Week 1 Update

Problem Statement:-

Tracking of eye gaze movement for understanding user interaction with the app or screen.

As sir has told , in this project we will try to integrate the eye gaze tracking system into a app which will receive information /data so that from there we can actually understand the state of the brain of humans and what he/she is thinking about.

This is only one part of the project .

- I studied some research papers where I got to know during the early days scientists did try to inculcate the sensor in the contact lenses and outside the pupil to detect the eye gaze movement , which can be really dangerous and ineffective
- Then they introduced a new technology named as EoG (Electroculography) sensors which is an effective one. It works on the basis of measures the difference between the electric potential dipole of the eyes , sensitive to the magnitic field , it can even detect the gaze when the person is sleeping

Through these years

- But eventually they found that both the method are obtrusive when its comes to interaction of eyes to glorify the human brain interactions about what they are thinking and stuff like that so they introduced the video capturing.
- After reading the research papers , I have come to know that for the cameras they have used high resolutions camera or the IR cameras for the reflection at the cornea for the “ red eye movement” technology.
- Many have used the controlled lighting effects of LED to create controlled effects of light. They have used different kinds of softwares for tracking the eye gaze movement like openCV, Dlib a library in C++. In some places they have used the tobii SDK pro, and eyetribe tracker and all kinds of software suitable for their for web and app environments.
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- Now lets dive into the algorithms they have used , firstly they have used the pupil detection algorithm which applies thresholding algorithms which differentiate the pupil from the surrounding areas. Circular Hough transform is also applied in some places which detects circle shapes and images and creates a potential space for the centres and radii of the pupil movements.
- In many places the eclipse fitting is used for the edges and its more accurate on the edge points and non circular points
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- Now for the corneal detection, they have used the thresholding which is again used for making the bright spots (Connected Component Analysis),
- Feature matching algo is also used o ensure consistent tracking.
- For the Gaze estimation , in most of the papers they have included two types of methods like one is 3D calculations of the positions of the pupil and the cornea
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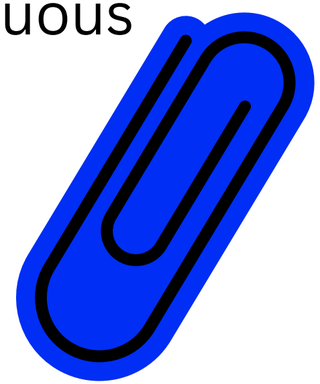
- In this 3D calculation they have tried to work on and calculate the pupil glint vector method , calculate vector between the pupil and the cornes and maps the vector to screen coordinates using a caliberation process

- Another method of calculation is the 3D eye model calculation

- Then the Ml algos they are using are CNNs, in CNNs they had to use many optimization techniques to reduce the loss function and backproportion for gradient loss. Architectures like Restet, VGG layers are connected
- SVM has been also used - for labelled data a kernal function is being used
- Random forests for gaze coordinates
- K Nearest Neighbours , Regression models for calculating the continuous values like gaze coordinates



This is what I have learned from this week .

-Thank you