors their activities in an outdoor scene[9] using a single monocular gray-scale or IR camera. It uses a combination of shape analysis and tracking to locate people and their parts, and to create models of their appearance such that they can be tracked through interactions as occlusions. The method uses the results of an iterative and dynamic probabilistic approach for object recognition. The object of interest is initialized by a user-specified bounding box, [10] but its category is not provided. Meanwhile, [11] video-based object recognition is applied on the tracked objects. When the target is recognized properly, the offline target model will be automatically incorporated to provide more information about the target. So target measurement at time t is $Z_t = I_t(x_t)$ where It is the input image at time t. Xt is the target state. Frame splitting is the process of splitting the given video into number of frames. In one second 24 frames are generated. Frames are stored in a separate file. Alternate Frame Rendering (AFR) is a technique of graphics [12] rendering in personal computers which combines the work output of two or more graphics processing units (GPU) for a single monitor, in order to improve image quality, or to accelerate the rendering performance. Extracting the background image from sequences of frames is a very important task in order to help tracker detect motion. This task is repeated from time to time in order to incorporate any changes in the illumination of the tracking scene, Here we are using the first frame as background image.

Background subtraction, [13] also known as Foreground Detection, is a technique in the fields of image processing and computer vision wherein an image's foreground is extracted for further Processing. $V(x,y,t)$ is image at time t and $B(x,y)$ background image at time t. If the difference is greater than the threshold, then the moving object is present. Else, there is no moving object.

$$[V(x,y,t) - B(x,y)] \geq Th$$

SVM (Support Vector Machine) is a useful algorithm for data classification and pattern recognition. A classification task usually involves with training and testing data which consist of some data instances. Each instance in the training set contains one "target value" (class labels) and several "attributes" (features) . The goal of SVM [10] is to produce a model which predicts target value of data instances in the testing set which are given only the attributes. In this work, moment features of detected objects are calculated from the first twenty frames of the video sequences and are stored in a database . Then we use these feature data to train the SVM. In the subsequent video sequences, the corresponding features extracted from each detected object in each frame are sent to the trained SVM. The SVM can accurately predict the class label of each object; consequently the system can recognize each object correctly.

The moment features provide some robustness to occlusion and background clutter. Color Moments and Wavelet Moments, in object recognition system, typically a set of numerical features are extracted from an image.

The purpose of feature extraction technique in image processing is to represent the image in its compact and unique form of single values or vectors. When the Kalman filter tracking system has a reliable prediction on the target movement, feature matching can be carried out in the relatively small region thus[13] Kalman filter plays an extremely important role in improving processing speed and performance of the tracking system. With the aim of finding the corresponding relationship in this system, we propose a Kalman tracking method based on object recognition. In visual surveillance system, Kalman filter is widely used for target prediction and tracking. After setting various appropriate parameters, we initialize the Kalman filter by the object segmentation results of the first two frames.

IV. Simulations Results

Fig. 2 : Video to frame

Fig. 3 : Background subtraction

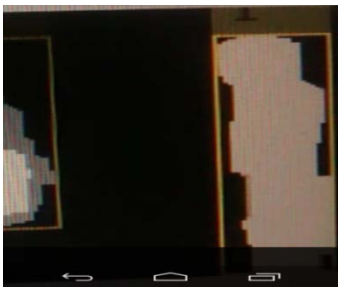


Fig. 4 : SVM output of object detected with bounding box and labeling

V. Comparison between Existing and Proposed Method

The performance of the prediction was evaluated in terms of recall, precision and accuracy.

Table 1 : Shows the comparison between fuzzy and SVM using recall

Number of frames	Recall	
	Fuzzy	SVM
1	85	90
2	85	90
3	85	90
4	85	89
5	88	89
6	81	85
7	85	89
8	80	81
9	80	84

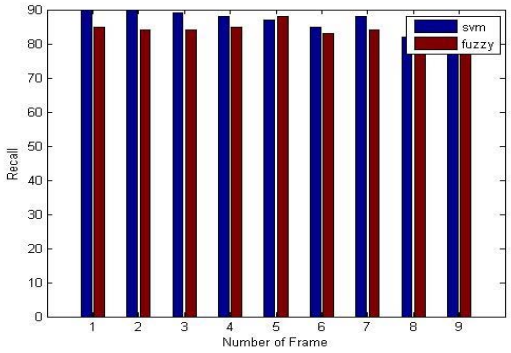
Table 2 : shows the comparison between fuzzy and SVM using prescision

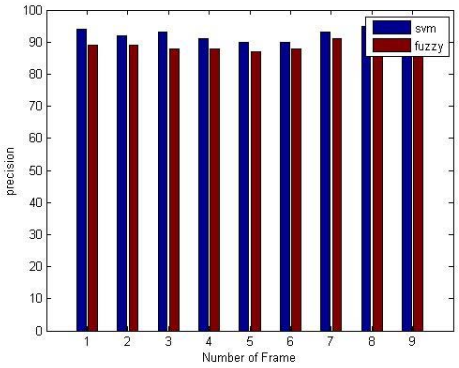
Number of frames	Precision	
	Fuzzy	SVM
1	89	95
2	90	93
3	89	95
4	90	92
5	89	92
6	90	92
7	90	95
8	95	98
9	89	92

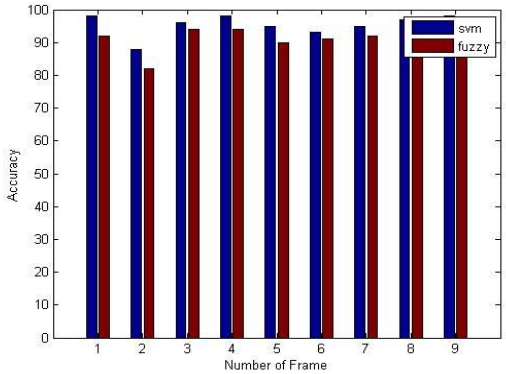
Table 3 : shows the comparison between fuzzy and SVM using accuracy

Number of frames	Accuracy	
	Fuzzy	SVM
1	91	99
2	82	90
3	95	98
4	95	99
5	90	95
6	90	92
7	92	95
8	95	98
9	90	99

Bargraphs showing the comparisons using recall, precision and accuracy.







Recall TP/TP+FP

Precision TP/TP+FN

Accuracy TP+TN/TP+TN+FP+FN

VI. Conclusion

In this paper we have proposed a robust and practical multiple objects recognition and tracking method. We integrate color moments and wavelet moments together for recognition and tracking. Moreover, we utilize a Kalman Filter framework to assist in tracking multiple objects. Our experimental results show that the proposed method can accurately recognize and robustly track multiple objects. Object recognition module improves the performance and accuracy of the Kalman filter tracking framework simultaneously the Kalman filter tracking framework can greatly improve the tracking speed. Furthermore, the

detection of multiple moving objects with occlusion is successfully finished which is a problem for recognition and tracking based on feature matching. The combination of these two modules nicely compensates for the weaknesses of each individually. The major limitation of this method is that for each object there have to be twenty frames for SVM training. For future work, we plan to introduce multimodal features to represent objects so that the recognition and tracking performance can be further improved.

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(d) An Introduction, giving necessary background excluding subheadings; objectives must be clearly declared.

(e) Resources and techniques with sufficient complete experimental details (wherever possible by reference) to permit repetition; sources of information must be given and numerical methods must be specified by reference, unless non-standard.

(f) Results should be presented concisely, by well-designed tables and/or figures; the same data may not be used in both; suitable statistical data should be given. All data must be obtained with attention to numerical detail in the planning stage. As reproduced design has been recognized to be important to experiments for a considerable time, the Editor has decided that any paper that appears not to have adequate numerical treatments of the data will be returned un-refereed;

(g) Discussion should cover the implications and consequences, not just recapitulating the results; conclusions should be summarizing.

(h) Brief Acknowledgements.

(i) References in the proper form.

Authors should very cautiously consider the preparation of papers to ensure that they communicate efficiently. Papers are much more likely to be accepted, if they are cautiously designed and laid out, contain few or no errors, are summarizing, and be conventional to the approach and instructions. They will in addition, be published with much less delays than those that require much technical and editorial correction.

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

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

Format

Language: The language of publication is UK English. Authors, for whom English is a second language, must have their manuscript efficiently edited by an English-speaking person before submission to make sure that, the English is of high excellence. It is preferable, that manuscripts should be professionally edited.

Standard Usage, Abbreviations, and Units: Spelling and hyphenation should be conventional to The Concise Oxford English Dictionary. Statistics and measurements should at all times be given in figures, e.g. 16 min, except for when the number begins a sentence. When the number does not refer to a unit of measurement it should be spelt in full unless, it is 160 or greater.

Abbreviations supposed to be used carefully. The abbreviated name or expression is supposed to be cited in full at first usage, followed by the conventional abbreviation in parentheses.

Metric SI units are supposed to generally be used excluding where they conflict with current practice or are confusing. For illustration, 1.4 l rather than 1.4 × 10-3 m3, or 4 mm somewhat than 4 × 10-3 m. Chemical formula and solutions must identify the form used, e.g. anhydrous or hydrated, and the concentration must be in clearly defined units. Common species names should be followed by underlines at the first mention. For following use the generic name should be constricted to a single letter, if it is clear.

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All manuscripts submitted to Global Journals Inc. (US), ought to include:

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Abstract, used in Original Papers and Reviews:

Optimizing Abstract for Search Engines

Many researchers searching for information online will use search engines such as Google, Yahoo or similar. By optimizing your paper for search engines, you will amplify the chance of someone finding it. This in turn will make it more likely to be viewed and/or cited in a further work. Global Journals Inc. (US) have compiled these guidelines to facilitate you to maximize the web-friendliness of the most public part of your paper.

Key Words

A major linchpin in research work for the writing research paper is the keyword search, which one will employ to find both library and Internet resources.

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

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Choice of key words is first tool of tips to write research paper. Research paper writing is an art.A few tips for deciding as strategically as possible about keyword search:

- One should start brainstorming lists of possible keywords before even begin searching. Think about the most important concepts related to research work. Ask, "What words would a source have to include to be truly valuable in research paper?" Then consider synonyms for the important words.
- It may take the discovery of only one relevant paper to let steer in the right keyword direction because in most databases, the keywords under which a research paper is abstracted are listed with the paper.
- One should avoid outdated words.

Keywords are the key that opens a door to research work sources. Keyword searching is an art in which researcher's skills are bound to improve with experience and time.

Numerical Methods: Numerical methods used should be clear and, where appropriate, supported by references.

Acknowledgements: Please make these as concise as possible.

References

References follow the Harvard scheme of referencing. References in the text should cite the authors' names followed by the time of their publication, unless there are three or more authors when simply the first author's name is quoted followed by et al. unpublished work has to only be cited where necessary, and only in the text. Copies of references in press in other journals have to be supplied with submitted typescripts. It is necessary that all citations and references be carefully checked before submission, as mistakes or omissions will cause delays.

References to information on the World Wide Web can be given, but only if the information is available without charge to readers on an official site. Wikipedia and Similar websites are not allowed where anyone can change the information. Authors will be asked to make available electronic copies of the cited information for inclusion on the Global Journals Inc. (US) homepage at the judgment of the Editorial Board.

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Tables: Tables should be few in number, cautiously designed, uncrowned, and include only essential data. Each must have an Arabic number, e.g. Table 4, a self-explanatory caption and be on a separate sheet. Vertical lines should not be used.

Figures: Figures are supposed to be submitted as separate files. Always take in a citation in the text for each figure using Arabic numbers, e.g. Fig. 4. Artwork must be submitted online in electronic form by e-mailing them.

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Even though low quality images are sufficient for review purposes, print publication requires high quality images to prevent the final product being blurred or fuzzy. Submit (or e-mail) EPS (line art) or TIFF (halftone/photographs) files only. MS PowerPoint and Word Graphics are unsuitable for printed pictures. Do not use pixel-oriented software. Scans (TIFF only) should have a resolution of at least 350 dpi (halftone) or 700 to 1100 dpi (line drawings) in relation to the imitation size. Please give the data for figures in black and white or submit a Color Work Agreement Form. EPS files must be saved with fonts embedded (and with a TIFF preview, if possible).

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

12. Make all efforts: Make all efforts to mention what you are going to write in your paper. That means always have a good start. Try to mention everything in introduction, that what is the need of a particular research paper. Polish your work by good skill of writing and always give an evaluator, what he wants.

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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 sufficient. Use words properly, regardless of how others use them. Remove quotations. Puns are for kids, not grunt readers. Amplification is a billion times of inferior quality than sarcasm.

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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.

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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.

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

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To make a paper clear

· Adhere to recommended page limits

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- 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
- Submitting a manuscript with pages out of sequence

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· Use standard writing style including articles ("a", "the," etc.)

· 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

· Shun familiar wording, don't address the reviewer directly, and don't use slang, slang language, or superlatives

· 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.

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- 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
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- Explain the value (significance) of the study
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- 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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- Embrace particular materials, and any tools or provisions that are not frequently found in laboratories.
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- 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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- To be succinct, present methods under headings dedicated to specific dealings or groups of measures
- 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.

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- 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.
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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.

Content

- Sum up your conclusion in text and demonstrate them, if suitable, with figures and tables.
- In manuscript, explain each of your consequences, point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation an exacting study.
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- Do not discuss or infer your outcome, report surroundings information, or try to explain anything.
- Not at all, take in raw data or intermediate calculations in a research manuscript.
- Do not present the similar data more than once.
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Approach

- As forever, use past tense when you submit to your results, and put the whole thing in a reasonable order.
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- Despite of position, each figure must be numbered one after the other and complete with subtitle
- In spite of position, each table must be titled, numbered one after the other and complete with heading
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- Make a decision if each premise is supported, discarded, or if you cannot make a conclusion with assurance. Do not just dismiss a study or part of a study as "uncertain."
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- Give details all of your remarks as much as possible, focus on mechanisms.
- Make a decision if the tentative design sufficiently addressed the theory, and whether or not it was correctly restricted.
- 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.

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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

INDEX

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ISSN 9755861