Computerized Neurological Exam

Goal

The goal of this project is to develop a computerized neurological exam that can be used to track a patient pointing to targets in attempts to create a performance metric.

A computer program will direct the patient to sit and touch their nose and various targets placed on the screen (although they will not touch the screen). An example video of what the patient should perform will be provided.

Technical Requirements

- Must be able to accurately detect finger and nose.
- Finger detection must run **at least** 30 fps. (face/nose detection can run slower)
- Recognition must occur with user sitting.
- Can use RGB, Depth, or both to detect hands and nose. Depth provided by Realsense camera (https://github.com/IntelRealSense/librealsense)
- Application must log everything in an organized manner (every finger movement, application state, etc.)
- Code must be properly commented and regular commits to a code repository are required.
- Solution should be developed so that it is camera agnostic. This means the code should be modular such that we can use different cameras/sdks by only changing one part of the code.
- Must work on windows (most Drs. have windows).

Application Flow

1. User is shown a start screen. Require the user to perform some type of gesture to start.
2. User is told to hold both arms out
3. User is asked to put their left arm down.
4. User is asked with right hand to touch their nose with their right index finger
5. After nose is touched, user is asked to point to the target on the screen which is in the right upper corner. Have use hold it there for 1 second (do not tell them, just detect that they are relatively in the right coordinate and motion has stopped)
6. User is asked to touch nose again
7. Ask user to point to target located in center of screen. (Same procedure as #5)
8. User is asked to touch nose again
9. Ask user to point to target located in upper left of screen. (Same procedure as #5)
10. User is asked to touch nose again then place right arm by their side.
11. Ask user to raise their left hand outward.
12. User is asked to touch nose with left index finger
13. Ask user to point to target located in upper left of screen with left index finger. (Same procedure as #5)

14. Ask user to point to target located in center of screen. (Same procedure as #5)
15. User is asked to touch nose again
16. Ask user to point to target located in upper right of screen. (Same procedure as #5)
17. User is asked to touch nose again
18. Show a test complete screen that thanks them.

Notes:

If you don't have access to a Realsense (e.g. realsense D435) and are remote, I will record the videos then you can use Intel Realsense viewer to play it back as if it is coming from the camera.

Resources

https://github.com/IntelRealSense/librealsense

https://github.com/xinghaochen/awesome-hand-pose-estimation

http://handtracker.mpi-inf.mpg.de/projects/GANeratedHands/ (Preferred algorithm, supposedly gets 50 fps)

https://youtu.be/7h5o-FJUDRA?t=136 – Clinical version of test

https://nuitrack.com/

https://github.com/CMU-Perceptual-Computing-Lab/openpose (Too slow but here for reference)