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Tamil sign language translation and recognition system for deaf-mute people using image processing techniques

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Abstract. This work concentrates on the device, which helps as a translation system for translating sign gestures into text. The disabled people, in particular, hearing and speech impaired people, are facing difficulties in society. Communication of disabled people becomes worse as the majority of ordinary people do not understand it. These disabled people face difficulty communicating with others; some have many problems communicating with others in sign language. It causes the communication gap between them where impaired people cannot share their views and skills with others. We headed to facilitate communication between the disabled people and the "Tamil sign language translator to solve this problem." Here, gestures are translated to Tamil language to find a localized solution. It processes 31 Tamil alphabets, 12 Vowels, 18 Consonants, and 1 Aayudha Ezhuthu. It is 32 combinations with five fingers points either up or down and mapped to decimal numbers. Here in this process, we need edge detection, which is accurately done and Processed by canny edge detection. In addition to this process, we have used two gesture recognition methods and training the input system through our mainframe algorithm called scale-invariant feature detection transform. We have developed this system, which is useful for deaf and dumb people for essential communication.

Keywords: sift, gesture recognition, sign language translator, tamil sign language, scale invariant.

1. Introduction

As the world population has been rising rapidly in today's world, there have been many measures we need to concentrate on some disability. Most ordinary people perform various gestures in daily life. These gestures have been involved in human life as it gives a perfect designation to human language through our body movements in particular hand gestures. The disabled people (speech impaired and hearing) troubles daily life while communicating with others. Some have some problems in even communicating with others in sign language. It causes a communication gap between them.

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A person with a disability cannot share their views and skills with others cluster is displayed as output, and the relevant audio file is played. The communication model for these people is language assign stands in the place where there is no appropriate language. Still, today sign language is predominantly used among deaf and dumb people. Based on the survey taken by the ministry of statistics and program implementations, the disabled persons constituted 2.21% total disabled population, particularly in Tamil Nadu we have statistics that 37.46 % disabled people are engaged, this states the communication gap with others in the cast of the inability in understanding the gestures in sign language in everyday life.

Tamil language translator aims to ease this communication gap face by a disabled person. As we move deeper into the interior part of the system, the pictures will be captured from the disabled persons as they give their inputs through hand gestures, and it led to being map with the alphabets, Tamil language that tends to display in a text form.

This work aims to bridge the communication gap faced by disabled people by developing an assistive system for disabled people to handle the communication gap. This method uses hand gestures that are done by fingers (right finger) have two possibilities, i.e., up/down. It is done using five fingers and provides total of 32 combinations. As the live image undergoes the edge detection process, SIFT scale-detection feature transform algorithm is done, which is applied for gesture recognition and system training. The phase includes data acquisition, scale-invariant feature prediction, edge detection, cluster identification, feature mapping, Model verification, Outlier detection, and test phase. After edge detection, we have implemented a feature where the pre-processed image is compared with training images' clusters.

2. Problem statement

People born with disabilities are those who become impaired at some of their life will experience many obstacles that can impact their individuals without disabilities. The main reason for this problem is because of the communication gap faced by them. The communication gap faced by disabled persons with others due to the inability to understand the gestures in sign language makes it difficult to lead an everyday life. It is a crucial issue faced by a disabled person in industrial organizations, educational institutions, and today's life. This device can create a working method of understanding impaired people directly to ordinary people. It is possible to keep this device in many areas such as Banks, Hospitals, Educational Institutions, Industrial Organizations, ticket booking counters, and many more places where people flow through to meet their daily needs. The development's main objective is to seek the communication difference between the disabled people by creating a hand gesture. By analyzing sensors that map the input gestures and transforms into a respective processed final image, which can easily understand by ordinary people without further research of their disabled language, this makes a lot easier for both the disabled and everyday people. The existed systematic application uses these techniques utilizes binary images of gestures. Fingers are used as the gesturing images, which helps map to 31 alphabets, 12 vowels in the Tamil language. The motion by disabled people is detected by edge detection called canny edge detection algorithm. The live feed of the signer's gesture will be captured by the webcam and fed to the system. The live image undergoes an edge detection process.

3. Related work

Various literature states that multiple techniques are anticipated to perform gesture recognition and help disabled people reduce communication gaps. Sriparmasaha et al. [1] expects an approach for gesture recognition with sign language applications using AVL tree and sum, and works in computing theory and been practicing the applications, 2013. AI approaches are developed with unknown gesture recognition using AVL trees as features. The author used 12 gesture recognition gives an accuracy of 88.3%. But responding compels joints in balanced binary tree form for each node involved in the binary computation.

Suraksha Devi et al. [2] modeled low-cost glove for translating sign gestures to text and speech for the Hindi language. It is developed with customized equipment with sensors. It is placed on fingers and

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thumb. As an outcome, the appropriate and precise recognition gesture is provided with lesser time. Moreover, the use of the sensor leads to wear and tear problems. Here, hand gestures are captured with a digital glove, converted to text/speech. MihaiGavrilescu et al. [3] predict the human motions from video by providing mutual context over hand movement and body position.

Saba Jadooki et al. [4] anticipates a fused feature mining for blind human communication and depth-based hand gesture recognition. Feature extraction and classification are expected to haul out certain appropriate features of images. The hand is partitioned from the data. An ANN classifier is trained with elements and performs critical analysis with diverse description performance. The depth-based data is exceptionally healthy to specific problems like orientation and position of illumination and hand. S.Jothialakshmi et al. [5] anticipated a novel dynamic sign language recognition system that formulated a vision-based approach with 2D discrete sine transform for compression and self-organizing pattern recognition purpose. The anticipated model gives 91% accuracy. The expected model predicts dynamic gestures. Rajat Sharma et al. [6] anticipate communication devices for differently-abled persons over the prototype model for a machine to transmit a message from the input format to another perform with or without a disability. These persons can receive notifications with an output format. It is significantly easier for further use.

Pramod B. et al. [7] designed a system composed of two modules. Initially, Indian sign language gestures from drawing for real-time video and mapping the human-understandable speech. Next, NL is inputted with the animated gestures where the text processing is done with speech inter-conversion using google text to address. P.Rajith et al. [8] anticipated the Tamil sign language prediction for disabled people. The static system uses pre-processing with grey conversion, filtering, and reduction of black and white conversion. SVM is used for classification and offers better results with lesser computation time for more massive datasets. V.Padmanabhan et al. [9] anticipated a novel gesture and voice conversion system with a prototype model with an artificial mouth based motion sensor. The template database is provided to the microcontroller and motion sensor, which is fixed in hand. The system output is measured in the speaker. Also, the system composed of text to speech conversion block, which interprets matched gestures. Solanikikrunal et al. [10] has made the microcontroller-based sign language glove has presented a prototype of an electronic device for the people who suffer from speech impairment and paralyzed patients.on analyzing techniques are anticipated with the use of edge detection techniques[11]. An appropriate feature identification process is essential to enhance the gesture recognition performance substantially with feature enhancements [12,13].

4. Research methodology

Checking for the image which has been inputted and ready for processing using many algorithms, this redeem process is termed image processing. Here we use many mathematical operations such as sift scale-invariant feature transform by any form of signal processing. The input image gathers a series of mages, videos, frames of video and photography and involves identification and verification[14]. Figure 1 shows the flow of input image processing.In some cases, the objects from the camera are not processed appropriately. However, it is pre-processed to improve the image based on a specific task. As the images are provided based on 2D, digital image processing is modeled in the multi-dimensional system form.

4.1. Edge detection

The edges which discontinue formed by the object boundaries color discontinues, lining distributes, sharp. Here the camera operations will be used with the color calibration, noise reduction, brightness, and contrast enhancement, at last with the geometric calibration. The location parts mention the matching, which involves correlation pattern matching, geometric pattern matching. Most measurement technique reign on edge detection algorithm, which is Original image.

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4.2. Binary image

Histogram involves pixel count, pixel value, intensity. The edge image, which is high-level contrast, analyses the grey level of the image, and the base of this identifies the shape and measures distances, calculates the geometry.

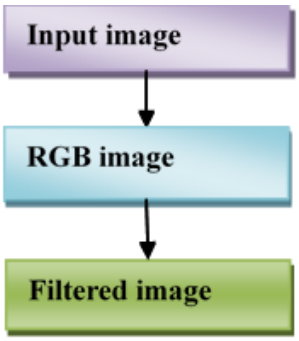

Figure 1. Architecture workflow of the system.

4.3. Canny edge detection

It filters the edge so that if there is any noise edge. It detects not all the edges, but it usually filters is using standard deviation sigma.These also compute the gradient in the x &y axis; if these are two filters, may be in x&y axis, you will get the gradient magnitude and direction. There will be a lot of edges standing nearby.

4.4. Non-maximum subtraction

It is used to make sure that the edge is fragile and not thick. If the gradient magnitude is more than the two points at the border, we point inside will be detected at a particular moment as the edge and convey those two specification points.

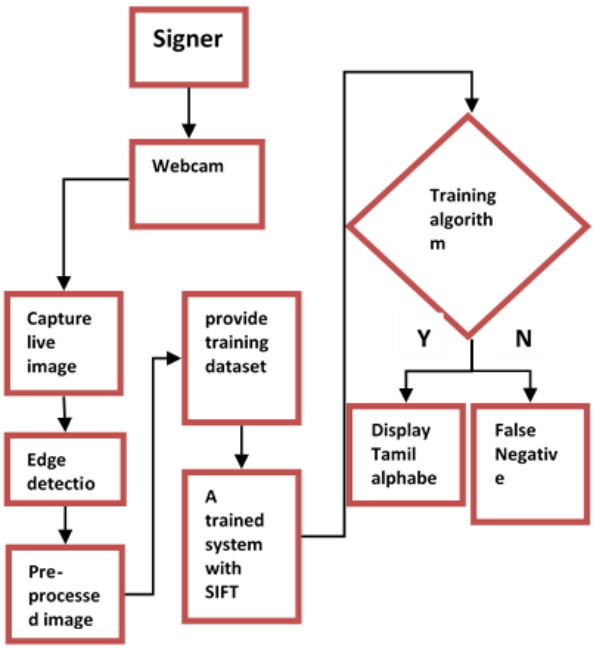

Figure 2. Framework of the system.

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4.5. Image acquisition

The transformation of an image into a device as a whole is a processed one.

4.6. Hysteresis thresholding

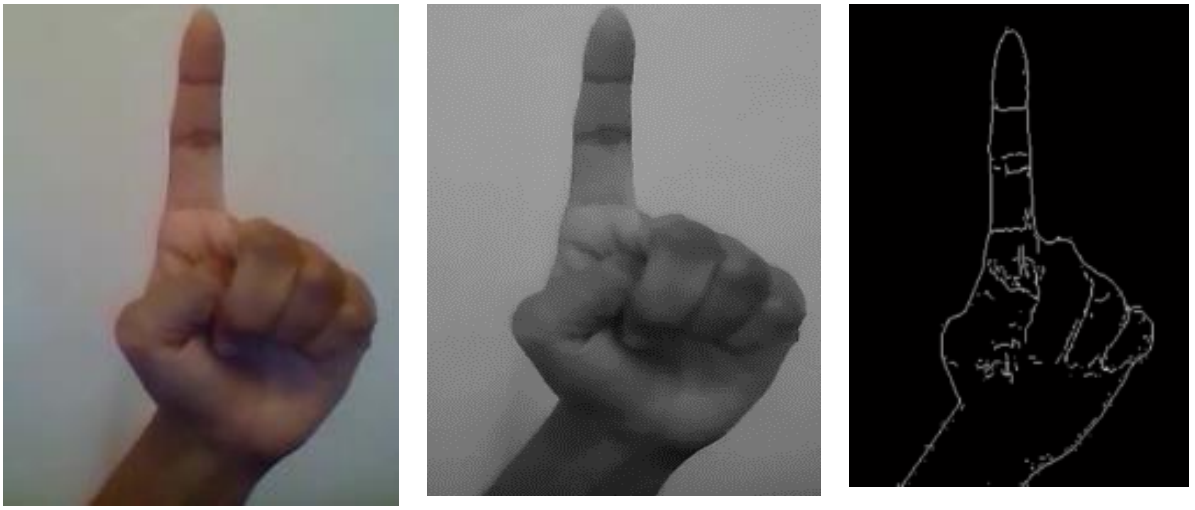
Thresholding says start detecting an edge detecting from the point more significant than the high threshold and go on seeing the edge. You will lead to reaching the low threshold, and it stops once if there is any point below the low threshold that will be omitted, and it will not be present after edge detection. Image enhancement is Processing the image without any damage to the image with a satisfactory resolution with good quality as represented in Figure 2. Image restoration is Bringing the noisy image back to the original that is a familiar image. Some more processes need to be added, such as segmentation, which is grouping and classification. Next, object recognition, which is photography and scanning.

4.7. Scalar interference feature transform

It is one type of transform which is used in the application for scaling of an image. It helps detect the corners, circles, and some blobs. Let us discuss scaling details, where the original input image is double up with 4 pixels and 4 pixels [2 pixels and 2 pixels]. The scaled image will be recognized and termed as filling nearby areas with duplicating the known colors. It can also be said as nearest-neighbor interpolation. Some will also prefer the other linear one, which works both in horizontal and vertical, too, named bi-linear interpolation.

5. Numerical results and discussion

A proper edge detection is needed which plays a significant role in mapping the inputted image to extract output from it. There have been some cases where we had a quiet lack of slowing down our processing rate, so we need to build it up to perform an efficient one. Features are modest standard, where it paved an excellent path, but the camera act as a significant terminator, which gave quiet trouble in capturing a good and clear original image. When we had wide thought about the images that the user input, these need to be edge detected, so we chose canny edge detection in finding proper edge detection. Here in our experiment, all the features are interrelated to make this excellent structure of a device for humanity's welfare and development. . Figure 3 depicts the image conversion from input image to greyscale and greyscale to the filtered image. Figure 4 shows the Tamil language translation process. The Machine learning based algorithms.



(a) Input image (b) Greyscale image (c) filtered image

Figure 3. Image conversion.

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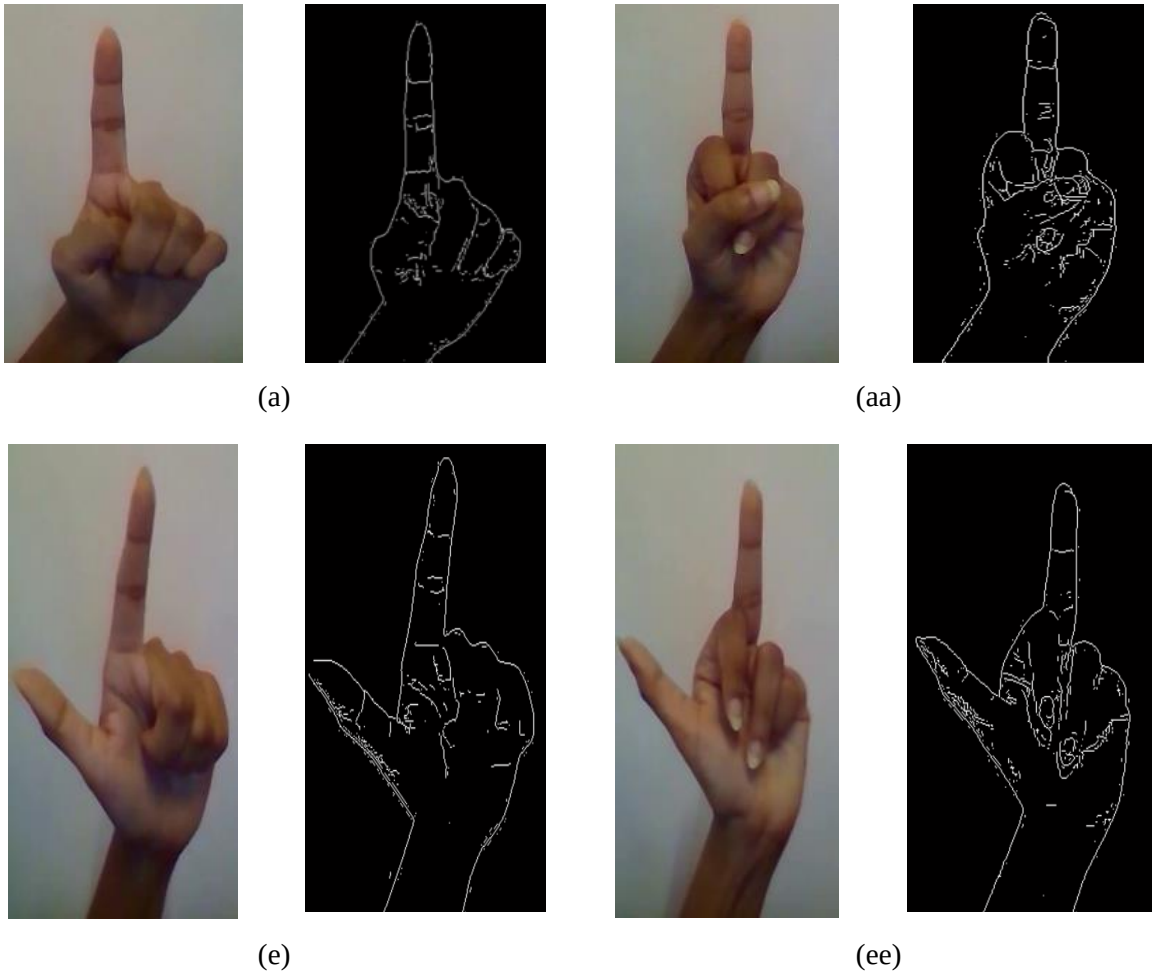

Figure 4. Tamil language translation process.

6. Conclusion

In this work, the translator gestures are made of predicted, and Tamil letters are displayed. Gesture identification and training are performed using the SIFT algorithm. This research aims to model static Tamil sign language prediction for dumb and deaf people. The anticipated model is executed for the Tamil alphabets; however, this model is generalized for regional languages where appropriate gestures are provided in 32 finger combination. In the future, the experimentation is carried out to play an audio file based on Tamil words, and the performance of the classification technique will be analyzed. And also machine learning based classification of symbols increase more efficiency of translation.

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