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DISCOVERING THOUGHTS AND INVENTING FUTURE

Highlights

Algorithms for Emotion State

Resonance Brain Images

Applications of Kort Spiral

Organising Maps Applied

Space Justin

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Performance Analysis of Machine Learning Algorithms for Emotion State Recognition through Physiological Signal

By Dr. Abhishek Vaish & Pinki Kumari

Indian Institute of information Technology Allahabad, India

Abstract - Human-Computer-Interface HCI) has become an emerging area of research among the scientific community. The uses of machine learning algorithms are dominating the subject of data mining, to achieve the optimized result in various areas. One such area is related with emotional state classification using bio-electrical signals. The aim of the paper is to investigate the efficacy, efficiency and computational loads of different algorithms that are used in recognizing emotional state through cardiovascular physiological signals. In this paper, we have used Decision tables, Multi-layer Perceptron, C4.5 and Naïve Bayes as a subject under study, the classification is done into two domains: High Arousal and Low Arousal;

Keywords : pca, emotion classification, ecg and data mining algorithms.

GJCST-E Classification: I.2.6

PERFORMANCE ANALYSIS OF MACHINE LEARNING ALGORITHMS FOR EMOTION STATE RECOGNITION THROUGH PHYSIOLOGICAL SIGNAL

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Performance Analysis of Machine Learning Algorithms for Emotion State Recognition through Physiological Signal

Dr. Abhishek Vaish [α] & Pinki Kumari [σ]

Abstract - Human-Computer-Interface HCI) has become an emerging area of research among the scientific community. The uses of machine learning algorithms are dominating the subject of data mining, to achieve the optimized result in various areas. One such area is related with emotional state classification using bio-electrical signals. The aim of the paper is to investigate the efficacy, efficiency and computational loads of different algorithms that are used in recognizing emotional state through cardiovascular physiological signals. In this paper, we have used Decision tables, Multi-layer Perceptron, C4.5 and Naïve Bayes as a subject under study, the classification is done into two domains: *High Arousal and Low Arousal;*

Keywords : pca, emotion classification, ecg and data mining algorithms.

I. Introduction

Emotion is a psycho-physiological process triggered by conscious and unconscious perception of an object or situation and is often associated with mood, temperament, personality and disposition and motivation [15]. Emotions play an important role in human communication and can be expressed either verbally or by non-verbal cues such as tone of voice, facial expression, gesture and physiological behavior.

Interestingly, it has been observed through past researches that various fields are utilizing this as a key signal for system development in different context and some of the most applied areas are:

In the area of medical science many physiological disorders exists those are directly correlated with the one of the different class of emotions. According to the prior art of healthcare, numerous study has been conducted to recognize the early stage of stress to prevent the human's life before entering in danger zone. The outputs of the studies are some kind of tools and algorithms which helps to detect the early stage of mental illness which is a manifestation of the fact that classification through machine learning is important.

In area of Multi-modal authentication system various bio-signals (ECG, EEG and SC etc) are fused and interpreted for generation of unique identification factors. These factors have the capability like unique and robust and are strong enough to be cracked. This system could be used in securing highly sensitive areas like defense and banking section etc.

In the area of affective gaming the different levels of emotions are used to make the gaming software more affective and easy to use. For example the famous is NPC (Non-player character) in which each and character associated with the different emotions [13].

In view of above described areas of emotional state classification, the accuracy of a prediction is the only thing that really matters. Here, we are proposing an alternative method that will increase the efficacy and efficiency of the system using machine learning algorithms of data mining. The scope of the study has considered four machine learning algorithms among top 10 algorithms of data mining: Decision tables, Multi-layer Perceptron, C4.5 and Naïve Bayes and applied over the ECG data corpus with full features dataset and with reduced features datasets and examined the result's effect due to highly contained features.

II. Literature Review

A copious number of researches are present in the literature for recognizing human's emotions from the physiological signals. Recently, among researches; a great deal of attention has been received on the efficacy improvement. In this section, we would like to briefly review the dynamics of the ECG signal followed by the current state of the scientific contribution in the subject under study.

Electrocardiography is a tool which measures and records the electrical potentials of the heart. A complete ECG cycle can be represented in a waveform and is known as PQRST interval. A close analysis of the same reveals that two major orientations exist i.e. the positive orientation and the negative orientation, PRT is a positive orientation and QS is a negative orientation in a given PQRST interval and the same can be seen in Fig 1. The description of ECG waves and intervals are vital to catch the state of emotions present in human body how he/ she is feeling as negative feeling and stress feeling leads the dangers state of life.

Author α σ : Indian Institute of information Technology Allahabad, India.
E-mails : abhishek@iiita.ac.in, pinkishrm204@gmail.com

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In the past, the use of ECG has become more extensive to include areas like lie detection, stress and emotion measurement and human identification as it generated a distinctive pattern. The same is visible through fig 2, where samples of ECG from the different emotions such as joy, sad, Angry and pleasure is been generated to have better understanding.

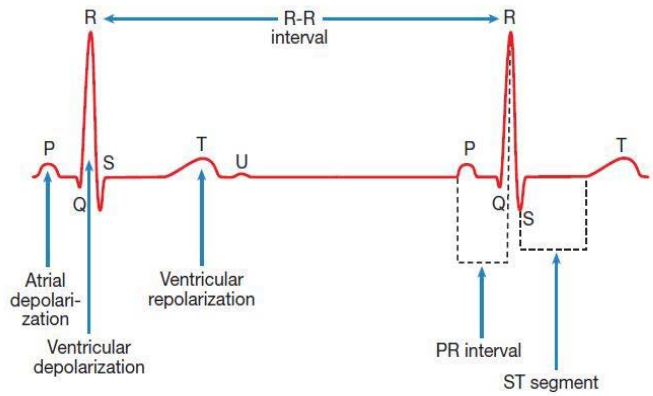

Fig. 1 : ECG Waveform generation from electrical activities of the heart

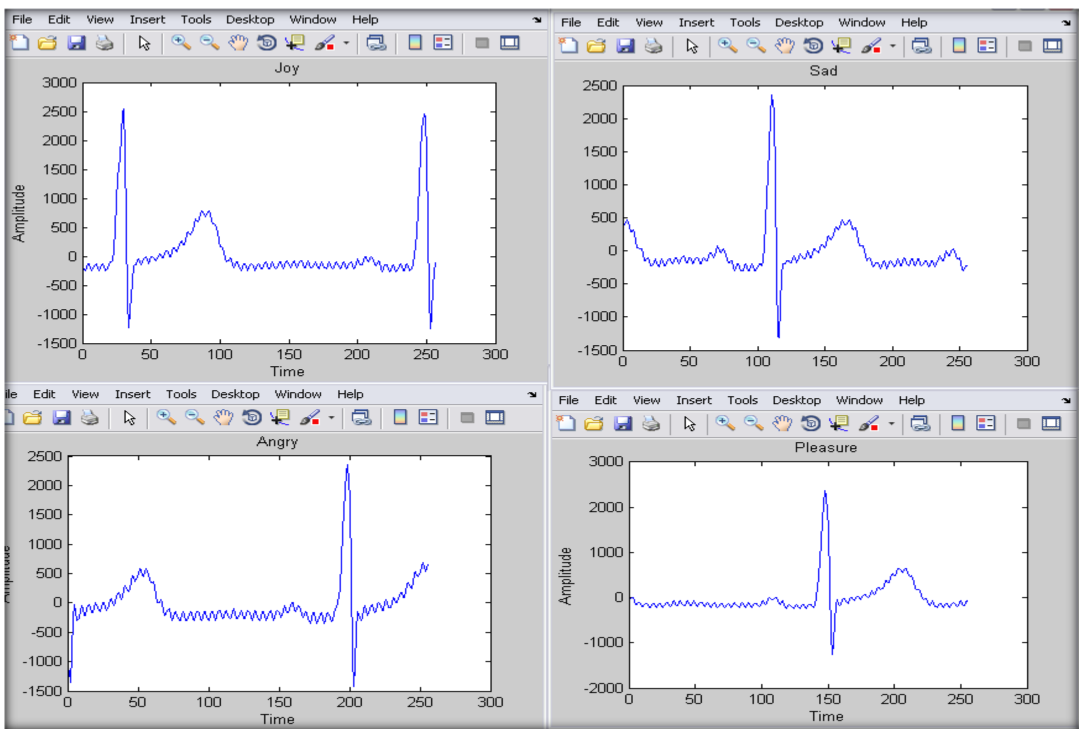

Fig. 2 : Sample signals from AuBT data corpus

Jang, E-H. et al. **[1],** have compared few data mining algorithm such as SVM, CART, SOM and Naïve Bayes over few Bio-signals like ECG, EDA and SKT and got the accuracy like 93.0%, 66.44%, 74.93% and 37.67%.

Chuan-Yu Chang: **[2],** they have uses two modal to classify the emotional state of human one is facial expression and another is physiological signals of various subjects and then applied classification algorithm to recognize the different emotional state and got the accuracy somewhere around 88.33% with the physiological signals. Gouizi, K.and Reguig. F.B **[3],** have used Support vector machine and obtained a result of 85% recognition rate.

Lan Li and Ji-hua **[4],** This paper proposed to recognize emotion using physiological signals such as ECG, SKT, SC and respiration, selected to extract features for recognition and achieved accuracy such as 82%-17 features, 85.3% with 22 features and same accuracy with the 20 features. Siraj, F and Yusoff, N **[5],** the presented paper says about classification of emotion of subject's in two classes' i.e. active arousal and passive arousal using ECG pattern and achieved the accuracy around 82%.

Mu Liand Bao-Liang Lu **[6],** this paper described how emotion could be classified through EEG signals. They considered two types emotions: Happiness and sadness. Using common spatial patterns (CSP) and linear SVM classification has been done and achieved the satisfied accuracy. Murugappan, M **[7],** presents Electromyogram (EMG) signal based human emotion classification using K Nearest Neighbor (KNN) and Linear Discriminant Analysis (LDA). Five most dominating emotions such as: happy, disgust, fear, sad and neutral are considered and these emotions are induced through Audio-visual stimuli (video clips).

Yafei Sun and Zhishu Li **[8],** in this paper, we evaluate these tools' classification function in authentic emotion recognition. Meanwhile, we develop a hybrid classification algorithm and compare it with these data mining tools. Finally, we list the recognition results by various classifiers. Ma Chang and Guang **[9],** Wavelet transform was applied to accurately detect QRS complex for its advantages on time-frequency localization, in order to extract features from raw ECG signals. A method of feature selection based on Ant Colony System (ACS), using K- nearest neighbor for emotion classification, was introduced to obtain higher recognition rate and effective feature subset.

Wagner, J and Kim J [10], this paper described four types of physiological signals and applied classification algorithm KNN, MLP and LDF to solve these problem. Khosrowabadi, R and Waheab bin Abdul Rahman,A **[11],** This paper presents the classification of EEG correlates on emotion using features extracted by Gaussian mixtures of EEG spectrogram. This method is compared with three feature extraction methods based on fractal dimension of EEG signal The K nearest neighbor and Support Vector Machine are applied to classify extracted features.

These research articles provide support for the conclusion that Bio-electrical signals carries generic information about the human behavior or different human emotions. There is however limited research which considers computational time effect by reducing the dimensionality of features of heart rhythms.

In the proposed article, we are trying to analyze the performance of the data mining algorithms with high feature dataset and reduced feature dataset.

III. Research Methodology

Person emotion recognition has lately evolved as an interesting research area. Physiological signals such as ECG, EEG, EMG and respiration rate are successfully utilized by quite a few researchers to attain the emotion classification **[3, 12].** In this research we have used simulative research design using quantitative data that has been collected using four Bio-sensors. In this section, we would be highlighting the schematic diagram in 3.1 that has been followed to extract the results and also to make sure that the contamination in the research design could be avoided. Additionally, the description of data corpus 3.2, and the use of different classification algorithm in 3.5 would be discussed.

a) High Level Schematic Diagram

The whole of this high level diagram is categorized into three main steps. These are as follows:

- Extraction of statistical features. - Help us to extract the maximum number of feature from the raw data set. Features are those data point that has potential information for output.
- Applying the PCA for Feature Reduction – Helps in extracting the best fit feature that without compromising the results improves the system performance.
- Classification algorithm to check the efficacy- Helps in the decision making system for accurate results.

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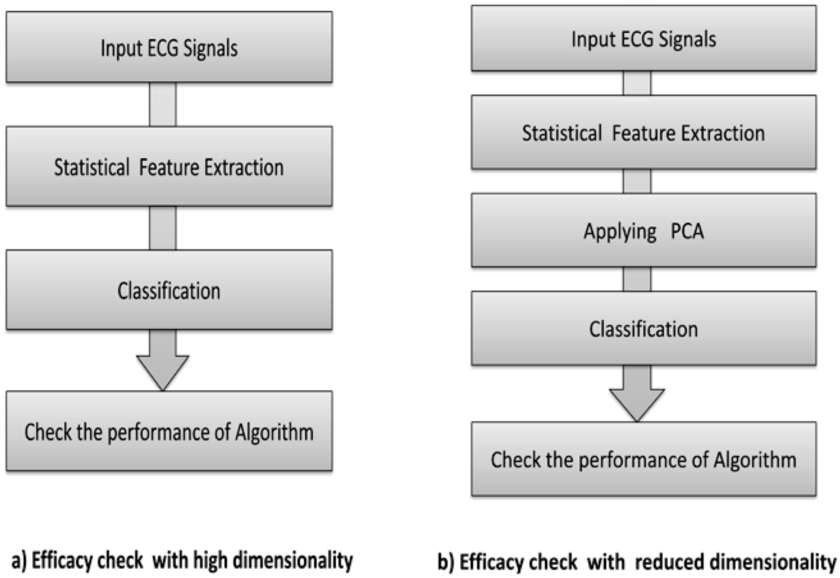

Fig. 3 : Schematic Diagram of Proposed work

b) Description of Subject

Each subject (participant) selects four favorite songs reminiscent of their certain emotional experiences corresponding to four emotion categories. Signals were collected with 25 subjects with 4 emotions within 25 days.

c) Mode of collection data

The physiological data were recorded through biosensor and the length of the recordings depends on the length of the songs, but was later cropped to a fixed length of the two minutes and ECG was sampled at 256 Hz.

AuBT comes along with two corpora, both recorded at the University of Augsburg: a corpus containing physiological data of a single user in four different emotional state and corpus containing physiological data recorded from a single user under varying stress. As per our interest which mentioned in above that performance analysis of data mining algorithms so that we have used only emotional state data set with ECG signal of all subjects. The corpus which contains the physiological signals in four emotional states: *Joy, Anger, Sadness and Pleasure*. For our Interest we have summarize these emotional states into two states i.e. *High Arousal and Low Arousal.*

d) Research procedure

In the field of automatic emotion recognition probably the most often used features are based on statistically such as Mean, Median, Standard deviation, max min of all waves of ECG i.e. PQRST waveform which represents complete ECG cycle.

For the feature extraction and feature selection of ECG signal in time domain we have used *Analysis of variance (ANOVA)* Method. After collecting the statistical features of cardiac signal then performed the different classification to investigate the efficacy of the classification algorithms of data mining such as Decision table, Multi-layer Perceptron, Naïve Bayes and C4.5.

IV. Experimental Results

In this section, the results are presented, the result are presented into different phases i.e. the feature selection and the classification of emotions, feature extraction with reduced dimensionalities and their classification , finally the computational load of each classification algorithm is presented.

Phase I

Figure 4, depicts the classification accuracy of different algorithms. The total numbers of feature extracted by inbuilt use of ANOVA were 82. It can be seen that multilayer perceptron is giving the best result among the four with approximately 60% and Naïve Bayes is showing a response of 53% which is considered to be the least. It can be interpreted with the result that the FAR is low and FRR is high.

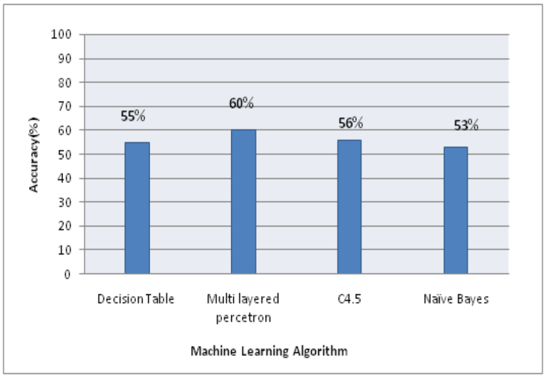

Fig. 4 : Performance of Machine learning algorithms with full features

Phase II

In order to optimize the result depicted in figure 4, we have used a dimensional reduction scheme and the most prevailing technique is the Principle component analysis. It is pertinent to briefly discuss the equation used in PCA [15].

Given the data, if each datum has N features represented for instance by x11 x12 … x1N, x21 x22….x2N, the data set can be represented by a matrix $X n \times m$.

The average observation is defined as:

$$\mu = \frac{1}{n} \sum_{i=1}^{n} x_i \qquad (1)$$

The deviation from the average is defined as:

$$\Phi_i = X_i - \mu/ \qquad (2)$$

Using eq 1 and 2, we have extracted the following results as depicted in table 1. The total numbers of extracted feature were 13 out of 82. The accuracy post extraction is depicted in figure 5. In this case c.4.5 is giving us the most optimized result. So it can be inferred that the combination of PCA +C4.5 in the given data set is the maximum. However, if we look at the more modest form, it can be seen that performance of all classification algorithm has gone up to the average of 20% using eq 3

Impact of post PCA= (Post PCA- Pre PCA) (3)

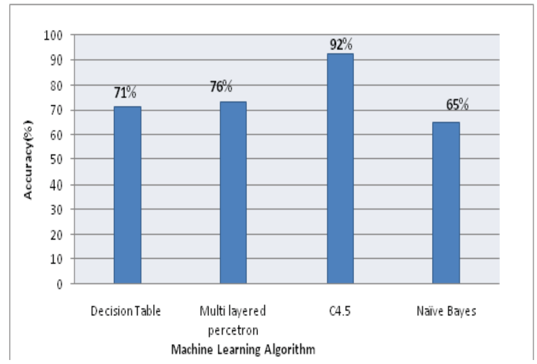

Fig. 5 : Performance of Machine learning algorithms with reduced features

	Number of Reduced Features
1	ecgQ-mean
2	ecgS-range
3	ecgQS-max
4	ecgT-std
5	ecgSampl-std
6	ecgSampl-mean
7	ecgPQ-range
8	ecgHrvDistr-triind
9	ecgQS-std
10	ecgHrv-specRange1
11	ecgHrvDistr-min
12	ecgHrv-specRange1
13	ecgHrv-pNN50

Table 1: Reduced data corpus with 13 features

Table 2 depicted in this section give the specific of the scalar value of the classification algorithm. The tabulation has been arranged with row and column. The first column is populating with the Machine learning algorithm and corresponding rows has the statistical measures like True –positive rate, precision, F-Measures and ROC Area. The classes are labeled as High Arousal, Low Arousal and same can be correlated with Fig 5.

ML's Algorithms	Class	TP Rate	Precision	F-Measure	ROC Area
C4.5	High Arousal	1	0.097	0.985	0.988
	Low Arousal	0.859	1	0.984	0.986
	Avg. Weighted	0.9295	0.985	0.984	0.987
Multi-Layer Perceptron	High Arousal	0.722	0.885	0.898	0.812
	Low Arousal	0.807	0.912	0.886	0.823
	Avg. Weighted	0.7645	0.8985	0.892	0.8175

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Naïve Bayes	High Arousal	0.64	0.867	0.65	0.924
	Low Arousal	0.67	0.594	0.596	0.806
	Avg. Weighted	0.655	0.7305	0.623	0.865
Decision Table	High Arousal	0.712	0.867	0.74	0.864
	Low Arousal	0.722	0.512	0.596	0.796
	Avg. Weighted	0.717	0.6895	0.668	0.83

Table 2 : Accuracy Chart of ML's algorithm over Electrocardiogram (ECG)

Phase III

This section is interesting for the readers and researchers because the most fundamental question with development of decision making system lies with cost of decision and accuracy. The latter has been discussed in this phase. In Fig 6 it can be seen that time taken to perform the task is categorizing in the domains i.e. with PCA and without PCA. The result is highly encouraging. Without PCA the time is reduced drastically. However, a important point worth observing that MLP is more computationally expensive among four in both the domains.

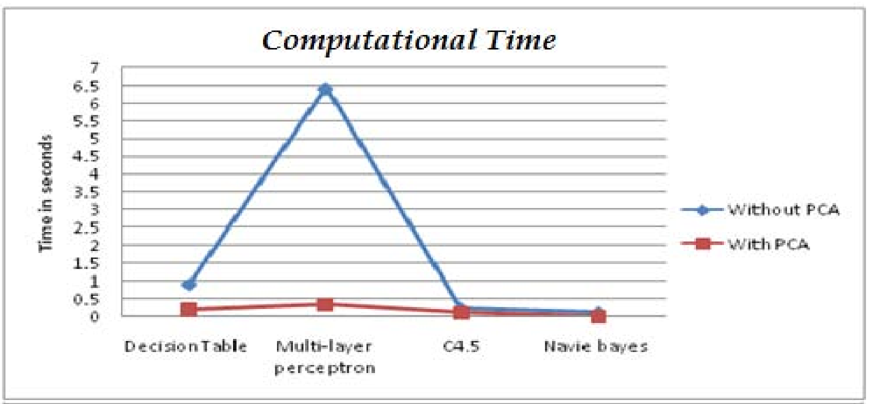

Fig. 6 : Comparison of computational load with and without feature reduction

V. Conclusion and Future Works

The work aimed at showing the possibility of recognizing the two levels of emotional state: *High Arousal and Low Arousal.* we have presented an alternative method to investigate the performance of data mining algorithms to raise the efficacy of the emotional recognition system and also give solution the question how dimensionality reduction can save the burden of computing. The recognition rates increased after applying proposed methods are: 16% with decision table; 12% with Multi-Layer Perceptron; 36% with C4.5 and 12% with Naïve Bayes. All experiments have done with openly available tool (WEKA) for data mining and machining Learning algorithms for data classification. There are few challenges we have faced which is the lack of data corpus quantum.

In future, we would like to explore another data corpus available in this domain. Furthermore , we would like to work on investigation of those classification algorithms which have been used for ECG classification in two different levels of emotional states with other physiological signals such as EMG, EEG, SC and Respiration. Another future work may be explored in area of affective computing like to automatically detect the stages of mental illness with good recognition rates through bio-signals. Bio-signals signals may also be fruitful in the area of multimodal authentication system or Cognitive biometrics; we may also use this method to raise the accuracy of cognitive biometrics systems as we all know that the important characteristics of any biometrics systems among all is robustness; it says how system maintains recognition rate under variable conditions.

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Tumor Extraction and Volume Estimation for T1-Weighted Magnetic Resonance Brain Images

By S.Satheesh, Dr.K.V.S.V.R Prasad & Dr.K.Jitender Reddy

G. Narayanamma Institute of Technology and Science, Hyderabad, India

Abstract - Magnetic Resonance Imaging (MRI) is a significant imaging technology for brain tumor diagnosis because physicians can identify precise pathologies by studying the variations of tissue characteristics that occurs in various kinds of MR brain images. Segmentation of MRI is a pre-process in determining the volume of different brain tissues, but here tumor detection is of primary concern. We proposed a method to extract tumors as seen through MR brain images using coclustering and morphological operations and its volume estimation was done by Cavalier's estimator of morphometric volume method. Quantitative analysis showed that the proposed method yielded better results in comparison with Fuzzy C-Means algorithm (FCM).

Keywords : tumor extraction, co - clustering, morphological operations, skull removal, magnetic resonance imaging, volume estimation.

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TUMOR EXTRACTION AND VOLUME ESTIMATION FOR T1- WEIGHTED MAGNETIC RESONANCE BRAIN IMAGES

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S.Satheesh [α], Dr.K.V.S.V.R Prasad [σ] & Dr.K.Jitender Reddy [ρ]

Abstract - Magnetic Resonance Imaging (MRI) is a significant imaging technology for brain tumor diagnosis because physicians can identify precise pathologies by studying the variations of tissue characteristics that occurs in various kinds of MR brain images. Segmentation of MRI is a pre-process in determining the volume of different brain tissues, but here tumor detection is of primary concern. We proposed a method to extract tumors as seen through MR brain images using co-clustering and morphological operations and its volume estimation was done by Cavalier's estimator of morphometric volume method. Quantitative analysis showed that the proposed method yielded better results in comparison with Fuzzy C-Means algorithm (FCM).

Keywords : tumor extraction, co -clustering, morphological operations, skull removal, magnetic resonance imaging, volume estimation.

I. Introduction

Tumor is one of the most common brain diseases; hence, its diagnosis and treatment are compulsory. In recent years, developments in medical imaging techniques have aided experts in numerous domains of medicine, such as computer-aided diagnosis, follow-up of pathologies, surgical planning and surgical guidance. Among the available medical imaging techniques, MRI is a popular neuroimaging technique for the evaluation and treatment of brain tumors. MRI devices generate images in sagittal, axial, and coronal planes that give a better localization of a lesion in a 3D space of the brain.

The segmentation of MR brain images is a complex task, as it involves a large amount of data. Few artifacts might arise due to a patient's motion or limited acquisition time; also, soft-tissue boundaries of tumor are vaguely defined. There exist a numerous classes of tumors with different shapes and sizes that appear at any location with dissimilar image intensities. A few of them might also deform the nearby structures or be associated to necrosis or edema that affects the image intensities in and around the tumor.

The conventional analysis of MR brain images with tumor by an expert is a complex and timely process. Thus, an automatic tumor segmentation method is desirable to give an adequate performance. As a result, tumor volume can be evaluated for follow-up of the disease effectively.

A number of popular brain tumor segmentation methods are briefly mentioned here. Clark et al. [1] proposed a tumor segmentation method by a set of rules with fuzzy classification and a knowledge base. Dou et al. [3] proposed a fuzzy information fusion frame work for tumor segmentation. Gordillo et al.[4] developed a fully automatic and unsupervised brain tumor segmentation method. Hassan Khotanlou et al. [5,6] introduced a tumor segmentation using symmetry analysis, fuzzy classification, and spatially constrained deformable models. Jingxin Nie et al.[9] proposed expectation maximization and a spatial accuracy-weighted hidden markov random field for tumor segmentation. Vida Harati et al.[15] proposed an automatic tumor segmentation technique based on improved fuzzy connectedness algorithm.

Despite various efforts and promising results in the medical imaging area, exact segmentation and characterization of tumors are still difficult and challenging.

This paper proposes a method that combines coclustering and morphological operations such as erosion, dilation and hole filling [12]. Firstly, morphological operations [13, 14] are performed on contrast-enhanced axial T1-weighted MR Head scans to remove non-brain data (skull, fat, skin, and muscle) to enhance tumor segmentation efficiency. These external tissues often interfere with a brain tissue during segmentation which accounts for poor segmentation efficiency. Secondly, coclustering algorithm [2, 10] is applied to segment brain tumor, and the volume of the tumor was evaluated by taking patient 1 of Table I. Performance of the proposed method was judged by comparing it with the most popular FCM algorithm [8].

II. Methodology

Our proposed method was divided into two parts. The output obtained from one part was taken as an input to the next part. The process flow chart is given in Figure1.The skull region was removed in stage I by morphological operations, and the tumor was extracted in stage II using co-clustering algorithm.

Author α : Dept. of ECE, G. Narayanamma Institute of Technology and Science, Hyderabad, India. E-mail : satheesh_ece@gnits.ac.in
Author σ : Dept. of ECE, D.M.S.S.V.H. College of Engineering, Machilipatnam, India.
Author ρ : Dept. of Radiology and Imaging Sciences, Apollo Health City, Hyderabad, India.

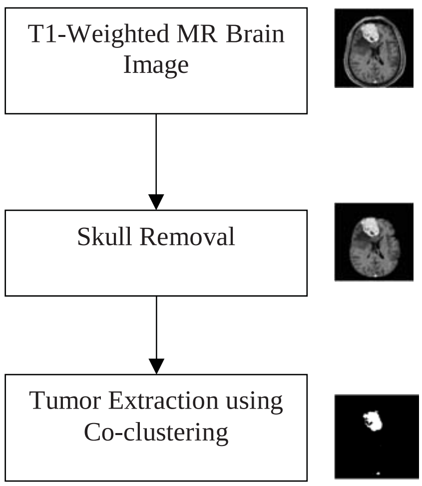

Figure 1 : Proposed methodology for tumor extraction

a) Skull removal

The objective of the process was to generate the brain region of the axial T1-weighted MR head scans by morphological operations namely, erosion and dilation [13, 14].

Erosion

Erosion operation was performed on the selected image (I) and used to split the image's weakly attached regions. The image was eroded by an octagonal structuring element. The eroded image I_1, would have several disconnected regions and was obtained using (1).

$$I_1 = I \ominus B \quad (1)$$

Where B is the octagonal structuring element with a size of 15 × 15.

Binarization

The preceding process decomposed the given image into several isolated regions. Then, the eroded image was converted to a binary image, I_2, using (2).

$$I_2(x,y) = \begin{cases} 1 & \text{if } I_1(x,y) \neq 0 \\ 0 & \text{otherwise} \end{cases} \quad (2)$$

Dilation

We performed a dilation operation on I_2 to recapture the brain tissues that were lost in the process of erosion. It was done with the same structuring element that was used for erosion. The dilated image, I_3, was obtained using (3).

$$I_3 = I_2 \oplus B \quad (3)$$

Thereafter, the binary mask was obtained by filling the holes in the dilated image. The binary mask was, thus, convolved with the original image to get the final brain portion. The results of the skull removal process are shown in Figure 2.

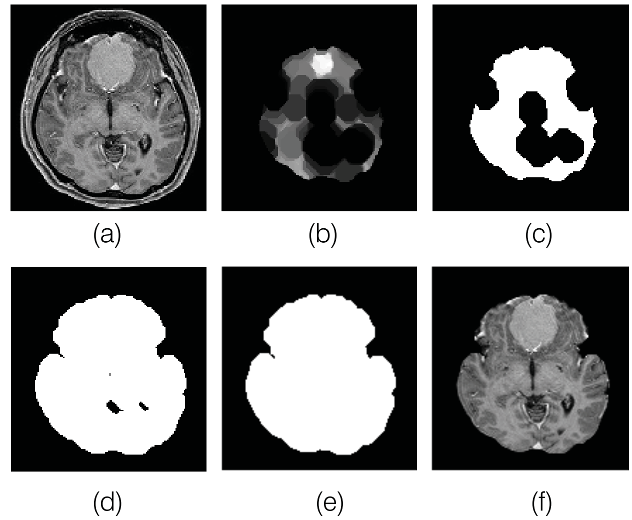

Figure 2 : Skull removal process results (a) Original MR brain image I; (b) Eroded image I_1; (c) Binarized image I_2; (d) Dilated image I_3; (e) Brain mask ;(f) Segmented brain image

b) Co-clustering algorithm

Clustering is a collection of similar image gray levels divided into segments. Co-clustering [2, 10] is the simultaneous partitioning of the rows and columns of an image matrix. This algorithm could be used to find *k*-clusters of MR brain images. The co-clustering algorithm can be summarized as follows:

Input: MR brain image of size $i \times j$ $(I_{i,j})$ and number of clusters (k)

Output: Segmented MR brain image with k clusters

1. Form $I_n = D_1^{\frac{-1}{2}} \times I \times D_2^{\frac{-1}{2}}$ where $D_1(i,i) = \sum_j I_{i,j}$ and $D_2(j,j) = \sum_i I_{i,j}$
2. Compute $[L = \log_2 k]$ singular vectors of I_n
3. Apply singular value decomposition (SVD) technique on I_n to obtain

$$[U\ S\ V] = SVD(I_n) \quad (4)$$

Where U and V represent the left and right eigenvector of 2nd to (L+1)th eigenvalues.

$$U = [u_2, u_3, \ldots, u_{L+1}] \text{ and } V = [v_2, v_3, \ldots, v_{L+1}]$$

4. Form the matrix

$$Z = \begin{bmatrix} D_1^{\frac{-1}{2}} \times U \\ D_2^{\frac{-1}{2}} \times V \end{bmatrix}$$

5. The *k*-means algorithm is applied on the *L*-dimensional data *Z* to get the *k* number of clusters.
6. Find out the mean of the centers and their indices from the obtained clusters.

7. Extract the segmented portion by indexing the obtained L-dimensional data with respect to the original image.
8. Apply the morphological region filling operator to refine the tumor region.

III. Evaluation Metrics

a) Performance estimation

The evaluation of tumor extraction results by the proposed method and the FCM algorithm was compared with the manually segmented tumors to measure its effectiveness. The manual segmentations were provided by medical experts, which might include abnormal tissues, like edema, along the tumor region. Let M be the manually segmented tumor and A be the segmented tumor by the proposed method or the FCM algorithm asshown in Figure 3. Here, the Similarity Index (SI), Correct Detection Ratio (CDR), Under Segmentation Error (USE), Over Segmentation Error (OSE), Hausdorff Distance (HD) and Average Surface Distance (ASD) were used for efficiency evaluation.

SI is a measurement that gives the true segmented region, which is relative to the total segmented region in both the segmentations.CDR value indicates the degree of trueness of the actual tumor. USE is the ratio of the number of voxels falsely identified as tumor portion by the proposed method to the manually segmented tumor. OSE is the ratio of number of voxels falsely identified non tumor region by the proposed method to the manual segmented tumor. Total Segmentation Error (TSE) is the sum of USE and OSE. HD is the largest difference between two surfaces and ASD illustrates how much the two surfaces differ on average. All these performance metrics also apply to FCM algorithm. The evaluation metrics SI, CDR, USE, OSE, HD, and ASD were obtained by using equations (5), (6), (7), (8), (9) and (10) respectively [5,6,7,15].

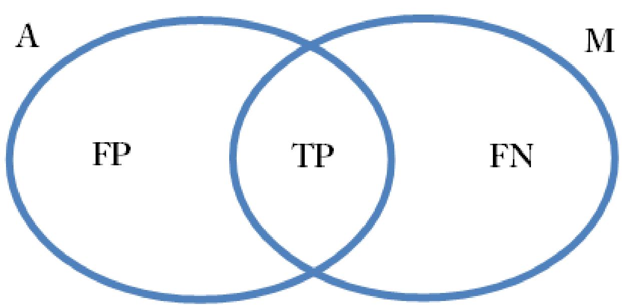

Figure 3 : Venn diagram representation of M, A, TP, FP and FN

$$\mathrm{SI} = \frac{2\mathrm{TP}}{2\mathrm{TP}+\mathrm{FP}+\mathrm{FN}} \times 100\% \quad (5)$$

$$\mathrm{CDR} = \frac{\mathrm{TP}}{\mathrm{TP}+\mathrm{FN}} \times 100\% \quad (6)$$

$$\mathrm{USE} = \frac{\mathrm{FP}}{\mathrm{TP}+\mathrm{FN}} \times 100\% \quad (7)$$

$$\mathrm{OSE} = \frac{\mathrm{FN}}{\mathrm{TP}+\mathrm{FN}} \times 100\% \quad (8)$$

Where True Positive (TP) is the number of pixels detected correctly, False Positive (FP) is the number of pixels detected falsely as tumor and False Negative (FN) is the number of pixels detected falsely as non tumor.

$$\mathrm{HD}\,(M,A) = \max\,(h(M,A),\, h\,(A,M)) \quad (9)$$

Where $h(M,A) = max_{m\in M} min_{a\in A} d(m,a)$, and $d(m,a)$denotes the Euclidean distance between m and a (m and a are points of M and A respectively)

$$\mathrm{ASD}(\mathrm{M},\mathrm{a}) = \frac{1}{2}[\mathrm{d_{mean}}(\mathrm{M},\mathrm{A}) + \mathrm{d_{mean}}(\mathrm{A},\mathrm{M})] \quad (10)$$
$$\text{where } \mathrm{d_{mean}}(\mathrm{M},\mathrm{A}) = \frac{1}{\mathrm{N_M}}\sum\nolimits_{m\in M} \mathrm{D}(\mathrm{m},\mathrm{A})$$
$$\mathrm{D}(\mathrm{m},\mathrm{A}) = [\min\nolimits_{a\in A} \mathrm{d}(\mathrm{m},\mathrm{a})]$$

b) Volume estimation

The volume of tumor V_t was estimated by Cavalier's estimator of morphometric volume method [11].The Cavalier's method was formulated on equally spaced slices of images using equation (11).

$$\mathrm{V_t} = \mathrm{d}(\sum\nolimits_{i=1}^{n} \mathrm{y_i}) - \mathrm{t}\mathrm{y_{max}} \quad (11)$$

Where'd' is the distance between each slice, 'y_i' is the area of slice 'i', 'n' is the total number of slices, 't' is the slice thickness, and 'y_{max}' is the maximum value of 'y'.

IV. Results and Discussions

The proposed method was verified on MRI brain image data sets of five patients named as patient 1 to patient 5, and one slice was selected from each patient's data set in random to evaluate the performance of the proposed method. Volume estimation has been done by taking all necessary slices of patient 1. These data sets have been acquired on a Philips Achieva 1.5T apparatus by an axial T1-weighted sequence. The slice thickness for patient 1 was 1.5mm, and the spacing between the adjacent slices was 0.9mm. The details of the data sets used are given in Table I. Data sets were collected from the Department of Radiology and Imaging Science, Apollo Health City, Hyderabad, India.

The evaluated segmentation results at pixel level are shown in Table II, and the extracted result of a meningeal tumor is shown in Figure.4 for the slice 105 of patient 3. It can be observed that the results exhibit close proximity to the manually segmented images by the experts and are superior to FCM. Quantitative results obtained by the proposed method in comparison with FCM are given in Table III.

From the Table III, the SI of the proposed method varies from 87.73% to 94.08% but for FCM it is

72.16% to 87.76% .The CDR of the proposed method ranges from 85.52% to 95.86%, and for FCM it is 85.69% to 91.61%. The TSE of the proposed method changes from 12.07% to 26.24%, and for FCM it is 24.75% to 70.69%.HD ranges from 5.4772 to 6.8557 for the proposed method and 5.6569 to 6.8557 for FCM, which proves a good position of the periphery of the tumors of the proposed method. ASD changes from 0.6375 to 1.3081 for the proposed method and 0.8761 to 1.5530 for FCM. The volume of tumor for patient 1 is 41,486mm^3 for the proposed method when compared with the value of 43,547mm^3 for manual segmentation shows close proximity as shown in Table IV.

Table I : Details of Data Sets Used

Patient	Gender	Age	Tumor Type
1	Male	54	Meningioma
2	Male	42	Cystic glioma
3	Female	48	Meningioma
4	Male	31	Dural tumor
5	Male	46	Metastatis

Table II : Evaluation of Segmentation Results at Pixel Level

Patient	Slice Number	FCM			Proposed Method		
		TP	FP	FN	TP	FP	FN
1	83	420	243	64	454	97	30
2	95	988	133	165	986	92	167
3	105	1255	191	159	1239	12	175
4	112	1201	258	150	1260	78	91
5	120	797	542	73	834	69	36

Table III : Evaluation of Segmentation Results of Tumors by the Proposed Method and Fcm

Patient	Slice No.	FCM							Proposed Method						
		SI	CDR	USE	OSE	TSE	HD	ASD	SI	CDR	USE	OSE	***TSE***	***HD***	***ASD***
1	83	72.23	86.78	50.21	13.22	63.43	5.6569	0.8761	87.73	93.80	20.04	6.20	26.24	5.4772	0.6375
2	95	86.90	85.69	11.54	14.31	25.85	6.3246	1.1738	88.39	85.52	7.98	14.48	22.46	6.4807	1.1296
3	105	87.76	88.76	13.51	11.24	24.75	6.7823	1.4961	92.98	87.62	0.85	12.38	13.23	6.5574	1.3025
4	112	85.48	88.90	19.10	11.10	30.20	6.8557	1.5530	93.72	93.26	5.77	6.74	12.51	6.8557	1.3081
5	120	72.16	91.61	62.30	8.39	70.69	6.2450	1.4178	94.08	95.86	7.93	4.14	12.07	6.4031	0.9403

Table IV : Estimation of Tumor Volume for Patient-1

Volume of tumor using manual segmentation (mm^3)	Volume of tumor using the proposed method (mm^3)
43,547	41,486

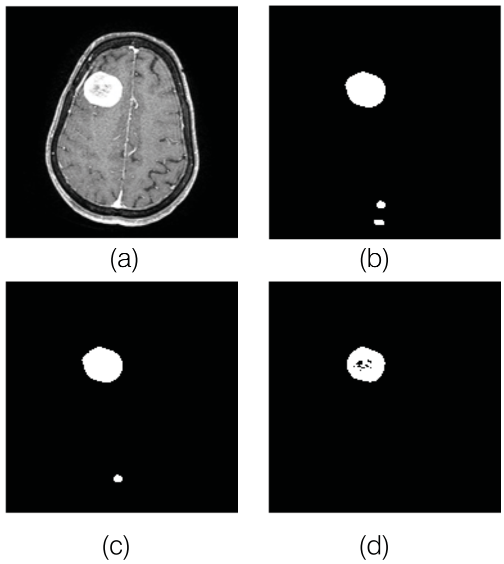

Figure 4 : Tumor extraction result of a meningeal tumor: (a) One axial slice of the selected tumor class; (b) Extracted tumor by the FCM; (c) Extracted tumor by the proposed method; (d) Manually segmented tumor

V. Conclusion

The presented tumor segmentation method was tested on five abnormal MRI brain slices of different patients, and the volume was evaluated for one of the patients. It was observed that integrating co-clustering with morphological operators minimizes segmentation error when compared with FCM. The qualitative evaluation of the obtained results for the proposed tumor extraction method achieved a good performance. A future scope in this area intends in finding the type of tumor based on ontology of tumors and segmentation of edema.

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Applications of Kort Spiral Learning Method on Learners Behaviour Based on Wavelet Transform Method (DWT) in E-Learning Environment

By E. Pandian & Dr. S.Santhosh Baboo

Manonmaniam Sundaranar University

Abstract - This paper is planning to address one of the important difficulties faced by the e-learning communities, that is, capturing of human emotion accurately both of a tutor and learner in e-learning sceanario. In this paper, an approach for human emotion recognition system based on Discrete Wavelet Transform (DWT) on korts spiral model of learning on learners and tutors is presented. The affective pedagogy is one of the important component in effective learning model. The Korts model helps us to understand the effectiveness of learners emotion in the learning environment. The Korts model can be better implemented by means of human emotion recognition system based on DWT method. The classification of human emotional state is achieved by extracting the energies from all sub-bands of DWT. The robust K-Nearest Neighbor (K-NN) is constructed for classification. The evaluation of the system is carried on using JApanese Female Facial Expression (JAFFE) database. Experimental results show that the proposed DWT based human emotion recognition system produces more accurate recognition rate which applied on Korts learning model we can able to produce the optimal e-learning environment(OELE).

Keywords : *DWT. korts model, affective learning, hci, knn classification, e-learning.*

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APPLICATIONS OF KORT SPIRAL LEARNING METHOD ON LEARNERS BEHAVIOUR BASED ON WAVELET TRANSFORM METHOD DWT IN E-LEARNING ENVIRONMENT

Strictly as per the compliance and regulations of:

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E. Pandian [α] & Dr. S.Santhosh Baboo [σ]

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I. Introduction

THE motion or positions of the muscles in the skin of a human face convey the emotional state of the individual to observers. These emotional states are a form of nonverbal communication. The recognition of emotional state of a human face has attracted increasing notice in pattern recognition, human-computer interaction and computer vision. A method for automatic recognition of facial expressions from face images by providing Discrete Wavelet Transform

DWT) features to a bank of five parallel neural networks is presented in [1]. Each Neural Network (NN) is trained to recognize a particular facial expression, so that it is most sensitive to that expression.

A new approach to facial expression recognition based on Stochastic Neighbor Embedding (SNE) is presented in [2]. SNE is used to reduce the high dimensional data of facial expression images into a relatively low dimension data and Support Vector Machine (SVM) is used for the expression classification. A new approach for the 3D human facial expressions analysis is presented in paper [3]. The methodology is based on 2Dand 3D wavelet transforms, which are used to estimate multi-scale features from real a face acquired by a 3D scanner. The different feature extraction techniques with advantage and disadvantage and find the recognition rate by using JAFFE databases is studied in [4]. The Adaboost classifier is used to classify the facial expression and from the JAFFE databases 60% data are used for the training and 40% data are used for the testing purpose.

Various feature representation and expression classification schemes to recognize seven different facial expressions, such as happy, neutral, angry, disgust, sad, fear and surprise, in the JAFFE database is investigated in [5]. A facial expression recognition system based on Gabor feature using a novel Local Gabor filter bank is proposed in [6]. A two-stage classifier for the elastic bunch graph matching based recognition of facial expressions is proposed in [7]. The distinctive similarity between image patterns are obtained by applying optimal weights to responses from different Gabor kernels and those from different fiducial points.

An algorithm based on Gabor filter and SVM is proposed for facial expression recognition in [8]. First, the features of facial expression emotion are represented by Gabor filter. Then the features are used to train the SVM classifier. Finally, the facial expression is classified by the SVM. A new method of facial expression recognition based on local binary patterns (LBP) and Local Fisher Discriminant Analysis (LFDA) is presented in [9]. The LBP features are firstly extracted from the original facial expression images. Then LFDA is used to produce the low dimensional discriminative embedded data representations from the extracted high dimensional LBP features with striking performance improvement on facial expression recognition tasks.

Author α : Research Scholar, Manonmaniam Sundaranar University. E-mail : repandian@hotmail.com
Author σ : Associate Professor, Department of Computer Science, D.G.Vaishnav College. E-mail : santhos2001@sify.com

The performance of different feature extraction methods for facial expression recognition based on the higher-order local auto correlation (HLAC) coefficients and Gabor wavelet is investigated in [10]. An experiment on feature-based facial expression recognition within an architecture based on a two-layer perceptron is reported in [11]. The geometric positions of a set of fiducial points on a face, and a set of multi-scale and multi-orientation Gabor wavelet coefficients' at these points are used as features. A method of facial expression recognition based on Eigen spaces is presented in [12]. In this paper, an automatic classification of human emotion based on UWT and KNN classifier is presented. The remainder of this paper is organized as follows: The methodologies and proposed method is described in sections 2 and 3 respectively. The comparative study between DWT and UWT is given in section 4. Finally, conclusion is given in section 5.

II. Methodology

a) *Discrete Wavelet Transform*

Nowadays, wavelets have been used frequently in image processing and used for feature extraction, denoising, compression, face recognition, and image super-resolution. The decomposition of images into different frequency ranges permits the isolation of the frequency components into different sub-bands. This process results in isolating small changes in an image mainly in high frequency sub-band images.

The 2-D wavelet decomposition of an image is performed by applying 1-D DWT along the rows and then columns. At first, 1-D DWT is applied along the rows of the input image. This is called row-wise decomposition. Then, 1-D DWT is applied again along the columns of the resultant image. This is called column-wise decomposition. This operation results in four decomposed sub-band images referred to as low–low (LL), low–high (LH), high–low (HL), and high–high (HH). For multi resolution analysis, the LL band of previous level is again decomposed by DWT. Figure 1 (a) shows the original image and Figure 1 (b) shows the wavelet transformed image at level 1.

(a) (b)

Fig. 1 : (a) Sample image from JAFFE database (b) 2-D Wavelet transformed image at level 1

III. Experimental Results

The JAFFE database [13] is used to evaluate the performance of the proposed system. The database contains 213 images of 7 facial expressions. The facial expressions in this database are happiness, sadness, surprise, anger, disgust, fear and neutral. The images in the database are grayscale images of size 256x256 in the tiff format. The heads of the subjects in the images are in frontal pose. The eyes are roughly at the same position with a distance of 60 pixels in the final images. The proposed system is implemented in MATLAB version 7.10. Many computer simulations and experiments with JAFFE images are performed.

All the images in the JAFFE database are considered for the emotion recognition test. Among the 213 images 140 images from 7 facial expressions are used for training the classifier and remaining 73 images are used for testing the classifier. The average classification rate obtained by the proposed emotion recognition system is shown in Table 1.

Level of decomposition	Average recognition rate (%)
	DWT
1	73.58
2	75.00
3	73.55
4	77.28
5	80.08
6	84.02
7	84.72

Table 1 : Average Classification rate of the proposed emotion recognition system

IV. Proposed Model

The proposed model is planning to apply the emotion captured by means of DWT method been applied to Korts Spiral Learning model, thereby to achieve the maximum learning comfort to the learners and teachers.

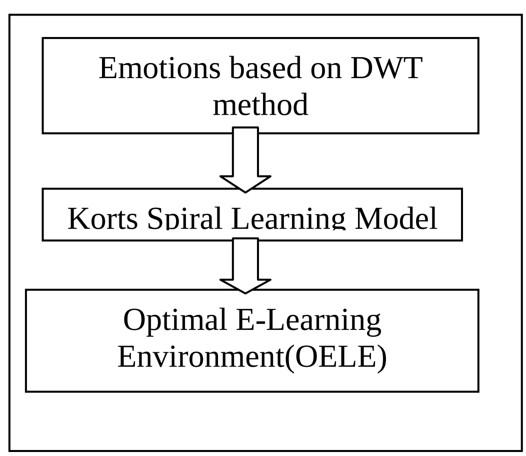

Fig. 2 : Block Diagram of OELE model

We can achieve Optimal E-Learning Environment(OELE) in e-learning only if could capture the human emotion correctly and apply proper learning model. Korts Learning Model is one of the proven learning model which stresses the importance affective components in learning environment.

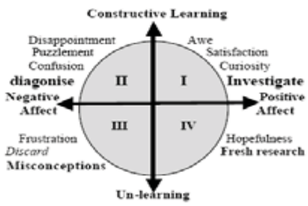

Figure 3a : Proposed model relating phases of learning to emotions in Figure 2

The student ideally begins in Quadrant I or II: they might be curious and fascinated about a new topic of interest (Quadrant I) or they might be puzzled or get confused (Quadrant II). In either case, they are in the top half of the space, if their focus is on learning.

At this point it is not uncommon for the student to move down into the lower half of the diagram (Quadrant III) where emotions may be negative and the cognitive focus changes to eliminating some misconception. As she consolidates her knowledge—what works and what does not—with awareness of a sense of making progress, she may move to Quadrant IV. Getting a fresh idea propels the student back into the upper half of the space, most likely Quadrant I. Thus, a typical learning experience involves a range of emotions, moving the student around the space as they learn.

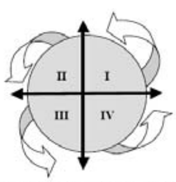

Figure 3b – Circular and helical flow of emotion

Axis	-1.0	-0.5		0	+0.5	+1.0
Anxiety-Confidence	Anxiety	Worry	Discomfort	Comfort	Hopeful	Confident
Boredom-Fascination	Ennui	Boredom	Indifference	Interest	Curiosity	Intrigue
Frustration-Euphoria	Frustration	Puzzlement	Confusion	Insight	Enlightenment	Epiphany
Dispirited-Encouraged	Dispirited	Disappointed	Dissatisfied	Satisfied	Thrilled	Enthusiastic
Terror-Enchantment	Terror	Dread	Apprehension	Calm	Anticipatory	Excited
Humiliated-Pride	Humiliated	Embarrassed	Self-conscious	Pleased	Satisfied	Proud

Figure 4 : Emotion sets possibly relevant to learning

If one visualizes a version of Figures 3a and 3b for each axis in Figure 4, then at any given instant, the student might be in multiple Quadrants with respect to different axes. They might be in Quadrant II with respect to feeling frustrated; and simultaneously in Quadrant I with respect to interest level. It is important to recognize that a range of emotions occurs naturally in a real learning process. We do not foresee trying to keep the student in Quadrant I, but rather to help him see that the cyclic nature is natural in learning process, and that when he lands in the negative half, it is only part of the cycle. Our aim is to help them to keep orbiting the loop, teaching them how to propel themselves especially after a setback.

In Quadrant I, anticipation and expectation are high, as the learner builds ideas and concepts and tries them out. Emotional mood decays over time either from boredom or from disappointment. In Quadrant II, the rate of construction of working knowledge diminishes, and negative emotions emerge as progress flags. In Quadrant III, the learner discards misconceptions and ideas that didn't work out, as the negative affect runs its course. In Quadrant IV, the learner recovers hopefulness and positive attitude as the knowledge set is now cleared of unworkable and unproductive concepts, and the cycle begins anew. In building a complete and correct mental model associated with a learning opportunity, the learner may experience multiple cycles around the phase plane until completion of the learning exercise. Each orbit represents the time evolution of the learning cycle. Note that the orbit doesn't close on itself, but gradually moves up the knowledge axis.

V. Conclusion

As E-learning are in the threshold of taking big leap in terms of volume and its reach, it is natural for the E-learning provider to go after the cognitive domain, but this paper strongly propose for the E-learning providers to have paradigm shift towards the affective aspect of the education and learning, which will instead of pushing the students, will pull the students towards effective learning in e-learning environment. The capturing of these affective aspects in e-learning environment can be done effectively by means of DWT method. Hence, applying this technology we can ensure Optimal E-Learning Environment (OELE) in E-learning scenarios.

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Data Mining Through Self Organising Maps Applied on Select Exchange Rates

By Ravindran Ramasamy & Krishnan Rengganathan

Graduate School of Business University Tun Abdul Razak Malaysia

Abstract - The self organising maps are gaining popularity as they help in organizing the haphazard data in topological maps. They conserve space in storing, help in pattern identification, matching, recognition, data mining etc. The Neural Networks designed by Hopfield is applied in this paper to organize the returns produced by seven exchange rates by the competitive Kohonen algorithm. Our analysis produces interesting self organizing maps for these currency returns. All exchange rate returns are nicely organized in a solid tight group and placed at the center of the boundary rectangle except for US dollar, European Euro and Korean Won. One weekly grouped return fall outside the boundary rectangle for these three exchange rates. These grouped returns are outliers which could have germinated by significant information or an economic event happened in these countries.

Keywords : competitive learning, data mining, exchange rates, neural networks, pattern recognition, self organizing maps.

GJCST-E Classification: H.2.8

DATA MINING THROUGH SELF ORGANISING MAPS APPLIED ON SELECT EXCHANGE RATES

Strictly as per the compliance and regulations of:

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Ravindran Ramasamy [α] & Krishnan Rengganathan [α]

Abstract - The self organising maps are gaining popularity as they help in organizing the haphazard data in topological maps. They conserve space in storing, help in pattern identification, matching, recognition, data mining etc. The Neural Networks designed by Hopfield is applied in this paper to organize the returns produced by seven exchange rates by the competitive Kohonen algorithm. Our analysis produces interesting self organizing maps for these currency returns. All exchange rate returns are nicely organized in a solid tight group and placed at the center of the boundary rectangle except for US dollar, European Euro and Korean Won. One weekly grouped return fall outside the boundary rectangle for these three exchange rates. These grouped returns are outliers which could have germinated by significant information or an economic event happened in these countries.

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I. Introduction

Globalistaion removed most of the barriers to international trade and facilitates large amount of capital flows among countries. The global economies are currently dependent on each other directly or indirectly, thus no economy is independent. When one economy is affected by the financial crises or big scams or any natural disaster, several other dependent economies are affected by these events as they are more integrated presently than ever. The 2008 global financial meltdown caused countries to take various preventive actions to protect their economies from the repercussion. Even Malaysian government released from its reserves about Ringgit 70 billion to stabilise the economy. The effectiveness of relative economic management of two countries converges and reflected in exchange rates (Baillie and McMahon, 1989). The exchange rate (XR) is the linking bond (Bartov and Bodnar, 1994) between any two countries' economies. If home country's economy is not well managed, the XR against every other country's currency will go up which indicates local currency's weakness and the strengthening of the foreign currency against the local currency. International trade and capital flows (Das, 1999) depend on the stability of local currency value and XRs (Ravindran and Hanif, 2010). All international economic activities like tourism, education, financial services in the form of banking, insurance, both foreign direct investments and portfolio investments have strong dependence on XRs (Amihud and Levich, 1985).

Traditional analysis of financial time series (Adya and Collopy, 1998) in parametric statistics have strong assumptions (B. Ripley, 1993) like normality of data, non stationary character of data and non correlated nature of residuals etc (Ravindran et.al 2011). Often they produce limited information for decision making and this information is spurious occasionally. The researchers constantly apply different techniques to understand the root causes for their dynamism and to know their direction of movement in advance (Atiya and Yaser, 1996). Once data is understood in proper perspective, studying and recording their pattern, properties and behavior are easy (E.M. Azoff, 1994). With this objective in mind this paper tries to organise the XRs in Self-Organising Maps (SOM). The SOM concept was proposed by Hopfield in understanding the topological arrangement (J.J. Hopfield, 1982, 1984, 1985) of physical objects by repeated learning with an organised neural network (NN) by adjusting initial values which are assigned arbitrarily by the researcher (Vanstone and Tan, 2005).

II. Literature Review

Neural sciences have been evolving for the last 30 years or so. These biological neurons are equated to artificial neurons and applied in many physical and social sciences. In the last decade, many econometric applications of NN have been tried by the researchers in understanding the properties, behaviour and the pattern of the economic variables such as Gross Domestic Product (GDP), interest rates, share prices (Vanstone and Tan, 2005) and XRs. This study is another attempt to apply NN in XRs to organize them and produce maps, popularly known as Self-Organizing Maps proposed by Nobel laureate Hopfield and applied by Kohonen (Kohonen, 1995; Xinyu Guo et. al, 2007).

III. Self-Organising Maps

Organising the data into the SOM is very important for three major reasons. Firstly, the scattered data which is strewn everywhere is to be organized into a form not only save space but also to organize them

*Author α : Graduate School of Business University Tun Abdul Razak Malaysia. E-mails : ravindran@unirazak.edu.my,
E-mail : klcp109009@unirazak.edu.my*

orderly, to observe whether any pattern (K.S. Fu, 1982; P. M. Grant, 1989) is formed. Secondly the SOM has the ability to reveal the existence of extreme data and this piece of information is extremely useful in data mining. Data mining is very useful in identifying the rogue or fishy transactions. Thirdly, the data could be stored, retrieved and transmitted economically since it is organized. Finally they can be matched with other SOMs to find similarities and deviations like correlation coefficients in parametric statistics to find co movements of data.

IV. Learning by Neural Networks

The NN is working on the principles of learning repeatedly and storing the learnt information in the neurons (K. Jason, 1988). The stored neuron contents will be retrieved back as and when the information is needed for recognition, matching etc. Secondly in data mining especially in ATM transactions the fraudulent are to be isolated from the millions of genuine transactions. This is possible in organizing the data in SOM.

There are two learning methods which are supervised and unsupervised. In supervised learning, there will be a teacher to correct when the student goes out of the right path. Similarly, when the network organizes the data, there will be a target data or threshold data it needs to compare and find the gap. If gap exists, in the next training round, the gap is to be reduced and this reduction is called supervised learning. After several rounds of training if a map is drawn for the learnt stored weights, one could observe a clear pattern emerging from the output of the network (Bartov, 1992; Devroye et.al, 1996).

On some occasions, the target value or threshold value will not be available for finding the gap. In such circumstances, the network will take the individual weights as targets and try to narrow the gap is known as unsupervised learning. In supervised learning the convergence will be faster than unsupervised learning. In this study, unsupervised learning is applied on XRs' returns to organize them in SOM. The command structure of the NN algorithm is given below.

V. Methodology

a) Algorithm

```
Given
    Exchange Rates of 2011 of seven
currencies
 Rates are detrended and returns
computed

Initialize
 Weights to some small random numbers
(50 weekly groups)
 Epoch
 Learning rate, alpha
Iterate
    Repeat
      {
       Pick a return Ri
       Find the Euclidean distance for
all weights
             D² = (Xi – Wi,j)²
       Find the shortest Euclidean
distance, winning neuron (i,j)
             Wij = min(D²)
       Update weight of winning, forward
and backward neurons
             Wij = Wij + alp(Xi-Wij)
i,j = 1...n
               Wi,j-1 = Wi,j-1 + alp(Xi-Wi,j-1)
               Wi,j+1 = Wi,j+1 + alp(Xi-Wi,j+1)
       Reduce the learning rate
      }
Until the learning rate is negligible
```

b) Data

We have chosen seven countries' exchange rates to perform the SOM mapping. The selected XRs are USD, EUR, GBP, AUD, NZD, JPY and KRW representing two currencies for each continent except Africa. American continent is represented by US dollar only as it is the most popular and globally accepted medium of pricing and transactions. USD is widely accepted by all nations as the benchmark currency and as such, it was treated as a distinct figure. The GBP and EUR represent European continent, JPY and KRW represent the Asia and the Pacific area is represented by AUD and NZD. These nations are also the major trading partners of Malaysia. The required daily XRs were downloaded from pacific XR services website and the analysis was performed. A MATLAB program was written to draw the SOM. The results are presented below.

VI. Results and Discussion

The SOM figures are prepared in three parts, the first part is for the raw returns, the second part is for initial unorganized weights connected by their path in a haphazard manner and the third and final part is for the organized SOM. Hopfield network is used in this experiment and the Kohonen competitive learning algorithm is applied in weight updating and organising the returns. A boundary rectangle is drawn to assess the scatter of returns before organising. The figure will reveal the spread of returns inside the boundary rectangle whether in a concentrated form or spread in various directions. The second part of the graph is assessing the spread of random weights assigned initially and they are connected by lines to see a SOM. The third portion of the graph is the organized SOM which will show the outliers and spread of organized returns.

VII. Usd - Ringgit Exchange Rate Returns

USD/Ringgit XR for 2011 is converted into returns to avoid non-stationary character and it is given in the first panel of the above graph in the form of a scatter diagram. The return scatters equally in all four directions of the boundary rectangle which indicates chaotic nature of the spread or behavior. The second panel is showing the 50 weekly representative groups of weights before organizing. The initial random weights spread at all directions of boundary rectangle. Six weights fall on the right hand side while on the left three weights fall. On the top and bottom, only a few weights appear before it is organized. These 50 weekly group weights of the network are trained in an unsupervisory competitive mode for organizing or clustering these returns. When the network is trained, the returns are coming closer and closer in each epoch and form a pattern which falls within the boundary rectangle. Only one weekly group return falls outside the rectangle on the right hand side. Closer observation reveal all weekly return groups are similar and cluster together tightly. The abnormal return falling outside the boundary rectangle may be due to the arrival of new significant positive information to the foreign exchange market because the return falls on the right hand side of the boundary rectangle. In data mining terms this is an abnormal transaction where something fishy.

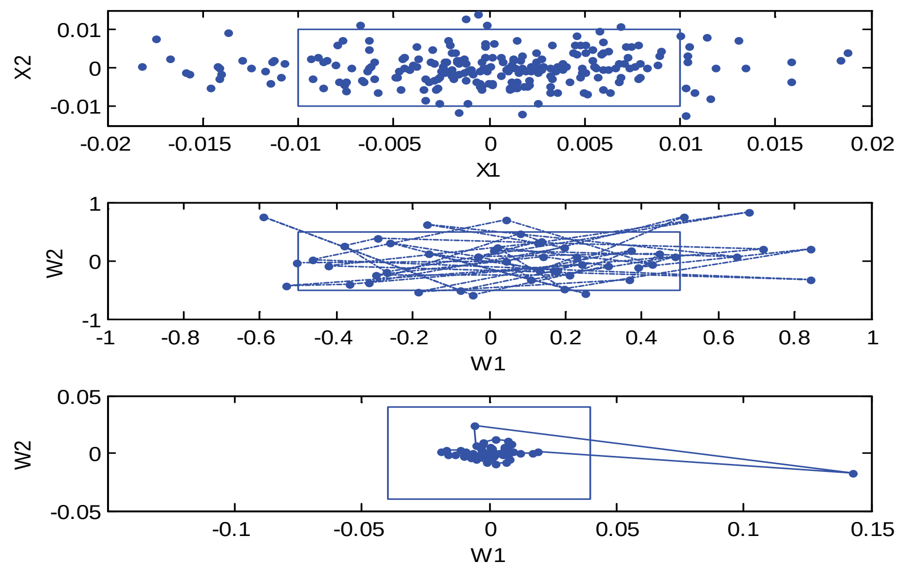
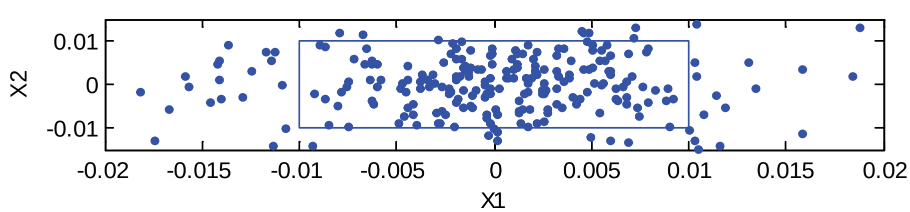


Figure 1 : USD / MYR Returns Self - Organising Map

VIII. Euro - Ringgit Exchange Rate Returns

The Euro XR returns against Ringgit are plotted in the panel one of the graph shown below. The first panel of this figure, the scatter graph indicates a uniform spread in the left, right, top and bottom side of the boundary rectangle. This implies that the rates are normally behaving in 2011. It further indicates the independent and identically distributed nature of the returns. The second panel exhibits the unorganized initial random weights which are generated to cluster 50 weekly groups. These weights are to be trained to cluster the returns on a weekly basis. They spread in all four directions of the boundary rectangle. The third panel shows the organized SOM. In Euro-Ringgit XR also one of the returns falls outside boundary rectangle. But this time it is diametrically opposite to the USD-Ringgit returns. This abnormality may be due to the arrival of significant information to foreign exchange market or may be due to any significant event in Euro zone. A lot of adverse information are emanating from Euro zone area of late. This could be the reason for this outlier.



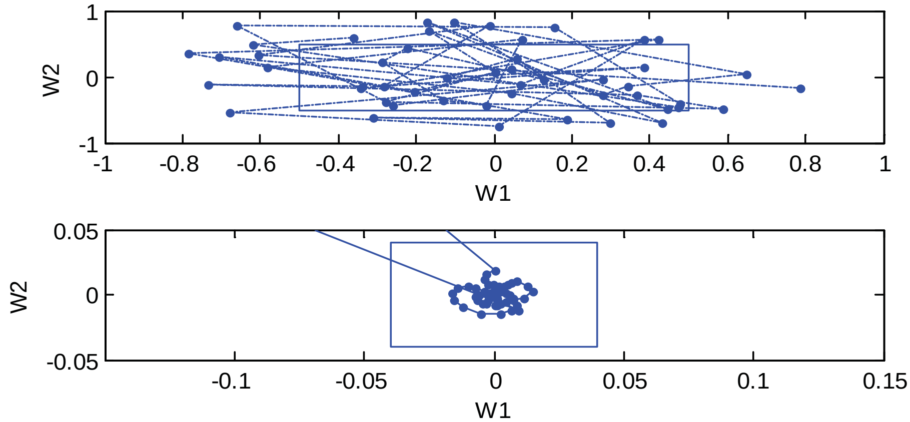


Figure 2 : EUR / MYR Returns Self - Organising Map

IX. Gbp - Ringgit Exchange Rate Returns

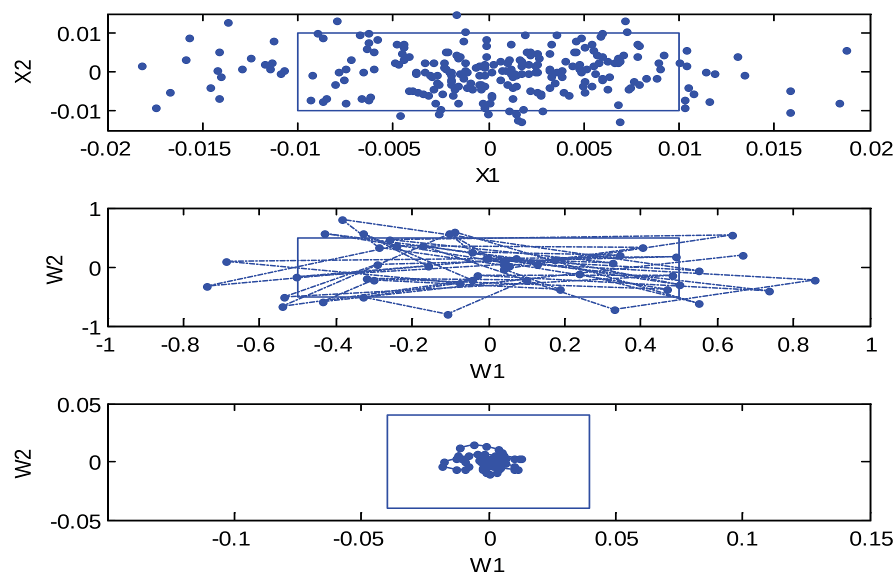
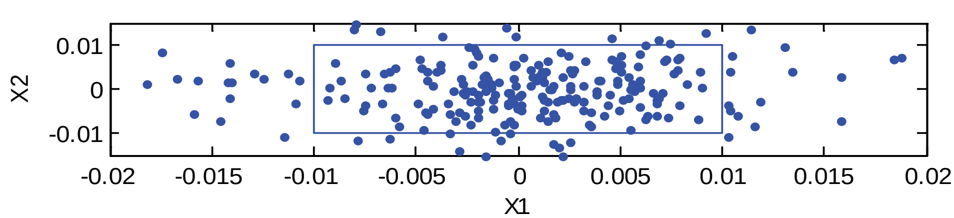


Figure 3 : GBP/ MYR Returns Self - Organising Map

First panel of GBP returns show the spread of returns. They spread in all directions equally which indicates the normal distribution of returns. The middle panel exhibits the initial unorganized weights assigned to train the 50 weeks returns in the competitive learning algorithm. These weights also spread in all directions of boundary rectangle. The last panel shows the organized SOM of GBP. The returns cluster in a compact group and they are placed at the center of the boundary rectangle. It seems there are no abnormal events or information to influence the GBP XRs against Ringgit.

X. Jpy - Ringgit Exchange Rate Returns



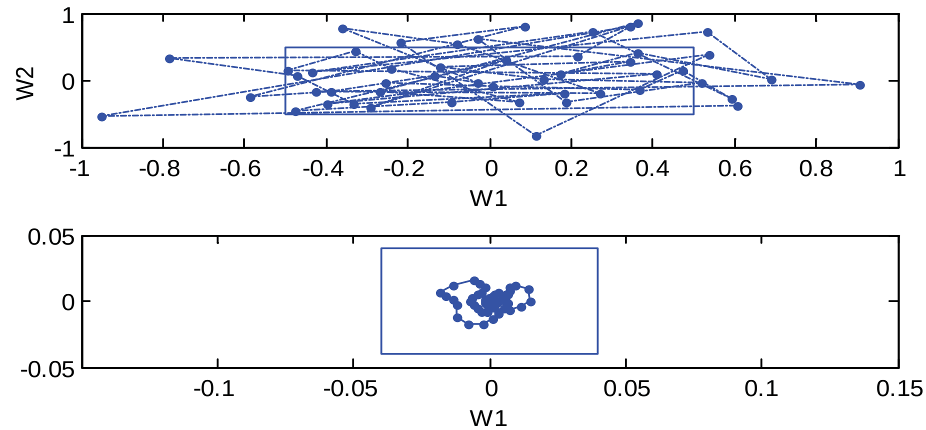


Figure 4 : JPY / MYR Returns Self - Organising Map

The JPY show a uniform pattern in panel one which produces scatter graph for returns in 2011. Panel one of the above graph shows that the initial returns fall inside and outside of the boundary rectangle equally and in all four directions. Panel two gives the scatter diagram of the unorganized random returns which are simulated pure random numbers. In panel three the SOM clustering is similar to GBP and it reveals that the JPY exchange rates against Ringgit are stable without any abnormal behavior.

XI. KRW - Ringgit Exchange Rate Returns

The Korean XR's returns are shown in the first panel of the following graph. The scatter spreads in all four directions equally. The second panel gives the unorganized returns' position which is also fairly spread like the real returns in panel one. The trained and organized SOM of KRW is also tightly clustered like the previous currencies' rates, but one trained rate just falls below the boundary rectangle, like USD rate. But this return is just below the boundary rectangle not like USD which falls at a fairly longer distance. This indicates some moderate information has come to the XR market which has temporarily influenced one of the returns.

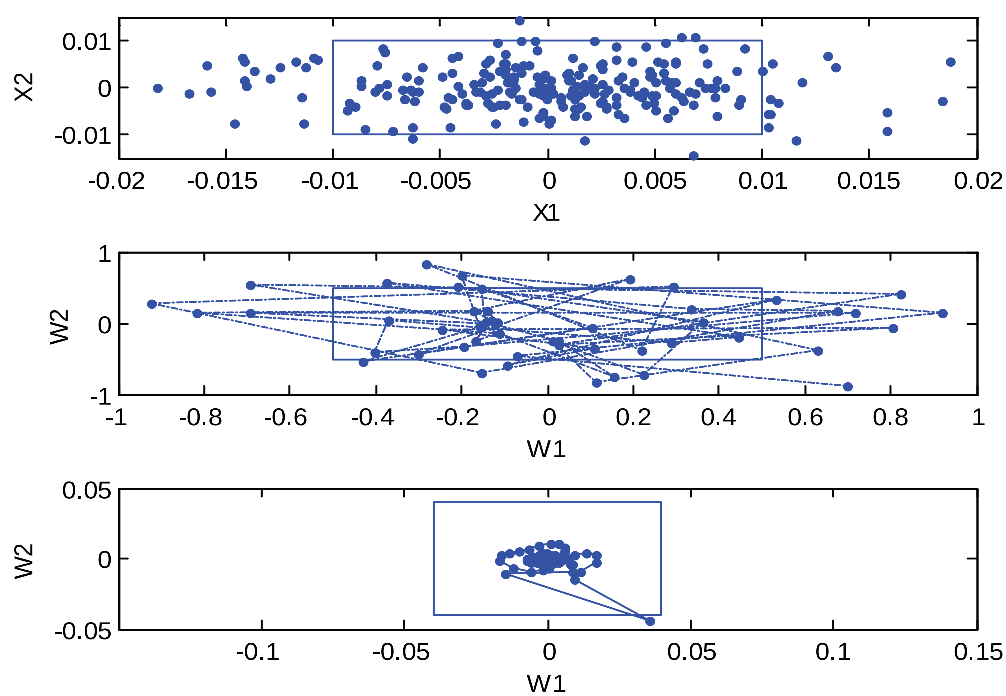


Figure 5 : KRW / MYR Returns Self - Organising Map

XII. AUD - Ringgit Exchange Rate Returns

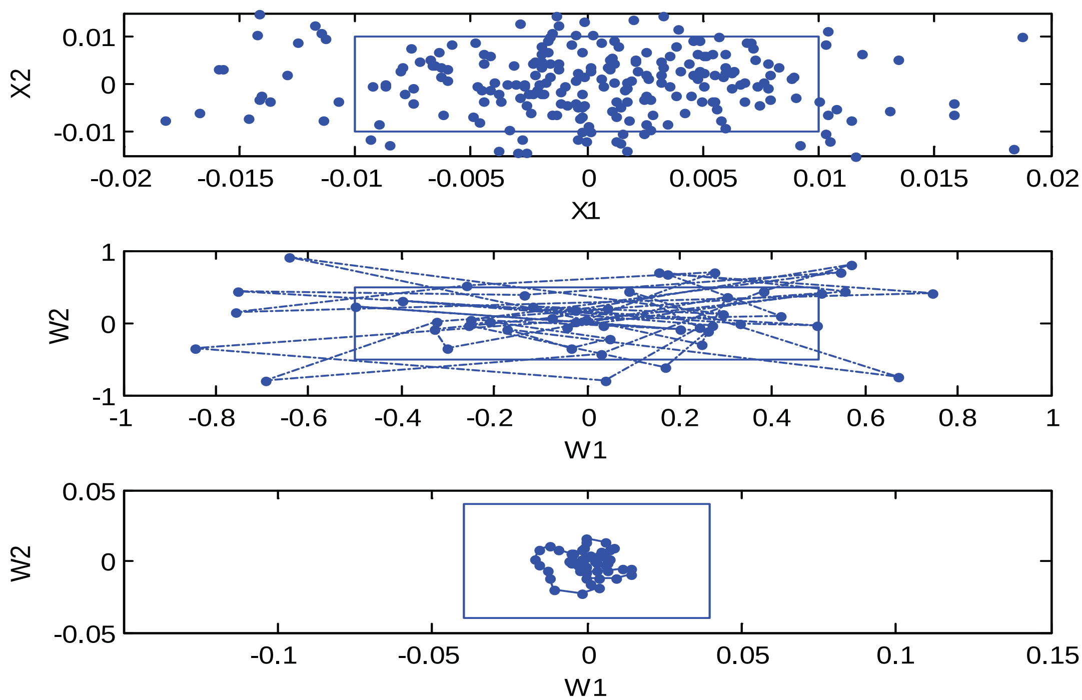
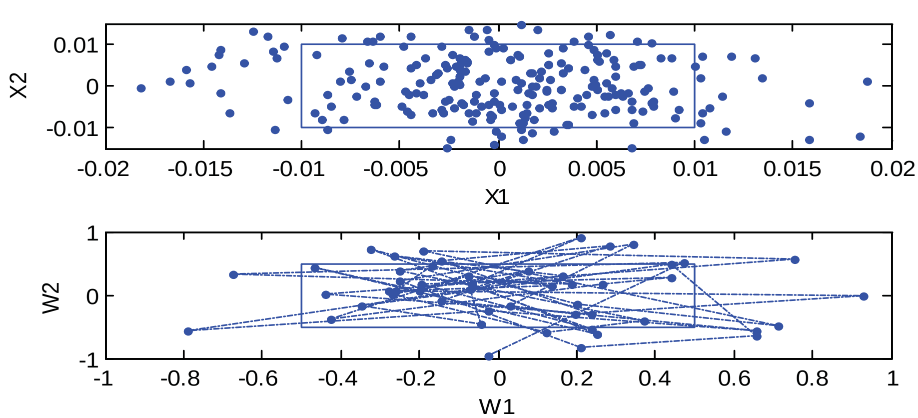


Figure 6 : AUD / MYR Returns Self - Organising Map

The first panel of figure six shows the spread of real returns of AUD. As other XR returns the AUD's returns also spread in all four directions. The second panel gives the random initial weights which will accommodate all 250 returns after training by Kohonen competitive training algorithm. Panel three gives the organized returns after training which are also tightly clustered like other currencies' returns and they are placed at the center of the boundary rectangle as a compact group. It seems AUD returns are also normal and there is no abnormal behavior.

XIII. NZD - Ringgit Exchange Rate Returns

The AUD and NZD XR returns behave more or less similarly. The NZD scatter diagram shows spread in all four directions of the boundary rectangle. The unorganized weights given in panel two spread more on the right hand side of boundary rectangle. When the returns are organized into 50 weekly groups after training, they show a pattern closely knit compact group placed at the centre of the boundary rectangle. This implies that both AUD and NZD XRs returns organize similarly in SOM.



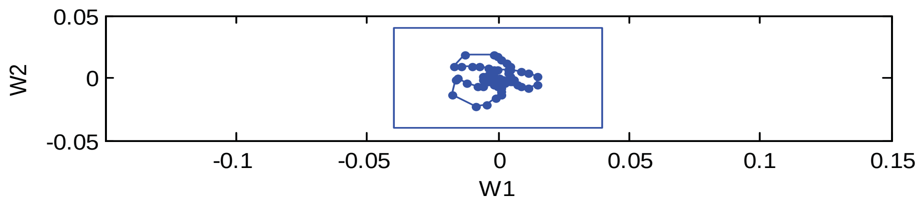


Figure 7 : NZD / MYR Returns Self - Organising Map

The above SOMs help in pattern recognition, organizing the data for storing and data mining purposes. XR returns of 2011 show a very tight compact clustering and placed well at the center of the boundary rectangle with three exceptions. This shows the economic stability and better management of these countries' economies by the respective governments and the central banks.

VI. Conclusion

SOMs are important in data storing, data mining, pattern recognition etc. We applied exchange rates to prepare SOMs for seven popular currencies' exchange rate returns. The SOMs are prepared in three parts, the first part was for the raw returns, and the second part was for 50 unorganized initial random weights which are haphazardly connected to each other. The third and final panel represents the organized SOM. Hopfield network was used in the experiment and the Kohonen competitive algorithm was applied in organizing the returns. The first part of the SOM the returns spread inside, outside, top and bottom of the boundary rectangle equally for all currencies. The second panel which is prepared with initial unorganized weights scattered in all directions of boundary rectangle as it appears in panel one. The third portion of the graph is the organized SOM which is prepared after training the weights with returns in Kohonen competitive algorithm. These returns are well organized and placed within the boundary rectangle except USD, Euro and KRW. One outlier is present in these currencies returns and they fall outside the boundary rectangle. These are outliers and may have arisen due to the arrival of some significant information to the exchange rate market. They are to be investigated to know in which week these are behaving like this and for what reason. This research lays the foundation for the behavior of the exchange rates in the form of SOM.

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MATLAB Program

```
close all
clear all
clc

load currency1
y=1./data;                     % Find direct exchange rate
x11=y(504:753,:);                    % 2011 data

%% Descriptive of exchange rates

ret11=price2ret(x11);                % Rates are converted to returns
x=[ret11(:,1)' rand(250,1)-0.5]';    % Exchange rate returns scattered
w=[rand(1,50)-rand(1,50); rand(1,50)-rand(1,50)]; % Random weights

%% Figure for returns scatter

figure
plot([-0.5 0.5 0.5 -0.5 -0.5],[-0.5 -0.5 0.5 0.5 -0.5]) % Rectangle
xlabel('X1')
ylabel('X2')

hold on
plot(x(1,:),x(2,:),'b.')             % Exchange rate returns scatter
axis([-1 1 -1 1])

%% Figure for unorganized returns
figure
plot([-0.5 0.5 0.5 -0.5 -0.5],[-0.5 -0.5 0.5 0.5 -0.5]) % Rectangle
xlabel('W1')
ylabel('W2')
hold on
plot(w(1,:),w(2,:),'b.',w(1,:),w(2,:),'-.') % Unorganised weights
axis([-1 1 -1 1])

%% Program parameters
alp=0.9;                                   % Learning rate
ite=1;                                     % Start the learning loop
epoch = 0;                                 % Epoch counter

while ite
for i=1:250                                % 250 exchange rates per year
    for j=1:50                       % Weekly grouping
        d=sum((w(:,j)-x(:,i)).^2);   % Find Euclidean distance
```

```
        d1(j,:)=d;                  % store d in d1 for finding winner
    end
 [wn wi]=min(d1);       % Minimum distance is the winner neuron
 fwd=wi+1;              % Forward neuron
 bwd=wi-1;              % Backward neuron
 if bwd<1, bwd=50; end  % If end is 0 then column is 50
 if fwd>50. fwd=1; end  % If end is 50 then column is 1
 w(:,wi)=w(:,wi)+alp*(x(:,i)-w(:,wi));     % Update winner neuron
 w(:,fwd)=w(:,fwd)+alp*(x(:,i)-w(:,fwd));  % Update forward neuron
 w(:,bwd)=w(:,bwd)+alp*(x(:,i)-w(:,bwd));  % Update backward neuron
end
  alp=alp*.9;           % Reduce the alpha rate or annealing
if alp < 0.01              % If alpha is too small
        ite=0;                % Stop the iteration
end
  epoch=epoch+1;        % Epoch counter
end

%% Figure for the self organized map
figure
plot([-0.5 0.5 0.5 -0.5 -0.5],[-0.5 -0.5 0.5 0.5 -0.5])
xlabel('W1')
ylabel('W2')

w = [w w(:,1)]             % Connect the last and first returns
hold on
plot(w(1,:),w(2,:),'b.',w(1,:),w(2,:))
                                 axis([-1 1 -1 1])
```

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3. Submission of Manuscripts,

4. Manuscript’s Category,

5. Structure and Format of Manuscript,

6. After Acceptance.

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- 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.

General style:

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

To make a paper clear

· Adhere to recommended page limits

Mistakes to evade

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

- Separating a table/chart or figure - impound each figure/table to a single page
- Submitting a manuscript with pages out of sequence

In every sections of your document

· 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

Title Page:

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

Abstract:

The summary should be two hundred words or less. It should briefly and clearly explain the key findings reported in the manuscript--must have precise statistics. It should not have abnormal acronyms or abbreviations. It should be logical in itself. Shun citing references at this point.

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

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

- Reason of the study - theory, overall issue, purpose
- Fundamental goal
- To the point depiction of the research
- Consequences, including definite statistics - if the consequences are quantitative in nature, account quantitative data; results of any numerical analysis should be reported
- Significant conclusions or questions that track from the research(es)

Approach:

- Single section, and succinct
- As a outline of job done, it is always written in past tense
- A conceptual should situate on its own, and not submit to any other part of the paper such as a form or table
- Center on shortening results - bound background information to a verdict or two, if completely necessary
- What you account in an conceptual must be regular with what you reported in the manuscript
- Exact spelling, clearness of sentences and phrases, and appropriate reporting of quantities (proper units, important statistics) are just as significant in an abstract as they are anywhere else

Introduction:

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

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

Approach:

- Use past tense except for when referring to recognized facts. After all, the manuscript will be submitted after the entire job is done.
- Sort out your thoughts; manufacture one key point with every section. If you make the four points listed above, you will need a least of four paragraphs.
- Present surroundings information only as desirable in order hold up a situation. The reviewer does not desire to read the whole thing you know about a topic.
- Shape the theory/purpose specifically - do not take a broad view.
- As always, give awareness to spelling, simplicity and correctness of sentences and phrases.

Procedures (Methods and Materials):

This part is supposed to be the easiest to carve if you have good skills. A sound written Procedures segment allows a capable scientist to replacement your results. Present precise information about your supplies. The suppliers and clarity of reagents can be helpful bits of information. Present methods in sequential order but linked methodologies can be grouped as a segment. Be concise when relating the protocols. Attempt for the least amount of information that would permit another capable scientist to spare your outcome but be cautious that vital information is integrated. The use of subheadings is suggested and ought to be synchronized with the results section. When a technique is used that has been well described in another object, mention the specific item describing a way but draw the basic principle while stating the situation. The purpose is to text all particular resources and broad procedures, so that another person may use some or all of the methods in one more study or referee the scientific value of your work. It is not to be a step by step report of the whole thing you did, nor is a methods section a set of orders.

Materials:

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

Methods:

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

Approach:

- It is embarrassed or not possible to use vigorous voice when documenting methods with no using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result when script up the methods most authors use third person passive voice.
- Use standard style in this and in every other part of the paper - avoid familiar lists, and use full sentences.

What to keep away from

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

Results:

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.
- Explain results of control experiments and comprise remarks that are not accessible in a prescribed figure or table, if appropriate.
- Examine your data, then prepare the analyzed (transformed) data in the form of a figure (graph), table, or in manuscript form.

What to stay away from

- 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.
- Manuscript should complement any figures or tables, not duplicate the identical information.
- Never confuse figures with tables - there is a difference.

Approach

- As forever, use past tense when you submit to your results, and put the whole thing in a reasonable order.
- Put figures and tables, appropriately numbered, in order at the end of the report
- If you desire, you may place your figures and tables properly within the text of your results part.

Figures and tables

- If you put figures and tables at the end of the details, make certain that they are visibly distinguished from any attach appendix materials, such as raw facts
- 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
- All figure and table must be adequately complete that it could situate on its own, divide from text

Discussion:

The Discussion is expected the trickiest segment to write and describe. A lot of papers submitted for journal are discarded based on problems with the Discussion. There is no head of state for how long a argument should be. Position your understanding of the outcome visibly to lead the reviewer through your conclusions, and then finish the paper with a summing up of the implication of the study. The purpose here is to offer an understanding of your results and hold up for all of your conclusions, using facts from your research and generally accepted information, if suitable. The implication of result should be visibly described. Infer your data in the conversation in suitable depth. This means that when you clarify an observable fact you must explain mechanisms that may account for the observation. If your results vary from your prospect, make clear why that may have happened. If your results agree, then explain the theory that the proof supported. It is never suitable to just state that the data approved with prospect, and let it drop at that.

- 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."
- Research papers are not acknowledged if the work is imperfect. Draw what conclusions you can based upon the results that you have, and take care of the study as a finished work
- You may propose future guidelines, such as how the experiment might be personalized to accomplish a new idea.
- 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.

Approach:

- When you refer to information, differentiate data generated by your own studies from available information
- Submit to work done by specific persons (including you) in past tense.
- Submit to generally acknowledged facts and main beliefs in present tense.

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

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