International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 07 Issue: 09 | September - 2023 SJIF Rating: 8.176 ISSN: 2582-3930

PUPIL BASED MOUSE CONTROL FOR DISABLED PEOPLE USING ARTIFCIAL NEURAL NETWORK

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Abstract

We describe a system that allows humans and computers to interact without using their hands. Our technology uses human facial traits to replace traditional mice in a novel way. It employs image processing techniques such as face detection and eye extraction. It captures an input image using a standard webcam. Controlling the mouse cursor is accomplished by moving the face up, down, left, and right, and mouse events are controlled by eye blinks, while keyboard events are controlled by handgestures. To carry out these actions, various algorithms such as the Haar Cascade method and Dlib are used. Our solution is primarily intended for impaired individuals to communicate effectively with computers.

INTRODUCTION

With today's technology, moving the cursor across the screen with the computer mouse or by moving the finger has become increasingly popular. The technology tracks any mouse or finger movement and maps it to the movement of the cursor. Some persons, referred to as "amputees," who are missing their arms will not be able to utilise the mouse with the current technology. Therefore, if their eyeball can be tracked and the direction it is gazing in can be established, the movement of their eyeball can be transferred to the cursor, allowing the amputee to move the cursor as they choose. An amputation will benefit greatly from a "eye tracking mouse." The eye tracking mouse is currently not widely available, and only a few businesses have created and made this technology available. The majority of mouse functionality will be available on our eye tracking mouse, allowing users to move the cursor with their eyes. We attempt to ascertain the user's "gaze" orientation and shift the pointer in the direction in which his eye is attempting to focus. The mouse's traditional pointing and clicking motion has been around for a while. There is a need to utilise these hands-free mice, however for various reasons one could find them uncomfortable or in the case of individuals who are unable to use their hands. Typically, hands-free mice work by tracking facial and eye movements. The only criterion for using the imouse system is that you have at least one eye with decent vision and the ability to manage a computer. Its users include both adults and children suffering from cerebral palsy and spinal cord injuries,wounds, psychological wounds, ALS, multiple sclerosis, brainstem strokes, and so forth. Eye gesture control systems can be used in homes, companies, schools, health centres, and long-distance mind offices. A person can execute computer software by looking at the control of a system that is displayed on a screen.

PROPOSED SYSTEM

This data set is challenging to effectively analyse due to the imbalance in passed and failed samples as well as the volume of measurement data collected from hundreds of sensors. As a result, our main objective is to develop a machine learning-based strategy for developing an accurate pupil identification model. The two algorithms for detecting the pupil and processing the coordinates of the pupil position on the computer screen are being worked on by the programme as soon as the computer turns on. It also includes the tool bar that is visible on the screen and contains the various mouse-controlling choices. This tool bar is chosen based on the user's eyes' gaze timings.

PROBLEM STATEMENT

Eye tracking technology has become one of the most popular techniques within the human and computer interaction (HCI) this is very important for the people who have difficulty with speech and movement disabilities, especially for the paralyzed and amputees person. The idea of controlling the computers with the eyes will serve a great use for handicapped and disabled person. Also this type of control will eliminate the help required by other person to handle the computer. This measure will be the most useful for the person who is without hands through which they can operate with the help of their eye and facial movements. The camera mouse was proposed by MargritBetkefor people who are quadriplegic and nonverbal. The movements of the user are tracked using a camera and these can be mapped to the movements of the mouse pointer which is visible on the screen. Yet another method was proposed by Robert Gabriel Lupu, for human computer interaction that made use of head mounted device to track eye movement and to translate it on screen. Another technique by Prof. Prashant salunkepresents a techniques of eye tracking using Hough transform.

REQUIREMENT SPECIFICATIONS

• Operating System : Windows XP Professional / Windows 10, 11

• IDE : Visual studio, Jupyter Notebook

• Database GUI : Python

HARDWARE REQUIREMENTS

• Processor : Core I3

• Hard Disk : 250 GB

• Monitor : 15 VGA Color

• RAM : 1 GB

• Mouse : Optical

• Keyboard : Multimedia

IMPLEMENTATIONS

Since the project is based on detecting the features of the face and mapping them to the cursor, the webcam needs to be accessed first, which means that the webcam will be opened. Once the webcam is opened, the program needs to extract every frame from the video. The frame-rate of the video is generally around 30 frames per second, so a frame at every 1/30th of a second will be used to be processed. This frame undergoes a set of processes before the features of the frame are detected and mapped to the cursor. And this process continuously takes place for every frame as a part of a loop.Once the frame is extracted, the regions of the face need to be detected. Hence, the frames will undergo a set of image-processing functions to process the frame in a suitable way, so that it is easy for the program to detect the features such as eyes, mouth, nose, etc.

i)Resizing: The image is first flipped over the y-axis. Next, the image needs to be resized. The resize function refers to setting the new resolution of the image to any value as per the requirement.

ii) BGR to gray: The data that we are using to detect the different parts of the face requires image of a grayscale format to give more accurate results. Hence, the image, i.e. the frame of the video from the webcam needs to undergo the process of converting its format from RGB to grayscale. Once the image is converted to a grayscale format, it can be used to locate the face and identify the features of the face.

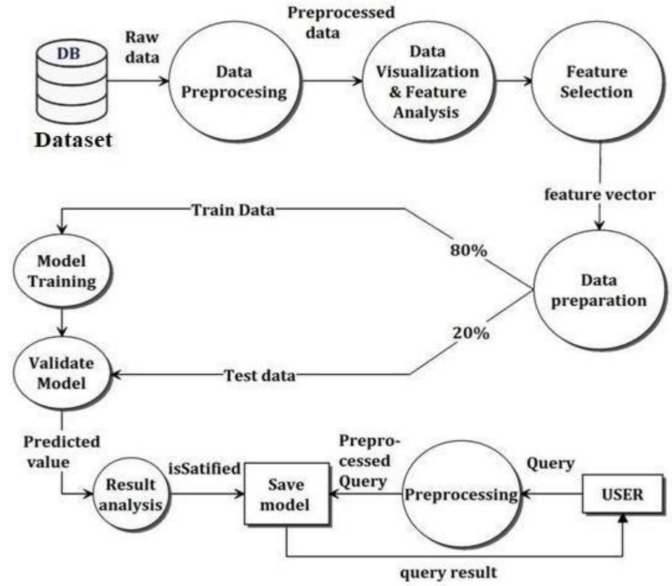
iii) Detection and Prediction of facial features: There is a function called 'detector()', made available by the models, which helps us to detect the face. After the face is detected, the features of the face can now be detected using the function 'predictor'. The function helps us to locate 68 points on any 2D image. These points correspond to different points on the face near the required parts such as eyes, mouth, etc. The values of the function that are obtained are in the form of 2D coordinates. Every one of the 68 points are essentially values of the x and y coordinates that, when connected, will roughly form an identifiable face.

iv) Mouth and Eye aspect ratios: The system is built on predicting facial landmarks of the face. The Dlib prebuilt model helps in fast and accurate face detection along with 68 2D facial landmarks as explained already. Here, EyeAspectRatio (EAR) and mouth-aspect-ratio (MAR) are used to detect blinking/winking and yawing respectively. These actions are translated into mouse actions.

v) Detection of actions performed by the face: For activating the mouse: The user needs to 'yaw' which is opening his mouth vertically.

Left/Right Clicking: For clicking, he needs to close any one of his eye, and make sure to keep the other open.

Scrolling: The user can scroll the mouse, either upwards or downwards. He needs to squint his eyes in such a way that the aspect ratio of both the eyes is less than the prescribed value.



Data Flow Diagram

ALGORITHM USED

Haar Cascade

The Haar cascade method may be trained to recognise various objects like eyes, automobiles, or people, but it is particularly good at detecting faces. An picture can be processed using a set of trained Haar-like features, which are straightforward rectangular filters.The phases of the Haar cascade method are referred to as cascades. Multiple weak classifiers, or straightforward decision rules based on Haar-like characteristics, make up each cascade. These weak classifiers are merged to create a strong classifier that is able to recognise the target object with accuracy.

A Haar cascade is trained in two steps: positive sample collection and negative sample collection. Positive samples are photographs that contain the object of interest, whereas negative samples are images that do not.Once trained, the Haar cascade can be used to recognise objects with relatively high accuracy and speed in new pictures or video streams. However, it has some limitations, such as

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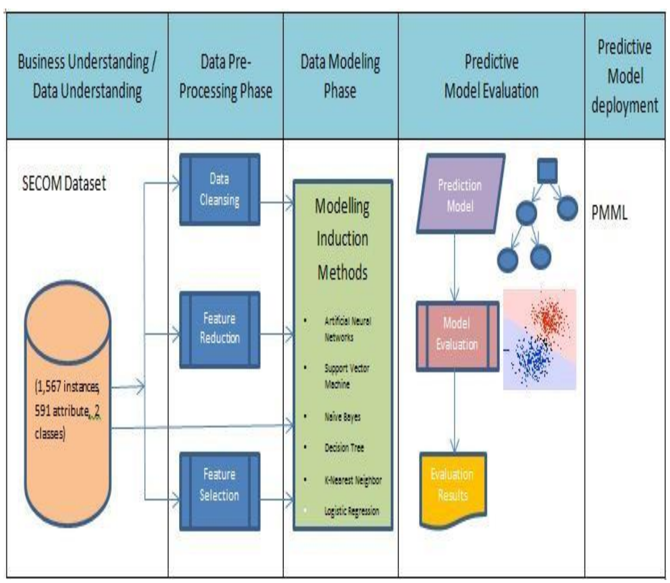
sensitivity to changes in illumination, posture, and occlusions. Deep learning-based techniques, such as the Single Shot MultiBox Detector (SSD) or the You Only Look Once (YOLO) algorithm, have emerged in recent years and generally outperform Haar cascades.

CNN

CNNs are a sort of deep learning model that is extensively used for image categorization, object recognition, and other computer vision applications. CNNs are designed to automatically learn and extract significant characteristics from pictures using convolutional layers, and to make predictions using hierarchical learning.



CNN Model

SNAP SHOTS

Fig 1

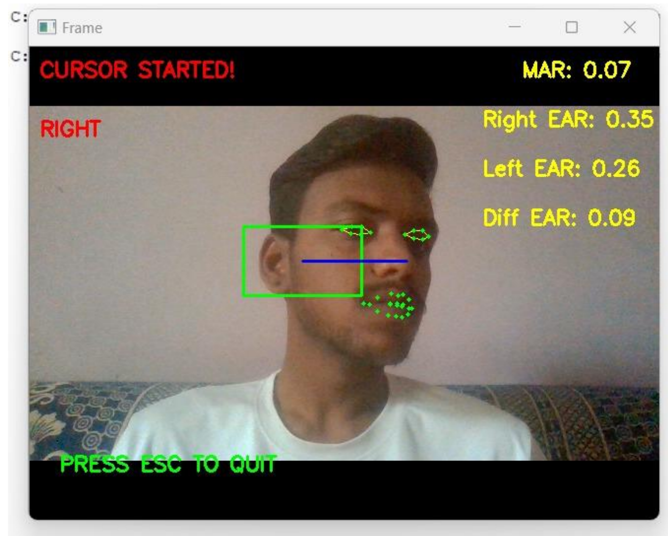


Fig 2

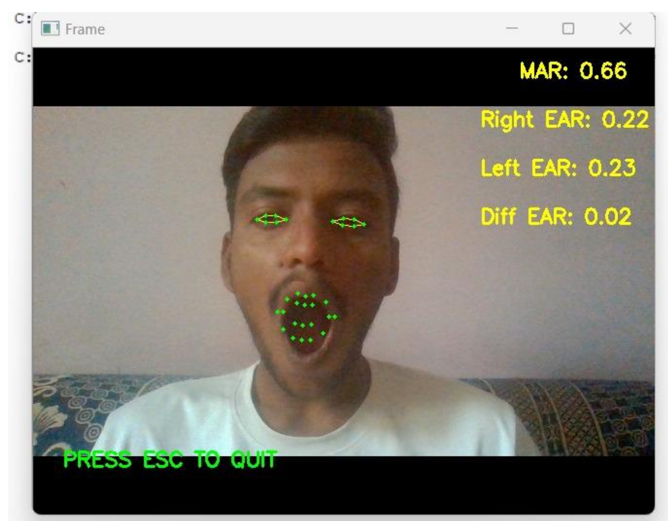


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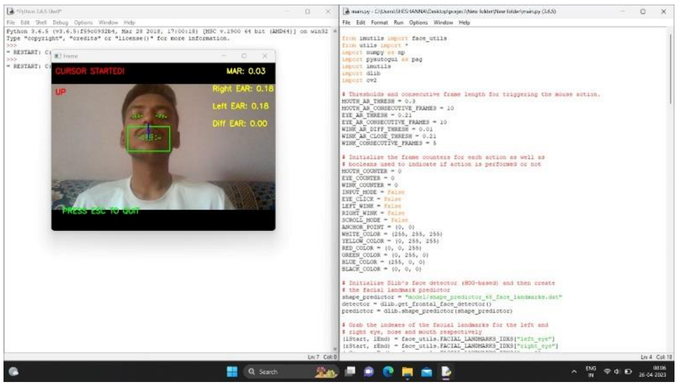
Fig 3



CONCLUSIONS

A system that makes it possible for a person with a disability to engage with a computer has been successfully created and tested. The technique can be improved even more and applied in several other applications.

The system can be modified to make it easier for people with disabilities to operate home appliances like TVs, lights, doors, etc. The technology can also be modified such that people with total paralysis can use it to steer and operate wheelchairs. In order to avoid car accidents, the eye mouse can also be used to identify driver tiredness. The detection and tracking of eye movements have potential applications in virtual reality and gaming.

REFERENCES

1] "Advanced correlation-based anomaly detection method for predictive maintenance," 2017 IEEE International Conference on Prognostics and Health Management (ICPHM), pp. 78–83, doi: 10.1109/ICPHM.2017.7998309. P. Zhao, M. Kurihara, J. Tanaka, T. Noda, S. Chikuma, and T. Suzuki.

2] "Early detection and classification of bearing faults using support vector machine algorithm," 2017 IEEE Workshop on Electrical Machines Design, Control and Diagnosis (WEMDCD), pp. 250–255, doi: 10.1109/WEMDCD.2017.7947755.

3] "Anomaly Detection Using Forecasting Methods ARIMA and HWDS," 2013 32nd International Conference of the Chilean Computer Science Society (SCCC), pp. 63–66, doi: 10.1109/SCCC.2013.18, by E. H. M. Pena, M. V. O. de Assis, and M. L. Proença.

4] "Macro-level accident fatality prediction using a combined model based on ARIMA and multivariable linear regression," 2016 International Conference on Progress in Informatics and Computing (PIC), 2016, pp. 133–137, doi: 10.1109/PIC.2016.7949481, by Z. Chen, Z. Gao, R. Yu, M. Wang, and P. Sun.

5] "Macro-level accident fatality prediction using a combined model based on ARIMA and multivariable linear regression," 2016 International Conference on Progress in Informatics and Computing (PIC), Shanghai, 2016, pp. 133–137. Z. Chen, Z. Gao, R. Yu, M. Wang, and P. Sun.

6] "A Statistical Approach to Reduce Failure Facilities Based on Predictive Maintenance," 2016 International Joint Conference on Neural Networks (IJCNN), Vancouver, BC, pp. 5156-5160; J. Shimada and S. Sakajo.

7] Prognostics and System Health Management Conference (PHM-Chengdu), Chengdu, 2016, pp. 1–7. Z. Yang, P. Baraldi, and E. Zio, "A Comparison Between Extreme Learning Machine and Artificial Neural Network for Remaining Useful Life Prediction," in press.

8] "Classification of Abstract Images Using Machine Learning," Proceedings of the 2017 International Conference on Deep Learning Technologies - ICDLT 17, 2017 by A. Karnewar, A. Kanawaday, C. Sawant, and Y. Gupta.

9]"ADE: An ensemble approach for early Anomaly Detection," 2017 IFIP/IEEE Symposium on Integrated Network and Service Management (IM), Lisbon, Portugal, pp. 442-448. T. S. Buda, H. Assem, and L. Xu.

10] "An introduction to variable and feature selection," Journal of Machine Learning Research, vol. 3, 2003, pp. 1157–1182.

11] "Minority class mining: progress and prospect," in Proc. the Chinese Conference on Pattern Recognition, 2009, pp. 1–5. S. Han, B. Yuan, and W. Liu.

12] Q. P. He and J. Wang, "Fault detection using the k-nearest neighbour rule for semiconductor manufacturing processes," IEEE Transactions on Semiconductor Manufacturing, vol. 20, no. 4, 2007, pp. 345–354.

13] "Fault diagnosis of plasma etch equipment," in Proc. the IEEE International Symposium on Semiconductor Manufacturing, 1997, pp. B49-B52.

14] "Robust fault detection and fault classification of semiconductor manufacturing equipment," in Proc. International Symposium on Semiconductor production, Tokyo, 1996, by A. M. Ison and C. Spanos.

15]"Principal component analysis based on wavelet characteristics applied to automated surface defect inspection," WSEAS Transactions on Computer Research, vol. 3, no. 4, 2008, pp. 193-202; H. D. Lin, C. Y. Chung, and W. T. Lin.

16]An image-based eye-controlled assistive device for people with paralysis, Neil Castellino and Michelle Alva, IEEE Conference Publications, 2017.

17] "Eye Tracking Based Control System for Natural Human-Computer Interaction", Computational Intelligence and Neuroscience, 2017. Shu-Fan Lin, Xuebai Zhang, and Shyan-Ming Yuan

18] "Real-Time Eye Blink Detection Using Facial Landmarks", Centre for Machine Perception, February 2016.