Hand Sign Language Detection Using Machine Learning

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Abstract: *Millions of people around the world suffer from hearing disability. This large number demonstrates the importance of developing a sign language recognition system converting sign language to text for sign language to become clearer to understand without a translator. CNN Algorithm is proposed based on Sign Language. Sign Language may be a language within which we tend to create use of hand movements and gestures to communicate with other people who are chiefly deaf and dumb.*

Keywords: Convolutional Neural Network, Sign Language, Machine Learning, Alphabet Predictions

I. INTRODUCTION

Machine learning is an application of artificial intelligence (AI) that provides systems the ability to automatically learn and improve from experience without being explicitly programmed. Machine learning focuses on the development of computer programs that can access data and use it learn for themselves. The Gestural Channel can be integrated in the Human Computer Interaction by promoting an active research in the gesture recognition field. The human gesture recognition concept comes under the general framework of pattern recognition. The system in this framework consists of two processes as Representation and Decision Processes. The representation process converts the raw numerical data into a form adapted to the decision process which has the capability to further classification of the data. The acquisition process and the interpretation process are two more processes which come under Gesture Recognition System. These processes convert the physical gestures into numerical data and give a meaning of the symbol series respectively. Any random hand gesture consists of four elements as hand configuration, movement, orientation and location. These gestures are further classified as static gestures and dynamic gestures. Over 5percent of the world population, which means 360 million people, including 32 million children and 328 million adults, has hearing disability according to World Health Organization (WHO) statistics. Hearing impaired people generally use sign languages for communicating with other people. But mostly hearing people do not know sign language. When considering large number of people who suffer from hearing disability, it is revealed how important providing them opportunity to communicate with hearing people who do not have knowledge of sign language a need to develop such a sign language recognition system arises day by day. The important key points of such a sign language system are reducing cost and obtaining more accurate rate efficiently. Developing a sign language system based on machine learning for automatically recognition sign language and converting sign language to text helps hearing people to communicate and understand hearing impaired people. The proposed system uses the images in the local system or the frame captured from webcam camera as input. Processed input image is given to the classifiers which use Convolution Neural Network Algorithm. It classifies the image and converts into model. Finally the predicted result is produced.

II. LITERATURE SURVEY

Salih Ertug Ovur, Xuanyi Zhou and, Wen Qi , "A novel autonomous learning framework to enhance sEMG-based hand gesture recognition using depth information", Science Direct 2021

1. A novel autonomous learning framework was presented to integrate the benefits of both depth vision and EMG signals.
2. Combination of depth information and sEMG with HSOM and MNN adopted to achieve better accuracy for the designed VR application.

3. A hand gesture recognition demonstration was implemented to verify the effectiveness of the proposed framework.

Salih Ertug Ovur, Xuanyi Zhou and , Wen Qi , "Multi-Features Capacitive Hand Gesture Recognition Sensor: A Machine Learning Approach", IEEE Sensors Journal 2021

1. Best Results other than using the sensor for hand gesture recognition
2. Error Correction Output Code Support Vector Machines (ECOC-SVM) and K -Nearest Neighbour (KNN) classifiers
3. Sensors were used to captures finger capacitance values
4. Achieved a classification rate of 97

N. Gopinath, J. Anuja, S. Anusha, V. Monisha, "A Survey on Hand Gesture Recognition Using Machine Learning", International Research Journal of Engineering and Technology 2020

1. Provides two-way communication which helps to interact between the impaired people to normal people without any difficulties
2. Used CNN algorithm techniques for hand gesture recognition
3. NLP was used to feed the data 4. Best Results other than using the sensor for hand gesture recognition

Rupesh Prajapati, Vedant Pandey, Nupur Jamindar, Neeraj Yadav, "Hand Gesture Recognition and Voice Conversion for Deaf and Dumb", International Research Journal of Engineering and Technology 2018

1. K nearest neighbors from the training data. The distance is calculated using n Euclidean Distance.
2. Support Vector Machine" (SVM) a supervised machine learning algorithm was used for both classification and regression challenges
3. Obtained Accuracy 90

Omkar Vedak, Prasad Zavre, Abhijeet Todkar, Manoj Patil, "Sign Language Interpreter using Image Processing and Machine Learning", International Research Journal of Engineering and Technology 2019

1. 6000 images Database used of English alphabets
2. 4800 used for training and 1200 for testing
3. Dataset consisted of 26 signs
4. SVM techniques used for classification 5. Obtained Accuracy around 88
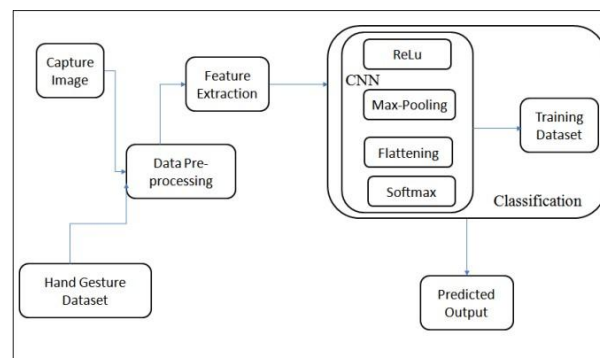
III. PROPOSED SYSTEM

Figure: System Architecture

- The image data were collected from kaggle.
- The collected dataset is divided into 2 parts. i.e :- 80percent fro training and 20percent for testing • Various Techniques like preprocessing , feature extraction are applied
- CNN was used for classification
- Web application is been developed using php and bootstrap for frontend and Python for backend.
- The user captured image is passed and captured images feature are extracted.
- Extracted Features will be matched with the trained model, depending on nearby match the predicted output is been obtained
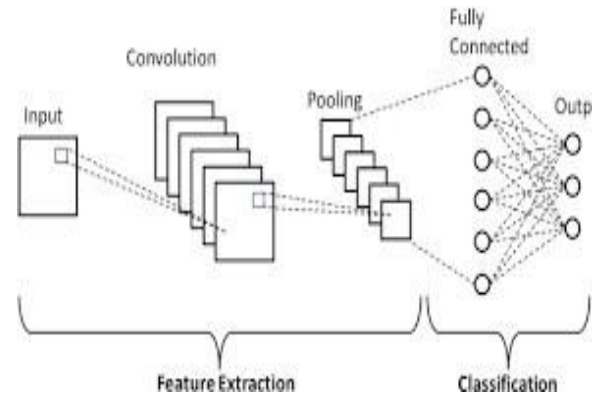
A CNN is made up of four parts.

- Convolution
- Non-Linearity (ReLU)
- Pooling or Sub Sampling
- Fully Connected Layer

Non-Linearity (ReLU)

The output is subjected to an activation function at the end of the convolution operation to allow for non-linearity. The Relu is the most used activation function for convnet. All pixels with a negative value will be replaced with a value of zero.

Pooling Layer

The goal of pooling is to minimize the input image's dimensionality. The procedures are taken to lower the operation's computing complexity. The network has fewer weights to compute as a result of reducing dimensionality, which minimizes overfitting. You must define the size and stride at this point. The maximum value of the feature map is a common approach to pool the input image. Take a look at the image below. The "pooling" function will screen a four-submatrix of the 44-feature map and return the highest value. The pooling algorithm takes the greatest value of a 22 array and moves it two pixels.

Fully Connected Layer

As in the previous course, the final stage is to construct a typical artificial neural network. All neurons from the previous layer are connected to the following layer. To classify the number on the input image, you utilize a softmax activation function.

Convolution

In the proposed framework this technology Hand Gesture can be recognized with the CNN algorithm will provide us the best result.The Hand Gesture Recognition will provide a two-way communication which helps to interact between the impaired people to normal people without any difficulties by recognizing the alphabets or number the person wants to say.Hence the implementation system can translate Sign Language and predict character and numbers.

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