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A LITERATURE REVIEW ON GESTURE RECOGNITION AND ITS APPLICATIONS IN HUMAN-COMPUTER INTERACTION

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ABSTRACT

Gesture recognition has garnered significant attention in recent years, particularly in human-computer interaction (HCI) and virtual reality (VR) systems. This paper reviews the advancements in gesture recognition technologies, including hand gesture-based cursor control, image segmentation, and real-time recognition systems, with a focus on applications in food quality evaluation and medical imaging. Several studies have explored innovative frameworks and algorithms for improving the efficiency of gesture recognition systems.

Keywords: Human Computer Interaction (HCI), Gesture Recognition, Virtual Reality, Image Segmentation, Food Quality Evaluation, Medical Imaging.

1. INTRODUCTION

In the context of cognitive InfoCommunications, the integration of human-computer interaction (HCI) and virtual reality (VR) has opened new possibilities for interactive systems. Researchers have focused on developing systems that allow users to control and interact with computers using natural gestures, such as hand movements. This review synthesizes key contributions in the field, focusing on hand gesture recognition, virtual mouse systems, and image processing for specialized applications.

2. GESTURE RECOGNITION IN HUMAN-COMPUTER INTERACTION

Katona [1] provides a comprehensive review of the human-computer interaction field, highlighting the role of virtual reality in cognitive InfoCommunications. The study emphasizes the evolution of VR systems, where gestures are used to improve the interaction between users and machines. As VR technologies advance, gesture recognition plays a critical role in creating immersive experiences and natural user interfaces.

A notable framework for building perception pipelines is introduced by Lugaresi [2], which leverages the MediaPipe library. MediaPipe provides efficient tools for real-time hand gesture recognition and is widely adopted in VR and augmented reality (AR) applications. This framework simplifies the process of building and deploying gesture-based systems by offering ready-made solutions for tracking hand movements and gestures.

3. HAND GESTURE-BASED CURSOR CONTROL

Hand gesture-based cursor control systems have gained popularity as a means of replacing traditional input devices like the mouse. Thomas [3] demonstrated the use of hand gestures to manipulate a virtual mouse. This system enables users to perform tasks that typically require a mouse, such as selecting and dragging objects, using only their hand movements. The system's robustness lies in its ability to accurately recognize hand gestures in real-time, providing a seamless user experience.

Vinay [4] also investigated cursor control through hand gestures, offering an innovative solution to traditional mouse inputs. Their work emphasizes the need for high accuracy in recognizing gestures, as any misinterpretation can disrupt the interaction flow. Such systems rely on advanced machine learning algorithms and image processing techniques to identify and translate hand gestures into commands.

4. IMAGE SEGMENTATION IN SPECIALIZED APPLICATIONS

Image segmentation is a crucial technique in fields such as food quality evaluation and medical imaging. Nandhini and Jaya [5] developed an image segmentation approach to assess the quality of food products. Their system utilizes computer vision to segment images of food items, evaluating them for defects or irregularities. The technique's accuracy is vital in ensuring that only high-quality food products reach consumers.

In addition to food quality evaluation, image segmentation is also used in medical imaging. Nandhini et al. [7] presented a review of computer vision systems used in medical imaging, focusing on segmentation techniques for identifying anomalies in medical scans. This application underscores the importance of image processing technologies in both healthcare and industrial settings.

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5. REAL-TIME HAND GESTURE RECOGNITION

Real-time gesture recognition systems have been a focal point of research. Dudhane [6] developed a system for cursor control using hand gestures, demonstrating that such systems can function efficiently in real-time environments. The study emphasizes the challenges of processing gestures rapidly while maintaining high accuracy. Their system incorporated motion tracking and image analysis techniques to capture and interpret hand movements.

Liou et al. [9] also contributed to this field by designing a real-time hand gesture recognition system based on motion history images (MHI). Their approach improves recognition speed and accuracy by encoding the temporal motion of hand gestures, which enhances the system's responsiveness in dynamic environments. This method provides a foundation for gesture-based control in a variety of applications, such as VR and gaming.

6. EARLY GESTURE RECOGNITION SYSTEMS

Early research in gesture recognition laid the groundwork for modern systems. Quam [10] explored gesture recognition using a DataGlove, a wearable device that captures hand movements for interaction with virtual environments. Although this technology was limited in comparison to current systems, it demonstrated the potential of gesture-based control in aerospace and military applications, marking an important step forward in HCI.

7. CONCLUSION

The field of gesture recognition continues to evolve, with significant advancements in hand gesture-based cursor control, image segmentation, and real-time systems. The integration of these technologies in HCI and VR systems opens up new opportunities for more intuitive and natural user interfaces. Future research will likely focus on improving the accuracy, efficiency, and real-time performance of gesture recognition systems, as well as expanding their applications across various industries, including healthcare, food quality control, and entertainment.

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