SIGN LANGUAGE RECOGNITION USING AI

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ABSTRACT

Sign language is the natural way of communication of speech and hearing-impaired people. Using American Sign Language (ASL) interpretation system, hearing impaired people may interact with normal people with the help of Human Computer Interaction (HCI). This paper presents a method for automatic recognition of two-handed signs of Indian Sign language (ISL). The three phases of this work include preprocessing, feature extraction and classification. We trained a BPN with Histogram Oriented Gradient (HOG) features. The trained model is used for testing the real time gestures. The overall accuracy achieved was 89.5% with 5184 input features and 50 hidden neurons. A deep learning approach was also implemented using AlexNet, GoogleNet, VGG-16 and VGG-19 which gave accuracies of 99.11%, 95.84%, 98.42% and 99.11% respectively. MATLAB is used as the simulation platform. The proposed technology is used as a teaching assistant for specially abled persons and has demonstrated an increase in cognitive ability of 60–70% in children. This system demonstrates image processing and machine learning approaches to recognize alphabets from the Indian sign language, which can be used as an ICT (information and communication technology) tool to enhance their cognitive capability.

INTRODUCTION

Hand gestures are used as communication media for carrying messages in sign language. This can involve simultaneously combining hand shapes, orientation and movement of the hands, arms or body, and facial expressions to express a speaker's thoughts. In sign language, signs are used to visually communicate between hearing and speech impaired people. Due to the complexity of sign language, most people lose interest in learning it and do not interact with the hearing and speech impaired people. This is the motivation to develop such a system which acts as a tool to educate people about sign language and create an interest in society to learn and communicate in sign language.

This work is an attempt to use sign language as a medium of teaching in order to develop interest in the teaching learning process of hearing and speech impaired children. This method will improve interest and cognition skills in the hearing-impaired children as they are being taught sign language, which is their first language. Efforts have been taken in making real time hand gesture recognition systems using low-cost sensors. This work aims at making an automated real time sign language recognition system using Computer Vision and Machine Learning which may be useful for the hearing-impaired people in learning English alphabets.

PROJECT DESCRIPTION:

SIGN LANGUAGE IS A FORM OF COMMUNICATION USED PRIMARILY BY PEOPLE HARD OF HEARING OR DEAF. THIS TYPE OF GESTURE-BASED LANGUAGE ALLOWS PEOPLE TO CONVEY IDEAS AND THOUGHTS EASILY OVERCOMING THE BARRIERS CAUSED BY DIFFICULTIES FROM HEARING ISSUES.

A MAJOR ISSUE WITH THIS CONVENIENT FORM OF COMMUNICATION IS THE LACK OF KNOWLEDGE OF THE LANGUAGE FOR THE VAST MAJORITY OF THE GLOBAL POPULATION. JUST AS ANY OTHER LANGUAGE, LEARNING SIGN LANGUAGE TAKES MUCH TIME AND EFFORT, DISCOURAGING TO FROM BEING LEARNED BY THE LARGER POPULATION.

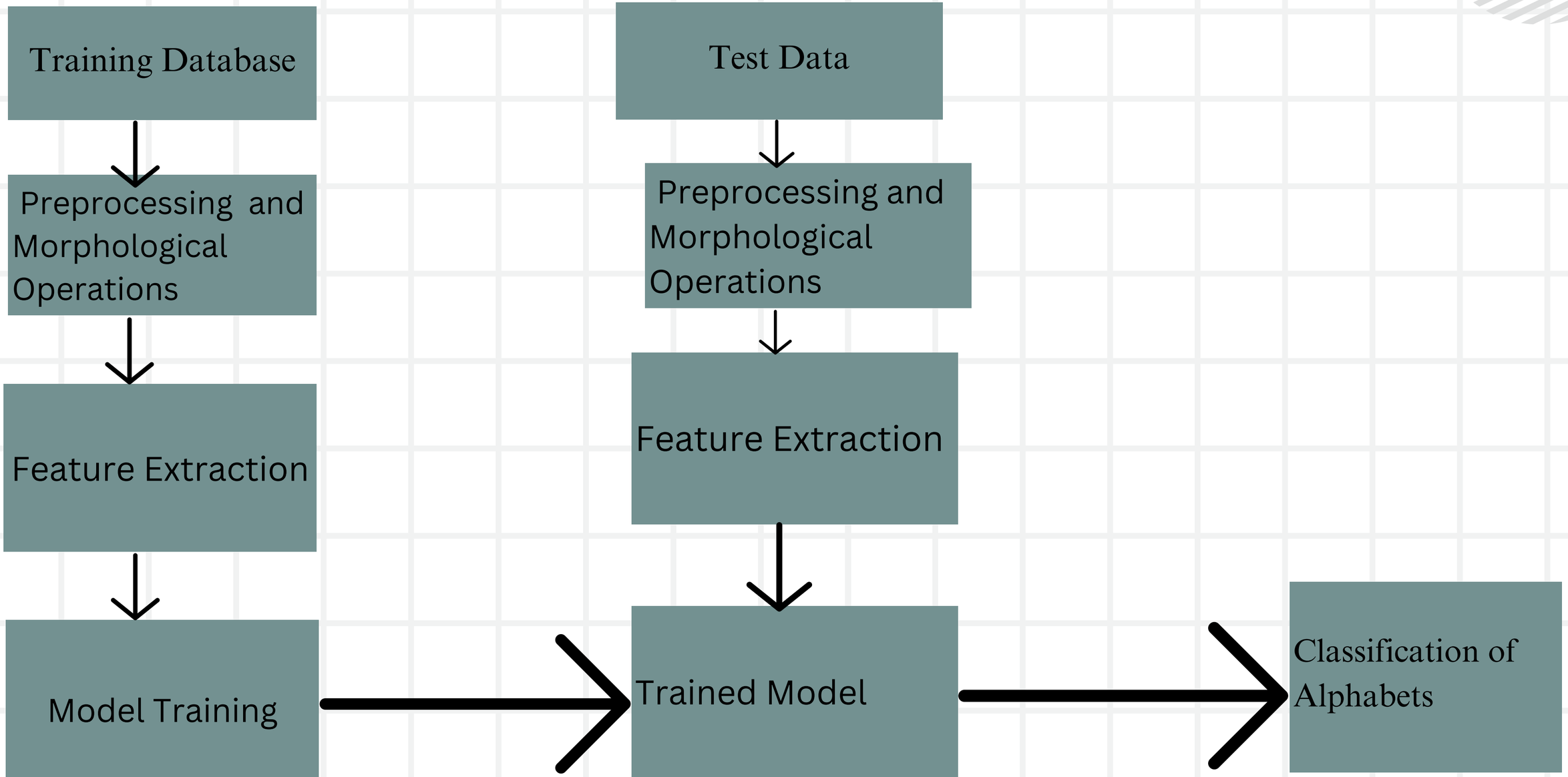
HOWEVER, AN EVIDENT SOLUTION TO THIS ISSUE IS PRESENT IN THE WORLD OF MACHINE LEARNING AND IMAGE DETECTION. IMPLEMENTING PREDICTIVE MODEL TECHNOLOGY TO AUTOMATICALLY CLASSIFY SIGN LANGUAGE SYMBOLS CAN BE USED TO CREATE A FORM OF REAL-TIME CAPTIONING FOR VIRTUAL CONFERENCES LIKE ZOOM MEETINGS AND OTHER SUCH THINGS. THIS WOULD GREATLY INCREASE ACCESS OF SUCH SERVICES TO THOSE WITH HEARING IMPAIRMENTS AS IT WOULD GO HAND-IN-HAND WITH VOICE-BASED CAPTIONING, CREATING A TWO-WAY COMMUNICATION SYSTEM ONLINE FOR PEOPLE WITH HEARING ISSUES.

MANY LARGE TRAINING DATASETS FOR SIGN LANGUAGE ARE AVAILABLE ON KAGGLE, A POPULAR RESOURCE FOR DATA SCIENCE. THE ONE USED IN THIS MODEL IS CALLED “SIGN LANGUAGE MNIST” AND IS A PUBLIC-DOMAIN FREE-TO-USE DATASET WITH PIXEL INFORMATION FOR AROUND 1,000 IMAGES OF EACH OF 24 ASL LETTERS, EXCLUDING J AND Z AS THEY ARE GESTURE-BASED SIGNS.

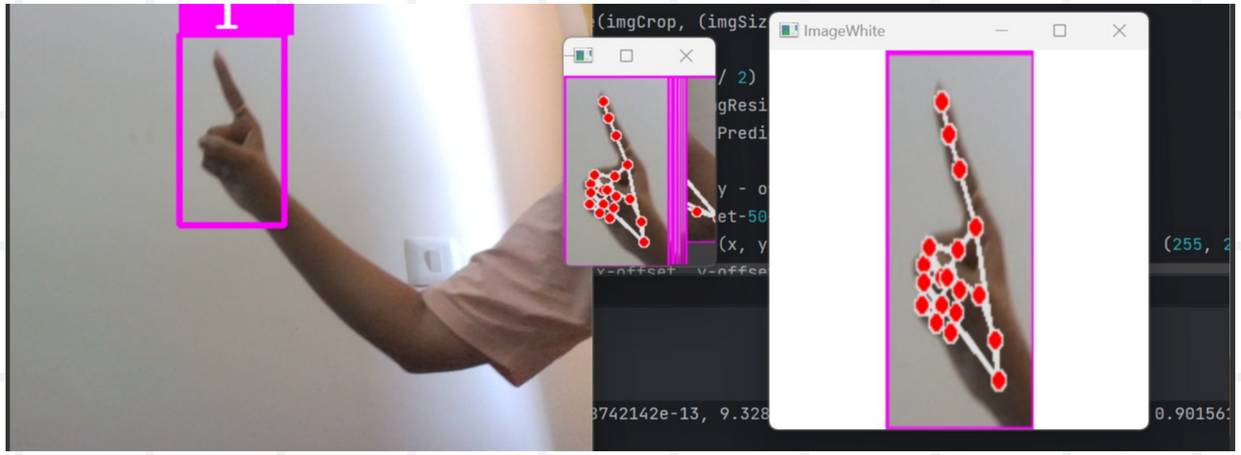
Problem Statement

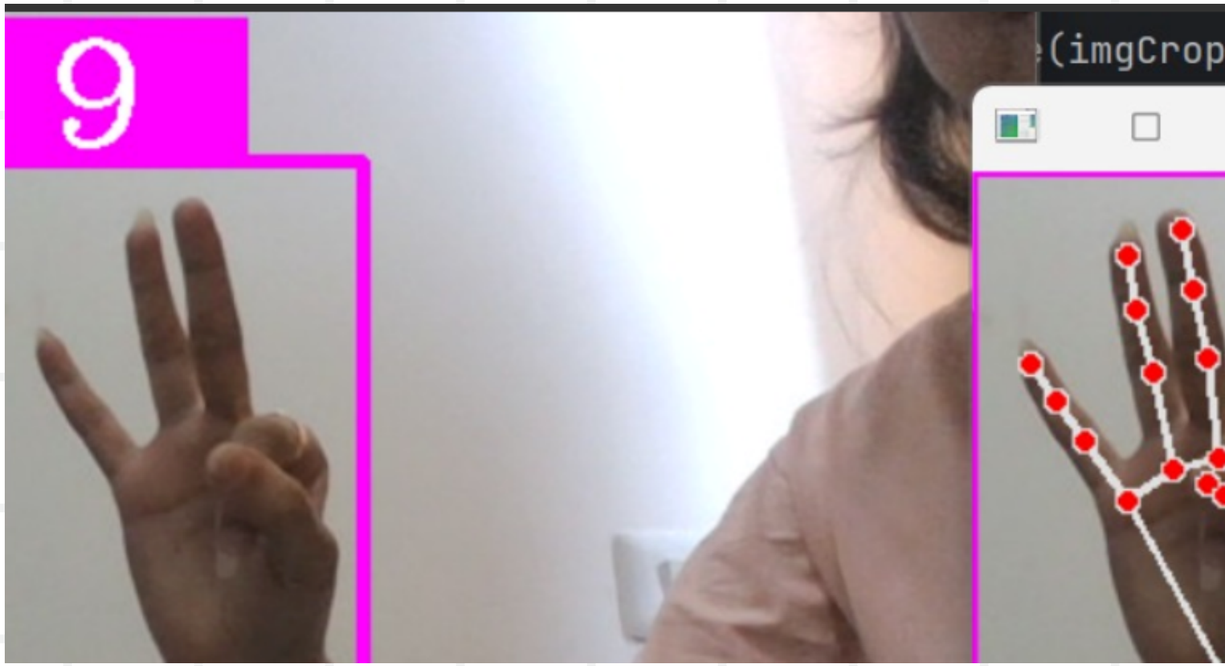
To interpret ASL sign language(029)

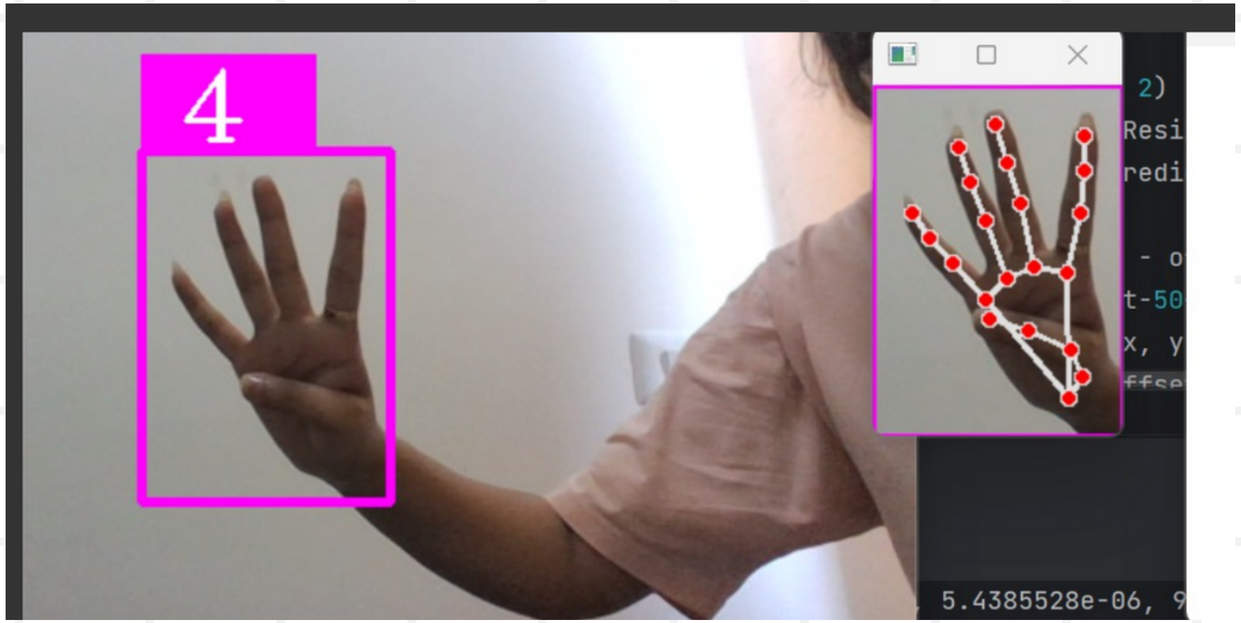
METHODOLOGY



RESULT







CONCLUSION

American Sign Language (ASL) interpretation system using automatic recognition of two-handed signs is implemented in this work. HOG descriptors are the most popular in the state of art for the purpose of object detection. Hence, HOG is used for feature extraction. This method is similar to that of edge orient histograms, scale invariant feature transform descriptors and shape contexts. The skin color detection is of paramount importance as it has been used to successfully differentiate hand region from the background which has substantially improved the accuracy of the automated system. Classification is done using the back propagation algorithm. Challenging task in this approach was to decide the block size of the HOG descriptor in order to improve the classification accuracy. The proposed system is efficient for all the 26 classes compared to state of art methods as it gives good training, validation, testing and overall accuracy. The overall accuracy achieved is 89.5% with 5184 input features and 50 hidden neurons. Using the deep learning approach; AlexNet, GoogleNet, VGG-16 and VGG-19 accuracies obtained are 99.11%, 95.84%, 98.42% and 99.11% respectively. This demonstrates that the deep learning approach is more accurate in predicting sign language gestures as compared to the machine learning based approach. In the future, the same technique can be used for word and sentence recognition which will improve the vocabulary of the students.

THANK YOU