Neurograph Project

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Facts about Parkinson's Disease in Australia

Image resource reference: http://parkinsons-qld.org.au/wp-content/uploads/2015/07/did-you-know.jpg

What this project is about?

The name tells the answer

Neuro

Graph

Detect Parkinson's Disease (Neurology)

By studying drawing patterns

What this project is about?

Neurograph Project:

Detect the Parkinson's Disease by studying people's drawing pattern.

It's actually a hot topic: From the research papers

present in 25 persons. Furthermore, in two persons (of which one person is familiar with autosomal dominant cerebellar ataxia) drawings were not suited for our post-processing analyses. Therefore, we chose to exclude these results and 1,912 persons were left for further analyses.

FINE MOTOR SKILL ASSESSMENT

Fine motor skill was assessed by requiring participants to trace a picture of a spiral template that was printed on a piece of paper attached to an electronic drawing board (WACOM Graphire Wireless Pen Tablet, model CTE-630BT). Participants were instructed to place the pen in the middle of the spiral before the tracing started (**Figure 1A**). They were not allowed to lean on the drawing board with their hand or arm. Participants were asked to trace the spiral as accurately and as fast as possible using their dominant hand.

Figure 1.

QUANTITATIVE ANALYSIS OF SPIRAL DRAWING

Automatic quantitative analyses were performed using custom-made software written in MatLab (version 8.1; The Mathworks, Natick, MA, USA). This yielded the following outcome measures: movement time (s), defined by the time it took the participant to trace the spiral; length of drawing (cm), defined as the length of the drawn spiral; *average speed*, defined by the ratio of length of drawing and movement time; speed variability (cm/s), defined as the SD of the instantaneous velocity; deviation from template (cm^2), defined as the area between the template and the drawn spiral; and number of crossings, defined as the number of times the drawn spiral crossed the template (**Figure 1A**). A smoothly drawn spiral with a clinical score of 0A would have a length of drawing about

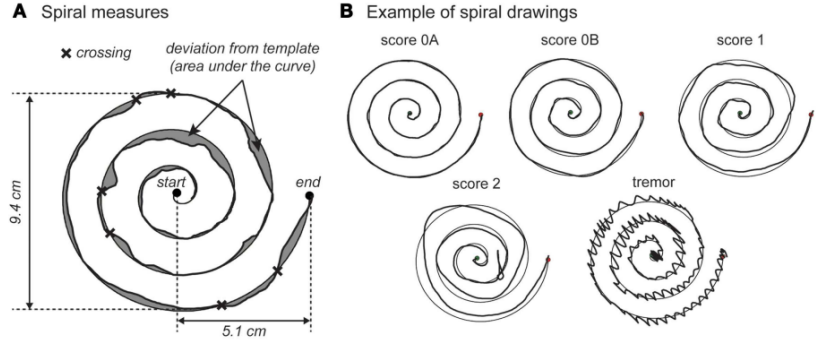

FIGURE 1 | Examples of spiral-drawing quantification and clinical scores. (A) shows an example of the calculation of quantitative measures of fine motor skills. The start and endpoint are indicated by a dot. The figure explains how deviation from template and crossings are defined. **(B)** shows examples of clinical scores of the spiral drawings with score 0A, 0B, 1, 2, and a tremor.

Research paper reference: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4174769/pdf/fnagi-06-00259.pdf

In the media:
Use drawing to detect Parkinson's Disease

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Health

Spiral drawing test detects signs of Parkinson's

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News reference from BBC: http://www.bbc.com/news/health-41176738

Drawing patterns and Parkinson Detection

What are the connections between them?

Neurograph, Drawing patterns and Parkinson Detection

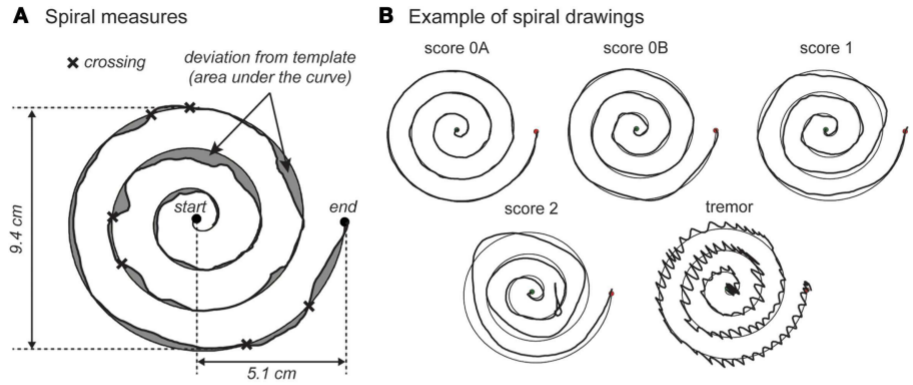
Parkinson

Shaking, maybe?

Drawing patterns may be potentially influenced

Or just can't focus

The drawing pattern may tell us something interesting



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By studying drawing patterns, such as

Average Speed

Drawing Speed changes

Touching pressure

Maximum differences in horizontal direction

Number of crossings

Total drawing time

Deviation from the template image

Analyse them statistically,

We could find some drawing characteristics that’s special for Parkinson patients.

Then we may be able to distinguish between normal people and Parkinson patients.

What this project contains

Two parts

Part 1: An Android app which captures the drawing data

Store the data into different format of data files which can be analysed

Part 2: Analyse the drawing data and study interesting features (Done by Cathy)

Introduction to Android app: Neurograph

The aim of this app

Capture the data

Store the data, and/or send the data

How the users use it? The Procedure

A new user

Who wants to know whether
he is a potential Parkinson patient

Register

Name, age, gender, education level
etc should be taken into account

Do the tests

How the users use it? The Procedure

Clinical staff

Output the data by

(1) Sending it via email

(2) Save it locally then connect the device to a PC

How the users use it? The Procedure

Data analyst analyse the data (Cathy)

Then tell whether this user has Parkinson or not

Done using R and matlab,
Sadly android is not good at data analysis

How the users use it? The Procedure

Maybe after a few months of treatment the user wants to come back to do the tests again

He/she can come back using the registration code (Something like an user name, it's unique for each user)

Do the tests again to see whether the disease condition changes or not

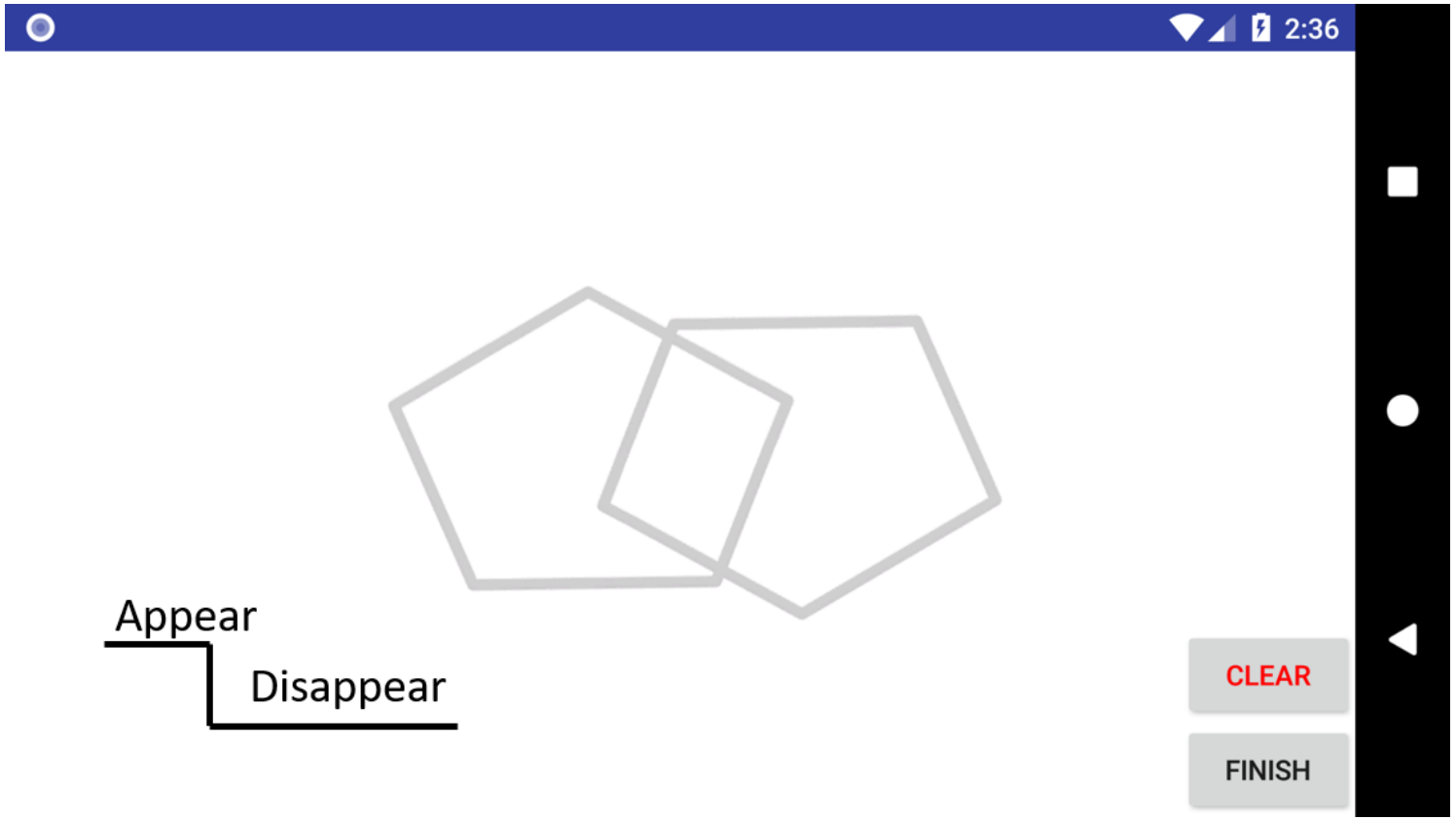
Drawing tests

In this app we have 6 different kinds of tests, some of them are from the research paper which has been used previously and proved to be useful.

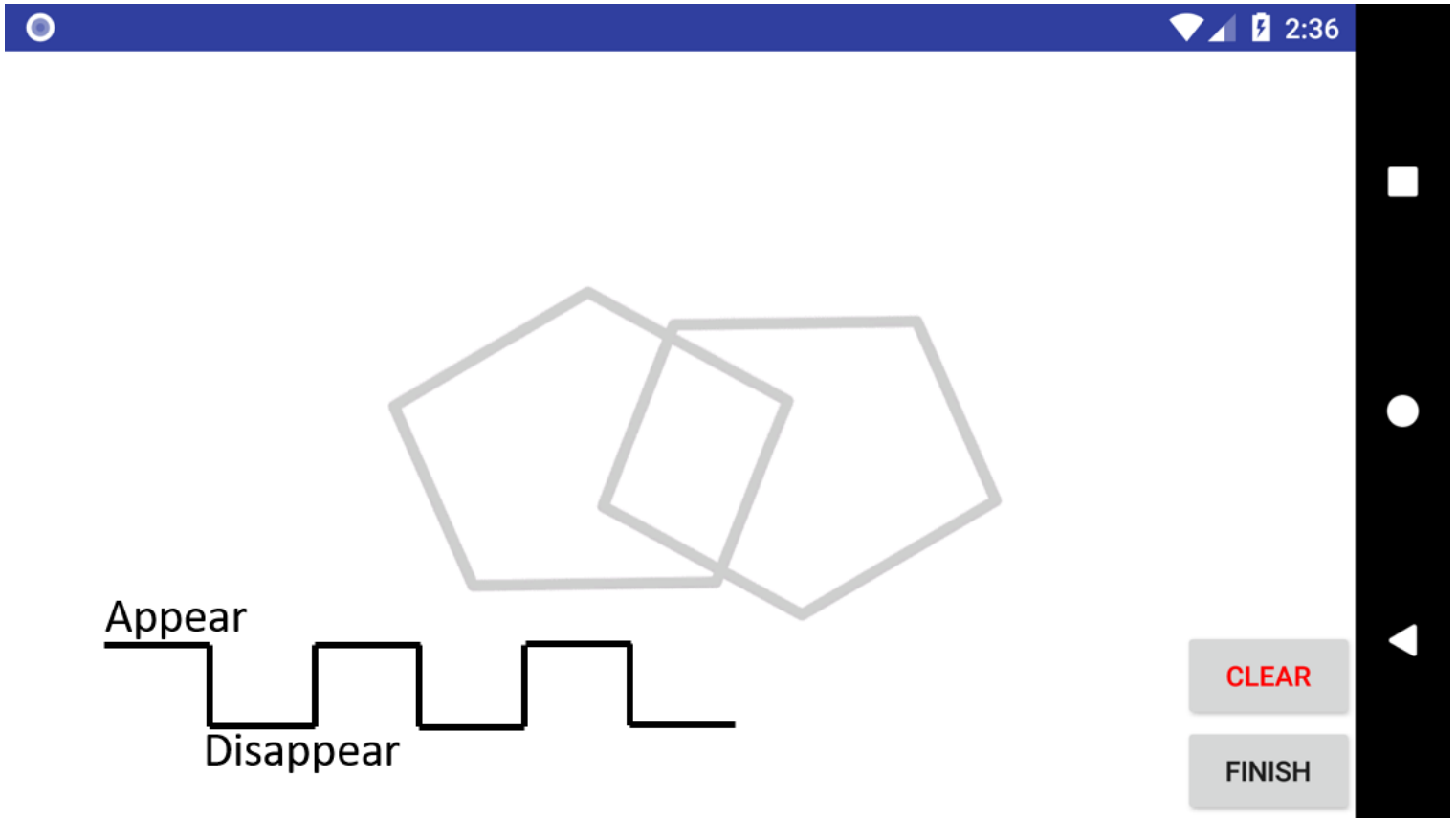
Static Background Test

Static Corner Background Test

Dynamic Blank Background Test

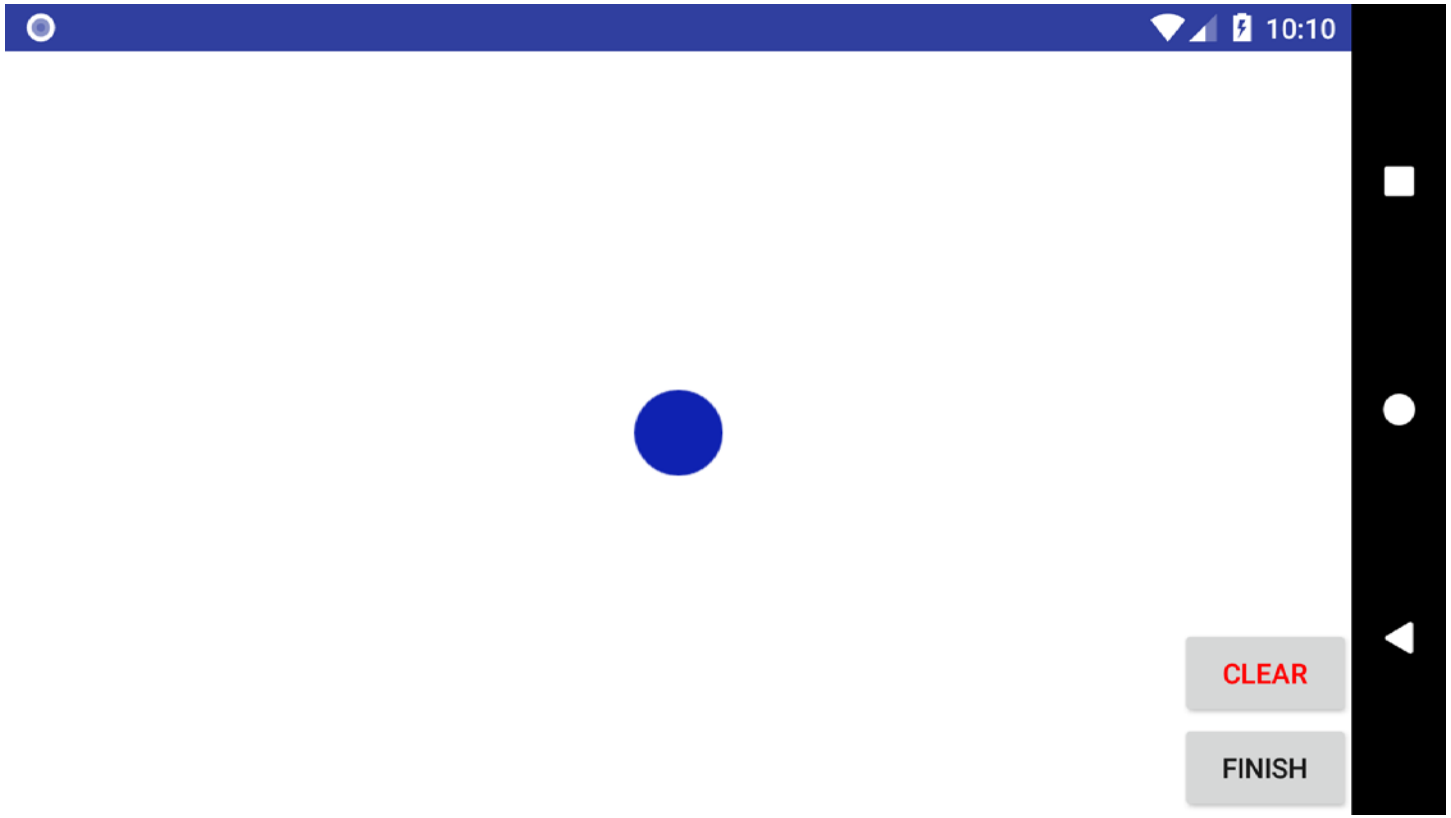


Dynamic Seasonal Background Test



Parallel Line Test

Circular Motion Test



Whether the user can draw the shapes as required helps us make the decision

Every single detail like deviation area or the changes of speed may tell whether this user has Parkinson’s disease or not

Interestingly, android captures dots, not line

In my eye,

In Android’s eye,

Actually, Android is smart enough

It captures a point every 0.02 second approximately

The precision can reach 5 decimal places

So there are enough “details” to help us detect the Parkinson’s Disease

While,

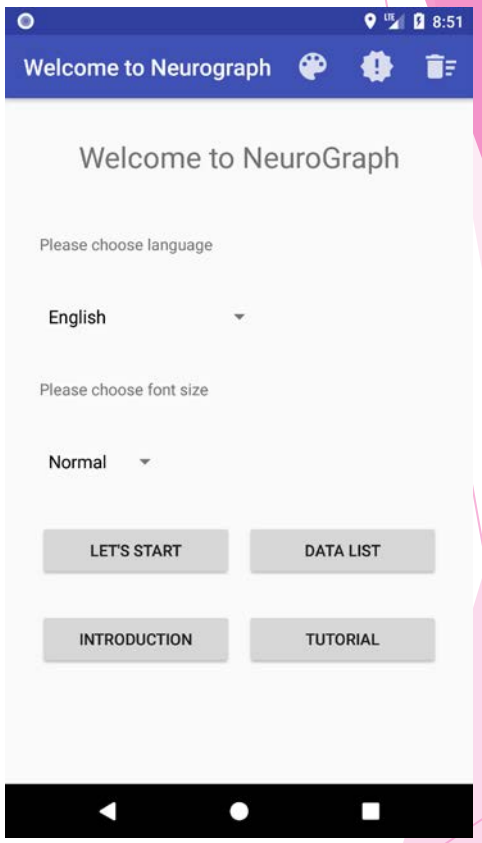
Talk is cheap,
Show me your app...

The app: App demonstration

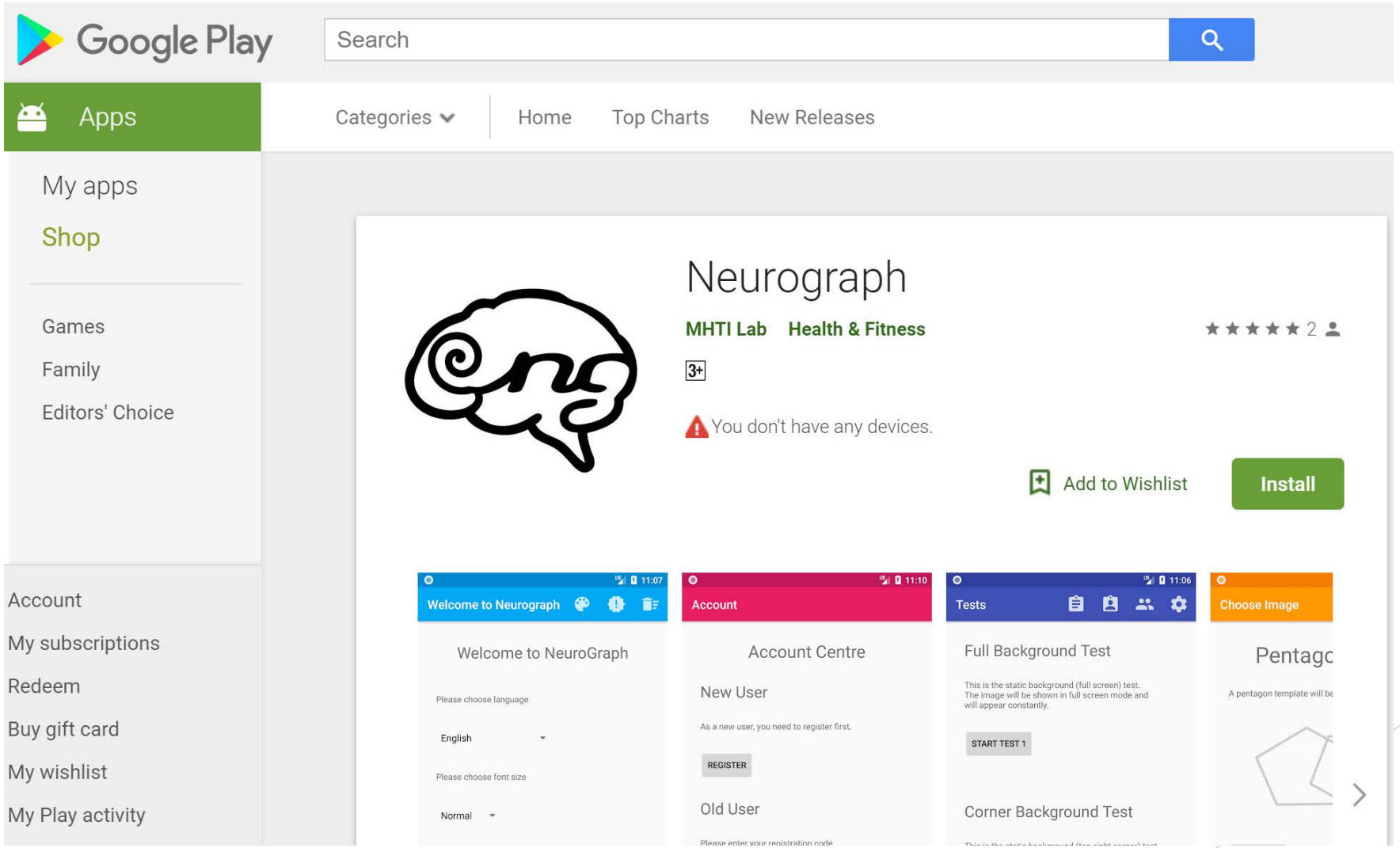
Collect information about the user

The tests

Output the data



App demonstration



Link to Google Play Store: https://play.google.com/store/apps/details?id=com.neurograph.usydjiashuwu.neurograph

Future TODOs

Identify Signatures

Q & A

Thank you ^_^