VARIOUS FUZZY REASONING SYSTEMS FOR FACIAL EMOTION AND HAND GESTURE OBJECT RECOGNITION

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Abstract:　In this paper, we are providing the concept of fuzzy reasoning systems which are now a days very useful in the Intelligent Information systems such as in Artificial Intelligence, Financial analysis, Robotics, Control Systems, Pattern Recognition systems, Decision Support Systems, Knowledge Base systems. Fuzzy sets and Fuzzy logic are basic part of any Fuzzy Reasoning systems. We study these techniques in the field of facial emotion and hand gesture recognition. These area of research is now hot topic in present scenario of HCI Systems. In this paper, we provide a short review of the most frequently used fuzzy reasoning schemes.

Index Terms **- Fuzzy Reasoning system, Fuzzy Logic, Fuzzy Set, Facial Emotion Recognition, Hand gesture, recognition, Extreme Learning Machines.**

I. INTRODUCTION

Zadeh (1965) Introduced a new way which was combination of fuzzy logic and neural networks. This combination is used to represent and manipulate unprocessed data. But the nature of that data should be Fuzzy. As we know that Fuzzy logic provides an implication morphology which applied for the knowledge-based systems. Fuzzy Logic has a strong mathematical strength which is able to capture the uncertainties of the human behavior. The traditional approaches for the knowledge representation are first order logic and classical probability theory which were insufficient to deal with the commonsense knowledge. There are major features of Fuzzy Logic which make it more convenient and useful such as exact reasoning. It is easy to understand, much more flexible, tolerant to imprecise dataset. It also handles the issues through the nonlinear functions with arbitrary complexity. Fuzzy Logic is very comfortable to blend with existing approaches with the flexible use of the natural language.

There is a Neural Network System which work on Artificial neural systems. This system is considered as a mathematical model which just like human 'brain systems and work based on the parallel distributed computing networks. There are many task such as facial expression recognition, speech recognition, gesture recognition Current AI is not performing well So the NN is emerged filed of AI and different sections of engineering fields such as mathematicians, computer scientists, neuroscientists and so on. There are many fields in the research which are embedded with the intelligence of a neural network. this is basically a collective behavior of neurons. These neurons perform only limited operations. Neural networks are composed with simple elements. These elements operating in parallel way. The Neural Network system is inspired through the human 'biological nervous systems. As human 'brain mechanism we can train our system to perform a particular function by adjusting the values of specified weights of the elements.

Every intelligent technique is able to learn, decision making which makes that technique adaptable, useful for real time problems. Also these approaches are particularly designed for the particular problem so that it gives more accurate, more efficient, and more effective output. Neural networks are good to recognize patterns but insufficient to explain the way to find their decisions. In other place, Fuzzy logic systems are good to explain the everything but cannot automatically acquire the decision making rules. These are some basic reason to design a Hybrid system with intelligence features. These system is able to overcome the issues occurred by the NN and FL systems. This hybrid system is important when there are variety of application domains exists. Also use for the Complex domain 'issues which requires different types of processing. There are many Ares where we can use intelligent hybrid systems successfully such as in engineering design, financial trading, process control, medical diagnosis, cognitive simulation, credit evaluation and so on.

II. STEPS FOR THE RECOGNITION PROCESS

2.1. Image Acquisition
For our research we take static images. Images used for facial emotion recognition are static images.

2.2. Image Preprocessing
In this phase, we try to normalize input image through the number of sub steps such as normalized intensity, uniform size and shape, and represent only a face part after face detection step. This step also used to reduce the effects of illumination and lighting. Emotion recognition and gesture recognition can be delicate to translation, scaling, and rotation of the heading a picture. To battle the effect of these pointless changes, the facial image may be geometrically institutionalized before classification.

2.3 Face Detection:

To recognize facial and hand gesture, first we take static image. In this input, skin color detection process is done through the HCV or RGB Color model. Then other sections like eyes, lips, nose, hand-posture are detected through the help of Viola-Jones Detection algorithm. For nose, eyes, hands, lips these all are specific sections of the detected image so through this procedure we can easily find out human face in the input image. Technically the algorithm searches bright vertical band, dark horizontal band and so on for the detections. On detected sections, Bezier curve on the different points by the function F(u)is calculated. The Feature localization process is done through the Morphological Operations. For designing an efficient algorithm for face detection based on main segment, preprocessing is applied through contrast equalization, skin color detection algorithm, features detection algorithm, rule detection methods, calculate feature distance algorithm are combined to get better result of the preprocessing phase. The important morphological operations are used to performed on an input image to enhance features regions which are required for further processing to get output. These are contrast stretching, Gray level or Intensity level slicing and Gamma intensity correction method .to implement those methods, facial region is divided into a number of windows which is responsible for the particular section of the face or hands such as eyes, nose, lips, hand on face-region, angle of the hand on the face and so on.

2.4 Feature Extraction

In developing accurate facial emotion recognition system feature extraction is the most important stage. Unprocessed facial images hold vast amounts of data and feature extraction is required to decrease it to smaller sets of data called features. Feature extraction change pixel information into a more elevated amount representation of color shape, motion, texture, and spatial configuration of the face or its features. The sea-rated representation is utilized for further emotion categorization. Feature extraction ordinarily decreases the information's dimensionality space. The reduction procedure ought to keep up essential data having high segregation force and high security.

2.4.1 Feature Selection

This stage searches the best features for the individually for its simplification. There are very important and efficient approach known as Adaboost-Based Approach for the feature selection. It is proposed by Fürst et al. who has taking care of both the properties of individual features. These are distinctiveness and productiveness and their interdependence. Basically AdaBoost approach is used to construct classifiers for the binary classification issues. Here each iteration of AdaBoost selects the classifier with the highest classification accuracy. This approach applies on the sample set with the current values of the weights. After iteration, it is used to select a classifier which is complementary to the one just selected.

2.5 Classification

The last step of any Facial Emotions and hand gesture Recognition systems is classification or say recognition. These all are based on the extracted features of a face and hand gesture. Classification approaches are used for the classify the features of a Face and hand gesture s. We use K-Nearest Neighbor classifier for classification. The K-Nearest Neighbor algorithm is a non-parametric method used for classification and regression. The input comprises of K closest training examples in the feature space. The output is class participation. By a majority vote of its neighbors a Face and hand gesture is classified, with the Face and hand gesture being allotted to the class most common among its k nearest neighbors.

In this work, we will try to extract seven emotions in this classification stage. Eyes, mouth, forehead lips, cheeks features are used to classify facial emotions and fingers, its angles, positions are used to find Hand gesture. Here generally for the classification of facial emotions and hand gesture, a classifier is used to retrieve from the large amount of dataset. There are many other classifiers are available such as Euclidean distance, histogram intersection distance, Support Vector Machine (SVM), chi square distance, etc. In Euclidean Distances, need to measure the outline of difference among the paired values of the feature set. To get its result, calculate the square root of the outline. This is the closest distance measure which is taken as required output of an input image. The approach of The histogram intersection distance is a very simple and more useful to calculate similarity measure. This approach is use where huge amount of dataset is used to get better result. In the Chi-Square Distance metric which is non-parametric test by nature. This is used to measure the goodness of a data specific with a specified class. Here we calculate the minimum distance between the two feature set. Training, Testing and validation steps are used in any classification algorithm. In the training phase, the important characteristic properties of the image features are taken. The input images and the database images can be trained by using a classifier. They are then compared to find out the final emotion. Using Support Vector Machine (SVM) classifier, images are trained by finding the Eigen faces which is detected by calculating the Eigen values [2].

3. Facial emotion & Hand Gesture recognition:

There are two types of face and hand gesture representations for facial emotion and hand gesture recognition. These are known as holistic template based and geometric feature based methods. In holistic method the whole Face and hand gesture is processed to obtain a template which is either a pixel image or a feature vector. In other place, geometric feature based approach focus on the shape and location of the Face and hand gesture that are used to obtain feature vector. The Extreme Learning Machines are basically feedforward NN. It is useful for classification through the feature learning. These can be done through the single layer or multiple layers of the hidden nodes. These hidden nodes are randomly selected for the assignment. also can be inherited from their previous layer. The Extreme Learning Machine is used for the calculate output weights for its hidden nodes. This machine also gives more accurate and gives better generalization performance then the existing approaches such as backpropagation.

In this developed system, we use local structures of input image through the comparing each pixel with its neighboring pixels. This system uses Extreme Learning Machine to label all pixels of an input image. they use 3X3 neighborhood for each pixel with its center value. After calculation, the obtained result id known as Extreme Learning Machines code. For the facial emotions and hand gesture recognition, the Face and hand gesture is divided into number of local regions and many histograms. These all are then extracted and concatenated to produce single enhanced histogram. The Extreme Learning Machine performs an excellent to produce very effective and more specified histograms which also known as a Region Descriptor. This descriptor gives small and

compact binary patterns. In this approach, the center symmetric pairs are only compared. It has been observed that Extreme Learning Machines gives better results than LBP and many other recognition approaches. In Fuzzy logic based emotion recognition and hand gesture recognition, the system compares an image of interest with its neutral emotion baseline to determine the expressed emotion and its hand gesture. These systems generally processed in two stages- 1) Image preprocessing and 2) Face and hand gesture recognition. In first stage, features of the Face and hand gesture s are extracted, preprocessed through many sub phases and then in second stage, extracted features are used to recognize and classified based on predefined set classes of emotions. All these processes are used to determines human facial emotions and hand gesture recognition.

4.Available Databases*:* There are many databases are available which can use for the research in the field of recognition of a Face and hand gesture. Majorly available databases are-

    a. Cohn-Kanade database which consist of 593 images with 7 standard emotions such as neutral, sadness, surprise, happy, anger, fear and disgust. Here all images are in the gray scaled.

    b. JAFFE database which stores 213 images with the 7 standard emotions. These standard emotions are neutral, sadness, surprise, happy, anger, fear and disgust. In this database, Female Japanese faces.

    c. F-M FACS 3.0 (EDU, PRO & XYZ versions) uses 10 subjects for the Facial expression labels with Posed and Spontaneous images.

    d. MMI Database with 43 subjects for AU label for the image frame with apex facial expression in each image of Posed and Spontaneous poses.

    e. FERG (Facial Expression Research Group Database) with 768 by 768 Emotion labels of the Frontal pose.

    f.Microsoft Kinect and Leap Motion Dataset-This dataset contains several different gestures which allows the construction and evaluation of hybrid gesture recognition systems. This dataset contains 14 different people 'gestures who are performing 10 different gestures. these all repeated 10 times each. So, total 1400 gestures in that dataset.

    f.Creative Senz3D Dataset-This dataset contains several different static gestures acquired with the Creative Senz3D camera. It has been broken the set to test prediction accuracy of a Multi-Class SVM gesture classifier which are trained on synthetic data. This dataset contains different gestures; these are performed by 4 different people with 11 different performed gestures. These are repeating 30 times each. So, total 1320 samples in this dataset.

    g. The "Jester" dataset –This is large dataset of short, densely labeled video clips which contains ~150,000 videos across 25 different classes of human hand gestures. it also includes two "no gesture" classes.

5. CONCLUSION

    This paper shows a various Fuzzy reasoning systems for facial and hand gesture object recognition such as neural network, artificial neural network, hybrid neural network, fuzzy logic system. There we also study and analysis Local Binary Pattern (EXTREME LEARNING MACHINES), Center Symmetric Local Binary Pattern (CSEXTREME LEARNING MACHINES), Thermal Image Processing, etc. Any Facial expression and hand gesture recognition system has 4 basic phases .1. Facial expression and hand gesture detection 2. Preprocessing of the detected Facial expression and hand gesture 3. Features extraction of a detected Facial expression and hand gesture and at last 4. Recognition or classification of the Facial expression and hand gesture bases on extracted features. The efficiencies of the surveyed approaches are varied from the 78-97%. Based on this study we can design an Intelligent system to recognize facial emotion based on hand gesture in near future.

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