Ollscoil Mhá Nuad
Maynooth University

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Pegboard test Data collection and analysis suite - SPUR Project.

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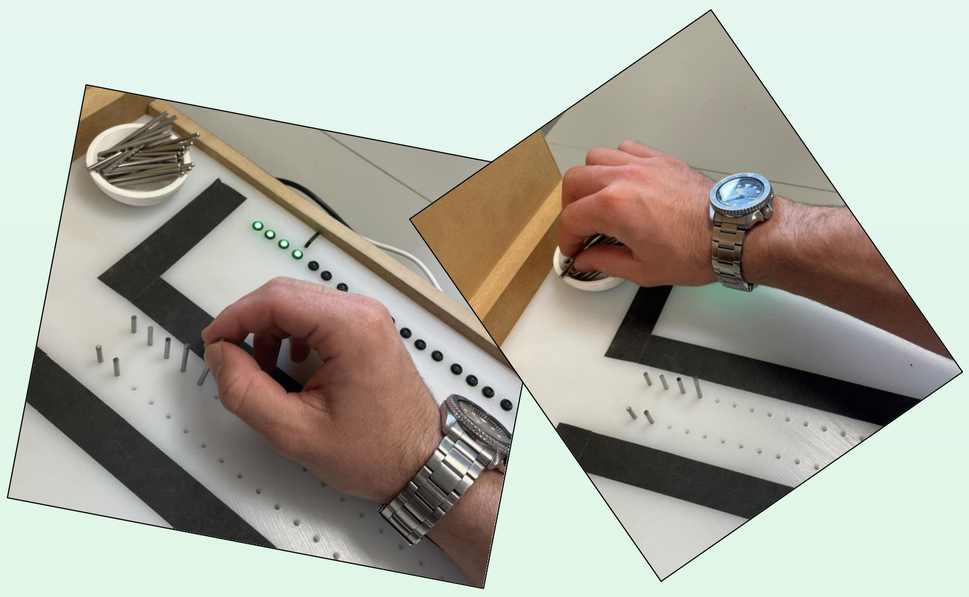
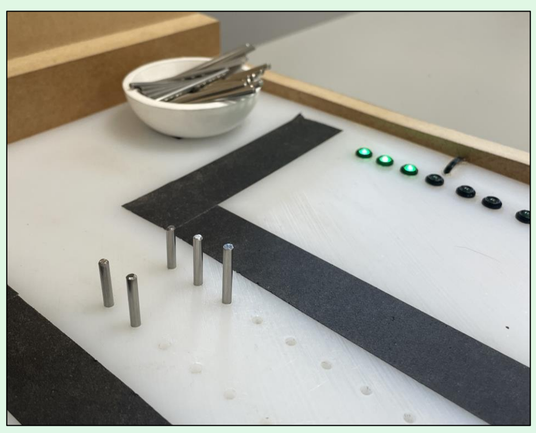


Goal

- The Goal of this SPUR project was to take an existing LED Pegboard and integrate it with some level of computer vision.
- The idea of integrating computer vision to a Perdue Pegboard test will hopefully allow for early identification of various medical conditions that may hinder a person's dexterity when taking the test by causing tremors in the hands and fingers.



Purdue Pegboard Test

- The Purdue Pegboard test is a manual finger and hand dexterity test developed in 1948 by Joseph Tiffin at Purdue University.
- The simple test consists of a pegboard with 25 holes on either side. The participant is given 30 seconds to see how many pegs they can take from the bowls and insert into the holes.

Types of hand tremors

There are 3 main categories of hand tremors associated with performing tasks.

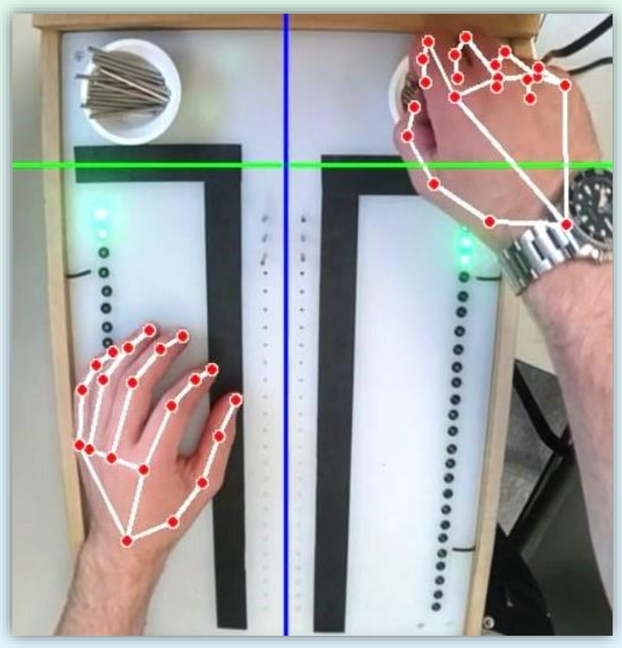
- **Postural tremor:** which occurs when your hands are outstretched, and gravity is pulling them down. You can't keep your hands completely steady while they're outstretched.
- **Intention tremor:** starts when you're reaching for a target, like a keyhole as you unlock your door.
- **Task-specific tremor** occurs when performing an activity, such as when you're writing.

As the pegboard test comprises of several actions including both reaching out with the hands, followed by locating the hole to put the peg in, it remains quite a thorough test when identifying these different hand tremors.

Causes for such hand tremors may be down to a serious illness such as Parkinson's disease or multiple sclerosis, however it is more common to see these 'action tremors' in the presence of a 'Essential tremor', a benign tremor that may be caused for a variety of reasons.

How it works

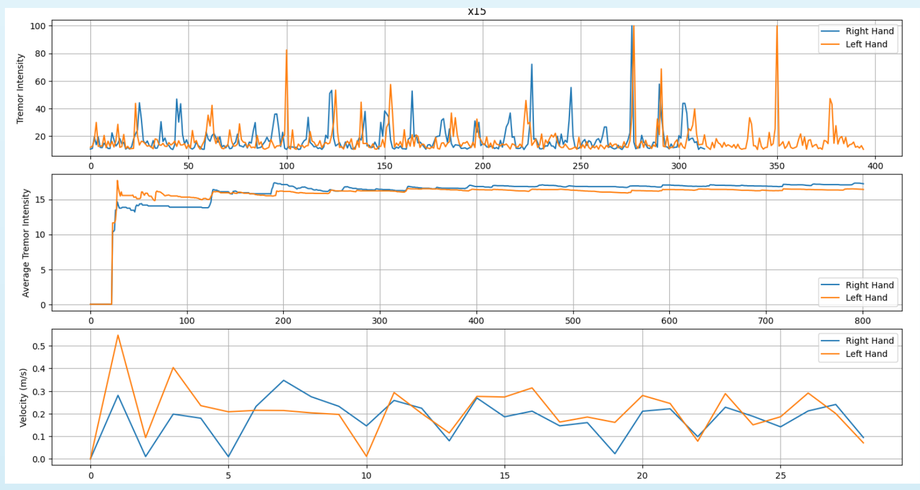
- The finished project uses an Oak-D Lite 3D camera along with a program I have written to utilize various Python libraries and MediaPipe Solutions to map landmarks to the hands and then track them to detect excessive shaking in any direction.
- The program also keeps track of the total distance each hand moves each second to accurately calculate the velocity.
- The camera feed is divided up horizontally and vertically in a tennis court like fashion to both detect which hand is which, and to keep track of how long hands spend above the green line picking up the pegs compared to how long they spend putting them in the holes



The Results

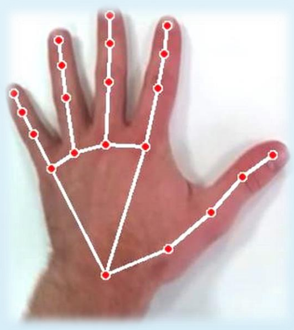
- There is a large amount of data collected from running this test for even just 30 seconds to see how many pegs the user has input with both hands.
- How many Pegs were input with each hand
- The speeds and steadiness of each hand
- Which hand may be steadier or faster and by how much
- How the fingertip dexterity differs from picking up the pegs to putting them in the holes.

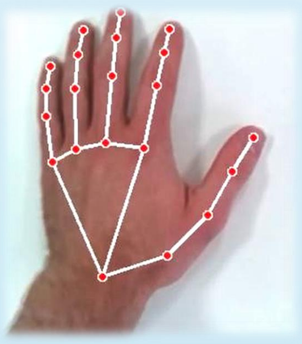
This information will be stored in a spreadsheet such as excel along with being graphed immediately as seen below to give a visual representation of the tremor intensity and pace throughout the test.



Acknowledgements

- Credit to Daragh Sutton for the original electronic pegboard test on which this computer vision project was based.





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