Hand Gesture Recognition System By IOT

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Abstract - Hand gesture recognition has emerged as a critical area in human-computer interaction, enabling intuitive and contactless communication. This survey explores the progress and challenges in hand gesture recognition systems, with a particular focus on methods implemented using OpenCV. The paper systematically reviews techniques in image preprocessing, hand segmentation, feature extraction, and gesture classification. Classical methods such as contour analysis and convex hull techniques are examined alongside machine learning approaches like Support Vector Machines (SVM) and K-Nearest Neighbors (KNN). Emerging trends, including integrating the deep learning and the hybrid models, are also explored.

The survey covers an extensive range of applications, including assistive technologies for differently abled individuals, gaming interfaces, and smart home automation. It emphasizes the practical implementation of these systems, identifying challenges such as sensitivity to lighting changes, complex backgrounds, and variations in hand shapes. Performance metrics like recognition accuracy, processing time, and system scalability are analyzed to evaluate the effectiveness of various techniques.

*Key Words*: Hand gesture, Recognition, Open CV, KNN

1.INTRODUCTION

Hand gesture recognition is a vital subdomain of human-computer interaction (HCI), focusing on enabling machines to interpret and respond to human gestures. As a natural and intuitive method of communication, gestures can bridge the gap between humans and technology, paving the way for applications in various fields such as healthcare, gaming, and automation . Over the years, advancements in computer vision and machine learning have spurred significant progress in this research area.

Traditional Image Processing Approaches

- **Contour and Convex Hull Techniques**: Studies leveraging contour analysis and convex hulls focus on extracting hand features like boundaries and finger counts. For instance, Gupta et al. (2019) utilized convex hulls to identify finger gestures with over 85% accuracy in static backgrounds but faced limitations in dynamic environments.
- **Skin Color Segmentation**: Skin detection using color spaces (e.g., HSV, YCbCr) has been widely employed. Chen et al. (2020) demonstrated efficient hand segmentation using the HSV model, achieving real-time performance but struggled with variable lighting conditions.

Figure 2 - Example of 2D convolution operation.
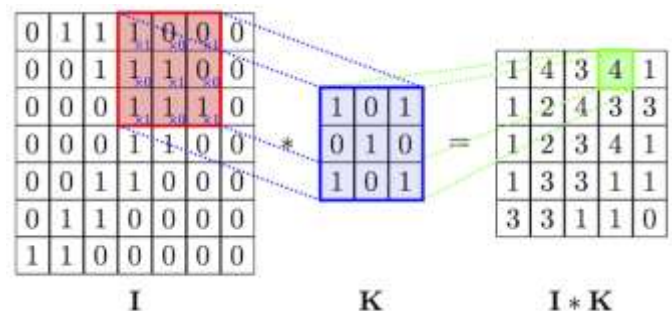
CNN are the current state-of-the-art model architecture for image classification tasks. CNNs apply a series of filters to the raw pixel data of an image to extract and learn higher-level features, which the model can then use for classification. CNNs contains three components
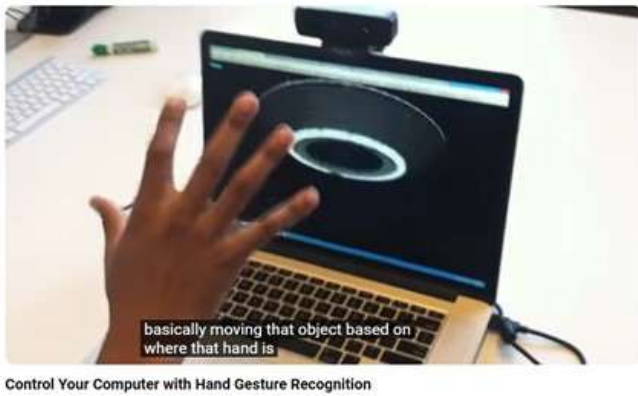
Control Your Computer with Hand Gesture Recognition

Fig -1: Figure

Charts

3. CONCLUSIONS

Hand gesture recognition using OpenCV has gained traction due to its capability to provide efficient and real-time solutions for human-computer interaction. This study surveyed various methodologies, highlighting the strengths and limitations of traditional image processing techniques and advanced machine learning models.

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