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Survey on Desktop Handling Using ASL

Yuvraj Rane [1], Gitesh Sagvekar[1], Rohit Parab [1]

U.G. Student, Department of Information Technology, Finolex academy of Management and Technology, Ratnagiri, Maharashtra, India[1]

ABSTRACT: This paper focuses on the achievement of effective human–computer interaction using only webcam by continuous locating and recognizing the hand region. American Sign Language is a universal sign language used by the people with Hearing and Speech Disabilities For communication in their daily activities. It is completely vision-based communication language through its native grammar, be unlike fundamentally from that of oral languages. In this research paper, presented an optimal approach, whose major objective is to accomplish the translation of 26 static signing alphabets into machine readable format through which computer can classify hand gestures for specific task which are predefined in a dataset. Pre-processing operations of the signed input gesture are wiped out the primary phase. In the next phase, the varied region properties of pre-processed gesture image is computed. In the final phase, supported the properties calculated of earlier phase, the transliteration of signed gesture into text has been administered.

KEYWORDS:ASL, Sign Language Character Recognition, Convolution Neural Network, Computer Vision, Machine Learning

I. INTRODUCTION

Desktop handling using American Sign Language is an important research problem for enabling communication with people having hearing and speech disabilities. This project introduces an efficient and probably most correct algorithm for identification of a gesture representing an alphabet of the American Sign Language. The project uses image processing system to identify, especially American Sign Language used by the deaf people to communicate. The basic objective of this project is to develop a computer based intelligent system that will enable people significantly to communicate with computer system using their natural hand gestures and perform general tasks such as starting the PC, opening any file, turning off the PC. The idea consisted of designing and building up an intelligent system using image processing, machine learning and artificial intelligence concepts to take visual inputs of sign language's hand gestures and take appropriate command assigned to that input. Hence the objective of this project is to develop an intelligent system which can act as a communicator between the people and the computer system and can make the communication both effective and efficient. The objective can be further elaborated to perform electronic devices functionalities.

II. LITERATURE SURVEY

Our project desktop handling using ASL is based on hand gesture detection and classification. This literature survey gives an overview of different architectural approaches used to build hand gesture application.

At present, the research direction of gesture recognition can be mainly divided into the following aspects.

- Gesture recognitionbased on wearable devices

Gesture recognition methods based on wearable devices are robust and accurate. It uses data gloves and sensors fixed on the hand to collect the data about position and orientation of hand. At present, common equipment includes data gloves, surface img signals, acceleration sensors and gyroscopes, etc.

In this approach the overall accuracy and speed of detected hand gesture is more and accurate due to use of hardware. But this method is quite expensive to implement as not user friendly as well.

- Vision-based gesture recognition:

The vision-based gesture recognition technology uses the camera to collect hand gesture information. It combines image processing technology to complete the process of segmentation, modeling, matching and recognition in order to detect a specific hand gesture.

A.pradhan [1] used camera and computer vision-based approach for hand gesture recognition. He uses image segmentation and feature extraction to detect hand gesture captured through camera. Project was developed in c++

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which supports opencv platform for image processing. The convex full and convexity defects algorithms from opencv library were used. Region between fingers causes convexity defect. These defects were used to count the no. Of fingers in the hand gesture. Point start represents start of contour where the convexity defect begins. Point end represents point of contour where the convexity defect ends. Point far represents point within the defect which is farthest from the convex hull. Distance between the convex hull is considered as depth. These points are used to determine a specific hand gesture. This approach is currently under development for its use in desktop handling.

Bhame [2] used hand gesture recognition (hgr) algorithm and sobel algorithm to capture hand gesture image using webcam. The project used 12-megapixel iball c12 webcam for capturing a rgb image. The image was then reduced to lower size to increase speed of the computation. Image preprocessing consists of hand segmentation by mapping in ycbcr color space into ycbcr color plane various possible ways of segmentation using different color spaces and models. Further, sobel's algorithm is used to extract region of interest. It finds the edge where gradient input binary image is maximum. The method assumes stationary background for getting good segmentation results. This approach is autonomous and easy to use.

A vision-based system to control various mouse activities such as left and right clicking using hand gestures to make the interaction more efficient and reliable is proposed. This paper delineates a vision-based interface for regulating a computer mouse via 2d hand gestures. Hand gestures rely upon camera-based color detection technique. This method mainly focuses on the use of a web camera to develop a virtual hci device in a cost-effective manner. Centroid of each input image is found. Hand movement also moves the centroid thus making it the principle of sensing for the alteration of cursor on computer screen. The hand image is treated here as the parent image. The left and right click functions of a mouse are implemented by folding the first and middle fingers of hand respectively and develop a baby image. So, by comparing the length of fingers in baby images with those in mother image gives an idea about the functionality performed by the hand gesture. When the length of finger crossovers the threshold length in baby image, it executes a clicking operation. Here, the efficiency of tracking the hand is improved by using red and blue colored caps on the fingers to make centroid looking more prominent.

This approach mainly falls under domain of computer vision and image processing. It does not require any special hardware as that of previous approach. Also, the detection and classification are quite simple.

Due to relatively low need of equipment, a lot of related researches have been made on this approach. However, this approach also has some drawbacks. The accuracy of the hand gesture detection greatly depends on the environment of the user. That is how the gesture is captured in camera and in angle of capture.

- Gesture recognition based on soft computing:

This is one of the recent approaches that has been used in hand gesture detection. It mainly consists of the approaches such as neural networks.

An artificial neural network is made of many highly interconnected processing elements, which are working in together to solve specific problems such as classification and pattern matching. The use of artificial neural network in hand gesture detection systems uses large datasets and trained models based on this data sets to classify this image.

Masood, sarfaraz & thuwal, harish & srivastava, adhyan.[3] used image augmentation and resizing to create training and testing dataset. It used image preprocessing and vgg16 model to create image classifier. Vgg16 is a deep convolutional neural network model proposed by k. Simonyan and a. Zisserman. This approach resulted in average accuracy of 95.54 percent.

Virendar ranga, nikita yadav, pulkit garg [4] used hybrid dwt-gabor filter to extract hand image from the captured image. The dwt is applied to hand signs to obtain the high-frequency components. Gabor filters are used for edge detection as they give the highest response at points where the texture changes. Four different classification models were used which were svm, knn, random forest and cnn. The highest accuracy of 97% was achieved using cnn model.

Du jiang, gongfa li1, ying sun, jianyi kong, bo tao[5] used joint bilateral filtering to extract the region of interest for the dataset. It is an improved algorithm of gaussian filtering. Along with that depth image denoising method was used to retain the edges in images. Near similar area filling algorithm was used to enhance the images for training on the dataset. Convolutional neural network approach was used to train image classifier model. Error back propagation algorithm and support vector machine to enhance the accuracy of model trained. The model was trained for 8 gestures. Results showed that in semi-supervised case, the eight types of gesture recognition the recognition rate is up to 98.52%.

Raimundo f. Pinto, carlos d. B. Borges, antônio m. A. Almeida and iális c. Paula [6] used morphological operations such as contour extraction and polygon approximation for extraction of region of interest(roi), hand gesture in this case. The model was trained on convolutional neural network using back propagation. 4 different cnn models were used with

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different no. Of convolution layer and pooling layer. Cnn1 model with 2 convolution layers and 2 pooling layers resulted with 94.7% accuracy. Cnn2, cnn3, cnn4 with 4, 7 and 9 convolution layers showed accuracy over 96%.

OYEDOTUN, OYEBADE&KHASHMAN, ADNAN [7] USED DEEP LEARNING-BASED NETWORKS SUCH AS CONVOLUTIONAL NEURAL NETWORK (CNN) AND STACKED DENOISING AUTOENCODER (SDAE). THE IMAGES USED IN TRAINING SET WERE HAND GESTURE CAPTURED WITH UNIFORM DARK BACKGROUND. THE HAND SEGMENTATION ALGORITHM WAS APPLIED ON REDUCED SIZE GRAYSCALE IMAGES TO EXTRACT REGION OF INTEREST. THE HAND SEGMENTATION ALGORITHM TRACKS THE BOUNDARY OF THE WHITE PIXELS IN THE CNN1, CNN2, CNN3 HAD 2, 3 AND 4 HIDDEN LAYERS RESPECTIVELY. ALL THE THREE MODELS SHOWED 98.13%, 96.32%, 93.54% RECOGNITION RATE FOR SAMPLES OF HAND GESTURES THAT ARE NOT PART OF THE TRAINING DATA ARE USED TO TEST THE NETWORKS

Author	Approach	Technologies Based	Highest Accuracy
[1]	Computer vision based	convex full convexity defects algorithms OpenCV C++	
[2]	Computer vision based	Hand gesture recognition algorithm Sobel's algorithm	94.9%
[3]	Neural networks	Image augmentation VGG16 image classifying algorithm	95.54%
[4]	Machine learning	Hybrid DWT-Gabor filter SVM KNN Random Forest CNN	97%
[5]	Neural Networks	Joint bilateral filtering Convolution neural network	98.52%
[6]	Neural Networks	Contour extraction Polygon extraction Multiple CNN models with different depth of layers	96%
[7]	Neural Networks	hand segmentation algorithm Gray scaling Convolutional neural networks Stacked denoising encoders	98.13%

III. MOTIVATION

Communication is one of the basic requirements for survival in society. Deaf people communicate among themselves using sign language but when it comes to desktop handling, it becomes difficult to them. Also, amid this COVID-19 pandemic everyone is trying to do contactless interaction. Our project aims at taking the basic step in bridging the communication gap between deaf people and Computer System using American sign language. Effective extension of this project to words and common expressions may not only make the deaf people communicate faster and easier with computers, but also provide a boost in developing autonomous systems for understanding and aiding them.

IV. CONCLUSION

Desktop Handling using ASL as the study found out will be helpful to deaf people in assisting them to interact with computers. The achievement of effective human–computer interaction using hand gesture recognition is the main focus of our study. Hand detection, tracking, and gesture recognition are the three main components of our proposed system

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