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Hand gestures recognition Using Media Pipe

[1]Miss.Akanksha S.Tayde, [2]Miss.Laxmi K.Khillare, [3]Miss.Pratiksha B.Mundhe, [4]Miss.M.A.Patil

[1 2]Department of Computer Science and Engineering, Anuradha Engineering, College, Chikhali, Maharashtra,India

[3]Assistant Professor Department of Computer Science and Engineering, Anuradha Engineering, College, Chikhali, Maharashtra,India

[1]taydeakanksha29@gmail,com,[2]lkhillare978@gmail.com,[3]pratikshamundhe2022@gmail.com, [4]megha.Patil@aecc.ac.in

ABSTRACT: Hand gesture recognition system received great attention in the recent few years because of its manifoldness applications and the ability to interact with machine efficiently through human computer interaction. In this paper a survey of recent hand gesture recognition systems is presented. Key issues of hand gesture recognition system are presented with challenges of gesture system. Review methods of recent postures and gestures recognition system presented as well. Summary of research results of hand gesture methods, databases, and comparison between main gesture recognition phases are also given. Advantages and drawbacks of the discussed systems are explained finally. Most of the articles focus on three key aspects of the vision-based hand gesture recognition system: data acquisition, data environment, and hand gesture representation. Successful efforts in hand gesture recognition research over the past two decades have paved the way for natural human–computer interaction systems. However, ongoing challenges—such as consistently identifying the gesturing phase, sensitivity to variations in size, shape, and speed, as well as issues caused by occlusion—continue to keep hand gesture recognition research highly active.

Keywords:- Classification, feature extraction, dynamic hand gesture recognition, sign language recognition.

Corresponding Author: *Miss.M.A.Patil*
Associate Professor Department of Computer Science and Engineering, Anuradha Engineering, College, Chikhali, Maharashtra,India

INTRODUCTION:

The primary goal of gesture recognition research is to develop a system that can accurately identify specific human gestures and use them for communication or device control. A gesture can be defined as any physical movement of the hands, arms, face, or body intended to convey information or meaning.

As information technology continues to evolve, computer systems are becoming more integrated into everyday life. This shift creates a demand for new, more natural, and user-friendly forms of human-computer interaction (HCI). Traditionally, personal computer interfaces have transitioned from text-based command lines to graphical interfaces using keyboards and mice. However, these methods can sometimes be cumbersome and less intuitive. Hand gestures present an attractive alternative for HCI, as they are a natural means of communication and emotional expression. Recognizing hand gestures visually can simplify interactions and make them feel more seamless. Vision-based recognition is also a cost-effective and efficient way to collect information, making it a promising solution for gesture recognition.

Recent research has emphasized the growing importance of gesture recognition in HCI. The primary aim of this research is to develop systems that can recognize specific human gestures and use them for communication or device control. Gesture recognition not only involves tracking movements but also interpreting them as meaningful commands.
There are two main approaches to interpreting gestures in HCI:

1. Data Glove Methods: This technique uses sensors attached to a glove to capture finger movements and convert them into electrical signals for hand posture recognition. However, it requires users to be physically connected to a computer via cables, making interactions feel less natural.

2. Vision-Based Methods: These approaches rely on computer vision to interpret gestures without the need for any physical devices. While designing a vision-based interface for general use can be challenging, it is feasible for controlled environments.

OBJECTIVE

The goal of hand gesture recognition is to detect and interpret human gestures and movements in videos for various applications:

Human-Computer Interaction (HCI): Hand gesture recognition plays a crucial role in enhancing HCI.

Accessibility: It helps improve usability and supports the development of assistive technologies.

HAND TRAKING MODEL

1.Media Pipe: Media Pipe is an open-source, Google-developed, cross-platform pipe-building machine learning framework. It provides an off-the-shelf solution to real-time perception tasks such as face detection, hand tracking, pose estimation, and object tracking. Key Features of Media Pipe:

1. Cross-Platform Support: Works on Android, iOS, Windows, macOS, and Linux.

2. Pre-Trained Models: Includes ready-to-use machine learning solutions for vision and audio tasks.

2.OpenCV: OpenCV, an open-source computer vision library, provides powerful tools to recognize hands in real-time by applying image processing, feature extraction, and machine learning. OpenCV provides powerful tools to recognize hands in real-time, permitting touchless interactions in many applications.

3.TensorFlow: Hand Gesture Recognition (HGR) is an important area in computer vision, through which users are able to communicate and control computers and smart devices in a touchless fashion. TensorFlow, an open-source platform for machine learning, provides effective tools to build deep models in Hand Gesture Recognition

SYSTEM ARCHITECTURE

Hand gesture recognition system comprises four various stages to recognize the gesture. The stages are the acquisition of the data, the pre-processing and the hand segmentation, the extraction of the features, and finally the recognition. The hand image is sensed by the proper input device. The image gets segmented to separate the hand from the background and other body parts, and the image gets processed later to remove the noise, to find the edges/contours, and to normalize to give the simplest and required model.

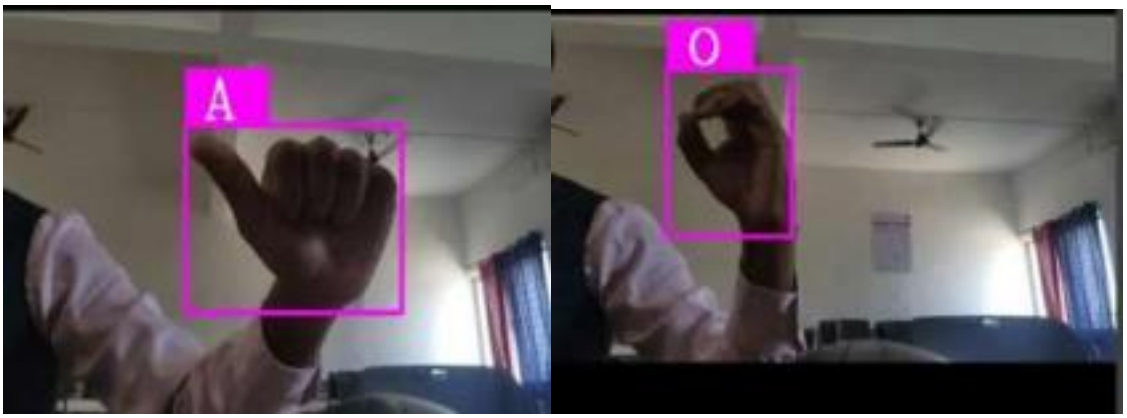

Figure: Hand Gesture result

The features are extracted from the pre-processed and segmented image to recognize. The final images are classified into a significant gesture based on the modeling.

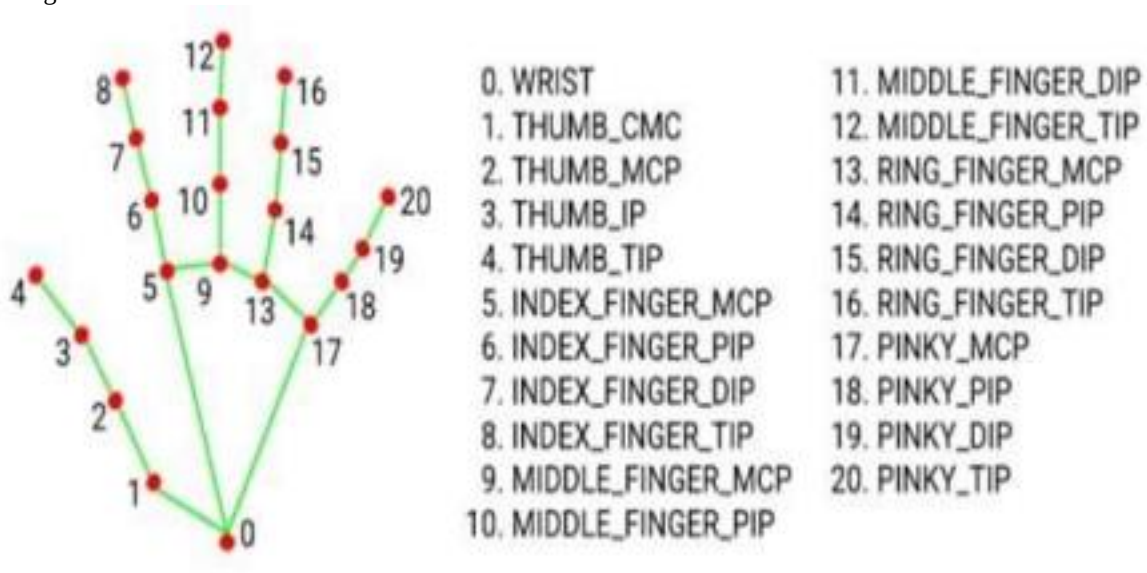

Figure : Media pipe Algorithm hand coordinates

5. Data Acquisition

➢ **Benefits of Hand Gesture Recognition**

• Enhanced User Experience: A more interesting and natural way to use technology.

• Accessibility: Opening up opportunities to differently-abled users to communicate in ways conventional interfaces are incapable of.

• Potential Uses: Used in numerous applications, from healthcare to video games, to home automation.

➢ **Economic Considerations**

• Development Costs: The initial cost to develop the technology, in terms of both the hardware and the software, could be significant.

• Market Demand: Increased demand from users who are interested in the convenience and ease of gestural interfaces could cover the cost.

➢ **Future Directions**

• R D: Continuing research to develop algorithms to recognize and interpret the movements, making them faster and less computationally intensive.

• Multimodal Systems: Development to merge the use of voice, touch, and gestural interactions to provide the users the most consistent experience.

6. Methodology

a) Technology Selection

• Choose Gesture Recognition Method: - Data Glove: Where precision and accurate tracking are required. - Vision-Based: For ease and ease-of-use. • Identify Hardware: Cameras (for vision-based systems), sensors (for data gloves), and processing units.

b) System Development

• Identify Gesture Set: List the to-be-recognized gestures, based on the use case and needs (e.g., swipe, pinch, open/close hand).

• System Architecture: - Plan the overall architecture, including the components involved in acquiring, processing, and displaying the data. - Identify the chosen software platforms and languages (e.g., Python, OpenCV for processing vision).

c) Data Acquisition

• Creating the Dataset: Record examples of various hands to train and test the algorithms.

• Variability in the Environment: Record under different lighting, background, and

variations in users to gain robustness.

d) Development of Algorithms

• Feature Extraction: Extract the most useful features from the gesture data (e.g., shape of the hand, trajectory of the hand's movement).

• Machine Learning Algorithms: Identify and train appropriate models for gesture recognition (e.g., Convolutional Neural Networks, Support Vector Machines). • Testing and Validation: Test model performance based on precision, accuracy, recall, and F1-score.

e) Testing and Assessment

• Testing by the Target Users: Conduct usability tests with intended users to gather feedback on system performance and interaction quality.

• Improvement through Iteration: Tweak algorithms and the overall system based on user feedback and evaluation results.

f) Deployment

• Real-World Testing: Implement the system in real-life applications to test performance and gather additional data for optimization.

• Training and Support: Provide user training and ongoing technical support.

7. Expected outcomes

Accurate Gesture Recognition: The system has to identify and classify a broad variety of hand gestures with high accuracy.

Real-Time Recognition: The system is also required to identify the gestures in real-time without noticeable latency.

These results are aimed at enhancing the quality of the user experience and increasing the applications of hand gesture recognition technology.

8.Future Scope

1.Artificial Intelligence and Machine Learning Integration

Future Direction: Integrating hand gesture recognition with AI and machine learning can significantly enhance its intelligence, speed, and adaptability. AI enables more accurate gesture analysis, even in noisy or complex environments.

Possible Uses: AI-powered gesture recognition, adaptive and personalized gesture detection, and gesture-based AI assistants.

2.Sign Language Recognition

Future Perspective: Sign language recognition technology has the potential to convert sign language into text or speech, making communication more accessible for individuals with hearing impairments.

Possible Uses: Real-time sign language interpreters, inclusive communication tools, and intelligent assistive technologies.

9.Conclusion

This paper had discussed the problems, progress, and future course of the vision-based hand gesture recognition system over a period of seven years. It was observed that almost every paper we considered had stressed the role of data acquisition, features, and the training data environment. It was also noted that the majority of databases utilized in hand gesture recognition research utilized databases of a constrained environment, and consequently, there is a need for databases on sign languages to be less constrained and comprise multiple environments. The paper thus concludes that in order to get the vision-based gesture recognition system prepared for usage in a real-world setup, there is a need to accord greater attention to the setup in the uncontrolled environment of setup

Reference

1. Comparison of Object Detection on Drone Using TensorFlow with Various Architectures. (2022). IEEE Xplore.HE.ORG

2. Google Al Blog - TensorFlow Overview: [https://ai.googleblog.com] Cognition

3. TensorFlow Official Documentation: [https://www.tensorflow.org]

4. TensorFlowGitHubRepository: [https://github.com/tensorflow/tensorflow].Ferludin, O., Eigenwillig, A., Blais, M., et al. (2022). TF GNN: GraphNeural Networks in TensorFlow.arXiv:2207.03522..

5. Brown, N., Echols, B., Zarins, J., Grosser, T. (2022). TensorFlow as a DSL forStencil-Based Computation on the Cerebras Wafer Scale Engine. arXiv:2210.04795.

6. Dr. Anjaneya L H., 2Dr.Mahanthesha U and 3Banumathi K L(2023) http://dx.doi.org/10.2432

7. Jiang et al (2021)https://www.sciencedirect.com/topics/computer science/handgesture-recognition

8. Victor Chang Rahman Olamide Eniola Lewis Golightly Qianwen Ariel Xu1(2023)https://doi.or023-01751- y

9. Accelerated Linear Algebra. (2023). Wikipedia

10. Image Classification using Deep Learning and TensorFlow. (2023). International Journal for Research in Applied Science Engineering Technology.

11. Keras/TensorFlow in Drug Design for Immunity Disorders. (2023). International Journal of Molecular Sciences.