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CREATION OF IMAGE SEGMENTATION CLASSIFIERS FOR SIGN LANGUAGE PROCESSING FOR DEAF AND DUMB

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Abstract : Sign language system is a way of communication between deaf and dumb people. While communicating with dumb and deaf peoples, those who have knowledge of sign language, can talk and hear properly. But untrained people cannot communicate with dumb and deaf people, because the person can communicate to dumb people by training sign language. Sign language to text system will be more useful for such a impaired people for communicate with normal people more fluently. In our proposed work using Radial Basis back propagation neural network to detect the sign languages.

I. INTRODUCTION

Image processing is a method to perform some operations on an image, in order to get an enhanced image or to extract some useful information from it. It is a type of signal processing in which input is an image and output may be image or characteristics/features associated with that image. Nowadays, image processing is among rapidly growing technologies. It forms core research area within engineering and computer science disciplines too. Image processing basically includes the following three steps:

- Importing the image via image acquisition tools;
- Analyzing and manipulating the image;
- Output in which result can be altered image or report that is based on image analysis.

There are two types of methods used for image processing namely, analog and digital image processing. Analogue image processing can be used for the hard copies like printouts and photographs. Image analysts use various fundamentals of interpretation while using these visual techniques. Digital image processing techniques help in manipulation of the digital images by using computers. The three general phases that all types of data have to undergo while using digital technique are pre-processing, enhancement, and display, information extraction.

Object recognition is one of the most difficult and urgent tasks of image processing. People can very easily solve this problem, but it is not such really simple for computer science. In this paper, the task of recognition of particular objects as faces and hand gestures

are considered. Face recognition is mostly investigated and used in the areas as digital image processing, computer vision, biometric system, videoconference organization, access control system and etc. Hand gesture recognition system is used to identify determined human gestures in order to transform information or control variety equipment. The object recognition process often consists of two phases. The first one is extraction and preservation of known objects features in database.

The second phase is comparison of unknown object features with the features locating in the database. Gesture recognition pertains to recognizing meaningful expressions of motion by a human, involving the hands, arms, face, head, and/or body. It is of utmost importance in designing an intelligent and efficient human–computer interface. The applications of gesture recognition are manifold, ranging from sign language through medical rehabilitation to virtual reality. Dumb people are usually deprived of normal communication with other people in the society. It has been observed that they find it really difficult at times to interact with normal people with their gestures, as only a very few of those are recognized by most people. Since people with hearing impairment or deaf people cannot talk like normal people so they have to depend on some sort of visual communication in most of the time. Sign Language is the primary means of communication in the deaf and dumb community.

As like any other language it has also got grammar and vocabulary but uses visual modality for exchanging information. The problem arises when dumb or deaf people try to express themselves to other people with the help of these sign language grammars. This is because normal people are usually unaware of these grammars. As a result it has been seen that communication of a dumb person are only limited within his/her family or the deaf community. The importance of sign language is emphasized by the growing public approval and funds for international project. At this age of Technology the demand for a computer based system is highly demanding for the dumb community. However, researchers have been attacking the problem for quite some time now and the results are showing some promise. Interesting technologies are being developed for speech recognition but no real commercial product for sign recognition is actually there in the current market. The idea is to make computers to understand human language and develop a user friendly human computer interfaces (HCI). Making a computer understand speech, facial expressions and human gestures are some steps towards it. Gestures are the non-verbally exchanged information.

A person can perform innumerable gestures at a time. Since human gestures are perceived through vision, it is a subject of great interest for computer vision researchers. The project aims to determine human gestures by creating an HCI. Coding of these gestures into machine language demands a complex programming algorithm. In our project we are focusing on Image Processing and Template matching for better output generation.

II. LITERATURE REVIEW

A. Image processing algorithms for gesture recognition using MATLAB

Gesture recognition is the fast growing field in image processing and artificial technology. The gesture recognition is a process in which the gestures or postures of human body parts are identified and are used to control computers and other electronic appliances. The most contributing reason for the emerging gesture recognition is that they can create a simple communication path between human and computer called HCI (Human Computer Interaction). This paper is confined to identification of hand postures and to establish a man-machine interaction. The hand region in the image is detected and the number of active fingers is determined. In this approach, the input which is an image or a frame from a video can be obtained from web camera or any other camera. This color image is converted into binary image and preprocessed and the number of fingers is counted using scanning method in MATLAB. This is a simple yet efficient approach. The main reason to employ scanning method is to make the code to recognize the finger count independent of size and rotation of the hand.

B. Hand gesture recognition system using image processing

A gesture is a form of non verbal communication or non vocal communication in which visible bodily actions communicate particular messages, either in place of, or in conjunction with, speech. Gestures include movement of the hands, face, or other parts of the body. Gestures differ from physical non-verbal communication that does not communicate specific messages, such as purely expressive displays, proxemics, or displays of joint attention. Gestures allow individuals to communicate a variety of feelings and thoughts, from contempt and hostility to approval and affection, often together with body language in addition to words when they speak. Gesture processing takes place in areas of the brain such as Broca's and Wernicke's areas, which are used by speech and sign language. In fact, language is thought to have evolved from manual gestures. The theory that language evolved from manual gestures, termed Gestural Theory.

C. Sign language recognition using image based hand gesture recognition techniques

Hand gesture is one of the method used in sign language for non-verbal communication. It is most commonly used by deaf & dumb people who have hearing or speech problems to communicate among themselves or with normal people. Various sign language systems has been developed by many makers around the world but they are neither flexible nor cost-effective for the end users. Hence in this paper introduced software which presents a system prototype that is able to automatically recognize sign language to help deaf and dumb people to communicate more effectively with each other or normal people. Pattern recognition and Gesture recognition are the developing fields of research. Being a significant part in nonverbal communication hand gestures are playing key role in our daily life. Hand Gesture recognition system provides us an innovative, natural, user friendly way of communication with the computer which is more familiar to the human beings. By considering in mind the similarities of human hand shape with four fingers and one thumb, the software aims to present a real time system for recognition of hand gesture on basis of detection of some shape based features like orientation, Centre of mass centroid, fingers status, thumb in positions of raised or folded fingers of hand.

D. Hand Segmentation Techniques to Hand Gesture Recognition for Natural Human Computer Interaction

This work is the part of vision based hand gesture recognition system for Natural Human Computer Interface. Hand tracking and segmentation are the primary steps for any hand gesture recognition system. The aim of this paper is to develop robust and efficient hand segmentation algorithm where three algorithms for hand segmentation using different color spaces with required morphological processing have were utilized. Hand tracking and segmentation algorithm (HTS) is found to be most efficient to handle the challenges of vision based system such as skin color detection, complex background removal and variable lighting condition. Noise may contain, sometime, in the segmented image due to dynamic background. An edge traversal algorithm was developed and applied on the segmented hand contour for removal of unwanted background noise.

E. Hand Gesture Recognition based on Digital Image Processing using MATLAB

This research work presents a prototype system that helps to recognize hand gesture to normal people in order to communicate more effectively with the special people. Aforesaid research work focuses on the problem of gesture recognition in real time that sign language used by the community of deaf people. The problem addressed is based on Digital Image Processing using Color Segmentation, Skin Detection, Image Segmentation, Image Filtering, and Template Matching techniques

III. EXISTING WORK

The basic phase of sign language recognition systems is accurate hand segmentation. This paper used Otsu's technique of segmentation to create an improved vision based recognition of sign language. identified the hand in the raw image and provided the static gesture recognizer (the multi-class classifier) with this section of the image. We build multi-class classifiers from the scikit learning library by first building the data set, each image being converted into a feature vector (X) and each has a label that matches the sign language alphabet denoted by (Y). Our predicted classifiers analyzed 65% of the said images with clarity.

Drawbacks:

- Classification accuracy is low
- Computational Complexity

IV. PROPOSED WORK

According to World Health Organization, over 5% of the world's population have hearing and speaking disabilities. The primary language of communication for people who are deaf and mute is the sign language. This can be a hindrance in day-to-day communications for them. Conversion of sign language to text can be a possible solution to this obstacle. The main objective of the project is to help the hearing and speaking impaired to communicate with people who do not understand sign language. In this we have following stages such as preprocessing, segmentation, feature extraction, classification.

A) Modules:

1. Get Image – Image Acquisition
2. Pre -processing
3. Segmentation
4. Feature extraction
5. Classification

V – BLOCK DIAGRAM

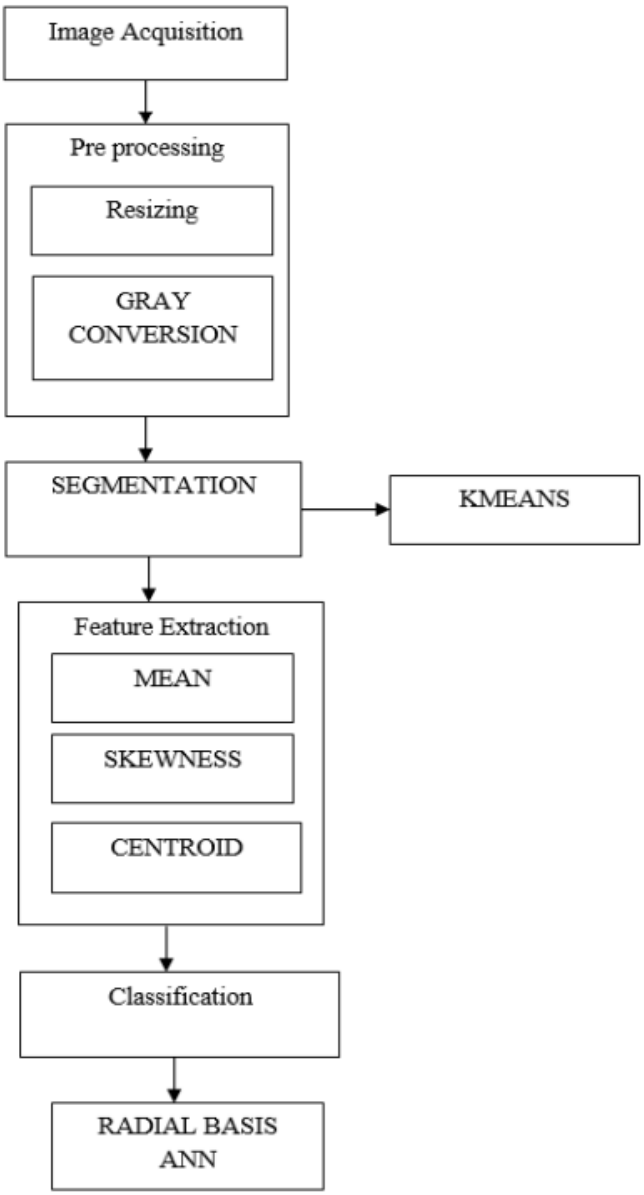

Fig 1 : Flowchart of the Image Classification Algorithm

VI - MODULE DESCRIPTION

A. Image Acquisition:

Image Acquisition is a process of getting an input image for the process of automatic detection of sign language using Digital Image Processing.

B. Pre processing:

Pre-processing is a common name for operations with images at the lowest level of abstraction both input and output are intensity images. The aim of pre-o.processing is an improvement of the image data that suppresses unwanted distortions or enhances some image features important for further processing. Image pre-processing before analysis of any image set can take place, preprocessing should be performed on all the images. This process is applied in order to make sure that all the images are consistent in desired characteristic. Very common operation in preprocessing is color components normalization, known as the histogram equalization. Image histogram is the distribution of colors values in between extreme colors used in the palette. Assuming the situation where the brightest points of the grayscale image are not white and the darkest points are not black, performing histogram equalization will redistribute all the colors of the image in a way that brightest spot of the processed image will be color and the darkest regions of the image will become black.

C. Segmentation:

In computer vision, image segmentation is the process of partitioning a digital image into multiple segments (sets of pixels, also known as super-pixels). The goal of segmentation is to simplify and/or change the representation of an image into something that is more meaningful and easier to analyze. Image segmentation is typically used to locate objects and boundaries (lines, curves, etc.) in images. More precisely, image segmentation is the process of assigning a label to every pixel in an image such that pixels with the same label share certain characteristics.

The result of image segmentation is a set of segments that collectively cover the entire image, or a set of contours extracted from the image (see edge detection). Each of the pixels in a region are similar with respect to some characteristic or computed property, such as color, intensity, or texture. We use Expectation Maximisation for segment the white blood cells. Thresholding is the simplest method of image segmentation. From a gray scale image, thresholding can be used to create binary images. Binary images are produced from color images by segmentation. Segmentation is the process of assigning each pixel in the source image to two or more classes. If there are more than two classes then the usual result is several binary images.

In image processing, thresholding is used to split an image into smaller segments, or junks, using at least one color or gray scale value to define their boundary. The advantage of obtaining first a binary image is that it reduces the complexity of the data and simplifies the process of recognition and classification. The most common way to convert a gray level image to a binary image is to select a single threshold value.

K-Means is a least-squares partitioning method that divide a collection of objects into K groups. The algorithm iterates over two steps:

1. Compute the mean of each cluster.

2. Compute the distance of each point from each cluster by computing its distance from the corresponding cluster mean. Assign each point to the cluster it is nearest to.

3. Iterate over the above two steps till the sum of squared within group errors cannot be lowered any more. The initial assignment of points to clusters can be done randomly.

In the course of the iterations, the algorithm tries to minimize the sum, over all groups, of the squared within group errors, which are the distances of the points to the respective group means. Convergence is reached when the objective function (i.e., the residual sum-of-squares) cannot be lowered any more. The groups obtained are such that they are geometrically as compact as possible around their respective means. For each additional script, one more cluster is added. Here, each feature is assigned a different weight, which is calculated based on the feature importance as described in the previous Section. The distance between two vectors is computed.

Once the image has been segmented using the K-Means algorithm, the clustering can be improved by assuming that neighboring pixels have a high probability of falling into the same cluster. Thus, even if a pixel has been wrongly clustered, it can be corrected by looking at the neighboring pixels.

D. Feature Extraction:

In machine learning, pattern recognition and in image processing, feature extraction starts from an initial set of measured data and builds derived values (features) intended to be informative and non-redundant, facilitating the subsequent learning and generalization steps, and in some cases leading to better human interpretations. Feature extraction is related to dimensionality reduction. When the input data to an algorithm is too large to be processed and it is suspected to be redundant (e.g. the same measurement in both feet and meters, or the repetitiveness of images presented as pixels), then it can be transformed into a reduced set of features (also named a feature vector).

Determining a subset of the initial features is called feature selection. The selected features are expected to contain the relevant information from the input data, so that the desired task can be performed by using this reduced representation instead of the complete initial data. We extract Statistical and texture features for pap smear segmented images. In machine learning, pattern recognition and in image processing, feature extraction starts from an initial set of measured data and builds derived values (features) intended to be informative and non-redundant, facilitating the subsequent learning and generalization steps, and in some cases leading to better human interpretations. Feature extraction is related to dimensionality reduction.

Statistical Features:

- *Mean*
- *Standard Deviation*
- *Variance*

E. Classification:

Image classification analyses the numerical properties of various image features and organizes data into categories. Classification algorithms typically employ two phases of processing: training and testing. In the initial training phase, characteristic properties of typical image features are isolated and, based on these, a unique description of each classification category, i.e. training class, is created. In the subsequent testing phase, these feature-space partitions are used to classify image features. Artificial neural networks (ANN) or connectionist systems are computing systems inspired by the biological neural networks that constitute animal brains.

The neural network itself is not an algorithm, but rather a framework for many different machine learning algorithms to work together and process complex data inputs. Such systems "learn" to perform tasks by considering examples, generally without being programmed with any task-specific rules. For example, in image recognition, they might learn to identify images that contain cats by analyzing example images that have been manually labelled as "cat" or "no cat" and using the results to identify cats in other images. They do this without any prior knowledge about cats, for example, that they have fur, tails, whiskers and cat-like faces. Instead, they automatically generate identifying characteristics from the learning material that they process.

VII. ADVANTAGES:

1. Segmentation result is best compared to existing method
2. High accuracy

VIII. CONCLUSION

We have seen a system to convert sign language into text with minimum complexity. On comparison with other methods, this method is extremely cost efficient as it does not require any complex hardware components. The input is given at runtime by capturing the image of the hand which is depicting the sign language and giving us the output .

We can, therefore conclude that the system gives sufficiently accurate results with minimum processing overhead. Such a simple system to convert sign language to text can be very useful to improve the life of the deaf and the mute in more than one way. It will make them self reliant and also increase their contribution in the society, leading to overall development

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