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Study And Analysis On Recognition Of Sign Language

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Abstract:
The project's goal is to create a machine learning model that can classify the numerous sign language hand movements used for spelling. Classification on machine learning methods are taught on a set of image data in this user-independent model, and testing is done on an entirely other set of data. Because the pre-processing time was less when depth photographs were used for the image dataset, they produced better results than some of the earlier work. The datasets are subjected to the application of numerous machine learning methods, including convolution neural network (CNN). The CNN model is pre-trained on the image net dataset in an effort to improve its accuracy. However, just a tiny dataset was employed for pre-training, which resulted in a 15% training accuracy. This is a suggestion for a system that can recognize sign language dynamically. Through this technology, the end user will be able to learn and comprehend sign language. For optical character recognition, which can identify both printed and handwritten characters, machine learning has been extensively applied. We have developed a wide variety of classification, prediction, and identification systems using the supervised learning principles.

Key Word*: convolution neural network (CNN), Tensor flow, Sign Language (SL), SciPy, Support Vector Machine (SVM), Principal Component Analysis (PCA) and Linear Discriminant Analysis (LDA).*

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I. Introduction

Deaf (hard hearing) and dumb people use Sign Language (SL) as their primary means to express their ideas and thoughts with their own community and with other people with hand and body gestures. It has its own vocabulary, meaning, and syntax which is different from the spoken language or written language. Spoken language is a language produced by articulate sounds mapped against specific words and grammatical combinations to convey meaningful messages. Sign language uses visual hand and body gestures to convert meaningful messages. There are somewhere between 138 and 300 different types of Sign Language used around globally today. In India, there are only about 250 certified sign language interpreters for a deaf population of around 7 million.

This would be a problem to teach sign language to the deaf and dumb people as there is a limited number of sign language interpreter's exits today. Sign Language Recognition is an attempt to recognize these hand gestures and convert them to the corresponding text or speech. Sign Language (SL) is not commonly learned by non - mute people, thus, mute people have problems communicating. Usually, people do not learn it if there is no mute person in their relation circles or if it is not required for their job. When they engage with a mute person the communication can be hard and tedious. As an example, a mute individual goes to an interview: if the interviewer does not know SL the common approach is to hire a translator. This action creates some problems, as hiring can be expensive and scheduling an appointment with three people, depending on the circumstances, difficulties. This is where image recognition techniques play an important role by automatizing the process of identify.

Deaf people around the world communicate using sign language as distinct from spoken language in their everyday a visual language that uses a system of manual, facial and body movements as the means of communication. Sign language is not an universal language, and different sign languages are used in different countries, like the many spoken languages all over the world. Some countries such as Belgium, the UK, the USA or India may have more than one sign language. Hundreds of sign languages are in used around the world, for instance, Japanese Sign Language, British Sign Language (BSL), and Spanish Sign Language.

Sign language is a visual language and consists of 3 major components:

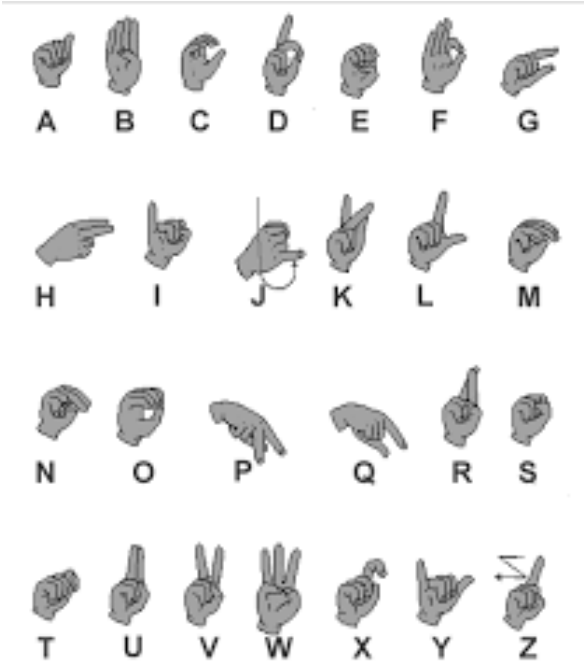

Fig.1.1: Spelling American Sign Language

Problem Statement:

Dumb people use hand signs to communicate, hence normal people face problem in recognizing their language by signs made. Hence there is a need of the systems which recognizes the different signs and conveys the information to the normal people. Speech impaired people use hand signs and gestures to communicate. Normal people face difficulty in understanding their language. Hence there is a need of a system which recognizes the different signs, gestures and conveys the information to the normal people. It bridges the gap between physically challenged people and normal people.

The main objectives of this project are to contribute to the field of automatic sign language recognition and translation to text or speech. In our project, we focus on static sign language hand gestures. This work focused on recognizing the hand gestures which includes 26 English alphabets (A-Z) and 10 digits (0-9) using Deep Neural Networks (DNN). We created a convolution neural networks classifier that can classify the hand into gestures English alphabets and digits. We have trained the neural network under different configurations and architectures like LeNet-5, MobileNetV2, and our own architecture. We used the horizontal voting ensemble technique to achieve the maximum accuracy of the model. We have also created a web application using Django Rest Frameworks to test our results from a live camera.

II. Literature Survey

In the recent years, there has been tremendous research on the hand sign language gesture recognition .For us to be able to build a system and choose which models/techniques to use, we need to know what is being used by other approaches with results that could satisfy our goals. First, we need to identify which approach is being used the most with satisfactory results: this is the case of Deep Learning, which is used across all recent papers we investigated, where all of them use, more specifically, Convolutional Neural Networks. Deep learning has shown considerable improvements when compared to older algorithms, especially when processing images and videos, which covers problems like object detection, object recognition and speech recognition, which are areas where our theme falls into. This explains why latest approaches are currently all adopting Deep Learning to solve these issues.

Existing System:

In Literature survey we have gone through other similar works that are implemented in the domain of sign language recognition. The summaries of each of the project works are mentioned below.

- A Survey of Hand Gesture Recognition Methods in Sign Language Recognition.
- Communication between Deaf-Dumb People and Normal People.
- A System for Recognition of Indian Sign Language for Deaf People using Otsu's Algorithm.

• Intelligent Sign Language Recognition Using Image Processing.
• Sign Language Recognition Using Image Processing.

In existing system the module was developed for dumb person using flex sensor, there user hand is attached with the flex sensors. On this module the flex sensor reacts on bend of each finger individually. By taking that value controller starts to react with speech, each flex sensor holds unique voice stored in APR Kit and for each sign it will play unique voice. And in other existing system, the work is done only for some alphabets and not for the words or sentences, and accuracy obtained is very low. Sign Language Recognition (SLR) system, which is required to recognize sign languages, has been widely studied for years. The studies are based on various input sensors, gesture segmentation, extraction of features and classification methods. This paper aims to analyse and compare the methods employed in the SLR systems, classifications methods that have been used, and suggests the most promising method for future research Due to recent advancement in classification methods, many of the recent proposed works mainly contribute on the classification methods, such as hybrid method and Deep Learning. This paper focuses on the classification methods used in prior Sign Language Recognition system.

Proposed System:

Our proposed system is sign language recognition system using convolution neural networks which recognizes various hand gestures by capturing video and converting it into frames. Then the hand pixels are segmented and the image it obtained and sent for comparison to the trained model. Thus our system is more robust in getting exact text labels of letters. In the proposed system the unable or dumb person should provide a gesture or sign image to the system. The system evaluates the sign input with mat lab image processing technique and classifies the input to the recognized identification. Later it initiates the voice media through the system when the input image matches with the given dataset. And the output will be shown in the text format too. This is a prototype to develop the concept of converting the sign language to speech and text. The aim of this paper is to provide an application to the society to establish the ease of communication between the deaf and mute people by making use of image processing algorithm.

Advantages of proposed system

➢ when comparing with existing system user can give more signs

➢ the module provides two way communications which helps in easy interaction between the normal people and disables

➢ Easy to Interface

➢ Flexible

III. Methodology:

It is also known as high level design that focuses on the design of system architecture. It describes the structure and behaviour of the system. It defines the structure and relationship between various modules of system development process.

- **Image Capture:-** This is the first step in sign recognition. Camera interfacing is a very critical part. Web camera is used to capture the hand gesture. Now web camera is also inbuilt in laptops & one can use external camera for interfacing. But captured images need to be in high definition. So selection of good webcam & its interfacing is an important task of this method.
- **Image Pre-processing:-** Image pre-processing contains cropping, filtering, brightness & contrast adjustment & many more. To do such process Image enhancement, Image cropping & Image Segmentation methods are used. Captured Images are in the form of RGB. So the first step is to convert RGB images to binary images then cropping of image is to be done so that unwanted part of i images can be removed. And now enhancement can be done in certain selected area. In Image segmentation, Edge detection method is used which can detect the boundary of cropped images which is further used for feature extraction method.
- **Feature Extraction:-** Feature extraction is a very useful step to create the database of sign recognition. To characterize the diverse visual principles of letters in manual alphabet efficiently and effectively, both the global visual features and the local visual features are extracted for letter image similarity characterization There are mainly two types of feature extraction method involved in sign recognition, First is Contour-based shape representation and description methods &I another is Region-based shape representation and description methods. Among those depending on application methods are selected.

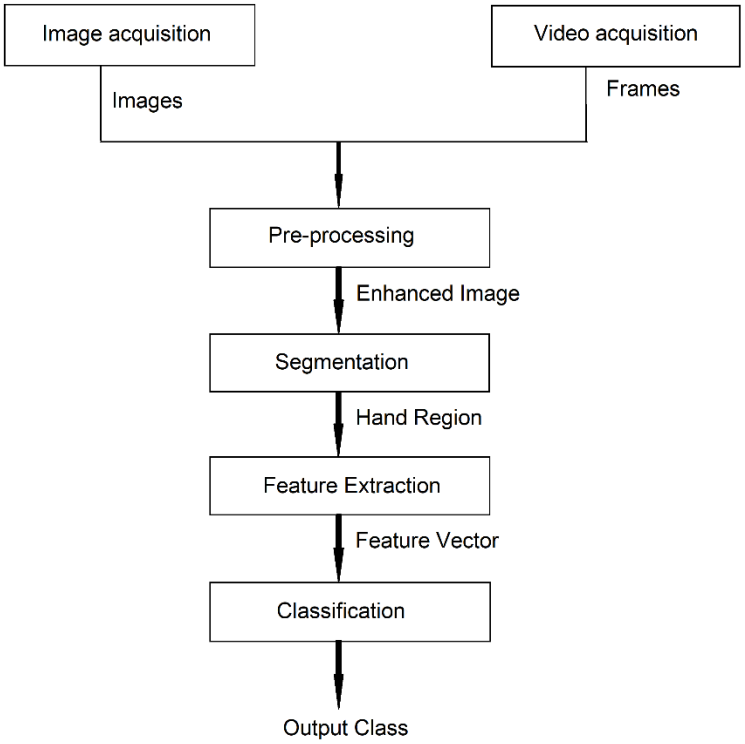

Fig.3.1: Architectural Design

IV. Implementation

Some of the libraries used in the implementation of Recognition of sign language are

- NumPy: The free source Python library NumPy (sometimes known as "Numerical Python") is utilised in practically all branches of research and engineering. It is an open source module of Python which provides fast mathematical computation on arrays and matrices. The scientific Python and PyData ecosystems are built on it, and it is the de facto standard for working with numerical data in Python. The majority of other Python data science and scientific programmers, including Pandas, SciPy, Matplotlib, scikit-learn, and scikit-image, make substantial use of the NumPy API. Data structures for multidimensional arrays and matrices are available in the NumPy library.
- Pandas: Similar to NumPy, Pandas is one of the most widely used python libraries in data science. It provides high-performance, easy to use structures and data analysis tools.
- Matplotlib: Matplotlib is a 2d plotting library which produces publication quality figures in a variety of hardcopy formats and interactive environments. Matplotlib can be used in Python scripts, Python and IPython shell, Jupyter Notebook, web application servers and GUI toolkits.
- OpenCV: OpenCV (Open Source Computer Vision Library) is a library of programming functions mainly aimed at real-time computer vision.[1] Originally developed by Intel, it was later supported by Willow Garage then Itseez (which was later acquired by Intel[2]). The library is cross-platform and free for use under the open-source BSD license. OpenCV application areas include.
- Image-Processing: Image processing is a method to perform some operations on an image, in order to get an enhanced image and or to extract some useful information from it. If we talk about the basic definition of image processing then “Image processing is the analysis and manipulation of a digitized image, especially in order to improve its quality”.
- Digital-Image: An image may be defined as a two-dimensional function f(x, y), where x and y are spatial (plane) coordinates, and the amplitude of fat any pair of coordinates (x, y) is called the intensity or grey level of the image at that point. In another word An image is nothing more than a two-dimensional matrix (3-D in case of coloured images) which is defined by the mathematical function f(x, y) at any point is giving the pixel value at that point of an image, the pixel value describes how bright that pixel is, and what colour it should be. Image processing is basically signal processing in which input is an image and output is image or characteristics according to requirement associated with that image.
- Keras: Keras is an open-source neural-network library written in Python. It is capable of running on top of Tensor Flow, Microsoft Cognitive Toolkit, R, Theano, or PlaidML. Designed to enable fast experimentation with deep neural networks, it focuses on being userfriendly, modular, and extensible. It was developed as

part of the research effort of project ONEIROS (Open-ended Neuro-Electronic Intelligent Robot Operating System), and its primary author and maintainer is François Chollet, a Google engineer. Chollet also is the author of the XCeption deep neural network model. Features: Keras contains numerous implementations of commonly used neural network building blocks such as layers, objectives, activation functions, optimizers, anda host of tools to make working with image and text data easier to simplify the 11 coding necessary for writing deep neural network code. The code is hosted on GitHub, and community support forums include the GitHub issues page, and a Slack channel. In addition to standard neural networks, Keras has support for convolutional and recurrent neural networks. It supports other common utility layers like dropout, batch normalization, and pooling. Keras allows users to productize deep models on smartphones (iOS and Android), on the web, or on the Java Virtual Machine. It also allows use of distributed training of deep-learning models on clusters of Graphics processing units (GPU) and tensor processing units (TPU) principally in conjunction with CUDA. Keras applications module is used to provide pre-trained model for deep neural networks. Feature extraction and fine tuning. This chapter explains about Keras applications in detail.

- Neural networks: With a wide number of connected processing nodes, neural networks mimic how the human brain functions. Natural language translation, picture identification, speech recognition, and image generation are just a few of the applications that benefit from neural networks' aptitude for pattern detection.

V. Result and Discussion

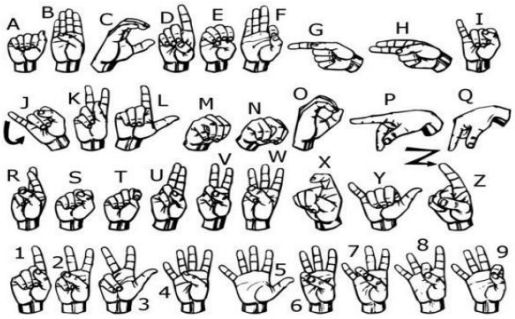

Fig.5.1: The Symbols of Sign Language

Fig.5.2: Screenshot of the result obtained for letter A

Fig.5.3: Screenshot of the result obtained for letter W

Fig.5.4: Screenshot of the result obtained for letter L

VI. Conclusion

Nowadays, applications need several kinds of images as sources of information for elucidation and analysis. Several features are to be extracted so as to perform various applications. When an image is transformed from one form to another such as digitizing, scanning, and communicating, storing, etc. degradation occurs. Therefore, the output image has to undertake a process called image enhancement, which contains of a group of methods that seek to develop the visual presence of an image. Image enhancement is fundamentally enlightening the interpretability or awareness of information in images for human listeners and providing better input for other automatic image processing systems. Image then undergoes feature extraction using various methods to make the image more readable by the computer .Sign language recognition system is a powerful tool to prepare an expert knowledge, edge detect and the combination of inaccurate information from different sources. The intend of convolution neural network is to get the appropriate classification

Future Enhancement

The system can be useful for static ISL numeral signs only. The ISL recognizer system cannot be considered as a complete system, as for complete recognition of sign language, we have to include ISL alphabets, words and sentences. These signs can be included in future. Also other feature extraction algorithms like Wavelet transform, Invariant moments, Shape lets descriptors and other existing methods can be included in conducting experiments for improvement in the results. Other classifiers like multi class Support Vector Machine (SVM), Principal Component Analysis (PCA) and Linear Discriminant Analysis (LDA) or a combination of these classifiers can be included in conducting experiments to improve the recognition rate. The proposed sign language recognition system used to recognize sign language letters can be further extended to recognize gestures facial expressions. Instead of displaying letter labels it will be more appropriate to display sentences as more appropriate translation of language. This also increases readability. The scope of different sign languages can be increased. More training data can be added to detect the letter with more accuracy. This project can further be extended to convert the signs to speech.

References

[1]. Joyeeta Singh, K. D. Indian Sign Language Recognition Using Eigen Value Weighted Euclidean Distance Based Classification Technique. International Journal Of Advanced Computer Science And Applications 4, 2 (2013). Neha V. Tavari, P. A. V. D.

[2]. Indian Sign Language Recognition Based On Histograms Of Oriented Gradient. International Journal Of Computer Science And Information Technologies 5, 3 (2014), 3657–3660.

[3]. Padmavathi. S, Saipreethy.M.S, V. Indian Sign Language Character Recognition Using Neural Networks. Ijca Special Issue On Recent Trends In Pattern Recognition And Image Analysis, Rtpria (2013).

[4]. Sakshi Goyal, Ishita Sharma, S. S. Sign Language Recognition System For Deaf And Dumb People. International Journal Of Engineering Research Technology 2, 4 (April 2013).

[5]. Vijay, P.K., Et Al., Recent Developments In Sign Language Recognition: A Review. International Journal On Advanced Computer Engineering And Communication Technology,2012.1(2):P.21-26.

[6]. Http://Citeseerx.Ist.Psu.Edu/Viewdoc/Download?Doi=10.1.1.734.8389&Rep=Rep1&Type=Pd.