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# Sign Language Recognition Using CNN

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## Abstract

Sign language is one of the oldest and most natural form of language for communication, but since most people do not know sign language and interpreters are very difficult to come by this project come up with a real time method using convolutional neural networks for fingerspelling based american sign language. Convolutional neural networks (CNNs) have shown great promise in this field due to their ability to automatically learn relevant features from raw input data. In this method, the hand is first passed through a filter and after the filter is applied then it involves pre-processing the input images, applying several convolutional and pooling layers to extract features, and finally using a fully connected neural network for classification.

**Keywords:** Convolutional Neural Network, Deep Learning Method.

## 1. Introduction

Sign language recognition is the process of using computer vision and machine learning techniques to interpret and translate sign language gestures into written or spoken language. Sign language is a visual language that is used by people with hearing impairments to communicate with one another. It is based on a system of hand and body movements, facial expressions, and other nonverbal cues.



 

The recognition of sign language gestures is a challenging task, as it involves the interpretation of complex hand and body movements in real-time. The recognition process typically involves the use of cameras or sensors to capture the movement of the signer's hands and body, and then processing this data to identify the specific signs being used.



There are several approaches to sign language recognition, including computer vision-based techniques, such as deep learning and neural networks, and rule-based systems that rely on predefined rules and patterns. Some of the key challenges in sign language recognition include dealing with variations in signing styles and the complexity of the gestures themselves.

Sign language recognition has numerous potential applications, such as improving communication between people with hearing impairments and those who do not use sign language, enabling people with hearing impairments to access online services, and assisting with the training of sign language interpreters.

## 2. Study Objectives

- To train a model on labeled datasets containing images of each alphabets using Convolutional Neural Network.
- To evaluate the performance of the algorithms in terms of accuracy and confusion matrix.

## 3. Methodology

The method for Recognizing Sign Language using Convolutional Neural Network algorithms can be divided into the following steps:

- Image collection and preprocessing: In this step, Images of each alphabets are collected and preprocessed. The preprocessing techniques can include Background Subtraction and then Data Augmentation using Flipping of images.

- Feature extraction: CNNs use convolutional layers to extract low-level features from the input images, followed by pooling layers that downsample the feature maps to reduce the dimensionality of the input. This is followed by additional convolutional and pooling layers to extract higher-level features from the input images.The features extracted by the CNN are then passed to a fully connected layer, which is responsible for classifying the input sign language gestures. The output of the fully connected layer is a probability distribution over the possible classes, and the class with the highest probability is selected as the predicted class for the input gesture.
- Training the models: The extracted features are used to train CNN models using a labeled dataset. These models learn to classify label as sign gestures based on the extracted features.
- Model evaluation: The trained model is evaluated on a test dataset to measure its performance. The evaluation metrics can include accuracy, and Confusion Matrix.

### 3.1. Sign Language Recognition

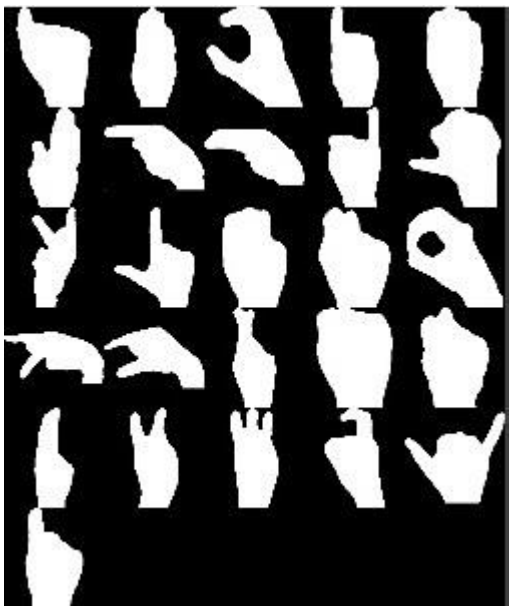

**Figure.1.** Image of each Sign Language Alphabets



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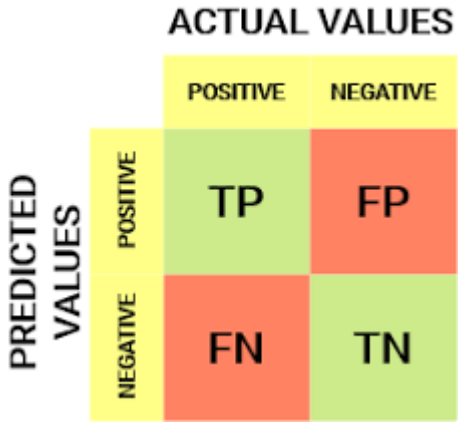
## 4. Conclusion

Two evaluation measures, namely accuracy and confusion matrix are used to evaluate the performance of classification algorithms. All of these evaluation measures can be calculated by using those following equations:

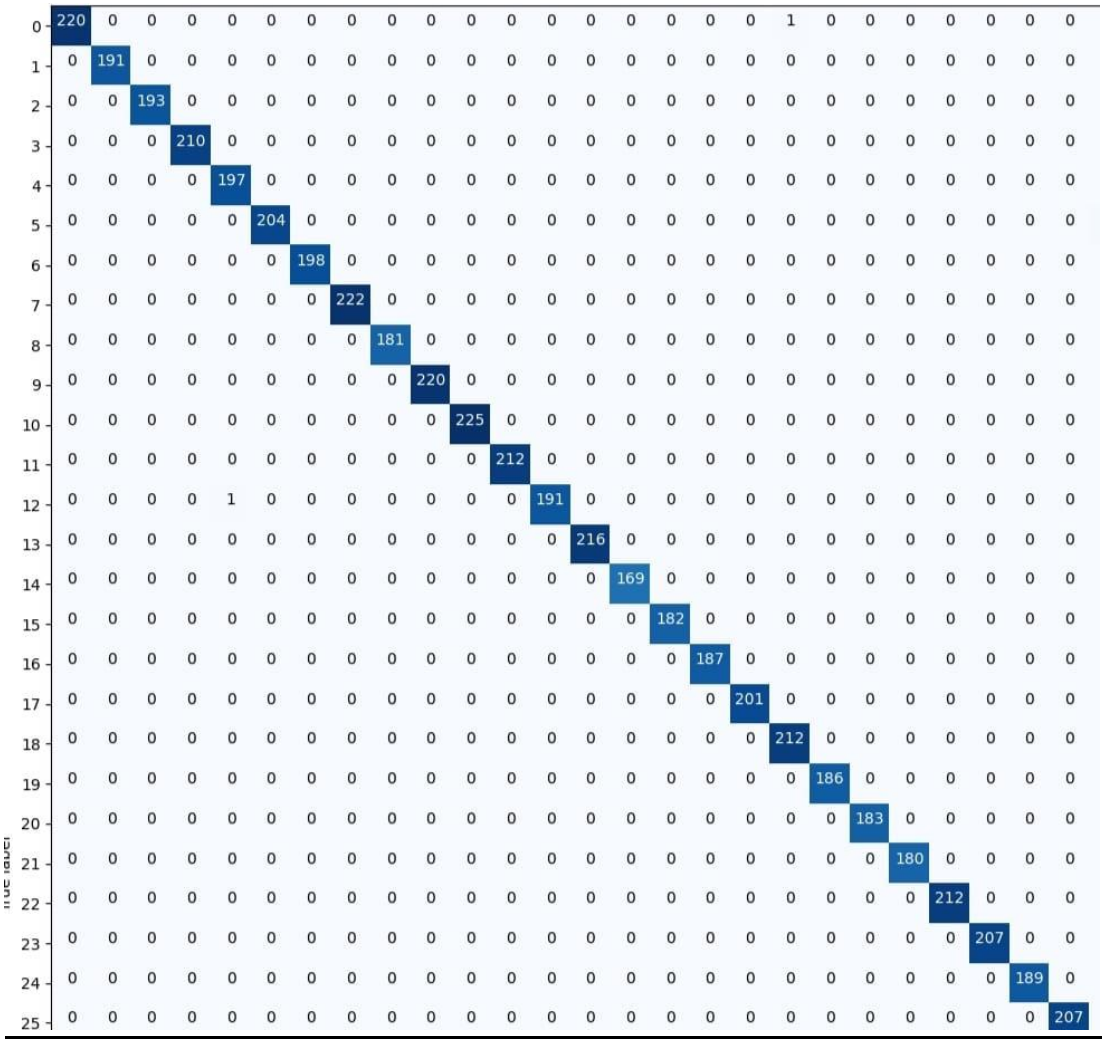
- Accuracy = $\frac{\text{Number of correct predictions}}{\text{Total prediction number}}$

- Confusion Matrix




In this Project the performance measure or Accuracy of the model with the test images is above 90% but while recognizing with the live stream the model has poor accuracy due to background images,lighting problem and bad hand histogram.

A confusion matrix is a table that is often used to evaluate the performance of a machine learning algorithm. In the case of sign language recognition, a confusion matrix can be used to evaluate how well the system is able to recognize different signs.Below Fig 2 shows the confusion matrix for the project.



**Figire.2.** Confusion Matrix for each Sign Language Alphabet

## 5. Future Directions

- One potential future direction for improving Sign Language is to integrate them with Text-to-Speech Conversion Module.
- By Incorporating it helps in building communication between hearing impairment people and blind people.
- In Future the model can be trained to recognize some of the most frequent common words.

## 6. Conclusion

The project entitled " Sign Language Recognition " has presented to recognize the Sign Language Alphabets for its respective gestures. This technology is important in facilitating communication between hearing-impaired individuals and the rest of society.While sign language recognition technology has made significant progress in recent years, there are still challenges to overcome, such as variability in sign language across regions, lighting and background noise, and the need for real-time recognition.

### 6.1. Final Outcome

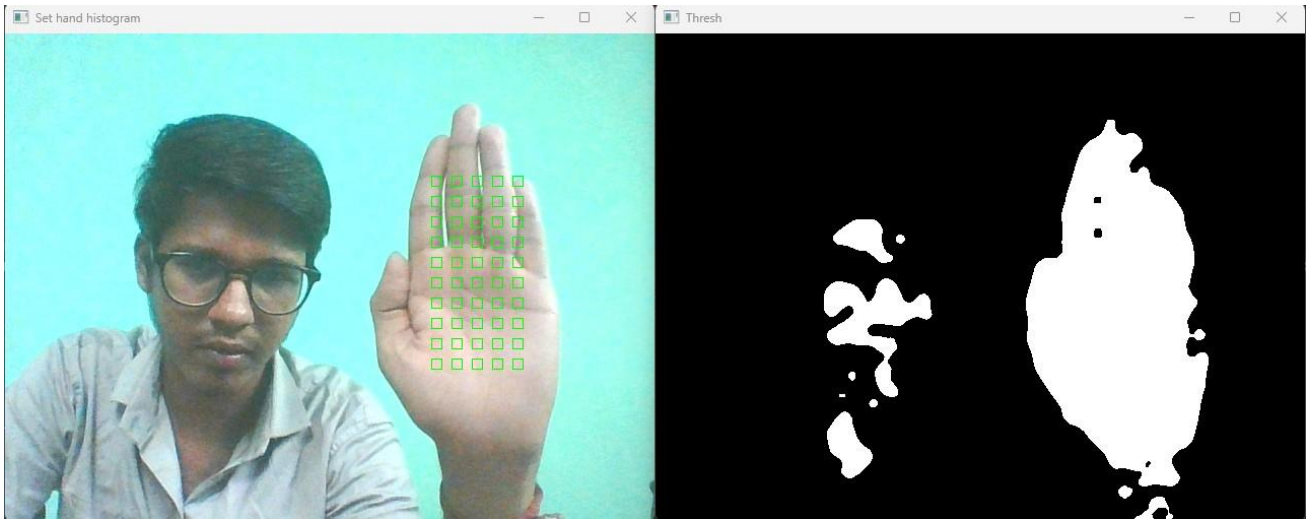



**Figure.3.** Setting Hand Histogram

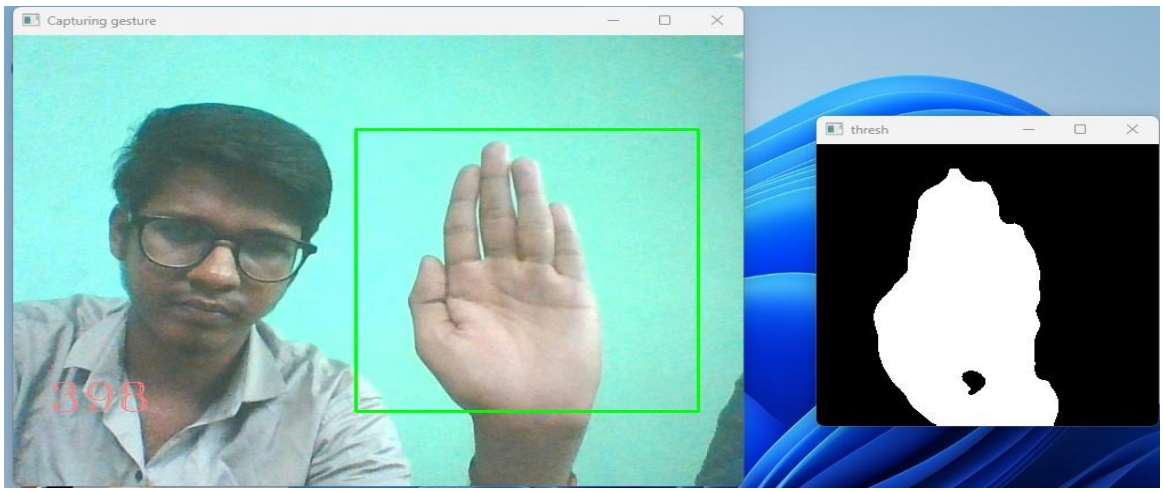



**Figure.4.** Creating Hand Gestures

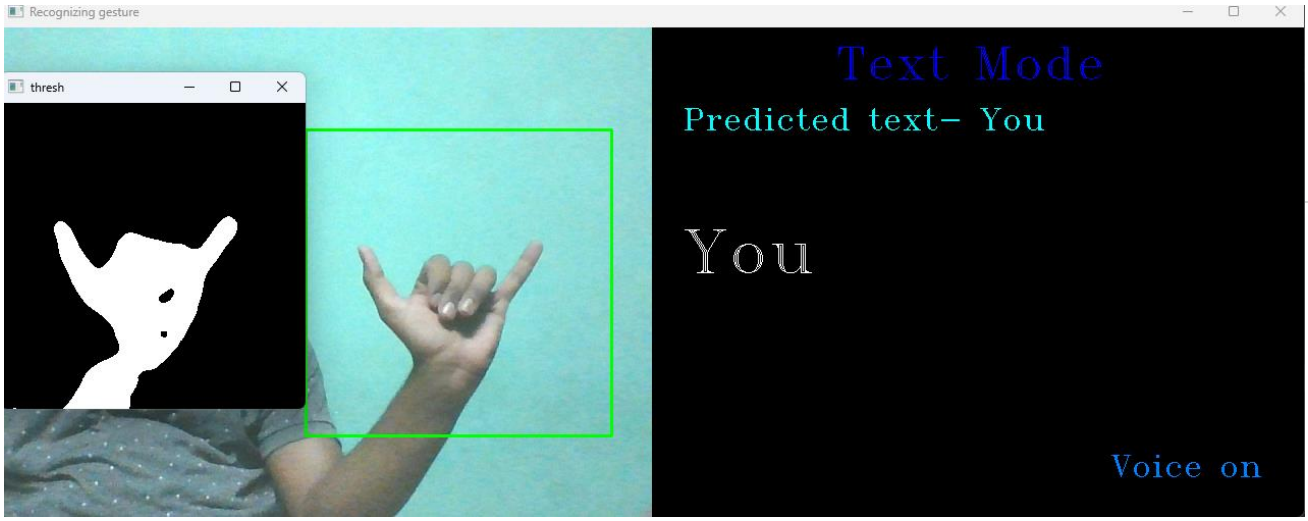



**Figure.5.** Recognizing Sign Gestures

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