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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).

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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*

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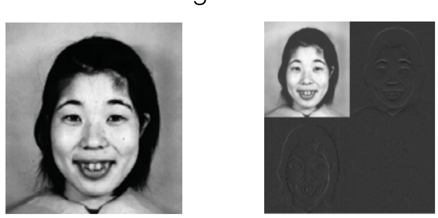
The performance of different feature extraction methods for facial expression recognition based on the higher-order local auto correlation (HLAC) coefficients and Gabor wavelet is investigated in [10]. An experiment on feature-based facial expression recognition within an architecture based on a two-layer 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.

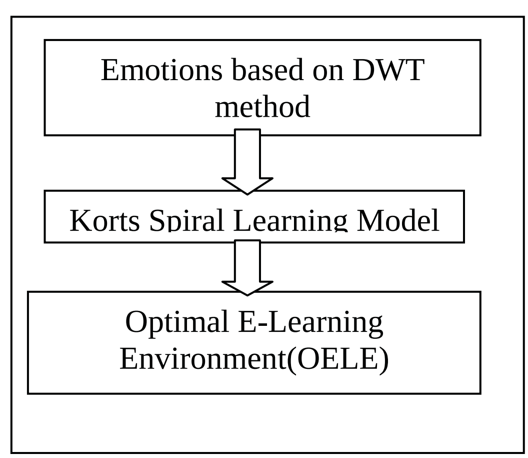



*Fig. 2 :* Block Diagram of OELE model

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.

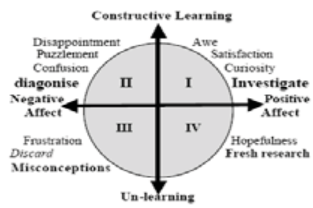



*Figure 3a :* Proposed model relating phases of learning to emotions in Figure 2

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.

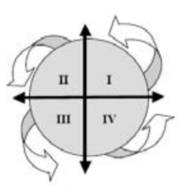



Figure 3b – Circular and helical flow of emotion

| 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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