LITERATURE SURVEY

In the recent years there has been tremendous research done on the hand gesture recognition.

With the help of literature survey, we realized that the basic steps in hand gesture recognition are: -

##### Data acquisition

##### Data pre-processing

##### Feature extraction

##### Gesture classification

##### **3.1 Data acquisition:**

##### The different approaches to acquire data about the hand gesture can be done in the following ways:

1. **Use of sensory devices:**

It uses electromechanical devices to provide exact hand configuration, and position. Different glove-based approaches can be used to extract information. But it is expensive and not user friendly.

1. **Vision based approach:**

In vision-based methods, the computer webcam is the input device for observing the information of hands and/or fingers. The Vision Based methods require only a camera, thus realizing a natural interaction between humans and computers without the use of any extra devices, thereby reducing cost. These systems tend to complement biological vision by describing artificial vision systems that are implemented in software and/or hardware. The main challenge of vision-based hand detection ranges from coping with the large variability of the human hand’s appearance due to a huge number of hand movements, to different skin-color possibilities as well as to the variations in viewpoints, scales, and speed of the camera capturing the scene.

**3.2 Data Pre-Processing and 3.3 Feature extraction for vision-based approach:**

* In [1] the approach for hand detection combines threshold-based colour detection with background subtraction. We can use AdaBoost face detector to differentiate between faces and hands as they both involve similar skin-color.
* We can also extract necessary image which is to be trained by applying a filter called Gaussian Blur (also known as Gaussian smoothing). The filter can be easily applied using open computer vision (also known as OpenCV) and is described in [3].
* For extracting necessary image which is to be trained we can use instrumented gloves as mentioned in [4]. This helps reduce computation time for Pre-Processing and gives us more concise and accurate data compared to applying filters on data received from video extraction.
* We tried doing the hand segmentation of an image using color segmentation techniques but skin colorur and tone is highly dependent on the lighting conditions due to which output, we got for the segmentation we tried to do were no so great. Moreover, we have a huge number of symbols to be trained for our project many of which look similar to each other like the gesture for symbol ‘V’ and digit ‘2’, hence we decided that in order to produce better accuracies for our large number of symbols, rather than segmenting the hand out of a random background we keep background of hand a stable single colour so that we don’t need to segment it on the basis of skin colour. This would help us to get better results.

**3.4 Gesture Classification:**

##### In [1] Hidden Markov Models (HMM) is used for the classification of the gestures. This model deals with dynamic aspects of gestures. Gestures are extracted from a sequence of video images by tracking the skin-color blobs corresponding to the hand into a body– face space centred on the face of the user.

##### The goal is to recognize two classes of gestures: deictic and symbolic. The image is filtered using a fast look–up indexing table. After filtering, skin colour pixels are gathered into blobs. Blobs are statistical objects based on the location (x, y) and the colorimetry (Y, U, V) of the skin color pixels in order to determine homogeneous areas.

##### In [2] Naïve Bayes Classifier is used which is an effective and fast method for static hand gesture recognition. It is based on classifying the different gestures according to geometric based invariants which are obtained from image data after segmentation.

##### Thus, unlike many other recognition methods, this method is not dependent on skin colour. The gestures are extracted from each frame of the video, with a static background. The first step is to segment and label the objects of interest and to extract geometric invariants from them. Next step is the classification of gestures by using a K nearest neighbor algorithm aided with distance weighting algorithm (KNNDW) to provide suitable data for a locally weighted Naïve Bayes‟ classifier.

##### According to the paper on “Human Hand Gesture Recognition Using a Convolution Neural Network” by Hsien-I Lin, Ming-Hsiang Hsu, and Wei-Kai Chen (graduates of Institute of Automation Technology National Taipei University of Technology Taipei, Taiwan), they have constructed a skin model to extract the hands out of an image and then apply binary threshold to the whole image. After obtaining the threshold image they calibrate it about the principal axis in order to centre the image about the axis. They input this image to a convolutional neural network model in order to train and predict the outputs. They have trained their model over 7 hand gestures and using this model they produced an accuracy of around 95% for those 7 gestures.