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Gesture Recognition Based Virtual Mouse and Keyboard

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Abstract - *Now a days computer vision has reached its pinnacle, where a computer can identify its owner using a simple program of image processing. In this stage of development, people are using this vision in many aspects of day to day life, like Face Recognition, Colour detection, Automatic car, etc. In this project, computer vision is used in creating an Optical mouse and keyboard using hand gestures. The camera of the computer will read the image of different gestures per- formed by a person's hand and according to the movement of the gestures the Mouse or the cursor of the computer will move, even perform right and left clicks using different gestures. Similarly, the keyboard functions may be used with some different gestures, like using one finger gesture for alphabet select and four-figure gesture to swipe left and right. It will act as a virtual mouse and keyboard with no wire or external devices. The only hardware aspect of the project is a web-cam and the coding is done on python using Anaconda platform. Here the Convex hull defects are first generated and then using the defect calculations an algorithm is generated and mapping the mouse and keyboard functions with the defects. Map- ping a couple of them with the mouse and keyboard, the computer will understand the gesture shown by the user and act accordingly.*

Key Words: Virtual Keyboard, Brain Computer Interface (BCI), RGB, Touch-less Keyboard, Colour Channels.

1. INTRODUCTION

The Gesture Recognition Based Virtual Mouse and Keyboard project is an innovative system that allows users to control their computer's mouse and keyboard functions using hand gestures. It aims to provide an alternative and more intuitive way of interacting with computers, particularly for individuals with physical disabilities or those seeking a more natural user interface.The system utilizes computer vision techniques to capture and interpret hand gestures in real-time. It involves a camera that captures the user's hand movements, which are then processed using image processing and machine learning algorithm.Through the recognition of specific hand gestures, the system can interpret various commands and translate them into corresponding mouse movements or keyboard inputs.The project often involves a combination of hardware and software components. The hardware includes the camera for capturing hand gestures, while the software entails the algorithms and models for gesture recognition and the necessary drivers for emulating mouse and keyboard inputs.Gesture Recognition Based Virtual Mouse and Keyboard projects have the potential to revolutionize human-computer interaction by providing an alternative means of input that is more intuitive, natural, and accessible. They can enhance user experience, facilitate computer accessibility for people with physical limitations, and open up new possibilities for human-computer interaction in various domains.

2. LITERATURE SURVEY

1. Research on the Hand Gesture Recognition Based on Deep Learning : With the rapid development of computer vision, the demand for interaction between human and machine is becoming more and more extensive. Since hand gestures are able to express enriched information, the hand gesture recognition is widely used in robot control, intelligent furniture and other aspects. The paper realises the segmentation of hand gestures by establishing the skin colour model and AdaBoost classifier based on haar according to the particularity of skin colour for hand gestures, as well as the denaturation of hand gestures with one frame of video being cut for analysis. In this regard, the human hand is segmented from the complicated background, the real- time hand gesture tracking is also realised by CamShift algorithm. Then, the area of hand gestures which has been detected in real time is recognised by convolutional neural network so as to realise the recognition of 10 common digits. Experiments show 98.3% accuracy.
2. Dynamic and Personalised Keyboard for Eye Tracker Typing : Patients who suffer from Amyotrophic lateral sclerosis (ALS) or stroke cannot talk and express their everyday basic needs and requests. They can communicate using eye trackers since they can still use their eyes and sometimes move their heads. This study suggests new methods for improvements in both speed and ease of use for eye tracker softwares. The first one is letter prediction to improve the speed, and second one is a new design that obviates the need of blinking with eye trackers, thus providing more comfortable and longer sessions of writing.
3.

3. Algorithm for decoding visual gestures for an assistive virtual key- board : Text production is one of the most frequent activities on a computer, a trivial task that can be limiting for individuals affected by severe neuromotor disorders such as Amyotrophic Lateral Sclerosis (ALS) that can lead to Locked-in syndrome (LIS). These individuals need augmentative and alternative communication tools, since they may have only the eye movements as a form of communication and interaction with the outside world. This work investigates methods of interaction based on eye movement tracking and presents a virtual keyboard that utilises gaze detection as a text input. It describes the development of the shape detection algorithm for the assistive keyboard, typed word voting from a Brazilian Portuguese lexicon and preliminary results on the decoding algorithm
4. Virtual Mouse Control Using Coloured Finger Tips and Hand Gesture Recognition : In human-computer interaction, virtual mouse implemented with finger tip recognition and hand gesture tracking based on image in a live video is one of the studies. In this paper, virtual mouse control using finger tip identification and hand gesture recognition is proposed. This study consists of two methods for tracking the fingers, one is by using coloured caps and other is by hand gesture detection. This includes three main steps that are finger detection using colour identification, hand gesture tracking and implementation on on-screen cursor. In this study, hand gesture track- ing is generated through the detection of the contour and formation of a convex hull around it. Features of hands are extracted with the area ratio of contour and hull formed. Detailed tests are performed to check this algorithm in real world scenarios.
5. Fully Imaginary Keyboard on Touch Devices Empowered by Deep Neural Decoder : Text entry aims to provide an effective and efficient pathway for humans to deliver their messages to computers. With the advent of mobile computing, the recent focus of text-entry research has moved from physical keyboards to soft keyboards. Current soft keyboards, however, increase the typo rate due to a lack of tactile feedback and degrade the usability of mobile devices due to their large portion on screens. To tackle these limitations, we propose a fully imaginary keyboard (I-Keyboard) with a deep neural decoder (DND). The invisibility of I-Keyboard maximises the usability of mobile devices and DND empowered by a deep neural architecture allows users to start typing from any position on the touch screens at any angle. To the best of our knowledge, the eyes-free ten-finger typing scenario of I-Keyboard which does not necessitate both a calibration step and a predefined region for typing is first explored in this article. For the purpose of training DND, we collected the largest user data in the process of developing I-Keyboard. We verified the performance of the pro- posed I-Keyboard and DND by conducting a series of comprehensive simulations and experiments under various conditions. I-Keyboard showed 18.95% and 4.06% increases in typing speed (45.57 words per minute) and accuracy (95.84%), respectively, over the baseline.

3. METHODLOGY

The implementation emphasises the method's practical relevance. The first stage, in particular, is to collect the necessary data as an input. The second step is to use data normalisation to remove noisy data from the dataset. This aids in the training of the model.

1. Input as live camera : As the input is a live camera the data is generated on the go from the camera which is in built in the users system.

2. Pre-processing: Pre-processing is mainly performed to remove gratuitous information from the acquired data and correct some values so that the values are the same throughout. In the preprocessing phase, sampling, which chooses a representative subset from a large population of data transformation, which modifies raw data to produce a single input, denoising, which eliminates noise from data, applicable data for missing values, normalisation, which arranges data for easier access, and point birth, which selects an applicable point subset that is significant in a particular terrain, are all part of the preprocessing phase .Training data use the reused training dataset is used to train our model using machine knowledge algorithms.

3. Classification: The results of our model is a virtual keyboard and a virtual mouse, which a user can interact with. Classification is predicated on Haar cascade Machine Learning Algorithm.

4. Load Details: The user must sign up into the interface but if its an old user then he is requested to sign in into the model

5. View Results: The visual keyboard and mouse are ready to provide the functionality of the normal wired mouse and keyboard but virtually using the haar cascade algorithm.

4. ARCHITECTURE DIAGRAM

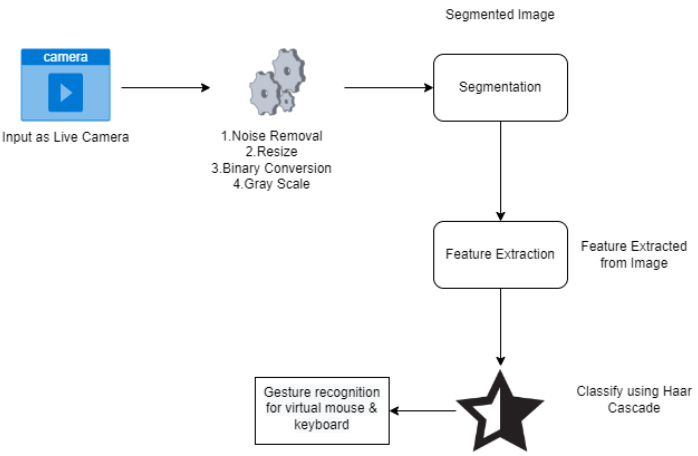

Fig 1. Architecture **Diagram**

5. ALGORITHM

1. **Logistic Regression:** By estimating chances, logistic regression analyses the connection between the categorical dependent variable and one or further independent factors. The first makes a logistic function supposition, whereas the alternate makes a normal distribution function supposition. The exponential function of the direct regression equation is identical to the liability that the dependent variable equals a case. This demonstrates how the sense acts as a connection between the probability and the equation for the direct regression. To choose discriminative characteristics for logistic regression, we also used cumulative selection.

2. **Haar Cascade :**The Haar cascade algorithm is a popular machine learning-based approach used for object detection in images. It was introduced by Viola and Jones in 2001 and has since become widely used for tasks like face detection.The algorithm begins with a training phase where it learns to distinguish between positive and negative samples. Positive samples contain the object of interest (e.g., faces) while negative samples do not. During training, the algorithm learns to identify certain features or patterns called Haar-like features that are indicative of the object Haar-like features are simple rectangular image features that capture variations in pixel intensities within subregions of an image. Examples of Haar-like features include edges, corners, and changes in texture. These features are computationally efficient to evaluate and provide useful information for object detection.To speed up computation, the algorithm uses integral images. Integral images allow for fast calculation of the sum of pixel values within any rectangular region of an image. This calculation is used to efficiently evaluate the Haar-like features.The Haar cascade algorithm organizes the Haar-like features into a cascade of classifiers. Each classifier in the cascade consists of multiple Haar-like features and is trained to determine if a region of an image contains the object of interest or not. The cascade is designed in such a way that it quickly rejects regions that are unlikely to contain the object, thereby reducing the number of computations required.During detection, the algorithm applies the cascade of classifiers to the input image using a sliding window technique. It scans the image at different scales and positions, evaluating the cascade at each step. Regions that pass through all stages of the cascade are considered positive detections. Since the sliding window approach can produce multiple overlapping detections, a post-processing step called non-maximum suppression is applied. It eliminates redundant detections by merging overlapping regions and keeping only the most confident ones. The Haar cascade algorithm is known for its efficiency and accuracy, making it suitable for real-time applications like face detection in cameras or video streams. It has been the foundation for various object detection systems and has influenced subsequent advancements in the field of computer

6. FLOWCHART

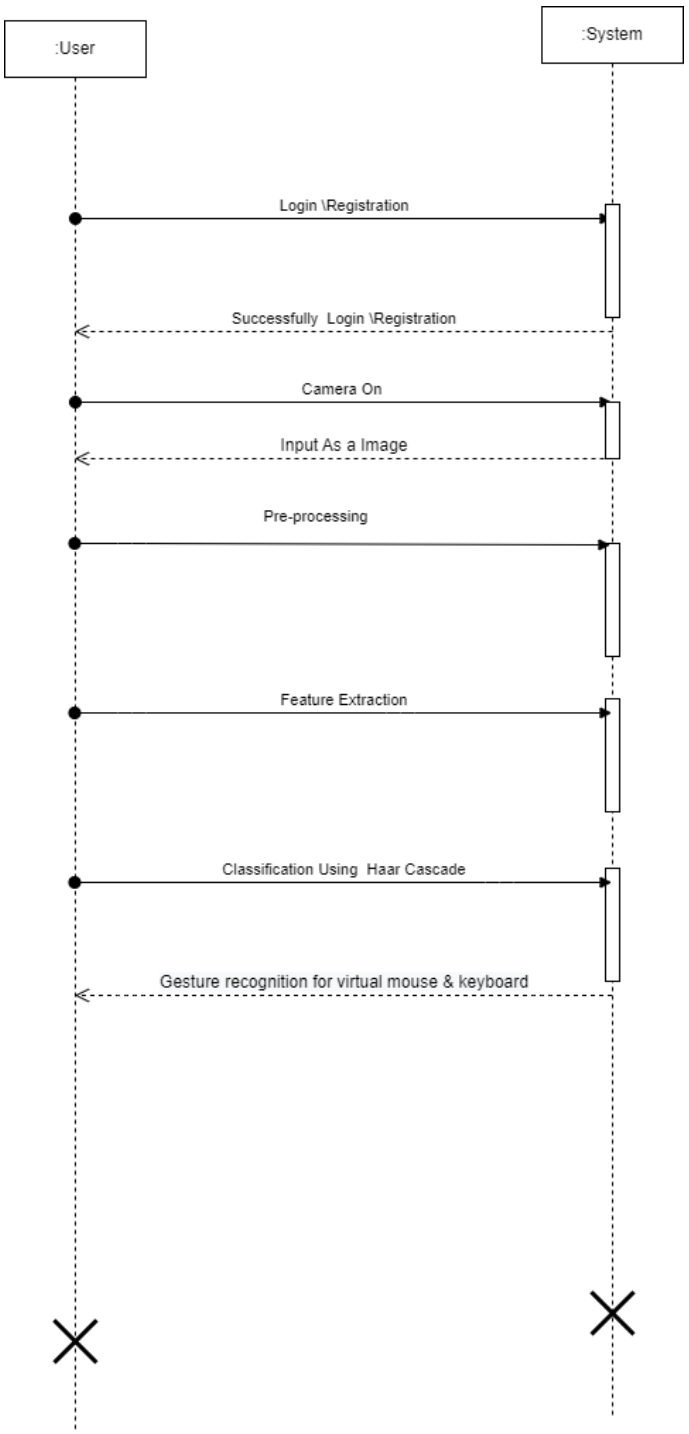

Fig 2. Flowchart

7. SYSTEM SPECIFICATION

Hardware Specifications
- System: Intel I3 Processor and over.
- Hard Disk: 20 GB
- Ram 4 GB
- System connected to a live camera

Software Specifications
- Operating system Windows 7 or further.
- Coding Language: Python
- IDE: Spyder.

8. EXPECTED RESULT

The expected result of a Gesture Recognition Based Virtual Mouse and Keyboard system is to provide users with an alternative and intuitive way of interacting with computers. It aims to enable users to control mouse movements, perform clicks, and emulate keyboard inputs through hand gestures. The system should accurately and reliably recognize a wide range of gestures, allowing users to navigate graphical user interfaces, perform tasks, and input text without the need for traditional physical input devices. The desired outcome is an improved user experience, increased accessibility for individuals with physical limitations, and the potential for more natural and immersive human-computer interaction.Overall, the expected result of Gesture Recognition Based Virtual Mouse and Keyboard is to redefine the boundaries of computer interaction, making it more intuitive, accessible, and engaging for users across various domains and applications

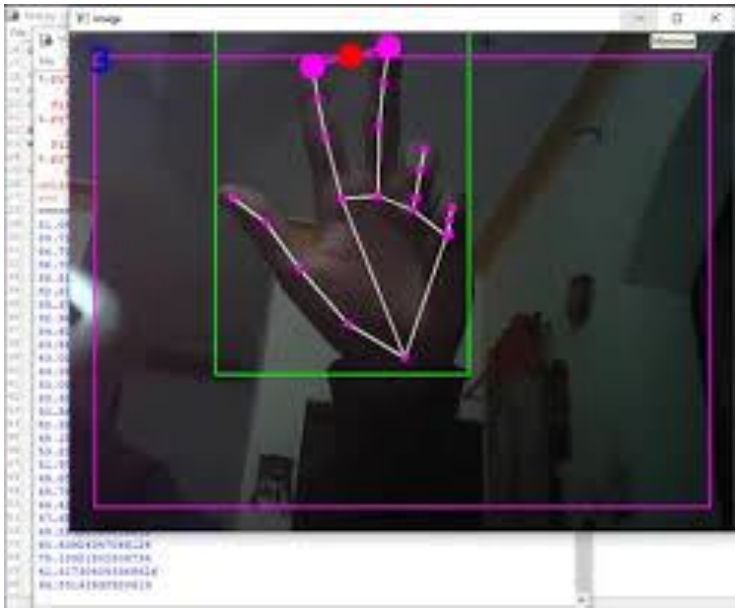

Fig 3. User Interface

9. CONCLUSION AND FUTURE WORK

This paper is proposing a system to recognize the hand gesture and replace the mouse and keyboard function. That includes the movement of the mouse cursor, the drag and click with the keyboard features like printing alphabets and other keyboard functions. The process of skin segmentation is utilized to separate the colour/image of hand with its background. Remove arm method, which effectively solves the situation of taking into the whole body into the camera. In general, the proposed algorithm can detect and recognize hand gesture so that it can operate mouse and keyboard features and also create a real world user interface. 3d printing, Architectural drawings and even doing medical operations from anywhere to everywhere. This project can be easily applied and its application can be very vast in medical science where computation is required but couldn't fully be implemented due to lack of human computer interaction

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