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Tataguni, off Kanakapura road, Bengaluru-560082
Approved by The All India Council for Technical Education (AICTE) - New Delhi;
Affiliated to VisvesvarayaTechnological University (VTU), Belagavi

Department of Artificial Intelligence and Machine Learning

Mini Project Presentation on

"ACTION DETECTION FOR SIGN LANGUAGE"

Batch-1

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ACTION DETECTION FOR SIGN LANGUAGE

USING DIGITAL IMAGE PROCESSING

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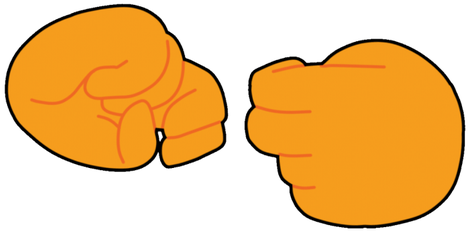
INTRODUCTION

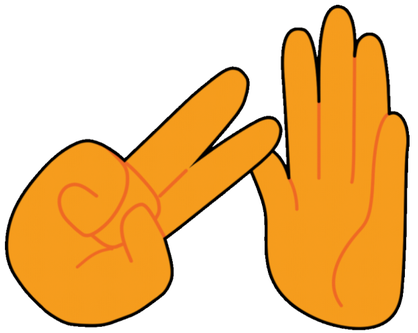


Sign language alphabets are essential for bridging the communication gap between hearing and speaking-impaired individuals and those without disabilities. With technology, sign language can be translated into readable text, reducing barriers to communication.

American Sign Language (ASL) is the most widely used sign language globally, and it is spoken by over a million people in the US and more than 30 other countries. ASL employs 19 different hand shapes to communicate, which combine to form the 26 American manual alphabets. Using convolution neural networks, this paper proposes a method for recognizing sign language using monocular camera images as the sole input source.

The study's findings can help develop real-time sign language recognition systems, making communication more accessible for those who are not proficient in the language.

BASE PAPER



Title: Sign Language Alphabet Recognition Using Convolution Neural Network
Author: Mayank Kumar

Year of publication: The paper was published in 2021.

Model type: The proposed approach uses a Convolutional Neural Network (CNN) model.

Method: The CNN model consists of multiple convolutional layers followed by max-pooling layers and fully connected layers. The training data consists of images of hand gestures representing different sign language alphabets. The data is preprocessed by converting the images to grayscale and resizing them to a fixed size
.
Dataset: The paper uses a dataset of 27,455 images of the input as 784 columns. To feed this data into the CNN model, converted the single-dimensional data into CNN accepted format of 3 dimensions

Result and accuracy: The proposed CNN model achieved an accuracy of 99.63% in recognizing sign language alphabets.

Proceedings of the Fifth International Conference on Intelligent Computing and Control Systems (ICICCS 2021)
IEEE Xplore Part Number: CFP21K74-ART; ISBN: 978-0-7381-1327-2

SIGN LANGUAGE ALPHABET RECOGNITION USING CONVOLUTION NEURAL NETWORK

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Abstract— **Sign Language plays an indispensable role in the lives of people having speaking and hearing disabilities. Recognition of American Sign Language using Computer Vision is very challenging due to its increasing complexity and high intraclass variations. In this paper, convolutional neural networks (CNNs) are used to recognize the ASL Alphabets. This algorithm is useful to recognize it as a deep network, which is expected for the ASL alphabet classification task. Pre-Processing steps of the MNIST dataset are done in the first phase. After the first phase, different important features of pre-processed hand gesture image are computed. In the final phase, depending on the properties computed or calculated in the initial phases, the accuracy and AUC score of the network model with which it can recognize the sign language Alphabets were detected. The proposed CNN network has achieved an AUC score of 0.9981 and an accuracy of 0.9963.**

Keywords— Convolution neural network (CNN), American Sign Language (ASL), ASL number, Data augmentation, Sign language recognition component

I. INTRODUCTION

The Sign Language Alphabets are created by using hand and facial gestures in order to express the thoughts of speaking and hearing disabled population to standard people, who may not purely understand the sign language. This develops a vast communication gap between normal people and the people with disabilities. There are certain technological developments to help the speaking and hearing disabled people as it is impossible for them to seek help all the time and assist them in their daily activities as a translator. A novel approach can clarify sign gestures into decipherable text with the help of technology so that it becomes understandable for the normal public. This approach will surely reduce the communication gap and initiate the communication between impaired and standard people in a more feasible way. More than 100 different sign languages are utilized across the world for understanding the deaf and speech impaired groups, they are Indian Sign Language, American Sign Language (ASL), Italian Sign Language, and many others. More than thousands and millions of people and about millions of people in India are using Sign Language as their primary mode of communication.
American Sign Language is the widely used sign language and it ranks fourth most used language in North America. It is a surprise to know that not only in the USA, ASL is also used in more than 30 other nations, where English is considered as the primary mode of communication. Around a million people in USA and various parts of the globe use ASL as their primary mode of communication [1]. ASL is quite vast and complex language, which is created by using hand, finger actions, and facial gestures to express the thoughts of speech-impaired people. ASL Language is recognized as an appropriate and original language, where it contains more number of variations like any other language. For example: Italian and German. Sign language is a magnificent piece of interaction art that is favourable to a wide community of speaking and hearing disabled people. The existence of ASL promotes the happiness and hope amongst impaired people and its wide impact is marvellous and eye-catching [2].
ASL is a set of 26 gesture signs popularly known as American Manual Alphabet, which can be used to express various words present in English Dictionary. There are 19 different hand shapes to communicate in ASL, which helps to form 26 American manual alphabets. Since, there are fewer hand shapes available, some hand shapes convey different alphabets if the orientation of that hand shape is changed. For Example: 'K' and 'P' letters. Hand gestures are also available to express the numbers from

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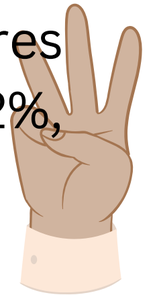
LITERATURE SERVEY

Title: Static Hand Gesture Recognition for American Sign Language using Deep Convolutional Neural Network, Author: Prangon Das, Year of publication:2019.

The proposed approach utilizes a DCNN model comprising convolutional layers, ReLU activation, max-pooling layers, batch normalization layers, and fully connected layers.The DCNN model consists of multiple convolutional layers with rectified linear unit (ReLU) activation, followed by max-pooling layers, batch normalization layers, and fully connected layers. The training data consists of images of hand gestures representing different American Sign Language alphabet letters and numbers. The data is preprocessed by resizing the images to a fixed size, converting them to grayscale, and applying normalization.The proposed DCNN model achieves an impressive accuracy of 99.66% in recognizing static hand gestures in ASL.

Title: Real Time Hand Gesture Recognition Using Different Algorithms Based on American Sign Language, Author: Md. Mohiminul Islam, Year of publication: 2018

The paper presents a real-time hand gesture recognition system for American Sign Language (ASL) using different algorithms. The system employs four algorithms: K-Nearest Neighbor (KNN), Support Vector Machine (SVM), Convolutional Neural Network (CNN), and Multi-Layer Perceptron (MLP).The study utilizes a custom dataset consisting of 1200 images of 24 different ASL gestures for training and evaluation. The reported accuracy values for the algorithms are: KNN - 90.2%, SVM - 91.3%, CNN - 96.4%, and MLP - 93.7%

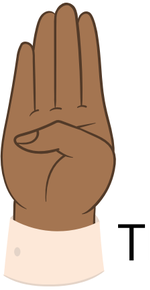


Title:Dynamic Hand Gesture Based Sign Word Recognition Using Convolutional Neural Network with Feature Fusion ,Author: Md Abdur Rahim,Year of publication-2019

The system captures input images from live videos using a low-cost device like a webcam and preprocesses the hand gesture images through various steps, including color space conversion, binarization, erosion, and hole filling. The model used is CNN. The fused features are then used for gesture classification through a softmax classifier, achieving high recognition accuracy for fifteen common words in real-time compared to state-of-the-art systems.. As a result, the average acceptance of gesture-based sign word recognition is 96.96% which leads to better results than state-of-art system

Title: American Sign Language Recognition using Deep Learning and Computer Vision ,Author:Kshitij Bantupalli , Year of publication-2018

The proposed model utilizes video sequences and extracts both temporal and spatial features from them. Inception, a Convolutional Neural Network (CNN), is employed to recognize spatial features, while a Recurrent Neural Network (RNN) is used to train on temporal features.In the study, the model experienced a decrease in accuracy when faces were included in the videos. This occurred because the model learned incorrect features due to the variation in signers' faces. To mitigate this, the videos were trimmed to focus solely on gestures, limited to the area extending up to the neck. Additionally, the model struggled with clothing variations.The proposed CNN model achieved an accuracy of 93.05%



Title:Indian Sign Language Gesture Recognition using Image Processing and Deep Learning , Author:Neel Kamal Bhagat, Year of publication-2019

This paper presents a real-time hand gesture recognition system for speech-impaired individuals using Microsoft Kinect RGB-D camera data. Computer vision techniques enable the establishment of a one-to-one mapping between depth and RGB camera pixels, followed by hand gesture segmentation. Convolutional Neural Networks (CNNs) are trained on 36 static ISL gestures, achieving 98.81% accuracy, while Convolutional LSTMs achieve 99.08% accuracy on 10 ISL dynamic word gestures. The model demonstrates accurate real-time performance and shows promise for further research in sentence formation through gestures, as well as adaptability to ASL gestures.

Title:Design of Sign Language Recognition Using E-CNN ,Author: Citra Suardi, Year of publication-2021

The Convolutional Neural Network (CNN) algorithm in Deep Learning is employed as a classification tool, leveraging its ability to learn and recognize various patterns.The study explores the effectiveness of combining CNN models using the Ensemble method, resulting in a significant increase in accuracy value to 99.4%. This demonstrates that the Ensemble approach enhances the performance of the system in accurately translating sign language gestures.

Title:Czech Sign Language Single Hand Alphabet Letters Classification , Author:Jiri Krejsa, Year of publication-2019

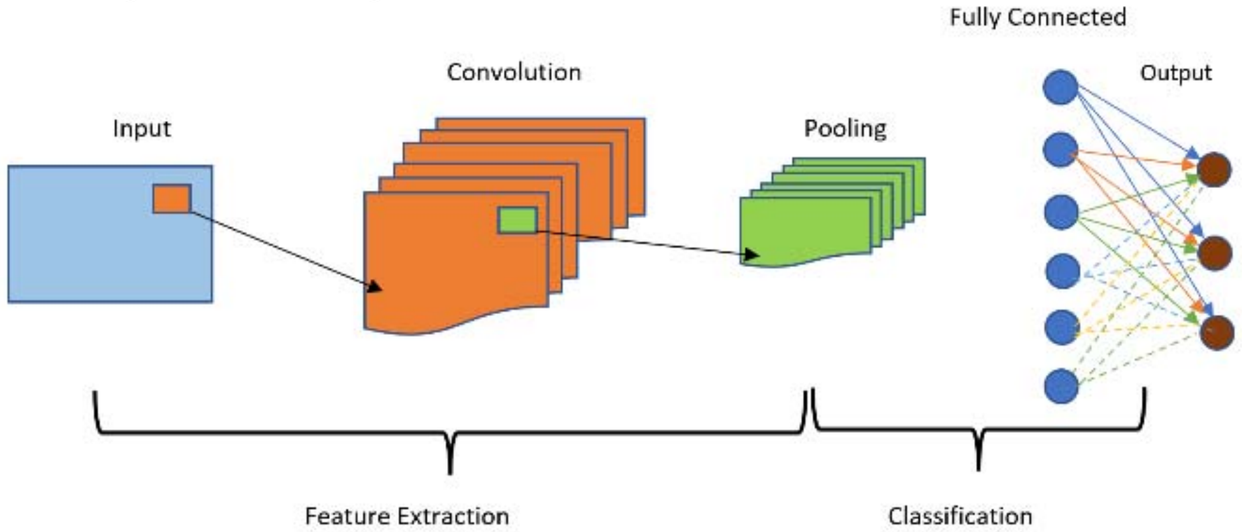
The paper proposes a machine learning approach to classify single-hand alphabet letters in Czech Sign Language. The paper highlights the importance of sign language recognition systems in improving communication with the deaf community and discusses the challenges of recognizing sign language gestures due to their dynamic and non-linear nature.The proposed approach uses a Convolutional Neural Network (CNN) model.The proposed CNN model achieved an accuracy of 99.7% in recognizing single-hand alphabet letters in Czech Sign Language.

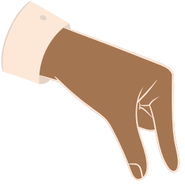
Title: Sign Language Recognition System using CNN , Author: Aditi Deshpande, Year of publication-2023

This human-computer interaction (HCI) system enables communication between speech-impaired individuals and those unfamiliar with sign language, offering a solution to bridge the communication gap and reduce isolation. The paper presents a real-time American Sign Language (ASL) translation system that utilizes a Convolutional Neural Network (CNN) algorithm. The model consists of 8 layers, and it achieves an impressive accuracy rate of 98%.

PROPOSED SYSYTEM

Our proposed system builds upon the existing model, incorporating Convolutional Neural Networks (CNN) due to their high accuracy. While the base model focuses on sign language recognition with hand gestures, our improvisation involves expanding the system to include sentences or words. For this expansion, we require a total of 1,200 images for each gesture, with each image having dimensions of 50x50 pixels. Consequently, each gesture encompasses a dataset of 2,400 images. By augmenting the model with sentence and word recognition capabilities, we aim to enhance the overall functionality and utility of the system for deaf and dumb individuals.





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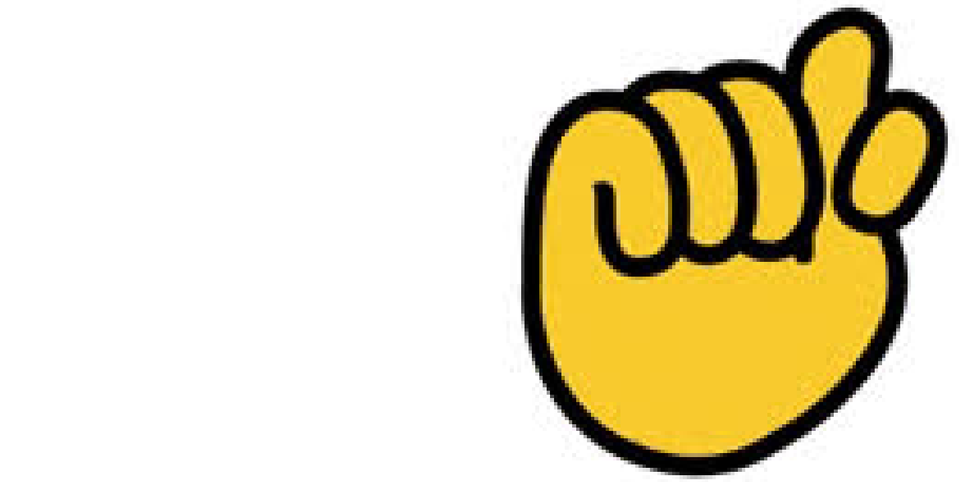

Thank you