Indian Sign Language Recognition using Python Programming

[1]D.Murugesan, [2] P.Kiruthika, [3] A.Rugiya, [4]S.Subhiksha, [5]M.Vinotha
[1]Associate Professor, Paavai Engineering College, Namakkal, Tamilnadu, India.
[2,3,4,5] UG Students, Paavai Engineering College, Namakkal, Tamilnadu, India.

Abstract— The system is trained with the hand poses in ISL. It have numerous benefits for Individuals who are deaf or hard of hearing, including enhanced cognitive development, improved social Skills, and increased access to information and communication. Future Research could focus on developing more sophisticated models and algorithms that can better analyze and Interpret sign language gestures. Convolutional Neural Networks (CNNs) excel in Image and video analysis tasks due to their hierarchical feature extraction. They find applications in image Recognition, object detection, facial recognition, medical image analysis, self-driving cars

Keywords: Convolution neural network, Deep Learning neural network, python programming, Machine Learning, Indian Sign Language.

I. INTRODUCTION

ISL, or Indian Sign Language, serves as a means of communication for individuals who are hearing and speech impaired. This paper focuses on research related to ISL, as described on the Talking Hands website , where gestures are utilized to convey intricate words and sentences. Accumulative video motion refers to analysing the motion of the hands and arms over time, and this can be done by analysing a sequence of video frames to track the movement of the hands and arms. Deep learning algorithms, such as Convolutional Neural Networks (CNNs) and Recurrent Neural Networks (RNNs), have been successfully applied to many computer vision tasks, including sign language recognition. This project aims to create a system capable of understanding and interpreting sign language used in indian using python programming. Accessibility and quality of life. Here the use of python programming is a cutting-edge project that focuses on developing a system to understand and interpret indian sign language gestures. This project leverages computer vision and machine learning techniques to enable real-time recognition of ISL signs. Others, This system converts the visually detected hand gestures into meaningful texts also that can identify various indications and provide information to common people are thus necessary.

[1] Hameed, H., Usman, M., Khan, M.Z., Hussain, A., Abbas, H., Imran, M.A. and Abbasi, Q.H., 2022, July. Privacy-preserving British sign language recognition using deep learning. In 2022 44th Annual International Conference of the IEEE Engineering in Medicine & Biology Society (EMBC) (pp. 4316-4319). IEEE. Hameed, H., et al sign language, a communication method between the deaf and individuals with normal hearing, uses hand gestures, facial expressions, and body language. Despite its complexity akin to spoken language, sign language has distinct sentence structures from English, involving diverse hand and finger articulations synchronized with head, face, and body movements. Current camera-based sign language recognition systems encounter limitations like poor lighting conditions, training challenges with lengthy video sequences, and significant privacy concerns.

[2] Tornay, S., Razavi, M. and Doss, M.M., 2020, May. Towards multilingual sign language recognition. In ICASSP 2020-2020 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP) (pp. 6309-6313). IEEE. Sandrine Torney et al Sign language recognition encounters resource challenges, especially for hand movements. While hand shape information can be estimated by pooling resources from various sign languages, a parallel approach for hand movement is absent. The proposed solution adopts a multilingual strategy, modeling hand movements with sign language independent data by deriving movement subunits. Validation on Swiss German, German, and Turkish Sign Languages confirms the method's effectiveness in developing sign language recognition systems using diverse multilingual resources.

[3] Qin, W., Mei, X., Chen, Y., Zhang, Q., Yao, Y. and Hu, S., 2021, December. Sign language recognition and translation method based on VTN. In 2021 International Conference on Digital Society

and Intelligent Systems (DSInS) (pp. 111-115). IEEE. Wuyang Qin et al sign language recognition across various applications and acknowledges the challenges faced by existing vision-based systems. It proposes a solution using VTN (Video Transformer Net) to develop a lightweight sign language translation network, leveraging the CSL_BS dataset. The results show that VTN outperforms I3D in isolated sign language recognition and achieves faster recognition speeds. In continuous sign language translation, VTN also demonstrates higher accuracy and faster recognition compared to I3D. Overall, the VTN approach shows promising results in sign language recognition, particularly in continuous translation tasks.

[4] Wang, Y., Zhang, K., Zhang, N., Deng, Z. and Zhang, L., 2022, December. Enhanced motion list reordering for video coding. In 2022 IEEE International Conference on Visual Communications and Image Processing (VCIP) (pp. 1-5). IEEE. Yang Wang et al which improves compression efficiency by using refined motion information instead of original data. EMLR employs a dedicated motion refinement process to derive this information. Additionally, a simplified version, EMLR-S, with two fast algorithms is proposed. Experimental results demonstrate that EMLR achieves an average BD-rate saving of 0.19%, while EMLR-S achieves 0.1% BD-rate saving with minimal complexity change compared to ECM-4.0 under random access configuration.

[5] Chen, P.Y., Lin, C.H. and Peng, W.H., 2022, August. A Study of Motion Coding Schemes for Learned Video Compression. In 2022 35th SBC/SBMicro/IEEE/ACM Symposium on Integrated Circuits and Systems Design (SBCCI) (pp. 1-6). IEEE. Peng-Yu Chen et al The paper explores motion coding for learned video compression, emphasizing optimizing motion representation using optical flow maps. Techniques like incremental flow map prediction and learned motion extrapolation are studied for efficient encoding. Novel approaches like double warping and frame synthesis with motion forward warping improve inter-frame prediction. Experiments show these methods outperform traditional predictive and intra motion coding.[6] Hori, N. and Yamamoto, M., 2022, September. Sign Language Recognition using the reuse of estimate results by each epoch. In 2022 7th International Conference on Frontiers of Signal Processing (ICFSP) (pp. 45-50). IEEE. Noriaki Hori et al Researchers have developed accurate sign language recognition systems, employing preprocessing like optical flow and posture estimation, followed by machine learning with models such as 3DCNN.

Models utilizing posture estimation generally perform well. Recent studies combine multiple recognition methods for enhanced accuracy. For example, SAM-SLR and SAM-SLR-v2 achieved high recognition rates using AUTSL for Turkish sign language. SAM-SLR-v2 introduced a skeleton-aware multi-model framework supporting three sign language datasets, achieving high recognition rates for isolated signs in Turkish Sign Language videos with RGB and Depth modalities. This study proposes reusing previous training models and estimating results at each epoch to boost recognition rates, utilizing posture estimation Joint and Bone features. Additionally, it reports the recognition rate of the Multi-stream, Modal-free Late-fusion Ensemble using this method with joint and bone features.

II. SYSTEM DESIGN AND DEVELOPMENT

Building a system for Indian Sign Language (ISL) recognition using Python involves several steps. Here's a simplified outline: Data Collection: Gather a dataset of ISL gestures. Consider collaborating with experts in ISL to ensure accuracy and cultural relevance. Preprocessing: Clean and preprocess the data, including resizing images, normalizing intensities, and removing noise. Feature Extraction: Extract relevant features from the preprocessed data. Popular techniques include histogram of oriented gradients (HOG) or convolutional neural networks (CNNs).Model Selection: Choose a suitable machine learning or deep learning model for sign language recognition. Options include SVM, Random Forest, or deep learning frameworks like Tensor Flow or PyTorch.Model Training: Train your chosen model using the preprocessed data. Ensure proper validation to avoid overfitting Evaluation: Assess the model's performance on a separate test set. Metrics like accuracy, precision, recall, and F1 score can be useful. Integration: Develop an application or system interface for real-time ISL recognition. Utilize libraries like OpenCV for camera input and model inference User Interface: Design a user-friendly interface, possibly integrating with GUI frameworks like Tkinter or PyQt.Deployment: Deploy the system on the desired platform. Consider optimizing the model for performance on devices with limited resources Continuous Improvement: Gather feedback, refine the model, and update the system to enhance accuracy and usability.

a) UML DIAGRAMS

UML is unified modeling language. The goal is for to become a common language for creating models of object oriented computer software. There are two major components: a meta-model and a notation. The UML is standard language for specifying, visualization, constructing and documenting the artifacts of software systems. This is a very important part of developing objects oriented software and software development process.

b) USE CASE DIAGRAM

A use case diagram in the UML is type of behavioral diagram. Its purpose is to present a graphical overview of the functionality provided by a system in terms of actors, their goals and any dependencies between the use cases.

c) CLASS DIAGRAM

In software engineering, a class diagram in the UML, is a type of static structure diagram that describes the structure of the system by showing the systems classes, their attributes, operations, and the relationships among the classes. It explains which class contains information.

d) DEPLOYMENT

Component diagrams are used to describe the components and deployment diagrams shows how they are deployed in hardware. Mainly designed to focus on the software artifacts of a system. However, these two diagrams are special diagrams used to focus on software and hardware components.

Block Diagram

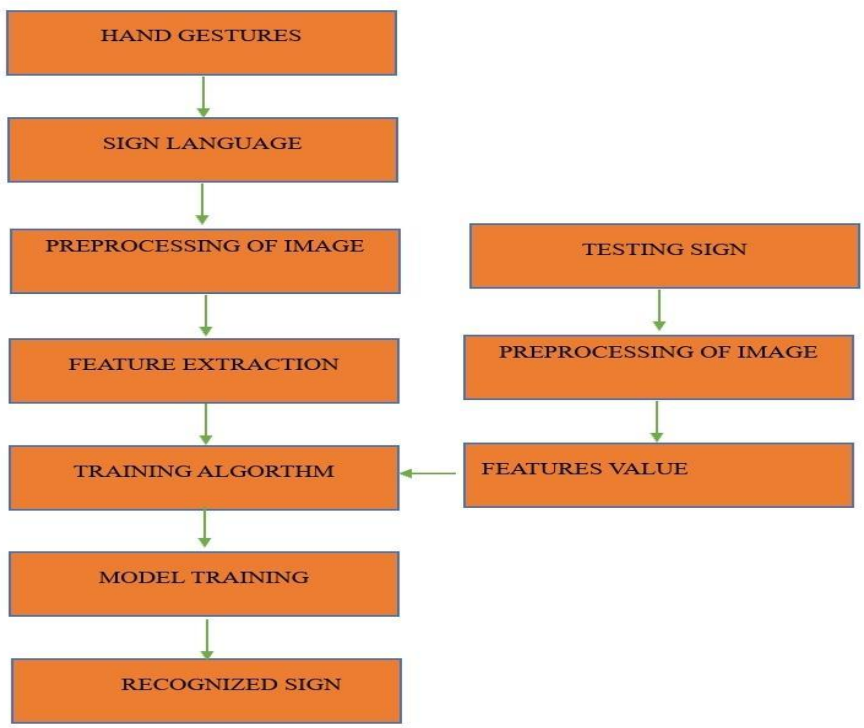

Fig A. BLOCK DIAGRAM

IV RESULT AND DISCUSSION

The comparative strengths of Convolutional Neural Networks (CNN) and Recurrent Neural Networks

(RNN) in the context of sign language recognition. CNNs are considered more powerful than RNNs due to their ability to capture complex spatial features. They operate on fixed-size inputs and produce fixed-size outputs, making them suitable for tasks like image classification. On the other hand, RNNs excel at handling sequences of arbitrary lengths, making them well-suited for tasks involving sequential data like natural language processing. That sign language recognition systems can benefit from incorporating accumulative video motion and deep learning techniques. By leveraging the strengths of both CNNs and RNNs, such systems can improve existing recognition capabilities. This improvement has the potential to facilitate more seamless and natural communication between sign language users and non-sign language users, enhancing accessibility and communication opportunities for individuals who rely on sign language.

V CONCLUSION

Isolated sign language recognition by accumulative video motion using deep learning is a promising approach for improving the accuracy and performance of sign language recognition systems. This approach involves using deep learning algorithms, to analyse and interpret the motion information from video frames.The accumulative video motion approach has shown good results in recognizing isolated sign language gestures, which can be useful for applications such as assistive technology and communication aids for the deaf and hard of hearing. By improving the accuracy and performance of sign language recognition systems, this approach can also help to bridge the communication gap between hearing and deaf communities. There are still challenges that need to be addressed, such as the high variability and complexity of sign language gestures and the need for large datasets for training deep learning models. Continued research in this area is important to further improve the accuracy and performance of sign language recognition systems and to make them more accessible and useful for people who rely on sign language to communicate.

REFERENCES

[1] Hameed, H., Usman, M., Khan, M.Z., Hussain, A., Abbas, H., Imran, M.A. and Abbasi, Q.H., 2022, July. Privacy-preserving British sign language recognition using deep learning.

[2]Tornay, S., Razavi, M. and Doss, M.M., 2020, May. Towards multilingual sign language recognition. In ICASSP 2020-2020 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP) (pp. 6309-6313). IEEE. Sandrine Torney et al Sign language recognition encounters resource challenges, especially for hand movements.

[3] Qin, W., Mei, X., Chen, Y., Zhang, Q., Yao, Y. and Hu, S., 2021, December. Sign language recognition and translation method based on VTN. In 2021 International Conference on Digital Society and Intelligent Systems (DSInS) (pp. 111-115). IEEE.

[4]Wang, Y., Zhang, K., Zhang, N., Deng, Z. and Zhang, L., 2022, December. Enhanced motion list reordering for video coding. In 2022 IEEE International Conference on Visual Communications and Image Processing (VCIP) (pp. 1-5). IEEE.

[5] Chen, P.Y., Lin, C.H. and Peng, W.H., 2022, August. A Study of Motion Coding Schemes for Learned Video Compression. In 2022 35th SBC/SBMicro/IEEE/ACM Symposium on Integrated Circuits and Systems Design (SBCCI) (pp. 1-6). IEEE.

[7]Hori, N. and Yamamoto, M., 2022, September. Sign Language Recognition using the reuse of estimate results by each epoch. In 2022 7th International Conference on Frontiers of Signal Processing (ICFSP) (pp. 45-50). IEEE.

[9] Murugesan, D., Sivadas, K., Keerthana, M., Shalini, S. and Vijayan, S., Hemogluco Analyser for Clinical and Diagnostic Purposes in Diabetic Patients.

[10] Mudhivarthi, B.R., Shah, P., Sekhar, R., Murugesan, D. and Bhole, K., 2023, July. Cybernetic Technologies in Industry 4.0. In 2023 14th International Conference on Computing Communication and Networking Technologies (ICCCNT) (pp. 1-6). IEEE.

[11] Shylla, D., Shah, P., Sekhar, R. and Murugesan, D., 2023, July. Embedded Systems in Industrial Automation 4.0. In 2023 14th International Conference on Computing Communication and Networking Technologies (ICCCNT) (pp. 1-6). IEEE.

[12] Dodia, A., Shah, P., Sekhar, R. and Murugesan, D., 2023, May. Smart sensors in industry 4.0. In 2023 4th International Conference for Emerging Technology (INCET) (pp. 1-6). IEEE.

[13] Murugesan, D., Jagatheesan, K., Shah, P. and Sekhar, R., 2023. Fractional order PIλDμ controller for microgrid power system using cohort intelligence optimization. Results in Control and Optimization, 11, p.100218.

[14] Murugesan, D., Jagatheesan, K., Shah, P. and Sekhar, R., 2023. Optimization of load frequency control gain parameters for stochastic microgrid power system. Journal of Robotics and Control (JRC), 4(5), pp.726-742.

[15] Murugesan, D., Kaviyarasan, M., Matheswari, S., Preethika, M. and Tamilarasan, B., IOT based Assist Device for Pulmonary Diseased Patients Monitoring Framework.

[16] 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.

[17] 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.

[18] 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.

[19] 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.

[20] 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.

[21] 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.

[22] 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

[23] 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

[24] 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 / IET International Conference organized by M.G.R.University, Chennai.Vol.no.1, pp.190-195, Dec.2007.

[25] 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

[26] 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