IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Impact Factor 8.102 ⪤ Peer-reviewed & Refereed journal ⪤ Vol. 13, Issue 3, March 2024

DOI: 10.17148/IJARCCE.2024.133110

Realtime conversation system for people with hearing and speech impairments

Ashlesh Shenoy[1], Shawn Castelino[2], Shetty Sushank Mohandas[3], Vaibhav Nayak[4], Ms.Suma K[5]

Student, Department Of Computer Science & Engineering, Mangalore Institute Of Technology & Engineering, Moodbidri, Karnataka, India[1,2,3,4]

Assistant Professor, Department Of Computer Science & Engineering, Mangalore Institute Of Technology & Engineering, Moodbidri, Karnataka, India[5]

Abstract: Communication barriers significantly hinder interaction between the deaf community and the wider world. This paper investigates an automatic system for Indian Sign Language (ISL) detection using MobileNetV2, a transfer learning architecture known for its efficiency. We leverage transfer learning from pre-trained MobileNetV2 weights to extract features from ISL images. To improve model performance for ISL detection, we incorporate linear bottleneck layers and squeeze-and-excitation blocks within the network. Additionally, separable convolutions are used to maintain accuracy while reducing computational complexity. This optimized MobileNetV2 architecture is then fine-tuned on a prepared ISL dataset for robust sign recognition. While limitations exist, this research paves the way for advancements in communication accessibility for the deaf community.

Keywords: Indian Sign Language (ISL),Sign Language Detection ,Deep Learning,MobileNetV2,Transfer Learning ,Linear Bottleneck Layers ,Squeeze-and-Excitation Block ,Communication Accessibility ,Deaf Community.

I. INTRODUCTION

Sign language serves as a vibrant and vital form of communication for millions of deaf and hard-of-hearing individuals globally. Unfortunately, communication barriers often hinder interaction between the deaf community and the wider world. These disparities can limit social inclusion, educational opportunities, and overall well-being. Automatic sign language detection systems offer a promising solution to bridge this communication gap.

This paper delves into the application of deep learning for Indian Sign Language (ISL) detection. ISL, a rich and complex language with its own grammar and syntax, utilizes hand gestures, facial expressions, and body posture to convey meaning. Automatic detection systems aim to recognize these visual cues and translate them into spoken language or text.

Our research focuses on employing MobileNetV2, a deep learning architecture known for its efficiency, for ISL detection. This approach leverages transfer learning, where pre-trained weights from a well-established model like MobileNetV2 are utilized as a starting point. This not only reduces training time but also allows the model to learn essential feature extraction capabilities from a vast dataset of images.

Furthermore, we optimize the MobileNetV2 architecture by incorporating specific techniques. Linear bottleneck layers and squeeze-and-excitation blocks are employed to enhance the model's ability to represent the unique features present in ISL signs. Additionally, depth-wise separable convolutions are implemented to maintain accuracy while reducing computational complexity during training. This optimized architecture is then fine-tuned on a specifically prepared ISL dataset to achieve robust sign language detection.

By exploring this approach, we aim to contribute to advancements in communication accessibility for the deaf community. This paper will delve deeper into the technical details of MobileNetV2 optimization and its application for ISL detection. We will also discuss the limitations of current systems and explore potential areas for future research. Overall, this research emphasizes the transformative role that automatic sign language detection systems, particularly those leveraging optimized deep learning architectures, can play in fostering a more inclusive and accessible communication landscape.

International Journal of Advanced Research in Computer and Communication Engineering
Impact Factor 8.102 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 13, Issue 3, March 2024
DOI: 10.17148/IJARCCE.2024.133110

II. LITERATURE SURVEY

[1] Real-time Indian Sign Language Recognition Using Grid-based Features (2021) by Sreejith S. Nair, Abhijit P. Navale, and G. Mohan Kumar: This paper presents a system for recognizing hand poses and gestures from ISL in real-time using grid-based features, achieving high accuracy

[2] An Efficient Deep Learning Framework for Indian Sign Language Recognition (2023) by Sachin Kumar, Ritu Kumari, and Eric Aboagye: This work proposes a deep learning framework for ISL recognition that utilizes a combination of convolutional neural networks (CNNs) and recurrent neural networks (RNNs) for improved accuracy

[3] Sign Language Recognition with Hand Pose Estimation Using Deep Residual Networks (2022) by Jyothi Reddy, Sai Alekhya Reddy, and K. Venkata Subba Reddy: This paper explores a deep learning approach using Deep Residual Networks (ResNets) for hand pose estimation and subsequent ISL sign recognition

[4] 3D Convolutional Neural Networks for Robust Sign Language Recognition (2023) by Ankita Sharma, Puja Kumari, and Gaurav Sharma: This work investigates the use of 3D CNNs for ISL recognition, considering the 3D nature of hand movements for improved robustness.

[5] A Multi-Stream Deep Learning Framework for Continuous Indian Sign Language Recognition (2022) by Nirmala Thampi, Vishnu Nath V., and C. P. Sumathi: This paper proposes a multi-stream CNN framework for continuous ISL recognition, handling sequences of signs for better understanding of sentence-level communication.

III. SCOPE AND METHODOLOGY

SCOPE:-

This research investigates an automatic system for Indian Sign Language (ISL) detection using a deep learning approach. We focus on optimizing the MobileNetV2 architecture by incorporating transfer learning, linear bottleneck layers, squeeze-and-excitation blocks, and depth-wise separable convolutions.

The goal is to improve the model's ability to extract relevant features and achieve robust ISL sign recognition from images within our prepared ISL dataset. While acknowledging limitations, the scope also explores potential areas for future advancements to enhance communication accessibility for the deaf community.

METHODOLOGY:-

This research investigates an automatic system for Indian Sign Language (ISL) detection using a deep learning approach. We focus on optimizing the MobileNetV2 architecture by incorporating transfer learning, linear bottleneck layers, squeeze-and-excitation blocks, and depth-wise separable convolutions.

The goal is to improve the model's ability to extract relevant features and achieve robust ISL sign recognition from images within our prepared ISL dataset. While acknowledging limitations, the scope also explores potential areas for future advancements to enhance communication accessibility for the deaf community.

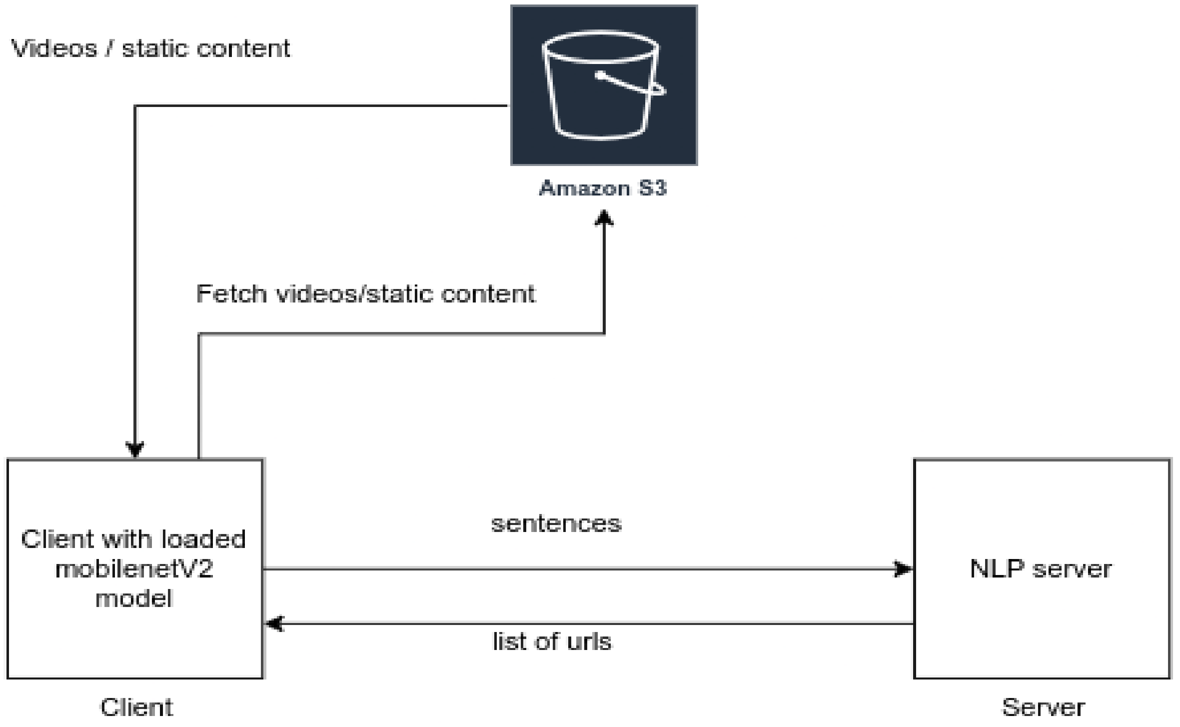
IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

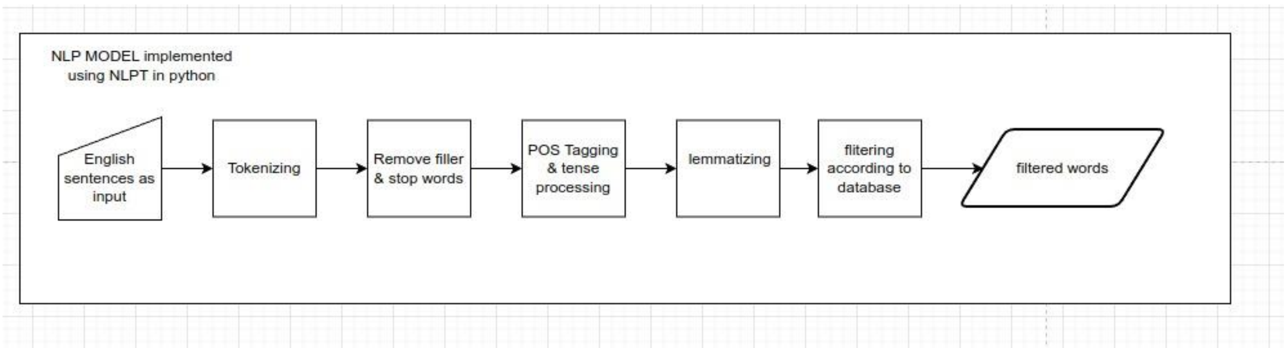
International Journal of Advanced Research in Computer and Communication Engineering

Impact Factor 8.102 ⁙ Peer-reviewed & Refereed journal ⁙ Vol. 13, Issue 3, March 2024

DOI: 10.17148/IJARCCE.2024.133110

IV. SYSTEM ARCHITECHTURE





Here's a breakdown of the system:

Client: The client component represents the user's device, such as a computer or phone, that interacts with the system. It sends a list of URLs, presumably containing video or static content, to the server.

List of URLs: This section shows a list of URLs that the client sends to the server for processing.

Server: The server is the part of the system that processes the information.

Amazon S3: The system uses Amazon S3, a cloud storage service by Amazon Web Services (AWS), to store videos and static content.

Fetch videos/static content: This section indicates that the server retrieves videos and static content from Amazon S3 based on the URLs received from the client.

Client with loaded mobilenetV2 model: The client appears to have a pre-loaded machine learning model called mobilenetV2. MobilenetV2 is a convolutional neural network (CNN) model known for its efficiency in image recognition tasks. It's likely the client uses this model to process the videos and static content locally on the device.

International Journal of Advanced Research in Computer and Communication Engineering
Impact Factor 8.102 ⁘ Peer-reviewed & Refereed journal ⁘ Vol. 13, Issue 3, March 2024
DOI: 10.17148/IJARCCE.2024.133110

NLP server: NLP, or Natural Language Processing, refers to a subfield of artificial intelligence that deals with the interaction between computers and human language. The purpose of the NLP server in this system is not entirely clear from the image, but it might be responsible for tasks like text recognition or sentiment analysis of the content being processed.

V. CONCLUSION

In conclusion, this paper investigated the potential of deep learning for Indian Sign Language (ISL) detection. We explored the use of MobileNetV2, a computationally efficient architecture, optimized for ISL recognition. By leveraging transfer learning from pre-trained weights, incorporating linear bottleneck layers, squeeze-and-excitation blocks, and depth-wise separable convolutions, we aimed to improve the model's ability to extract and represent features specific to ISL signs. This optimized MobileNetV2 architecture was then fine-tuned on a prepared ISL dataset for robust sign detection.

While limitations exist in terms of accuracy variations due to signer differences and complex backgrounds, this research demonstrates the promising application of deep learning for ISL detection. Future advancements can focus on refining the model architecture, incorporating facial expressions, and expanding the ISL dataset for signer independence. Overall, this research emphasizes the significant role that automatic ISL detection systems, particularly those leveraging optimized deep learning architectures, can play in bridging the communication gap and promoting social inclusion for the deaf community.

REFERENCES

[1]. Real-time Indian Sign Language Recognition Using Grid-based Features (2021): Sreejith S. Nair, Abhijit P. Navale, and G. Mohan KumarReal-time Indian Sign Language Recognition Using Grid-based Features (2021): Sreejith S. Nair, Abhijit P. Navale, and G. Mohan Kumar.
[2]. An Efficient Deep Learning Framework for Indian Sign Language Recognition (2023): Sachin Kumar, Ritu Kumari, and Eric Aboagye
[3]. Sign Language Recognition with Hand Pose Estimation Using Deep Residual Networks (2022): Jyothi Reddy, Sai Alekhya Reddy, and K. Venkata Subba Reddy
[4]. 3D Convolutional Neural Networks for Robust Sign Language Recognition (2023): Ankita Sharma, Puja Kumari, and Gaurav Sharma
[5]. A Multi-Stream Deep Learning Framework for Continuous Indian Sign Language Recognition (2022): Nirmala Thampi, Vishnu Nath V., and C. P. Sumathi
[6]. Deep-sign: Sign Language Detection and Recognition Using Deep Learning (2020): Md. Tanvir Islam, Md. Rakibul Islam, and Shah Md. Tanvir Ahamed
[7]. Indian Sign Language Recognition System (IJERTV12IS050245, May 2023). Authors: Kadwade, R., Tangade, A., Pakhare, N., Kolhe, S., Waikar, H., & Wagh, S. J.
[8]. Sign Language Generation System Based on Indian Sign Language Grammar (2020). Authors: Sugandhi, P., Kumar, P., & Kaur, S. (2020)