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Tamil Sign Language Recognition using Machine Learning to Aid Deaf and Dumb People

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Abstract - *Sign language recognition is an emerging research field to aid deaf and dumb people. The research on recognition and bringing best results is challenging in this area of interest. The overcome the challenges, the proposed system uses convolutional neural networks for training the dataset images of various sign with output in sound wave files, which will be effective solution for both deaf and dumb. This paper proposes a method that provides the conversion of a set of few combinations of the signs, which represents positions of fingers and palms into Tamil letters. For the conversion of signs, image processing and feature extraction method is used, training phase is done using Conv2D and testing phase is done. The static images and dynamic images (from web camera) can be converted by these methods.*

Key Words: **Sign Language, Conv2D, Convolutional Neural Networks, Feature Extraction, Image processing**

1. INTRODUCTION

Language is the prime means of communication of people. Sign is the oldest way of communication of the primitive man when there is no proper language. Nowadays the sign language is also preferred among the deaf-dumb people. Possibilities are very less in understanding the sign language of the deaf dumb people by normal people in such places like bank, booking counters etc. Conversion of sign language into text or voice reduce the problems arise there. Sign Language Recognition (SLR) is a tool executes the conversion of sign language into text or voice. Research in SLR started two decades before all over the world especially in American and Japanese Sign languages. Some researchers mainly concentrated on the capture, recognition and classification of the gestures of sign language. American, Australian, Korean, and Japanese sign languages contributed more in this area. Many more techniques and algorithms have been proposed in using a variety of methods based on the sensor fusion signal processing, image processing, and pattern recognition methods till now. International Sign Languages including Chinese, and Arabic used these applications to some extent. There were no such contributions to Tamil Sign Language Recognition system by any of the researcher in this area. Even though many regional languages are in practice in all countries the sign language should be one. But the language varies from one country to another. This paper deals with a system which recognizes the Tamil Sign Language for human – computer interaction.

2. EXISTING SYSTEM

International Sign Languages including Chinese, and Arabic used these applications to some extent. There were no such contributions to Tamil Sign Language Recognition system by any of the researcher in this area. Even though many regional languages are in practice in all countries the sign language should be one. But the language varies from one country to another. Sign language should be available for regional languages. Though some research on sign language using palm and fingers are available, there is no complete sign language recognition using Tamil is available. We can review some of the sign language recognition and used techniques in the following paragraphs. Many approaches have been proposed that combine Dynamic time wrapping or Hidden Markov Models (HMMs) with discrimination classifier for recognizing speech, handwriting or Sign Language. Starnet et al, had presented in Real time ASL recognition using vision – based approaches based on HMMs. This system involved in two proposed methods by using 40 signs. The first proposed method used a single camera mounted on a desk and obtained 92% accuracy. The second method used a camera mounted on a cap worn by the user and obtained 98% accuracy. Their methods were performed with continuous ASL data set for which only hand motion features were used. Hee–Deok et al, had developed Sign Language spotting with a threshold model based on Conditional Random Fields (CRF). This involved in an adaptive threshold for differentiating between sign in a vocabulary and non sign pattern. This method performed with CRFs without threshold model, short-sign detection, sub sign reasoning and hand sign verification for recognition. The experiments were performed with continuous data set with an 87% spotting rate and recognized the signs from isolated data with 93.5%. T. Shanableh developed a method for recognizing isolated Arabic sign language gestures in a userindependent mode. In this method, gloves were worn by the signers in order to simplify the process of segmenting out the hands of the signer via colour segmentation. Two different classification techniques; namely, K-NN and polynomial networks were used to assess the effectiveness of the proposed user independent feature extraction scheme. Variety of feature extraction methods for Arabic Sign

Language. Recognition was contributed by them. These techniques used temporal and spatial domain in order to capture the motion information of video segments i.e. image sequence into single representing image which is transformed into the frequency and parameterized into a precise and concise set of features and compared with other classical techniques. A variety of special devices were utilized to recognize the Sign Language. Hand shape and motion were extracted accurately and easily by these devices.

3. PROPOSED SYSTEM

To overcome the challenges in sign language system and to make more useful for deaf and dumb people who knows Tamil as only known language. To propose sign language system using convolutional neural networks for training the dataset images of various sign with output in sound wave files. For the conversion of signs, image processing and feature extraction method is used, training phase is done using Conv2D and testing phase is done. The static images and dynamic images (from web camera) can be converted by these methods. The hand sign recognition algorithm is proposed. The hand sign of Tamil alphabets are acquired using a digital camera. The still images of these hand signs are in RGB color space and it is converted to HSV color model for foreground extraction. The image is converted to gray scale images. Deep learning techniques of convolutional neural network from keras is applied for classification. In the training phase, the signature of hand signs are stored as images along with the corresponding voice wave files. In the testing phase, a person shows the hand signs of Tamil alphabets as an input and the features are extracted. The features of training hand signs set are extracted and stored in trained model for template matching.

4. Overall System Architecture

Initially, user have to learn the Tamil sign language.

4.1 DATASET COLLECTION

Different signs of input images are collected from web camera. The value output of signs is given along with dataset image collection. We have also created sound value file of corresponding values of input image. We can collect as many signs as possible to show our model effectively.

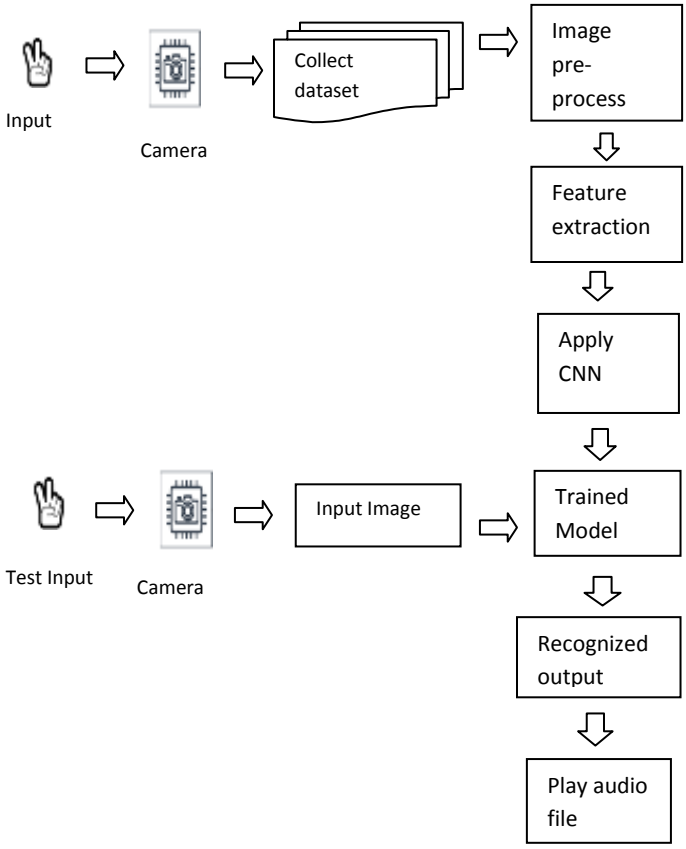

Fig -1: Architecture Diagram

4.2 IMAGE PRE-PROCESSING

Image pre-processing is carried out into steps such as color conversion and Gaussian blurring. Color conversion function converts input image from one color space to other, here we used BGR2GRAY for converting the input image to gray scale image. The next step of pre-process is Gaussian blurring of images. Gaussian blurring removes noises from images and smoothes the images. For image segmentation, Adaptive Gaussian Threshold is applied and Threshold is calculated for every small region of images.

4.3 FEATURE EXTRACTION

Binarymask is applied to create/ choose particular Region of Interest (ROI) from image. After masking, color image is converted to GRAYSCALE image. Gaussian blurring applied, which is highly effective in removing gaussian noise from the image.[blur = cv2.GaussianBlur(gray,(5,5),2)]. After applying GaussianBlur, adaptive thresholding is used, which is the method where the threshold value is calculated for smaller regions and therefore, there will be different threshold values for different regions.[th3 = cv2.adaptiveThreshold]

4.4 CONVOLUTIONAL 2D NEURAL NETWORK

Sequential Model

Models in Keras can come in two forms – Sequential and via the Functional API. For most deep learning networks, the Sequential model is likely. It allows to easily stack sequential layers (and even recurrent layers) of the network in order from input to output.

The first line declares the model type as Sequential().

5. CONCLUSION

A method for the recognition of static signs of Tamil sign language alphabets for HCI is proposed. The static hand signs are captured using a web/digital camera. The normalized signature of the hand sign is extracted. The feature vector representing the hand sign is made scale. Deep learning technique of Convolution neural network in Keras is used for classifier test hand sign by matching with the feature vector from trained model. The output of the SLR is tagged with the voice wave format, when the sign is recognized, the output sound wave file will play. This proposed method is very useful for the deaf and dumb people to communicate with normal people in Tamil letters. This approach can handle different types of alphabets in a uniform background. In future the dynamic gestures can be considered for creating words or sentences.

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