Sign Language Translator

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ABSTRACT. -Sign Language Translator aims to develop a Sign Language Translator system that bridges communication gaps between individuals with speaking impairments and the wider community. Sign language is a rich and expressive form of communication, but the deaf and hard-of-hearing face challenges when interacting with those who do not understand sign language. Sign language translator leverages advanced technologies in computer vision and natural language processing to enable real-time translation of sign language gestures into spoken or written language. The system employs deep learning models, including convolutional neural networks (CNNs) and recurrent neural networks (RNNs), to recognize and interpret sign language gestures captured through video input. For translation, our work employs state-of-the-art sequence-to-sequence models to convert the recognized sign language sequences into coherent and contextually relevant spoken or written language. Transfer learning techniques may be applied to adapt pre-trained models to specific sign languages or dialects, ensuring versatility across different linguistic contexts. Sign Language Translator emphasizes user-friendliness and accessibility, intending to make the Sign Language Translator system readily available on various platforms, including mobile devices and web applications. The system's user interface provides an intuitive experience, allowing users to receive translations in real time, fostering seamless communication between individuals who use sign language and those who do not.Furthermore, the work recognizes the importance of ongoing collaboration with the dumb and hard-of-hearing community to refine the system's accuracy, address user-specific needs, and enhance overall usability. User feedback and iterative testing will guide continuous improvement, ensuring that the Sign Language Translator becomes a valuable tool for fostering inclusive communication and breaking down barriers for individuals with speaking impairments.

I. INTRODUCTION

In a world where effective communication is fundamental, the language barrier often isolates individuals with speaking disabilitity, hindering their ability to interact seamlessly with the broader community. Sign language, a rich and expressive form of communication, becomes a powerful tool for those with hearing challenges. However, a significant gap in understanding persists, as many individuals do not comprehend sign language. The Sign Language Translator Project seeks to address this disparity by leveraging cutting-edge technologies in computer vision and natural language processing. This project aims to develop an innovative system capable of translating sign language gestures into spoken or written language in real time. The primary goal is to empower individuals with hearing impairments, fostering inclusivity and breaking down communication barriers. For the translation aspect, state-of-the-art sequence-to-sequence models, inspired by transformer architectures, are employed. These models are designed to convert recognized sign language sequences into coherent and contextually relevant spoken or written language. Transfer learning techniques may be applied to make the system versatile across different sign languages and dialects. The user-centric design of the project emphasizes accessibility and user-friendliness. The system is envisioned to be available on various platforms, including mobile devices and web applications, ensuring that individuals with hearing impairments can access it effortlessly. The real-time translation feature aims to facilitate seamless communication between individuals who use sign language and those who do not, fostering a more inclusive society.

Crucially, the Sign Language Translator Project recognizes the significance of continuous collaboration with the dumb and hard-of-hearing community. User feedback and iterative testing will play a pivotal role in refining the system's accuracy, addressing user-specific needs, and enhancing overall usability. By prioritizing user engagement, the project aspires to create a transformative tool that not only translates sign language but also represents a step towards a more inclusive and communicatively connected world.

EXISTING SYSTEM

Current sign language translation systems often struggle to provide accurate and natural translations. Many existing systems have a limited vocabulary and struggle to understand the context in which signs are used. Some sign language translation systems are not designed for real-time communication.

LITERATURE REVIEW

N. C. Camgoz, O. Koller, S. Hadfield, and R. Bowden, addresses the novel architecture that combines Continuous Sign Language Recognition (CSLR) and Translation (SLT) in an end-to-end manner [1]. The authors propose a new approach that exploits the supervision power of glosses to improve recognition and translation accuracy. They evaluate their approach on a large-scale dataset of German sign language videos and show that it outperforms previous state-of-the-art approaches. The paper provides details about the network architecture and training process, including the use of dropout and Xavier initialization. The authors also introduce a novel approach to handling out-of-vocabulary (OOV) signs. Overall, the paper presents a significant contribution to the field of SLT by introducing a novel architecture that achieves state-of-the-art results on a large-scale dataset and provides new baseline results.

R. A. A. R. Agha, M. N. Sefer, and P. Fattah, addresses a comprehensive literature review of various techniques and approaches used in the development of sign language recognition systems [2]. It discusses computer vision-based, soft computing, and gloves-based techniques, as well as sensor-based and vision-based systems. The review includes an overview of works focusing on Indian Sign Language, American Sign Language, and Turkish Sign Language, highlighting the methodologies and results of each approach, and comparing their effectiveness in recognizing different sign languages. Additionally, the paper addresses the challenges faced in sign language recognition, such as hand movement extraction and feature depiction, and emphasizes the importance of leveraging innovative technologies to enhance communication between the hearing-impaired and hearing communities.

J. Huang, W. Zhou, H. Li, and W. Li, provides a comprehensive overview of conventional and recent methods in sign language recognition (SLR) [3]. It discusses the challenges in SLR, such as the lack of large diverse datasets and the limitations of early SLR systems using datagloves and specific sensors. The review covers the use of vision input, including the Microsoft Kinect, and the application of Hidden Markov Models (HMMs) in SLR. Additionally, it highlights the transition to deep learning-based approaches, particularly CNNs and RNNs, and the recent focus on attention models. The review sets the stage for the proposed attention-based 3D-CNN method by contextualizing it within the evolution of SLR techniques and the need for improved performance and robustness.

O. Koller, H. Ney, and R. Bowden addresses “How to Train a CNN on 1 Million Hand Images" presents a new approach to training a frame-based classifier on weakly labelled sequence data using a CNN [4]. The authors provide a detailed description of their method, which involves an iterative EM algorithm that allows for training on a vast number of example images when only loose sequence level information is available. They demonstrate the effectiveness of their approach in hand shape recognition and continuous sign language recognition, and provide a large dataset of manually labelled hand shape images for the community. The paper also includes a literature review of related work in the domains of gesture and sign language recognition, and compares their results to the current state-of-the-art. Overall, the paper presents a valuable contribution to the field of video recognition and provides a useful resource for researchers working in this area.

S. Islam, S. S. S. Mousumi, A. S. A. Rabby, S. A. Hossain, and S. Abujar, addresses a comprehensive overview of existing approaches for sign language recognition, highlighting the limitations of rule-based or template matching methods and the lack of research on recognizing Bangla sign language [5]. The authors discuss the shortcomings of traditional approaches, such as the need for extensive feature engineering and their inability to handle variations in sign language gestures. They also review recent deep learning-based approaches, emphasizing the promising results of Convolutional Neural Networks (CNNs) and Recurrent Neural Networks (RNNs) in recognizing sign language gestures. Overall, the literature review sets the stage for the proposed CNN-based model, positioning it as a more robust and accurate approach for recognizing Bangla sign language digits.

A. Sharma, S. Panda and S. Verma discusses the various technologies developed for the translation of sign languages across the world. It highlights the limitations of hardware-based devices in capturing facial expressions and body language and emphasizes the need for an interface that can aid in interpreting sign language in real-time [6]. The review also emphasizes the importance of recognizing hand gestures, facial

expressions, and body language in the implementation of the design. Additionally, it highlights the motivation behind the work, which is to develop technology for the translation of Indian Sign Language (ISL) and the lack of work done in this area.

A. T. Magar and P. Parajuli, provides an overview of existing systems for hand gesture recognition, highlighting the challenges associated with these systems, such as the need for special input devices and heavy computational resources [8]. It discusses various techniques used in the domain of human-computer interaction for hand gesture recognition, including HOG transforms, SIFT, BRIEF, and ORB, as well as classification techniques such as Support Vector Machines (SVMs) and Hidden Markov Models (HMMs). The review emphasizes the demand for heavy computational resources with these methods. The paper positions its contribution as a novel method for recognizing American Sign Language (ASL) using image pre-processing methods and a Convolutional Neural Network (CNN) for classification, implemented in Raspberry Pi3, which addresses the limitations of existing systems and provides a promising approach to ASL recognition with practical applications in the field of assistive technology.

K. M. Lim, A. W. C. Tan, C. P. Lee, and S. C. Tan, addresses in "Isolated Sign Language Recognition Using CNN Hand Modelling and Hand Energy Image" provides a comprehensive overview of the existing research in the field of sign language recognition, hand tracking, and hand representation [9]. The authors discuss the use of prominent American Sign Language datasets, recent advances in visual tracking, and existing methods for hand tracking and representation. The review highlights the limitations of existing methods and the need for more accurate and efficient techniques. The paper also acknowledges the contributions of previous research and provides context for the expertise and support of the authors. Overall, the literature review sets the stage for the proposed methodology and highlights the significance of the study in advancing the state-of-the-art in sign language recognition.

PROPOSED SYSTEM

Implement a system that continuously learns and updates its vocabulary, allowing it to understand a wider range of signs and their contextual meanings. Design the new system with a focus on real-time communication. Minimize processing delays to ensure seamless and near-instantaneous translation during live conversations.

PROJECT MODULES

Block Diagram of the Project

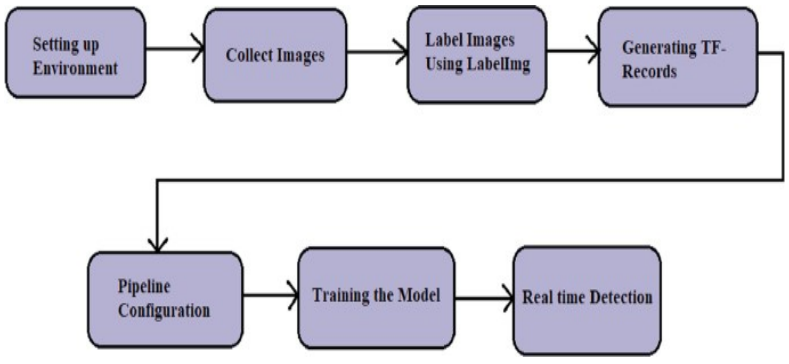

Figure1. Block Diagram

Image Capture and Collection using OpenCV

Image capture and collecting using OpenCV module is responsible for capturing images or video frames using the OpenCV library. It involves accessing the camera feed, capturing live video frames, and saving the images for further processing and analysis. Additionally, the module facilitates the collection of a diverse dataset of sign language gestures and expressions, ensuring that the dataset encompasses various lighting conditions,

angles, and backgrounds to improve the robustness of the training data.

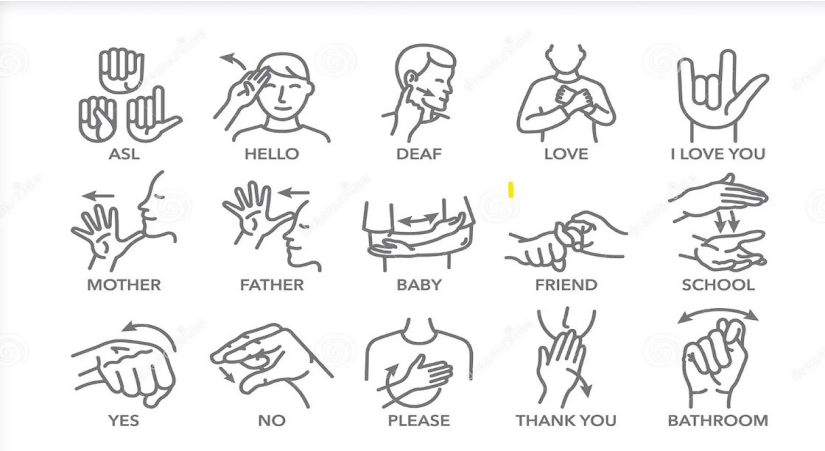

Figure2. Sign Language Examples

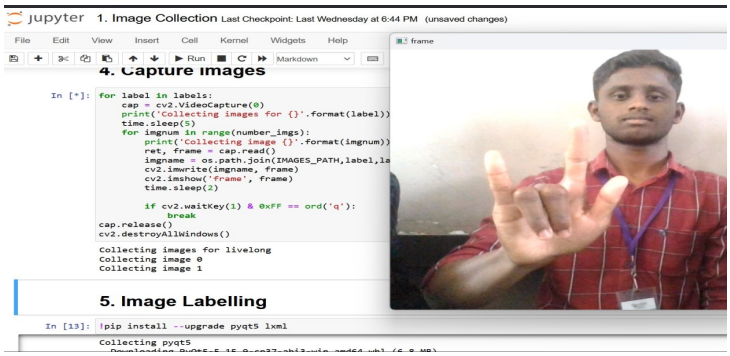

Figure3. Image Collection Using OpenCV

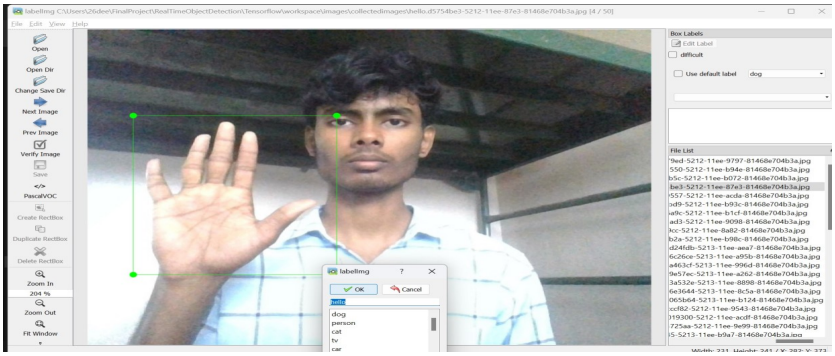

Figure4. Annotating the collected image

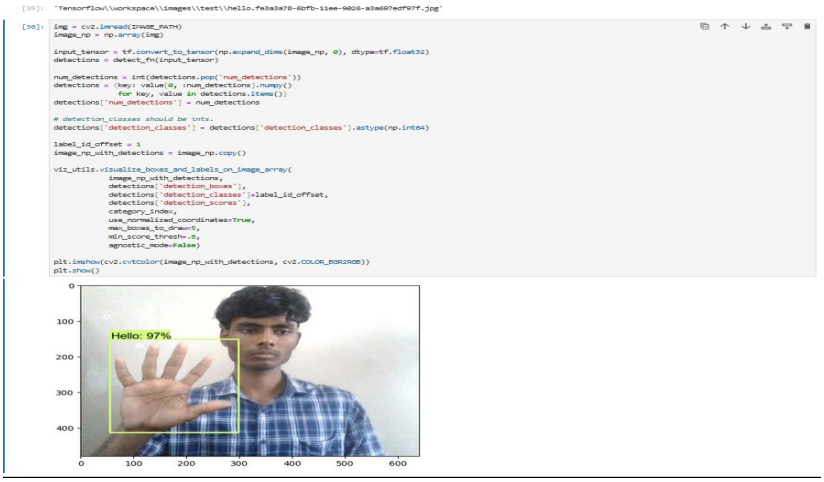

Figure5. Real Time Detection

CONCLUSION

The development of the advanced sign language translator system represents a significant step forward in promoting inclusivity and effective communication for individuals with speaking impairments. By successfully integrating cutting-edge computer vision and better processing techniques, the system demonstrates the potential to bridge the gap between the deaf community and the hearing population. The project's emphasis on real-time translation and the integration of deep learning models and attention mechanisms underscores its commitment to ensuring accurate and timely communication between individuals with diverse linguistic capabilities. Moving forward, it is imperative to continue refining and optimizing the system's performance to enhance its accuracy and usability. Additionally, fostering collaboration with the deaf community and incorporating their feedback throughout the development process remains crucial to tailoring the system to their specific needs and preferences. By prioritizing accessibility and user-friendliness, the sign language translator system aspires to become a valuable tool in promoting a more inclusive and equitable society for all individuals, regardless of their communication abilities.

REFERENCES

[1] N. C. Camgoz, O. Koller, S. Hadfield, and R. Bowden, ‘‘Sign language transformers: Joint end-to-end sign language recognition and translation,’’ in Proc. IEEE/CVF Conf. Comput. Vis. Pattern Recognit. (CVPR),Jun. 2020.

[2] R. A. A. R. Agha, M. N. Sefer, and P. Fattah, ‘‘A comprehensive study on sign languages recognition systems using (SVM, KNN, CNN and ANN),’’ in Proc. 1st Int. Conf. Data Sci., E-Learn. Inf. Syst., Oct. 2018.

[3] J. Huang, W. Zhou, H. Li, and W. Li, ‘‘Attention-based 3D-CNNs for large-vocabulary sign language recognition,’’ IEEE Trans. Circuits Syst. Video Technol., vol. 29, no. 9, Sep. 2019.

[4] O. Koller, H. Ney, and R. Bowden, ‘‘Deep hand: How to train a CNN on 1 million hand images when your data is continuous and weakly labelled,’’ in Proc. IEEE Conf. Comput. Vis. Pattern Recognit. (CVPR), Jun. 2016.

[5] S. Islam, S. S. S. Mousumi, A. S. A. Rabby, S. A. Hossain, and S. Abujar, ‘‘A potent model to recognize Bangla sign language digits using con- volutional neural network,’’ Proc. Comput. Sci., vol. 143, Jan. 2018.

[6] A. Sharma, S. Panda and S. Verma, "Sign Language to Speech Translation," *2020 11th International Conference on Computing, Communication and Networking Technologies (ICCCNT)*, Kharagpur, India, 2020.

[7] A. Moryossef, I. Tsochantaridis, R. Aharoni, S. Ebling, and S. Narayanan, ‘‘Real-time sign language detection using human pose estimation,’’ in Proc. Eur. Conf. Comput. Vis. Cham, Switzerland: Springer, 2020.

[8] A. T. Magar and P. Parajuli, ‘‘American sign language recognition using convolution neural network for raspberry Pi,’’ EasyChair, Tech. Rep. 2957, 2020.

[9] K. M. Lim, A. W. C. Tan, C. P. Lee, and S. C. Tan, ‘‘Isolated sign language recognition using convolutional neural network hand modelling and hand energy image,’’ Multimedia Tools Appl., vol. 78, no. 14, pp. 19917–19944, Jul. 2019.

[10] M. J. Cheok, Z. Omar, and M. H. Jaward, ‘‘A review of hand gesture and sign language recognition techniques,’’ Int. J. Mach. Learn. Cybern.,vol. 10, no. 1, pp. 131–153, Jan. 2019.

[11] Q. Xiao, M. Qin, and Y. Yin, ‘‘Skeleton-based Chinese sign language recognition and generation for bidirectional communication between deaf and hearing people,’’ Neural Netw., vol. 125, May 2020.

[12] O. K. Oyedotun and A. Khashman, ‘‘Deep learning in vision-based static hand gesture recognition,’’ Neural Comput. Appl., vol. 28, no. 12, pp. 3941–3951, ….2017.

[13] N. C. Camgoz, S. Hadfield, O. Koller, and R. Bowden, ‘‘Sub-UNets: End-to-end hand shape and continuous sign language recognition,’’ in Proc. IEEE Int. Conf. Comput. Vis. (ICCV), Oct. 2017.

[14] C.Nagarajan and M.Madheswaran - ‘Experimental verification and stability state space analysis of CLL-T Series Parallel Resonant Converter’ - Journal of ELECTRICAL ENGINEERING, Vol.63 (6), pp.365-372, Dec.2012

[15] C.Nagarajan and M.Madheswaran - ‘Performance Analysis of LCL-T Resonant Converter with Fuzzy/PID Using State

Space Analysis'- Springer, Electrical Engineering, Vol.93 (3), pp.167-178, September 2011.
[16] C.Nagarajan and M.Madheswaran - 'Stability Analysis of Series Parallel Resonant Converter with Fuzzy Logic Controller Using State Space Techniques'- Taylor & Francis, Electric Power Components and Systems, Vol.39 (8), pp.780-793, May 2011.
[17] C.Nagarajan and M.Madheswaran - 'Experimental Study and steady state stability analysis of CLL-T Series Parallel Resonant Converter with Fuzzy controller using State Space Analysis'- Iranian Journal of Electrical & Electronic Engineering, Vol.8 (3), pp.259-267, September 2012.
[18] Nagarajan C., Neelakrishnan G., Akila P., Fathima U., Sneha S. "Performance Analysis and Implementation of 89C51 Controller Based Solar Tracking System with Boost Converter" Journal of VLSI Design Tools & Technology. 2022; 12(2): 34–41p.
[19] C. Nagarajan, G.Neelakrishnan, R. Janani, S.Maithili, G. Ramya "Investigation on Fault Analysis for Power Transformers Using Adaptive Differential Relay" Asian Journal of Electrical Science, Vol.11 No.1, pp: 1-8, 2022.
[20] G.Neelakrishnan, K.Anandhakumar, A.Prathap, S.Prakash "Performance Estimation of cascaded h-bridge MLI for HEV using SVPWM" Suraj Punj Journal for Multidisciplinary Research, 2021, Volume 11, Issue 4, pp:750-756
[21] G.Neelakrishnan, S.N.Pruthika, P.T.Shalini, S.Soniya, "Perfromance Investigation of T-Source Inverter fed with Solar Cell" Suraj Punj Journal for Multidisciplinary Research, 2021, Volume 11, Issue 4, pp:744-749
[22] C.Nagarajan and M.Madheswaran, "Analysis and Simulation of LCL Series Resonant Full Bridge Converter Using PWM Technique with Load Independent Operation" has been presented in ICTES'08, a IEEE / I/ET International Conference organized by M.G.R.University, Chennai.Vol.no.1, pp.190-195, Dec.2007
[23] M Suganthi, N Ramesh, "Treatment of water using natural zeolite as membrane filter", Journal of Environmental Protection and Ecology, Volume 23, Issue 2, pp: 520-530,2022
[24] M Suganthi, N Ramesh, CT Sivakumar, K Vidhya, "Physiochemical Analysis of Ground Water used for Domestic needs in the Area of Perundurai in Erode District", International Research Journal of Multidisciplinary Technovation, pp: 630-635, 2019.