EYE MOVEMENT COMPUTER VISION PROJECT
METHODOLOGY – Adithya SR

ENVIRONMENT SETUP:

Prerequisites: To execute the program, kindly please download and install Anaconda python distributor, the spyder environment, OpenCV and Streamlit package.

1) Spyder Environment:

- Open Anaconda and launch spyder
- Copy the shared code (neweye.py) and save the code in the folder with user's name under User folder of C drive (eg: C:\Users\John\'programfile'). To ensure the code works where package is installed.
- Launch anaconda prompt
- Navigate to the project folder using cd command and confirm which drive is being accessed
- Run the application using: streamlit run programfile.py (.py indicated python supporting file format)

2) Using VS code:

- Open Visual studio code from anaconda
- Open project folder (File -> Open folder)
- Open the integrated terminal
- Run: streamlit run programfile.py

3) Using Jupyter Notebook:

- Open Jupyter notebook from anaconda
- Navigate to project directory

- Open a terminal from jupyter
- Execute: streamlit run programfile.py

Once the program file is executed through the prompt, the program would open the application in the default browser set by each user's pc.

EYE MOVEMENT CV STREAMLIT APP:

Once the application is popped on the browser, proceed with the following steps:

1) The homepage pops up, and enter the phone number to login. As for the test purpose, select continue as Guest option
2) Before proceeding with the test, kindly allow permission to access pc camera for capturing the eye videos.
3) Once camera access is permitted, the below 3 tests would be screened:

SCREENING TESTS:

1) Test 1: Saccade test (5 sec):
   - Horizontally, the red dots are blinked randomly left right going from middle to the two extreme sides for 5 seconds.
   - The user has to follow the red dots without blinking the eyes.
   - Assesses the rapid movement of eye.
2) Test 2: Pursuit test (10 sec):
   - The blue dot follows a circular pathway with a minimal speed for 10 seconds.
   - The user should follow the dot along with the speed.
   - No blinking of eye is expected.
   - Aids in capturing the eye's flow speed.

3) Test 3: Fixation test (8 sec):

- A green dot is fixed at centre of the screen for 8 seconds.
- User is asked to see the fixed dot for stipulated time.
- The user is requested not to blink their eye.
- Helps to assess both the eye's corporation and focus.

DATA PROCESSING:

1) From each test the videos are converted into frames
2) Each frame is then converted to grayscale format
3) The system detect two features:
   a. Face
   b. Eyes
4) The pupil positions is traced in the frames collected
5) The frames which has noise, blur, no eye are neglected

FEATURE EXTRACTION:

1) The frames are the primary features, that collect and transform the grayscale data into numbers
2) From each screening tests, few parameters are obtained as mentioned below:
   a. Speed of the eye movement
   b. Smoothness of tracking
   c. Amount of eye jitter
3) The above values are converted into arrays forming matrix like mathematical figures

RANDOM FOREST MODEL PREDICTION:

1) Numerical data obtained from the test is trained to the random forest model
2) Model is then compared with preloaded sample
3) Two labels are mentioned for the prediction:
    a. Healthy eye
    b. Chances of Parkinson's related abnormality
4) The overall score is obtained as confidence level i.e based on the numerical data received from the tests between 0 and 1. Score ranging between 0.75 to 1, is considered to be healthy. Below the mentioned range, it is obvious to consult a neurologist.

RESULT AND SUMMARY REPORT DISPLAY:

1) The predicted result is displayed on the screen
2) A green tick symbol would support the patient is healthy
3) A red x cross symbol depicts the individual might be exposed to Parkinson's disease

(Note: this acts as a screening report not a diagnosis)

RESTART OR EXIT:

1) To review once again, the user would be able to click on restart button that redirects to the login page.
2) It is to be noted that when the user tries for new screening test, the previous data won't be available because no separate server or storage is implemented.
3) Once satisfied with the test, consult with the neurology specialist
4) Exit the code by closing the browser and anaconda prompt