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SIGN LANGUAGE DETECTION USING DEEP LEARNING

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1. Abstract :

There are many ways to communicate with deaf and dumb people,one of them is the sign language.Due to the differrences in the way of communication its difficult for us to interact with deaf and dumb people.So its important for us to learn the sign language to make communication easier.

This paper presents a sign language detection system that aims to improve communication for individuals who are deaf or hard of hearing, or for communication between individuals who use different sign languages.The proposed system uses deep learning techniques to detect and recognize signs from video or image data.The architecture of the system includes the use of convolutional neural networks (CNNs) and recurrent neural networks (RNNs) for feature extraction andsign classification. A large dataset of sign language examples was used for training and testing the model.Data pre-processing and augmentation techniques were employed to improve the diversity and size of the dataset.The experimental results show that the proposed system is able to achieve high accuracy and efficiency in sign language detection.The potential impact of this system is to improve communication for individuals who use sign language,and to promote the development of sign language recognition technology.

2. INTRODUCTION :

Sign Language is a means of communication used by individuals who are deaf or hard of hearing. It is made up of various gestures, including hand shapes, movements, orientations, and facial expressions. Globally, there are approximately 466 million people with hearing loss, with 34 million of them being children.People who are deaf or hard of hearing use sign language to communicate with others.Different sign languages are used in different regions of the world, and there are fewer sign languages compared to spoken languages.India has its own sign language known as Indian Sign Language (ISL). In developing countries,there are few schools for deaf students and the unemployment rate among adults with hearing loss is high.Data from Ethnologue shows that among India's deaf population, which is about 1% of the total population, literacy rates and the number of children attending school are low. Recognizing sign languages, increasing the availability of interpreters, and providing transcription in sign languages can greatly improve accessibility. In sign languages, signs are equivalent to words in spoken languages. This manuscript aims to identify alphabets in Indian Sign Language from corresponding gestures using computer vision and machine learning algorithms, rather than using high-end technology such as gloves or kinect.

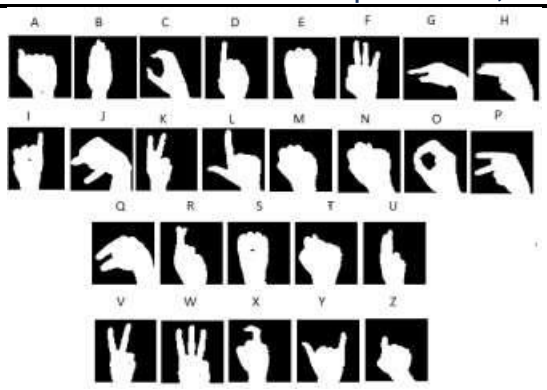

Fig 2: Sign laguage

3. Motivation:

Communication is a fundamental need for survival in society. Individuals who are deaf and hard of hearing use sign language to communicatewith each other, but it can be difficult for those who can hear to understand. While there has been significant research on American Sign Language (ASL) recognition,Indian Sign Language (ISL) is vastly different from ASL. Indian Sign Langusge uses two hands for communication, whereas American SignLanguage uses only one hand, which can lead to difficulty in identifying features due to overlapping of hands. Furthermore, there is a lack of datasets and variations in Indian Sign Language based on region, which has limited research in ISL gesture detection.Our project aims to take the first step in reducing the communication barrier between those who can hear and those who are deaf and hard of hearing by using ISL.The potential for this project to extend to words and common phrases could not only make communication easier for those who are deaf and hard of hearing, but also improve the development of autonomous systems that can understand and assist them.

4. Challenges:

Research in Indian Sign Language (ISL) has been hindered by a lack of standard datasets, which has caused it to lag behind American Sign Language (ASL). Unlike ASL, ISL utilizes both hands for making gestures, which can result in obscured features. Additionally, ISL is known for its variance in signs based on location and the presence of multiple signs for the same character. Certain characters also share the same alphabet (e.g. V and 2 have the same sign, and W and 3 have the same sign) and the interpretation of the sign can depend on the context.

5. METHODOLOGY:

In our approach to tackle the classification problem, we divided the collected dataset into three stages. The first stage involves segmenting the skin portion from the image, as the remaining parts can be considered as noise in relation to the character classification problem. The second stage focuses on extracting relevant features from the skin-segmented images that are deemed significant for the next stage, which is the learning and classification phase. The third stage involves using the extracted features as input into various supervised learning models for training, and then utilizing the trained models for classification.

Feature Extraction :

that each pixel is assigned a class label based on its own attributes. In contrast, feature extraction approaches group pixels into objects, and then assign a class label to each object based on the attributes of the pixels within that object.This method can be more efficient and accurate than traditional pixel-based classification methods, as it takes into account the context of the pixels within an object. Additionally, feature extraction can be used as a preprocessing step in machine learning and image processing tasks to reduce the dimensionality of the data and make it more manageable for further analysis.

Image Capture :

One key step in sign recognition is the proper interfacing of a camera. This is particularly crucial when using a webcam,which is often employed to capture hand gestures. Today, many laptops come equipped with a built-in webcam, but an external camera can also be used.However, regardless of the camera type, it is important to ensure that the captured images are of high definition, as selecting a high-quality webcam and properly interfacing it is a critical aspect of this method.

Algorithms used:

Convolutional Neural Network:

A Convolutional Neural Network (CNN) is a type of deep learning system that can analyze an image and assign importance to various objects and features within it, while also being able to differentiate between them. It requires less pre-processing than other image classification techniques and can learn image characteristics through training. CNNs are made up of multiple layers of interconnected neurons, and can capture both the spatial and temporal aspects of an image by applying filters. Additionally, by reducing the number of parameters and reusing weights, the architecture can better fit the image collection and extract relevant characteristics while preserving important information for accurate predictions.This makes CNNs highly useful for handling large amounts of image data.

6. Proposed system :

Our proposed system is a sign language recognition system that uses convolutional neural networks to recognize different hand gestures.It captures video and converts it into frames, then segments the hand pixels, and compares the obtained image to a trained model.This approach makes our system more accurate in identifying the text labels of letters in sign language.

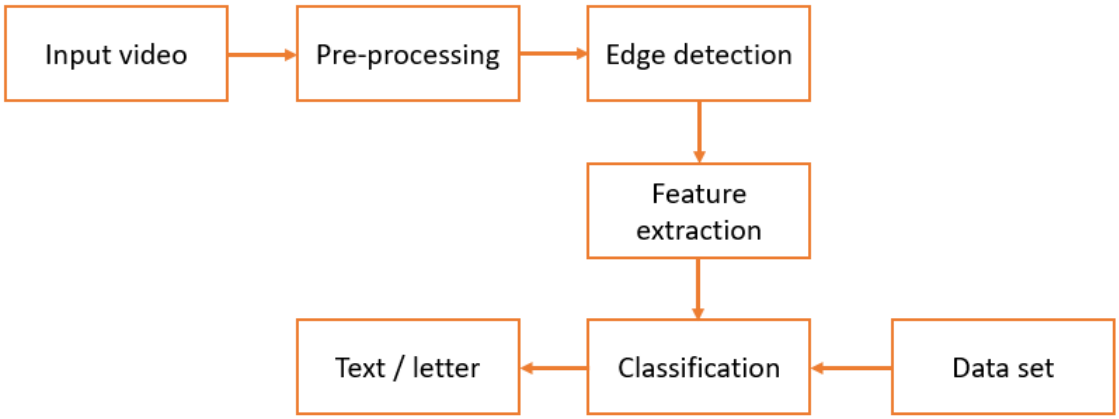

Fig2 : Architecture

A. Image Processing :

The process of image preprocessing includes a variety of techniques such as cropping, filtering, adjusting brightness and contrast, and more.To accomplish these tasks, methods such as image enhancement, cropping and segmentation are often utilized. The captured images typically come in the form of RGB, so the initial step is to convert them to binary images.This is followed by cropping, to eliminate any unwanted parts of the image. Enhancement can then be performed on specific areas.

In image segmentation, edge detection is employed to detect the boundaries of the cropped image, which is then used for feature extraction.

B. Feature Extraction :

An important step in creating a database for sign recognition is feature extraction. To effectively and efficiently characterize the diverse visual principles of letters in manual alphabet, both global and local visual features are extracted for letter image similarity characterization.There are two main methods of feature extraction involved

in sign recognition: contour-based shape representation and description methods,and region-based shape representation and description methods. Depending on the application, the appropriate method is selected.In this proposed method, the 7 Hu moments technique is utilized, from which 7 moments are found. A database of gestures is then created using these moments.

C. Edge Detection :

Edge detection is the process of identifying the boundaries of objects within an image. This is a crucial step in understanding the features present within an image,as it is believed that edges contain meaningful information and structural properties that are important for a business problem. By detecting edges, the size of the image that needs to be processed is reduced, and less relevant information is filtered out.Edge-based segmentation algorithms use various methods, such as discontinuities in grey level, color, texture, brightness, saturation, and contrast,to detect edges in an image. Additional processing steps may be used to combine edges into edge chains that correspond to the borders within the image to further enhance results. Edge detection algorithms primarily fall into two categories: gradient-based methods and gray histograms.Common edge detection operators like Sobel operator, Canny and Robert's variable are used to detect edge discontinuities and mark the edge boundaries. The ultimate goal is to achieve partial segmentation by grouping local edges into a new binary image where only edge chains that match the desired objects or image parts are present.

D. Pre-Processing :

Pre-processing is the name given to operations on images at the lowest level of abstraction where both the input and output are intensity images.The goal of pre-processing is to improve the image data by eliminating unwanted distortions. There are several point processing techniques that can be used for pre-processing, such as contrast stretching, global thresholding, histogram equalization, log transformations, and power law transformations. Mask processing techniques include averaging filters, sharpening filters, and local thresholding.Data preprocessing is a data mining technique that involves transforming raw data into a format that can be understood and used. It is a proven method for resolving issues with raw data and prepares it for further processing. Additionally, data preprocessing can also enhance certain image features that are important for further processing.

E. Classification

Image classification is the task of grouping and labelling the pixels or vectors within an image, based on predefined rules.The classification rules can be established using one or more spectral or textural characteristics. There are two main methodologies forimage classification: 'supervised' and 'unsupervised'. In digital image classification, the spectral information represented by digital numbers in one or more spectral bands is used to classify each individual pixel. This method is known as spectral pattern recognition.

7. Project Management Plan :

The main objective of a sign language recognition system is to provide a convenient means of communication between individuals who are both hearing and deaf by utilizing hand gestures. The proposed method employs the use of a webcam or built-in camera to detect and process signals for recognition.

The system has been found to produce reliable results when lighting and intensity conditions are controlled. Additionally, new hand gestures can be easily incorporated and incorporating more images captured from various angles and perspectives can improve the accuracy of the model. However, limitations such as low light and an unstructured background can decrease the accuracy of the detection. Therefore, further research will be conducted to address these issues and expand the dataset for more accurate results.

8. Future scope :

Our goal is to develop a system for recognizing sign languages that is practical for both hearing and deaf individuals to communicate through hand gestures.The proposed method can be implemented using a webcam or other built-in camera that detects and processes indicators for recognition.From our findings, it can be inferred that the system produces reliable results under controlled lighting and intensity conditions. Additionally, new gestures can be easily incorporated, and increasing the number of photographs captured from different angles and frames can improve the model's accuracy. However, limitations such as low light intensity and uncontrolled backgrounds can decrease the accuracy of the detection.

Therefore, we plan to address these issues and expand the dataset for more accurate results. Another area of focus is adapting the concept to other sign languages such as Indian and American sign languages.

Additionally, we aim to improve the neural network's ability to recognize symbols by further training it and enhancing its ability to recognize facial emotions.

9. Conclusion:

In this study, we explored the use of various tools to develop an automatic sign language gesture recognition system that operates in real-time.Despite our efforts to create a system capable of recognizing sign language and converting it into text, there is still room for further improvement and additional research. Possible areas of focus for future work include

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