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Sign Language Recognition using Deep Learning

Prof. S. R. Pandit[1], Mr. Jayesh Pawar, Mr. Rohit Pawar,
Ms. Priyanka Pote, Mr. Vishal Sangale
Professor, Department of Computer Engineering[1]
Students, Department of Computer Engineering [2,3,4,5]
Amrutvahini College of Engineering, Sangamner, Maharashtra, India

Abstract: *Most dumb and deaf (hard of hearing) people use sign language to communicate both inside and outside of their groups. They utilize hand gestures to communicate because they are mute and deaf. Sign Language Recognition (SLR) objective is to recognize and learn hand signals and to keep going until the corresponding hand movements can be translated into text or speech. We have utilized computer vision to recognize hand motions by creating Deep Neural Network Designs Using Con- volution Neural Network Architectures, where the model will learn to recognize the hand gesture photographs throughout an epoch. A text file in the English Language is created once the motion has been correctly recognized by the model and may then be converted to voice. The main Motive of the Project is to make Deaf and Dump people's communication easier.Deaf (hard of hearing) and stupid individuals mostly utilise sign language to communicate inside and outside of their respective communities. Because they are unable to speak or hear, they use hand signals to communicate. The goal of sign language recognition (SLR) is to identify acquired hand motions and to continue until related hand gestures are translated into text or speech. Building Deep Neural Network designs (Convolution Neural Network Architectures), where the model will learn to recognise the hand gesture photos throughout an epoch, allows us to use computer vision to recognise the hand motions.*

Keywords: Gesture recognition, Sign language recognition, Hand pose estimation, Sign language translation, Machine Learning

I. INTRODUCTION

A completely complex language that uses facial emotions along with hand and arm movements to create signals, sign language is based on computer vision. People with poor hearing or no hearing use this natural language to communicate. Using vari- ous hand gestures, sign language can be used to convey letters, words, or sentences. Hearing-impaired people can communicate their opinions more easily with this form of communication, which also helps to close the communication gap between them and others. Since ancient times, people have adapted to using sign language for communication. The history of hand gestures predates that of human civilization. Particularly help- ful for communicating any word or emotion are hand signs. Therefore, despite the development of writing conventions, people constantly communicate by hand ges- tures all across the world.[1] The Deaf utilize signs that resemble spoken language in terms of internal structure. The signs of SLs are formed using a finite number of ges- tural elements, just as hundreds of thousands of English words are produced using a limited number of different sounds. Thus, signs are not complete movements but can be broken down into various linguistically relevant components. SLs are made up of the following indivisible features, just as spoken languages:

Features of the hand, such as shape, location, and movement of the way the palm or fingers are positioned, and Eye gazing, head nods and shakes, shoulder orientations, and different types of facial expressions like mouthing and mouth movements are non-manual features.

The majority of deep learning-based sign language recognition research is conducted on sign languages other than Indian Sign Language. Recently, research professionals have been more interested in this field. Machine learning techniques are the basic foundation of the earliest known work on sign language recognition. As these algo- rithms do not automatically extract features, the accuracy is low. Automatic feature engineering is the primary objective of deep learning techniques.[1] To recognize sign language, the idea behind this is to automatically learn a set of features from unprocessed input. By automatically learning as a set of features, it avoids the tedious effort of handcrafted feature engineering.

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Research Motivation

The motivation behind this work is the possibility of reducing the communication barrier which exists between the deaf and hearing communities. For those who are Deaf and Mute, or those who cannot hear and communicate for them sign language is crucial. It becomes crucial for people to comprehend their language because it is the only means of communication for these individuals. In contrast, the National Association of the Deaf in India believes that there are 18 million deaf people in the country or around 1% of the total population. There is a need for a system since those with speech impairment and those who are deaf require a proper channel to communicate with everyday people. Not everyone who can read lips can understand the sign language of the disabled. Thus, our project aims to translate sign language motions into text that normal people can understand.

II. LITERATURE SURVEY

Cheok et al.[2] have proposed that Recognition of hand gestures can be achieved by using either a vision based or sensor based approaches. Vision based and sensor based approaches are successfully recognize the hand gestures. This paper provides a thorough review of state of the art techniques used in recent hand gesture and sign language recognition research.

Pigou et al.[3] have proposed Sign Language Recognition Convolutional Neural Network are used using deep learning. This paper shows that convolutional neural networks can be used to accurately recognize different signs of a sign language, with users and surroundings not included in the training set.

Wadhawan et al.[4] have Written Literature findings of this paper indicate that the major research on sign language recognition has been performed on static, isolated and single handed signs using camera. Overall, it will be hoped that the study may provide readers and researchers a road map to guide future research and facilitate knowledge accumulation and creation into the field of sign language recognition.

Adaloglou et al.[5] have proposed in-depth analysis of the most characteristic DNN- based SLR model architectures was conducted. Through extensive experiments in three publicly available datasets, a comparative evaluation of the most representative SLR architectures was presented

Rastgoo et al.[6] have proposed Real-time isolated hand sign language recognition system. Paper proposed a low-complex model benefiting from the combination of deep learning models and the singular value decomposition (SVD) method for real time Isolated Hand Sign Language Recognition (IHSLR) from RGB video.

III. PROPOSED SYSTEM

A CNN model is used to extract features from frames and predict hand gestures. It is a multilayer feedforward neural network primarily used in image recognition. The CNN's architecture consists of several convolutional layers, each consisting of a pooling layer, an activation function, and an optional batch normalization.[8] It also has a set of fully connected layers. As one of the images moves over the network, it is scaled down. This happens as a result of max pooling. The final layer provides predictions of class probabilities and gives output in the form of text.[8]CNNs are widely used for satellite image identification, medical image processing, time series forecasting, and anomaly detection.CNN has several layers to process and extract features from data:

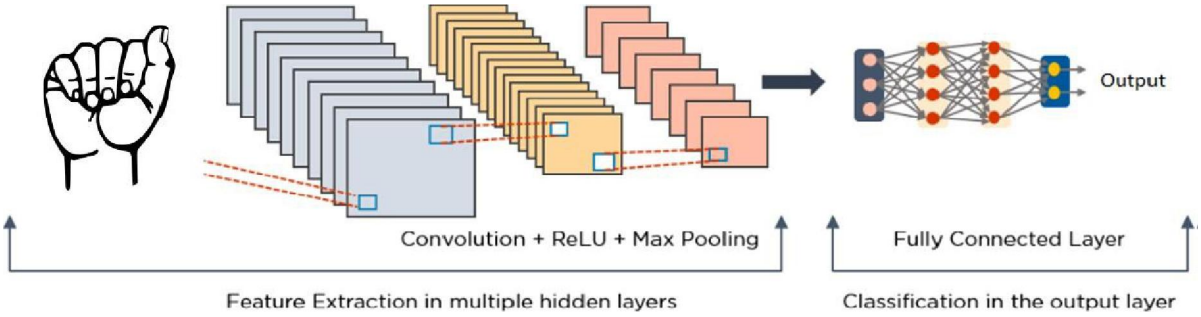

Fig- CNN Architecture

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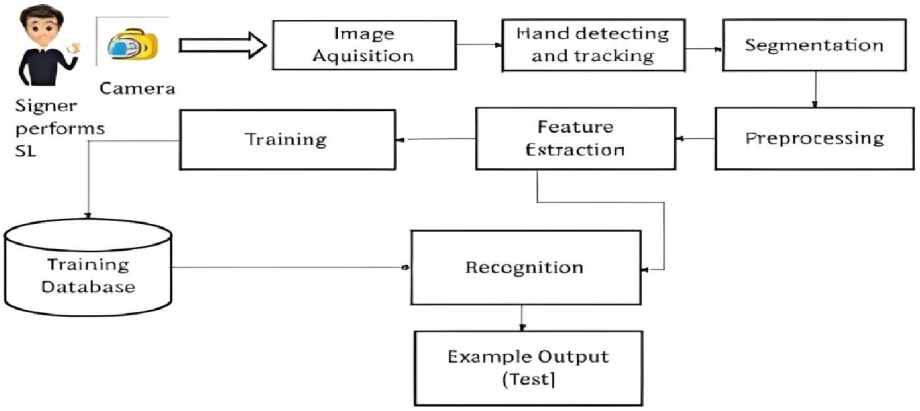

Fig-System Architecture

Analysis Models: SDLC Model to be applied

The first process model to be used is the waterfall model. The linear sequential life cycle model is another name for this. Very simple to use and understand. The waterfall paradigm demands that each phase be finished in its entirety before moving on to the next.[7] This kind of architecture is widely utilized for short projects with clear requirements. We evaluate the project's direction at the conclusion of each phase to determine whether to move forward or terminate. In this strategy, testing doesn't start until development is finished.

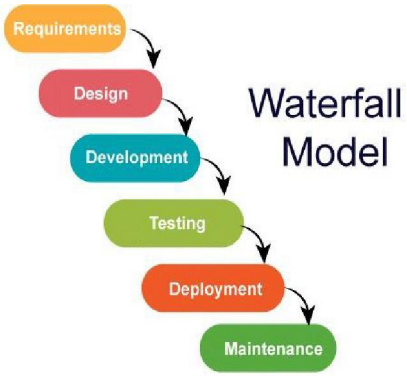

Fig-Waterfall Model

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Fig –Timeline Chart

3.1 Advantages

- The purpose of Sign Language Recognition (SLR) systems is to provide an ef- ficient and accurate way to translate sign language into text aids for the hearing impaired.
- Sign language brings many benefits to all children, regardless of whether they are deaf or hard of hearing. In addition to helping children communicate and express themselves fully, it also improves their social skills by increasing their confidence and self-esteem.

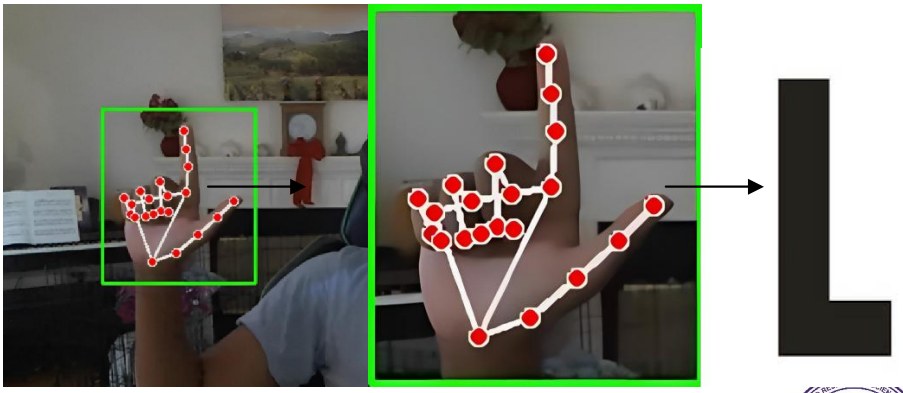
3.2 Disadvantages

- There are some signs that look a little similar which is one of the limitations of this system in recognizing the appropriate alphabet.
- Since there are similar-looking gestures for alphabets like (E, F), (U, V, W), (M, N) they are misclassified the greatest number of times.

3.3 Applications

- This system is useful in recognizing the different signs which are called sign language. It is the only mode of communication for such people to convey their message and it becomes very important for people to understand their language.
- CNN model is used to extract features from the frames and to predict hand gestures.

IV. RESULT AND ANALYSIS



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V. CONCLUSION

Sign language recognition (SLR) system takes an input expression from the hearing impaired person gives output to the normal person in the form text. Implement sign language recognition using concepts from deep learning and image processing. After our application is implemented, it will be a real-time hand gesture identification system and thus will benefit NGOs and various organizations involved with people with special needs. System response time can also be reduced with better camera and graphics support.

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