KANNADA SIGN LANGUAGE RECOGNITION USINGMACHINE LEARNING

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Abstract - The literature contains many proposed solutions for automatic language recognition. However, the ARSL (Arabic Sign Language), unlike ASL (American Sign Language), didn't take much attention from the research community. In this paper, we propose a new system which doesn't require a deaf wear inconvenient devices like gloves to simplify the method of hand recognition. The system is based on gesture extracted from 2D images. the scale Invariant Features Transform (SIFT) technique is employed to achieve this task because it extracts invariant features which are robust to rotation and occlusion. Also, the Linear Discriminant Analysis (LDA) technique is employed to solve dimensionality problem of the extracted feature vectors and to extend the separability between classes, thus increasing the accuracy of the introduced system. The Support Vector Machine (SVM), k-Nearest Neighbor (kNN), and minimum distance are going to be used to identify the Arabic sign characters. Experiments are conducted to test the performance of the proposed system and it showed that the accuracy of the obtained results is around 99%. Also, the experiments proved that the proposed system is strong against any rotation and that they achieved an identification rate concerning 99%. Moreover, the evaluation shown that the system is such as the related work.

***Key Words*: SIFT, LDA, KNN, ARSL.**

1. INTRODUCTION

A sign language may be a collection of gestures, movements, postures, and facial expressions similar to letters and words in natural languages. So, there should be the way for the non-deaf people to recognize the deaf language (i.e., sign language). Such process is understood as a sign language recognition. The aim of the sign language recognition is to supply an accurate and convenient mechanism to transcribe sign gestures into meaningful text or speech so communication between deaf and hearing society can easily be made. to achieve this aim, many proposal attempts are designed to create fully automated systems or Human Computer Interaction (HCI) to facilitate interaction between deaf and non-deaf people. There are two main categories for gesture recognition glove-based systems and vision-based systems. Glove-based systems: In these systems, electromechanical devices are accustomed collect data about deaf' s gestures. With these systems, the deaf person should wear a wired glove connected to many sensors to gather the gestures of the person's hand.

1.1 PROBLEM DEFINITION

The traditional existing system for sign language recognition is based on mainly hand recognition techniques, which were useful in communicating the words between the normal people and deaf people. The combinational use of sign and behavior signals used in our project helps in identifying what the person is trying to communicate. So much helpful in security concerned field. Based on various signs we can communicate with the person with more accuracy using many instance learning algorithms. Using hand recognition, we can communicate with a deaf person and dumb person to display weather it is letter, word or trying to convey something. This software system is designed to recognize the hand using gesture. The system then computes various hand parameters of the person's gesture. Upon identifying and recognizing these parameters, the system compares these parameters with gesture for human communication. Based on this static gesture the system concludes the person's communication state.

1.1 OBJECTIVE

The main objective of our project is to make the communication experience as complete as possible for both hearing and deaf people. The work presented in Indian Regional language, Kannada, the goal is to develop a system for automatic translation of static gestures of alphabets in Kannada sign language. Sign of the deaf individual can be recognized and translated in Kannada language for the benefit of deaf & dumb people.

1.2 SCOPE

Communication forms a very important and basic aspect of our lives. Whatever we do, whatever we say, somehow does reflect some of our communication, though may not be directly. To understand the very fundamental behavior of a human, we need to analyze this communication through some hand gesture, also called, the affect data. This data can be sign, image etc. Using this communicational data for recognizing the gesture also forms an interdisciplinary field, called Affective Computing. This paper summarizes the previous works done in the field of gesture recognition based on various sign models and computational approaches

2. LITRATURE SURVEY

[A]Title:- New Methodology for Translation of Static Sign Symbol to Words in Kannada Language.
Authors:- Ramesh M. Kagalkar, Nagaraj H.N Publication Journal & Year:- IRJET-2020.

Summary: During this paper the goal is to develop a system for automatic translation of static gestures of alphabets in kannada sign language. It maps letters, words and expression of a particular language to a collection of hand gestures enabling an in individual exchange by using handsgestures instead of by speaking. The system capable of recognizing signing symbols may be used as a way of communication with hard of hearing people

[B]Title:-Sign language Recognition Using Machine Learning Algorithm.
Authors:- Prof. Radha S. Shirbhate, Mr. Vedant D. Shinde
Publication Journal & Year:- IJASRT, 2020.

Summary:- Hand gestures differ from one person to a different person in shape and orientation, therefore, a controversy of linearity arises. Recent systems have come up with various ways and algorithms to accomplish the matter and build this method. Algorithms like KNearest neighbors (KNN), Multi-class Super Vector Machine (SVM), and experiments using hand gloves were using decode the hand gesture movements before. during this paper, a comparison between KNN, SVM, and CNN algorithms is completed to see which algorithm would offer the simplest accuracy among all. Approximately 29,000 images were split into test and train data and preprocessed to suit into the KNN, SVM, and CNN models to get an accuracy of 93.83%, 88.89%, and 98.49% respectively.

[C]Title:- Sign Language Recognition Using Deep Learning On Static Gesture Images.
Authors: Aditya Das, Shantanu
Publication Journal & Year:- 2019

Summary:- The image dataset used consists of static sign gestures captured on an RGB camera. Preprocessing was performed on the pictures, which then served as cleaned input. The paper presents results obtained by retraining and testing this signing gestures dataset on a convolutional neural network model using Inception v3. The model consists of multiple convolution filter inputs that are processed on the identical input. The validation accuracy obtained was above 90% This paper also reviews the assorted attempts that are made at sign language detection using machine learning and depth data of images. It takes stock of the varied challenges posed in tackling such an issue, and descriptions future scope also.

[D]Title:- Indian Sign Language Recognition Based Classification Technique.
Authors:- Joyeeta Singha, Karen Das Publication Journal & Year:- IEEE, 2019.

Summary:- Hand gesture recognition (HGR) became a very important research topic. This paper deals with the classification of single and double handed Indian sign language recognition using machine learning algorithm with the help of MATLAB with 92-100% of accuracy.

[E]Title:- Indian Sign Language Gesture Recognition using Image Processing and Deep Learning.
Authors:- Vishnu Sai Y, Rathna G N.
Publication Journal & Year:- IJSCSEIT, 2018.

Summary:- Speech impaired people use hand based gestures to talk. Unfortunately, the overwhelming majority of the people aren't tuned in to the semantics of these gestures. To bridge the identical attempt to bridge the identical, we propose a real time hand gesture recognition system supported the data captured by the Microsoft Kinect RGBD camera. on condition that there is no one to 1 mapping between the pixels of the depth and thus the RGB camera, we used computer vision techniques like 3D contruction and transformation. After achieving one to 1 mapping, segmentation of the hand gestures was done from the background. Convolutional Neural Networks (CNNs) were utilised for training 36 static gestures relating Indian sign Language(ISL) alphabets and numbers. The model achieved an accuracy of 98.81% on training using 45,000 RGB images and 45,000 depth images. Further Convolutional LSTMs were used for training 10 ISL dynamic word gestures and an accuracy of 99.08% was obtained by training 1080 videos. The model showed accurate real time performance on prediction of ISL static gestures, leaving a scope for further research on sentence formation through gestures. The model also showed competitive adaptability to American Sign language (ASL) gestures when the ISL models weights were transfer learned to ASL and it resulted in giving 97.71% accuracy

3. EXISTING SYSTEM

The Indian sign language lag its American counterpart as the research in this field is hampered by the lack of standard datasets. Unlike American sign language uses single hands for making gesture. Indian sign language is subjected to variance in locality and the existence of multiple signs for the same character.

4. PROPOSED SYSTEM

The training set consists of 70% of the aggregate data and remaining 30% are used as testing. We concentrate more on developing ISL along with Indian regional language, Kannada.KSL uses single hand for text recognition, provided in KSL Swaragalu(ಸ್ವ ರಗಳು), is in under researchand implementation. Implementing both Swaragalu(ಸ್ವರಗಳು), and vyanjanagalu(ವ್ಯ ಂOಜನಗಳು), We totally implement 49 Varna male(ವ್ ್ ಣ ಮಾಲೆ) letters and Try recognising giving the 80-90% accuracy.

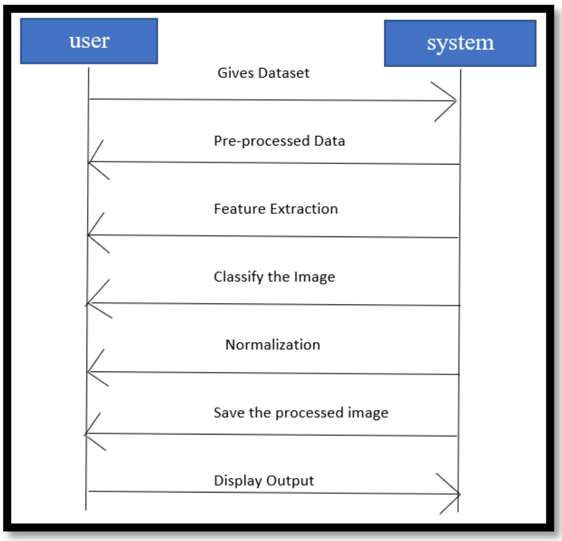

Fig. 1: Sequence Diagram

5. METHODOLOGY

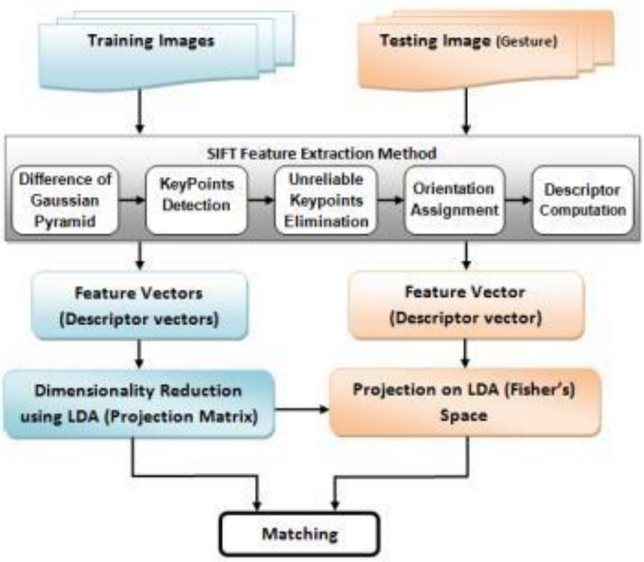

Fig. 2: Flow Chart

5.1 Scale Invariant Features Transform (SIFT)

The SIFT algorithm takes an image and transforms it into a collection of local feature vectors. Each of these feature vectors is supposed to be distinctive and invariant to any scaling, rotation or translation of the image.

We locate the highest peak in the histogram and use this peak and any other local peak to create a keypoint with that orientation. Some points will be assigned multiple orientations if there are multiple peaks of similar magnitude. The assigned orientation, location and scale for each keypoint enables SIFT features to be robust to rotation,scale and translation.

5.2 Descriptor Computation

In this stage, the goal is to create descriptive for the patch that is compact, highly distinctive and to be robust to changes in illumination and camera viewpoint. The image gradient magnitudes and orientations are sampled around the key point location.

The Number of features depends on image content, size, and choice of various parameters such as patch size, number of angels and bins, and peak threshold. These parameters will be briey described below. Peak Threshold (PeakThr) parameter is used to determine the dimension of feature vectors because PeakThr represents the amount of contrast to extract a keypoint. The optimum value of PeakThr is 0.0 because when the value of PeakThr parameter increased, the number of features decreased and more keypoints are eliminated.

The patch size (Psize) parameter is used to extract differentgrained of features. Increasing the size of patches will decrease the dimension of feature.

5.3 Linear Discriminant Analysis (LDA)

LDA is one of the most famous dimensionality reduction method used in machine learning. LDA attempts to find a linear combination of features which separate two or more classes.

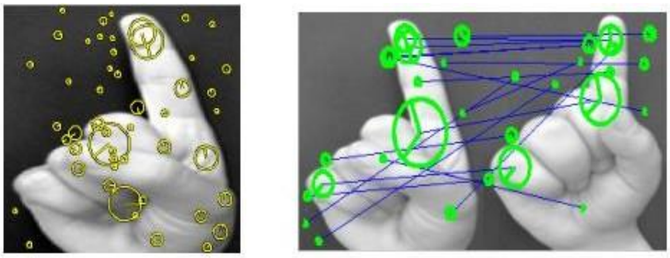

Fig. 1: Keypoints and matching between two different characters of Arabic sign language images, (a) Keypoints or Extrema of SIFT, (b) Matching between two images based on SIFT features

5.4 Classifiers

In this paper, we have applied three classifiers to assess their performance with our approach. An overview of these classifiers is given below:

5.4.1 Support Vector Machine (SVM)

SVM is one of the classifiers which deals with a problem of high dimensional datasets and gives very good results. SVM tries to find out an optimal hyperplane separating 2-classes basing on training cases.

Geometrically, the SVM modeling algorithm finds an optimal hyperplane with the maximal margin to separate two classes, which requires solving the optimization problem

$$maximize \sum_{i=1}^{n} \alpha_i - \frac{1}{2} \sum_{i,j=1}^{n} \alpha_i \alpha_j y_i y_j (x_i, x_j)$$

$$\text{subject to:} \sum_{i=1}^{n} \alpha_i y_i, 0 \leq \alpha_i \leq C$$

where, αi is the weight assigned to the training sample xi (if αi > 0,then xi is called a support vector); C is a regulation parameter used to find a trade of between the training accuracy and the model complexity so that a superior generalization capability can be achieved; and K is a kernel function, which is used to measure the similarity between two samples.

5.4.2 Nearest-Neighbor Classifier

The nearest neighbor or minimum distance classifier is one of the oldest known classifiers. Its idea is extremely simple as it does not require learning. Despite its simplicity, nearest neighbors has been successful in a large number of classification and regression problems. To classify an object I, first one needs to find its closest neighbor Xi among all the training objects X and then assigns to unknown object the label Yi of Xi . Nearest neighbor classifier, works very well in low dimensions. The distance can, in general, be any metric measure: standard Euclidean distance is the most common choice.

5.4.3 The Proposed ArSL Recognition System

The output of the SIFT algorithm is feature vectors with high dimension for each image. Processing these high dimension vectors takes more CPU time. So, we need to reduce the dimensions of the features by applying dimensionality reduction method, such as LDA which is one of the most suitable methods to reduce the dimensions and increase the separation between different classes. LDA also decreases the distance between the objects belong to the same class. The feature extraction and reduction are performed in both training and testing phases. The matching or the classification of the new images are only done in the testing phase.

6. RESULTS

Following are the screenshots of the interface and output of the proposed system.

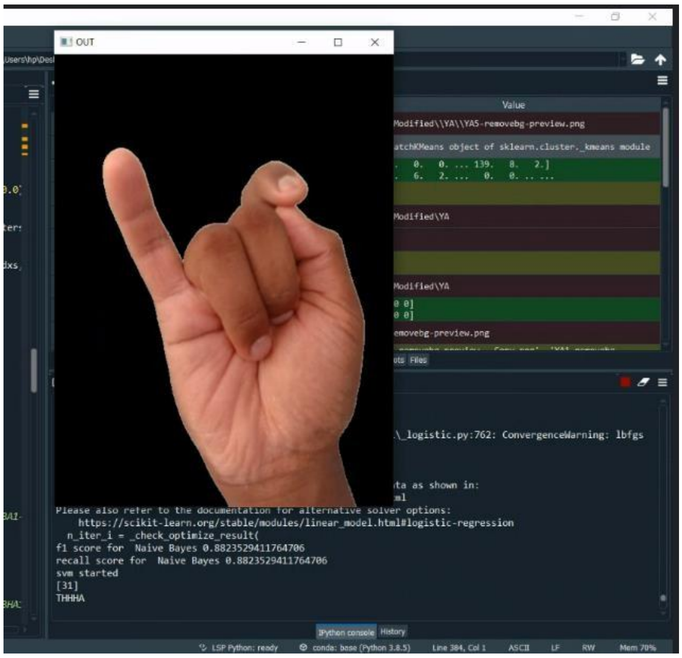

Fig. 3: Kannada Sign showing "THHA"

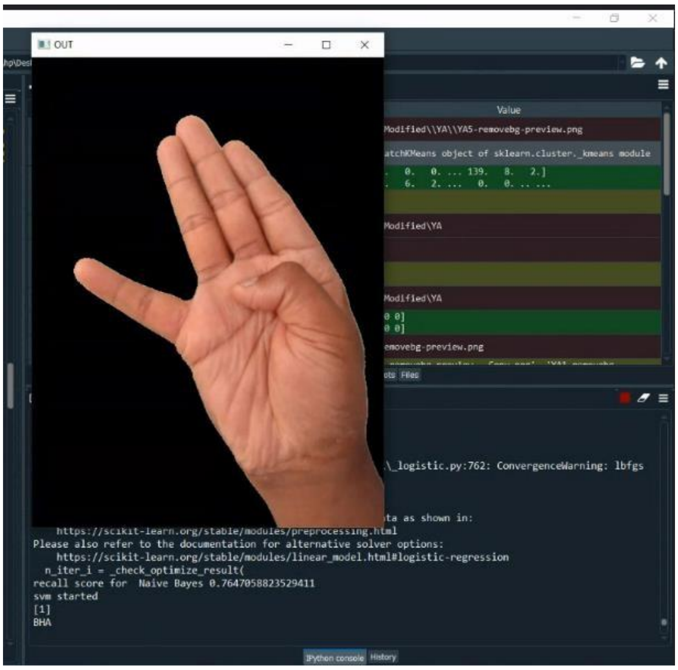

Fig. 4: Kannada Sign showing "BHA"

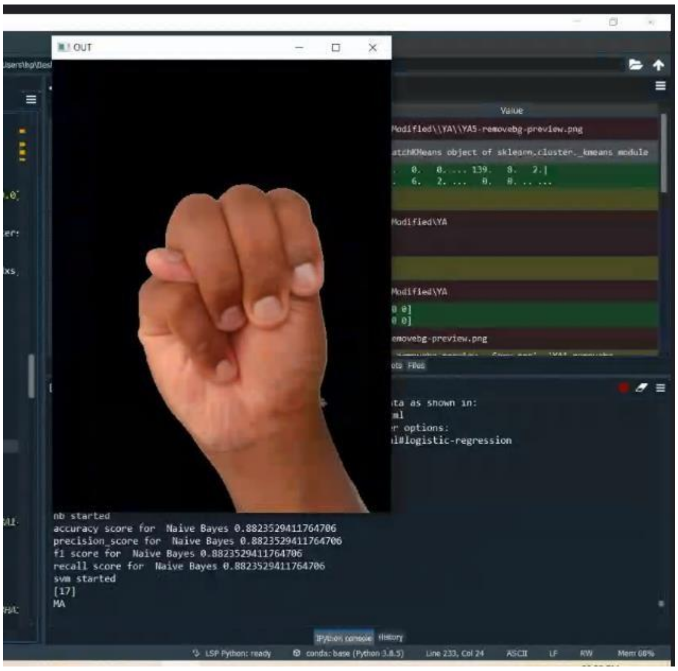

Fig. 5: Kannada Sign showing "MA"

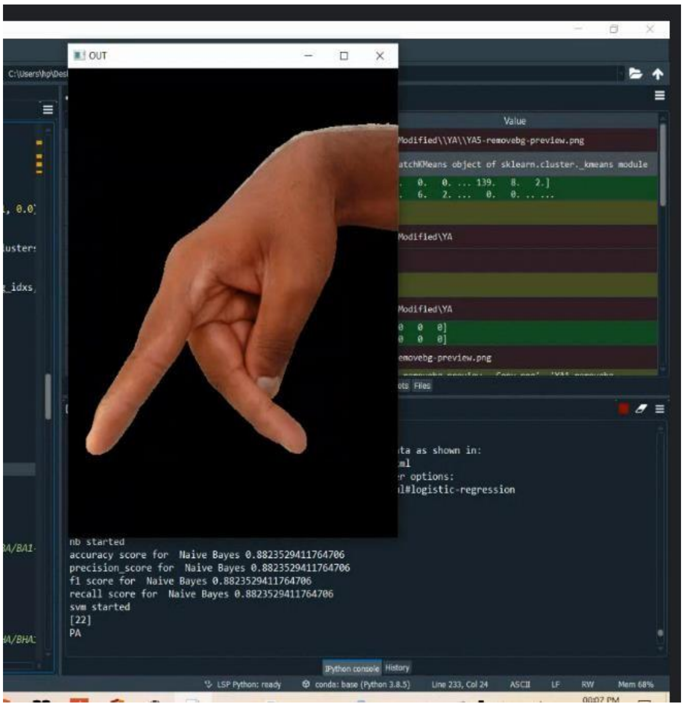

Fig. 7: Kannada Sign showing "PA"

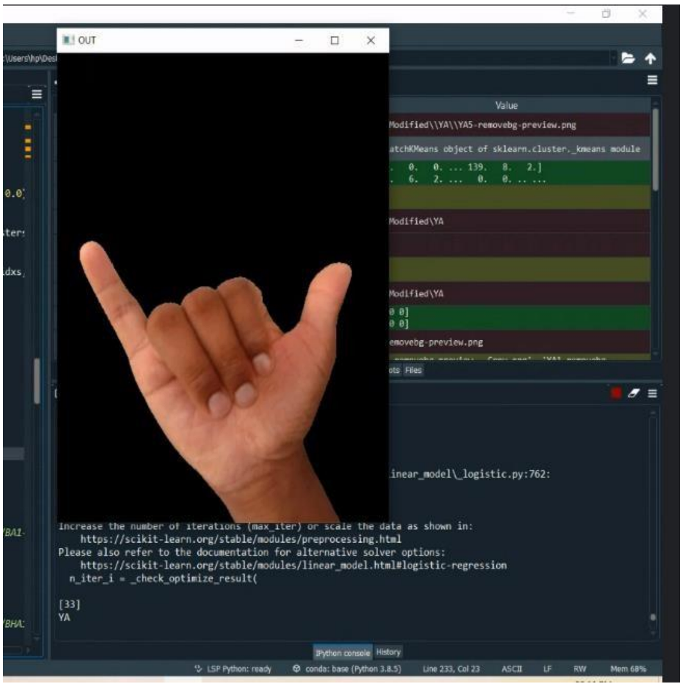

Fig. 6: Kannada Sign showing "YA"

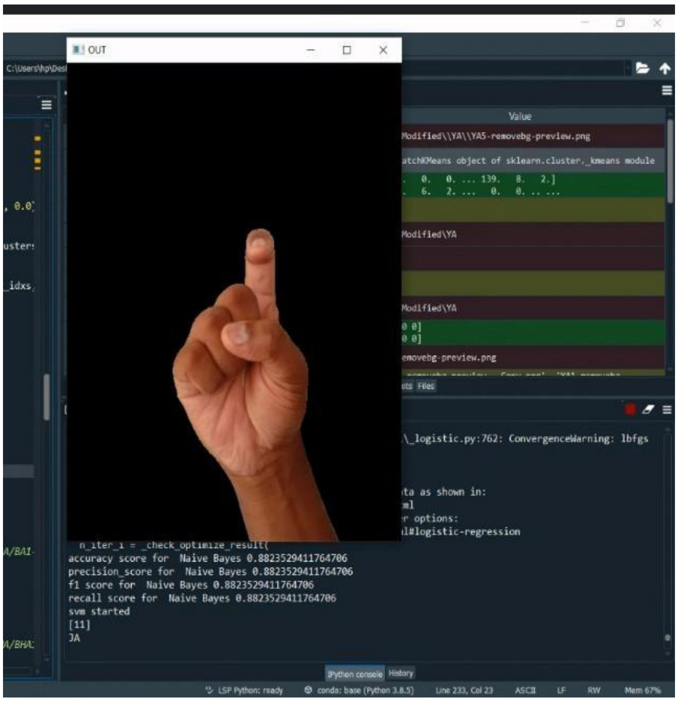

Fig. 8: Kannada Sign showing "JA"

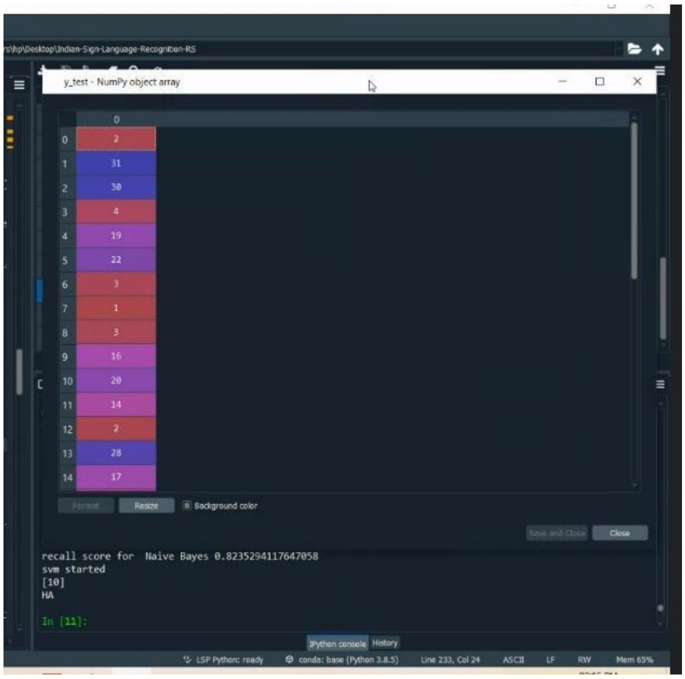

Fig. 10: TEST CASES DIVISION

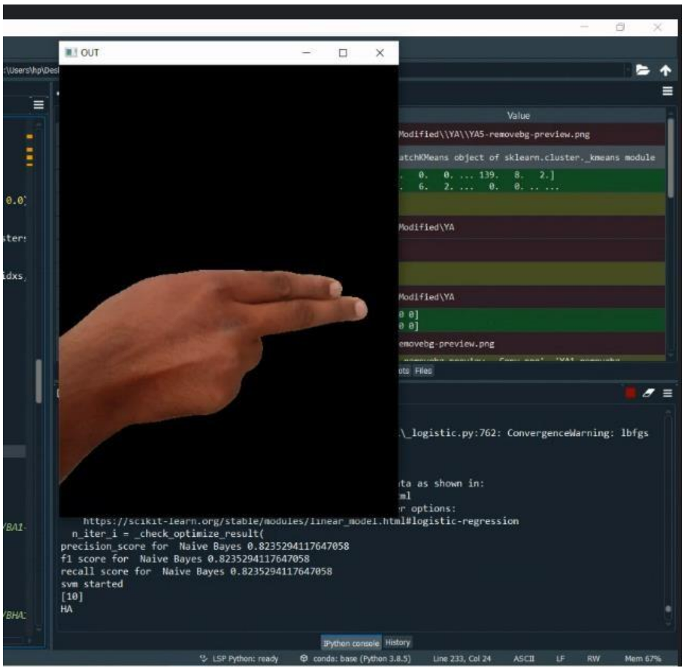

Fig. 9: Kannada Sign showing "HA"

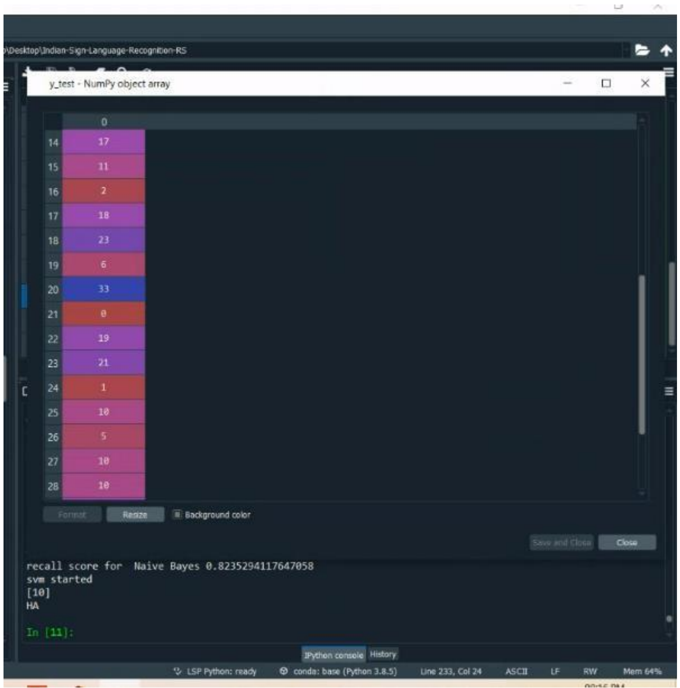

Fig. 11: TEST CASES DIVISION

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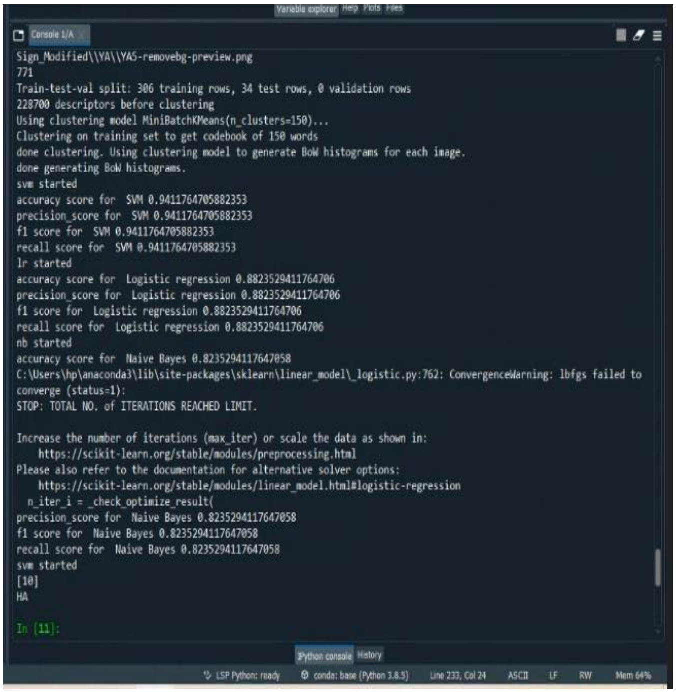

Fig. 12: Algorithms with their Accuracy

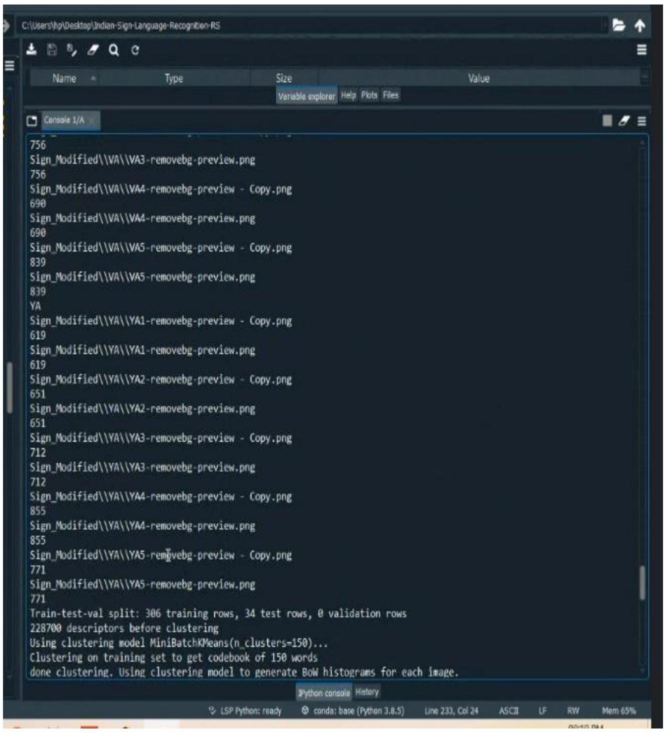

Fig. 13: Classification of Training and Testing cases

7. CONCLUSION

In this paper, we have proposed a system for ArSL recognition based on gesture extracted from Arabic sign images. We have used SIFT technique to extract these features. The SIFT is used as it extracts invariant features which are robust to rotation and occlusion. Then, LDA technique is used to solve dimensionality problem of the extracted feature vectors and to increase the separability between classes, thus increasing the accuracy for our system. In our proposed system, we have used three classifiers, SVM, k-NN, and minimum distance. The experimental results showed that our system has achieved an excellent accuracy around 98.9%. Also, the results proved that our approach is robust against any rotation and they achieved an identification rate of near to 99%. In case of image occlusion (about 60% of its size), our approach has accomplished an accuracy (approximately 50%). In our future work, we are going to find a way to improve the results of our system in case of image occlusion and also increase the size of the dataset to check its scalability. Also, we will try to identify characters from video frames and then try to implement real time ArSL system. We can develop a model for KSL word and sentence level recognition. This will require a system that can detect changes with respect to the temporal space. We can develop a complete product that will help the speech and hearing-impaired people, and thereby reduce the communication gap We will try to recognize signs which include motion. Moreover, we will focus on converting the sequence of gestures into text i.e. word and sentences and then converting it into the speech which can be heard.

REFERENCES

[1] Assaleh, K., Al-Rousan, M.: Recognition of Arabic sign language alphabet using polynomial classifiers. EURASIP Journal on Applied Signal Processing 2005 (2005) 21362145

[2] Samir, A., Aboul-Ela, M.: Error detection and correction approach for Arabic sign language recognition. In: Computer Engineering & Systems (ICCES), 2012 Seventh International Conference on, IEEE (2012) 117123

[3] Tolba, M., Elons, A.: Recent developments in sign language recognition systems. In: Computer Engineering & Systems (ICCES), 2013 8th International Conference on, IEEE (2013)

[4] Tolba, M., Samir, A., Aboul-Ela, M.: Arabic sign language continuous sentences recognition using pcnn and graph matching. Neural Computing and Applications 23(3-4) (2013) 9991010

[5] Al-Jarrah, O., Halawani, A.: Recognition of gestures in Arabic sign language using neuro-fuzzy systems. Artificial Intelligence 133(1) (2001) 117138

[6] Albelwi, N.R., Alginahi, Y.M.: Real-time Arabic sign language (arsl) recognition. In: International Conference on Communications and Information Technology (ICCIT-2012), Tunisia, 2012. (2012) 497501

[7] Tolba, M., Samir, A., Abul-Ela, M.: A proposed graph matching technique for Arabic sign language continuous sentences recognition. In: 8th IEEE International Conference on Informatics and Systems (INFOS),. (2012) 1420

[8] Al-Jarrah, O., Al-Omari, F.A.: Improving gesture recognition in the Arabic sign language using texture analysis. Journal of Applied Artificial Intelligence 21(1) (2007) 1133

[9] Digital Image. Processing. Third Edition. Rafael C. Gonzalez. University of Tennessee. Richard E. Woods. NledData Interactive. Pearson International Edition.

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