Sign language recognition

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Abstract

Gesture-to-text translation systems have been developed to improve communication between hearing-impaired individuals and the general population. These systems capture and recognize hand gestures and convert them into text format. In this project, we propose a gesture-to-text translation system for Indian Sign Language (ISL) that recognizes ISL gestures and translates them into English text. Our system is based on computer vision techniques that process input from a video stream and recognize gestures using a machine learning-based classifier. We hope to achieve state of the art accuracies. The proposed system can be useful for improving communication between hearing-impaired individuals who use ISL and the general population.

1. Introduction

Sign language is a form of communication used by hearing-impaired individuals to communicate with others. However, communication can be challenging for hearing-impaired individuals, especially when communicating with those who do not know sign language.

People face significant challenges in their daily lives, such as limited access to education and employment opportunities, social exclusion, and difficulties in communication [4]. Due to their condition, they can only converse by using signs and gestures, which is further complicated by the diverse regional sign languages in India. Various communities utilize the following sign languages to exchange ideas and converse. There are two forms of ISL: manual and non-manual signs. Manual gestures include one-handed and two-handed signs, in which the hands of the signer are used to express information.

This project aim is to contribute to the ongoing research in this area by providing an ISL gesture to a text translator. For alphabet letters and numerals, a gesture recognition dataset was created. The attributes would be derived from segmented data by utilizing picture pre-processing and then the bag of visual words model, These alphabetic characters are mapped to photos using histograms. In the later part , such qualities will be classified using supervised machine learning models.

2. Related Work

Kulkarni A. et al. [2] intended to bridge the communication divide between individuals unable to speak and those unfamiliar with ISL. Their research was conducted in three categorical testing phases, which included inflection management testing, tense conversion testing, and stop word removal. The objective was to provide a practical and accessible solution for people who struggled to communicate due to speech or hearing impairments.

In 1998 and 1999, GrieveSmith developed SignSynth [3], which utilised the ASCII-Stokoe technique to describe signals. The result of translating ASCII-Stokoe into VRML (virtual reality modelling language) was displayed. Using appropriate transfer linguistic forms that satisfied both the input and output languages, any input phrase or conversation could be converted into a syntactically and semantically appropriate target language.

Mahesh M. et al. [5] offered an Android app that translated sign language into standard English, enabling mute and impaired individuals to communicate via mobile phones. The app captured a photo with the device's camera, processed it, and located an object within it.

Purva C. Badhe et al. [1] proposed a method in which embedded videos were collected, processed, and features were extracted from them for testing purposes. To detect motion, the researchers compared the resulting code vector to an existing codebook. The integrated output algorithm, 2D FFT Fourier feature output, and four-vector codebook LBG determined vector measurement methods. The programme was designed for ten users, with physical data consisting of ten numerals, twenty-six character letters, and ten unique sentences.

2.1. Dataset Used

We used Indian sign Language (ISL) dataset on kaggle.It has over 42000 images of hand gestures divided into 35 classes. 26 for english Alphabet characters(A-Z) and numbers (1-9).

Contributions
Tanmay Agrawal - Literature review , pre-processing
Pothula Akash - Dataset selection , feature extraction

2.2. Methodology

Pre-processing

The images were first converted from RGB to HSV Colour space. It is done as in case of irregular luminance, even normalized RGB doesn't work well. We want to seperate the foreground object i.e. the hand from the background so, that our pre processing is focused only on the area of interest. For that we created a mask (which has the colour of the skin tone)and biwise multiplied it with the original image. We applied morphological operations to remove any small noise. Then, we applied Canny edge detection to have only the edges of the hand.

Feature Extraction

We applied Scale invariant feature transform (SIFT) on the input edges , to detect the keypoints . We want the keypoints to be invariant of viewpoint,rotation and scaling. Going forward we will be using SURF (Speeded-Up Robust Features) as its speed is high and its more robust than SIFT.

Figure 1. Pre-processing

References

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