EF Games: A Fun, Kid Friendly Way of Diagnosing Autism Spectrum Disorder

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Problem

The Autism Spectrum Disorder (ASD) is a difficult condition to diagnose, due to the lack of conclusive medical test.

Solution

In order to create a better, kid friendly way to diagnose ASD, SCITL team developed a mobile games that are designed to collect children's executive function. These executive function data is then used to train machine learning models that are designed to accurately diagnose ASD. Our solution is able to accurately predict ASD with 70% accuracy.

Responsibility

- Creating secure channel of communication between client's devices and Seattle Children server.
- Improve and optimize the game's data collection process in order to capture more relevant data that can be used to more accurately diagnose ASD
- Simulating a game session based on the log files created during the gameplay
- Research how to utilize rewards to incentivize children to play the games.

Autism Spectrum Disorder (ASD) Facts

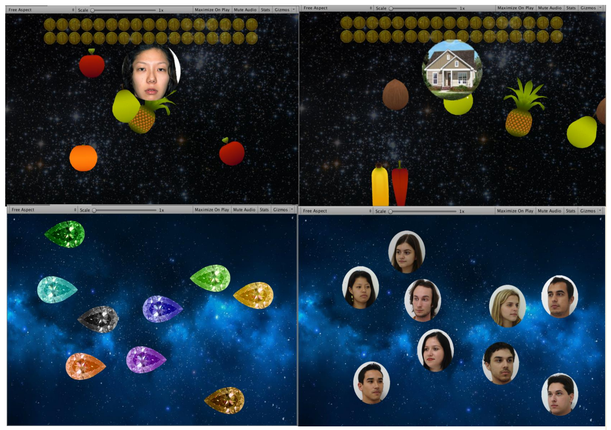
> 1 in 59 children is diagnosed with ASD

> 1 in 37 boys

> 1 in 151 girls

> There is no currently medical detection for ASD

> Most people diagnosed with autism is diagnosed after the age of 4, even though it can reliably diagnosed at age 2



Webserver and REST API

Client's medical data, including executive function data, is protected under HIPAA and we have to create a secure channel of communication between the client's devices and the Seattle Children's Server. I created a secure TLS Webserver in Node JS and Express JS to facilitate this data transfer.

Use Case:

- Securely transfer game session log data from the client's device to the Seattle Children's High Performance Computer.
- Design and query the database to store and access user's information including game score, location, owned avatars and keep track of the in game currency.
- Create a secure channel to transfer survey information and automatically update all the client's survey questions.

Reward System Research

Problem:
Incentivize gameplay over long period of time in order to capture possible changes of data over time.

Solution:

- In game currency that rewards users for playing the game.
- Scoreboard that compares their score with people in the area.
- Avatars that can be bought using the in game currency.

Problem:
Disproportionate amount of game data collected because some games are more popular than the other games.

Solution:
Extrinsic reward in the form of extra coins when the users play the non-popular games

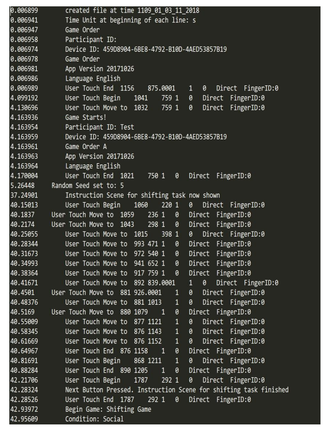
Problem:
More qualitative information is needed in order to understand whether or not a child has ASD.

Solution:
On top of the quantitative data that are collected by the game session logs, we added a form where users can answer questions in exchange for in-game currency. These questions will then be used to understand the child's conditions.

Log Data Collection

Problem:
Designing a document format that can capture all the data needed to successfully simulate a game session.

Solution:
Implemented a logging system that tracks the location of every user touches, swipes and the location of all objects in the screen.



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0.006899        created file at time 1109_01_03_11_2018
0.006941        Time Unit at beginning of each line: s
0.006947        Game Order
0.006958        Participant ID:
0.006974        Device ID: 45908904-68E8-4792-810D-4AED53857B19
0.006978        Game Order
0.006981        App Version 20171026
0.006986        Language English
0.006989        User Touch End  1156    875.0001    1   0   Direct  FingerID:0
4.099332        User Touch Begin    1041    759 1   0   Direct  FingerID:0
4.138696        User Touch Move to  1032    759 1   0   Direct  FingerID:0
4.163936        Game Starts!
4.163954        Participant ID: Test
4.163959        Device ID: 45908904-68E8-4792-810D-4AED53857B19
4.163961        Game Order A
4.163963        App Version 20171026
4.163964        Language English
4.170004        User Touch End  1021    750 1   0   Direct  FingerID:0
5.26448     Random Seed set to: 5
37.24901        Instruction Scene for shifting task now shown
40.15013        User Touch Begin    1060    220 1   0   Direct  FingerID:0
40.1837     User Touch Move to  1059    236 1   0   Direct  FingerID:0
40.2174     User Touch Move to  1043    298 1   0   Direct  FingerID:0
40.25055        User Touch Move to  1015    398 1   0   Direct  FingerID:0
40.28344        User Touch Move to  993 471 1   0   Direct  FingerID:0
40.31673        User Touch Move to  972 540 1   0   Direct  FingerID:0
40.34993        User Touch Move to  941 652 1   0   Direct  FingerID:0
40.38364        User Touch Move to  917 759 1   0   Direct  FingerID:0
40.41671        User Touch Move to  892 839.0001    1   0   Direct  FingerID:0
40.4581     User Touch Move to  881 926.0001    1   0   Direct  FingerID:0
40.48376        User Touch Move to  881 1013    1   0   Direct  FingerID:0
40.5169     User Touch Move to  888 1079    1   0   Direct  FingerID:0
40.55089        User Touch Move to  877 1123    1   0   Direct  FingerID:0
40.58345        User Touch Move to  876 1143    1   0   Direct  FingerID:0
40.61669        User Touch Move to  876 1152    1   0   Direct  FingerID:0
40.64967        User Touch End  876 1158    1   0   Direct  FingerID:0
40.81691        User Touch Begin    868 1211    1   0   Direct  FingerID:0
40.88284        User Touch End  890 1205    1   0   Direct  FingerID:0
42.21786        User Touch Begin    1787    292 1   0   Direct  FingerID:0
42.28314        Next Button Pressed. Instruction Scene for shifting task finished
42.28526        User Touch End  1787    292 1   0   Direct  FingerID:0
42.93972        Begin Game: Shifting Game
42.95609        Condition: Social
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0.015736    ACC -0.001251221    0.0859375   -0.9896698
0.015736    GYR -0.003219241    0.08545668  -0.9963367
0.049156    ACC -0.001724243    0.0847168   -0.9896698
0.049156    GYR -0.003126211    0.08549355  -0.9963338
0.082455    ACC -0.001580391    0.08274841  -0.9894257
0.082455    GYR -0.003146617    0.08540883  -0.996341
0.122439    ACC -0.002227783    0.08642578  -0.9906311
0.122439    GYR -0.003176428    0.08549052  -0.9963339
0.149244    ACC -0.0007629395   0.08618164  -0.9874725
0.149244    GYR -0.003129252    0.08559478  -0.9963251
0.182519    ACC -0.002944946    0.08494568  -0.9879608
0.182519    GYR -0.003136341    0.08567501  -0.9963182
0.215836    ACC -0.002212524    0.08398438  -0.9901581
0.215836    GYR -0.003140859    0.08565754  -0.9963197
0.252388    ACC -0.002456665    0.08518982  -0.9877167
0.252388    GYR -0.003116608    0.0856069   -0.9963241
0.282529    ACC -0.005126953    0.08467102  -0.9855194
0.282529    GYR -0.003286732    0.08557197  -0.9963268
0.316066    ACC -0.002471924    0.08592224  -0.9874725
0.316066    GYR -0.003212397    0.08555531  -0.9963282
0.349264    ACC -0.002700806    0.08496094  -0.9911346
0.349264    GYR -0.003184176    0.08556499  -0.9963275
0.382544    ACC -0.002471924    0.08616638  -0.9886932
0.382544    GYR -0.003192188    0.0856294   -0.9963219
0.415877    ACC -0.003921509    0.08518982  -0.9886932
0.415877    GYR -0.003216265    0.08568434  -0.9963171
0.449252    ACC -0.003662109    0.08348083  -0.9884491
0.449252    GYR -0.003268673    0.08566696  -0.9963185
0.482562    ACC -3.051758E-05   0.08570862  -0.9894257
0.482562    GYR -0.003187155    0.08577034  -0.9963098
0.515825    ACC -0.003219604    0.08787537  -0.9889221
0.515825    GYR -0.003113278    0.08587241  -0.9963013
0.549056    ACC -0.004684448    0.08932495  -0.9893951
0.549056    GYR -0.003190852    0.08606779  -0.9962842
0.582398    ACC -0.004394531    0.08323669  -0.9891815
0.582398    GYR -0.003299798    0.0860424   -0.996286
0.61573 ACC 0.0009765625    0.08958167  -0.9879148
0.61573 GYR -0.003155831    0.08583388  -0.9963045
```