Personality Characterization Using Eye Tracking

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Introduction

- Knowing an individual's personality is important because it helps everyone understand why they do things or react in a certain way

- The Big Five Personality Traits (BFPTs) is a widely accepted model to measure personality dimensions. They are shown in Figure 1 below
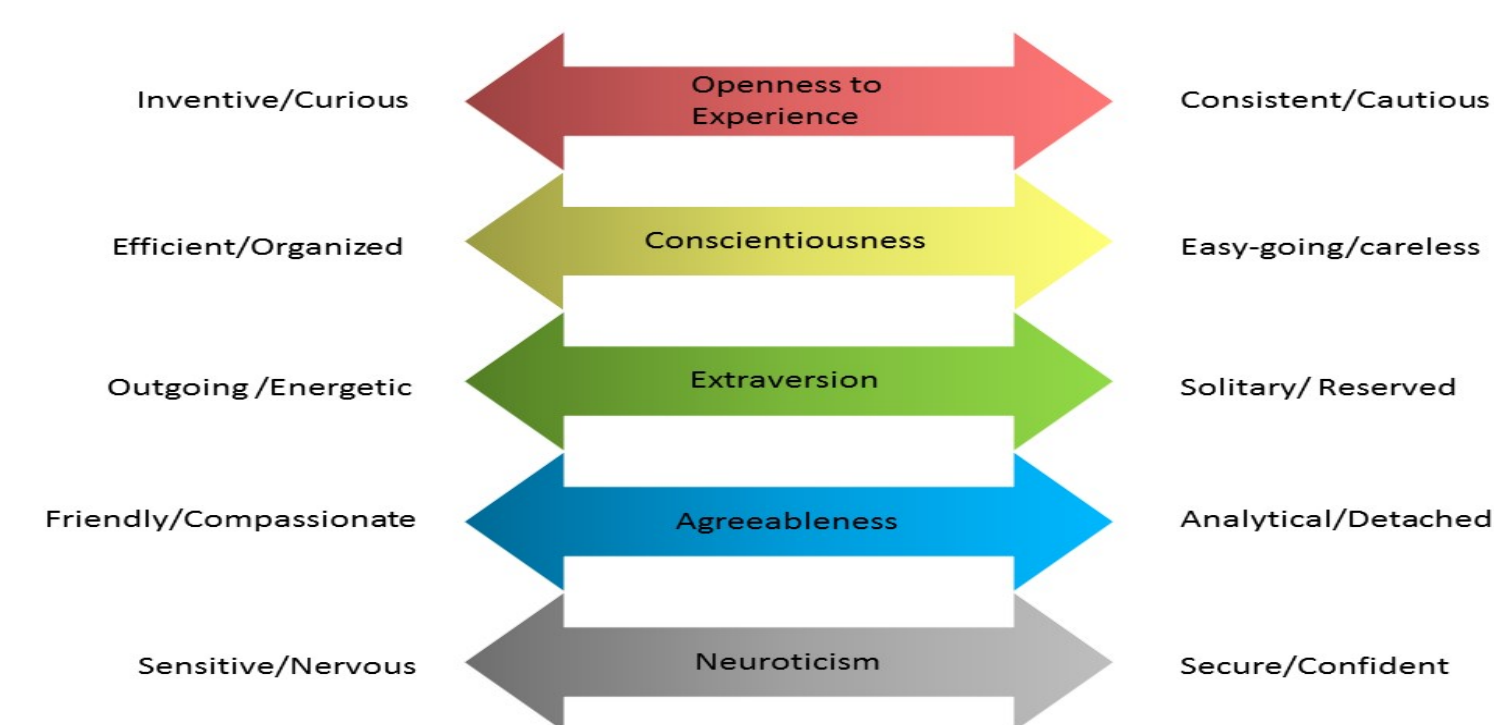

Figure 1: The Big Five Personality Traits

- Today, online or written personality tests are the most common method to determine one's BFPTs

- A limitation of these tests is that they are easy to fake

- 13% of employers use personality tests when hiring [1]

- 40% of job applicants manipulate their answers! [2]

Project Goal and Requirements

Project Goal

- Try to determine a subject's personality by recording and analyzing their eye movements when presented with a set of pictures on a screen

Requirements

- The application must be able to accurately predict at least one BFPT

- The mean error must be within a 10% range

- Any correlations obtained from the experiment must be tested to ensure that they are statistically significant

Walkthrough of Experiment

- Ask subject to take a validated online personality quiz

- Perform the eye tracking experiment on the subject. Examples of pictures that were shown are in Figure 2 below

Figure 2: Fearful, Happy and Angry Pictures of Faces

Data Analysis

- Eye tracker records the x & y coordinates of the region of the screen that the subject looked at, along with the timestamp

- Our team developed a program that parses the coordinates to generate heat maps. Sample heat maps generated by the program are shown in Figure 3 below
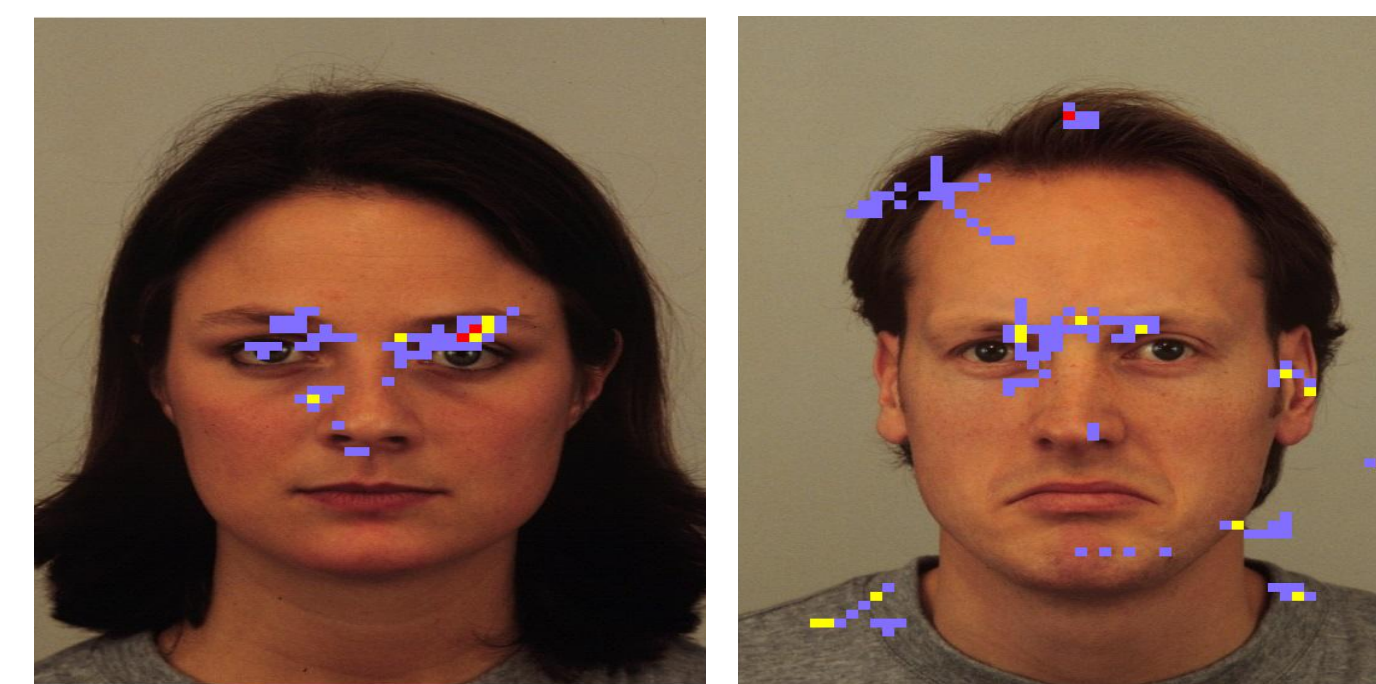

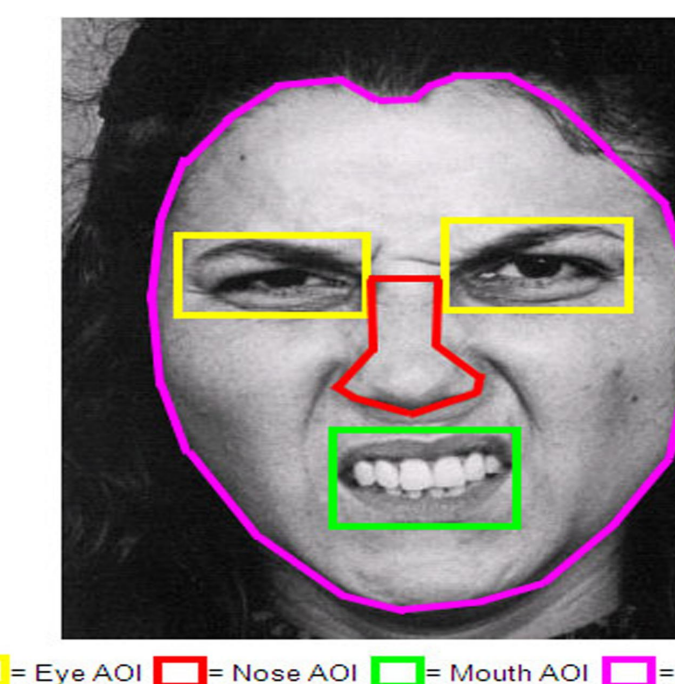**Figure 3: Sample Heat Maps**   **Figure 4: AOIs of different parts of the Face**

- We can look at these heat maps to determine Areas of Interest (AOI). Different possible AOIs are shown in Figure 4 above

- We can then calculate the dwell times on these AOIs and see if they correlate with the results of the online personality quiz

Results

- Obtained valid data by running the experiment on 26 subjects

Method 1: Univariate Linear Regression

- Uses the average dwell time for any one emotion

- Found a maximum correlation of 0.48. See Table 1 and Figure 5 below

Table 1: Correlation Between Trait and Human Emotion

Trait	Fearful	Happy	Sad	Disgusted	Surprised	Angry	Neutral
Agreeableness	0.28	0.48	0.27	0.38	0.22	−0.01	0.31
Openness to Exp.	0.28	0.14	0.23	0.09	0.23	0.10	0.01
Neuroticism	0.12	−0.06	0.19	0.06	0.26	0.01	0.08
Consc.	0.12	0.04	0.01	0.01	−0.08	−0.04	−0.19
Extraversion	−0.02	0.11	−0.07	0.04	−0.13	−0.21	0.03

Figure 5: Line of Best Fit

Table 2: Mean Error for all BFPTs using Method 1

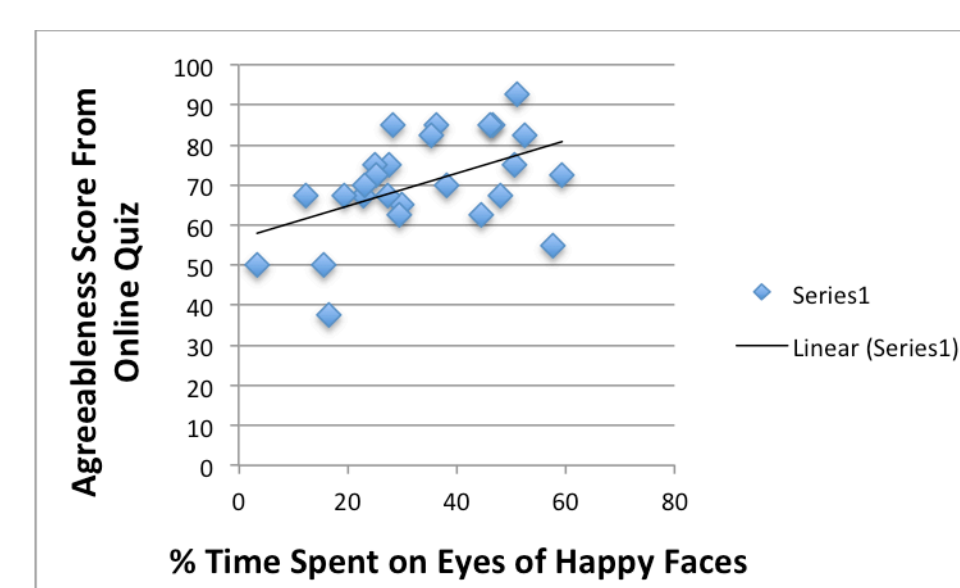|	
Agreeableness	10.96
Openness to Experience	11.11
Neuroticism	17.14
Conscientiousness	13.95
Extraversion	16.16

- The mean error using the emotion with the highest correlation for all BFPTs can be found in Table 2 above

Method 2: Multivariate Linear Regression

- Uses the average dwell time for all 7 emotions. The mean error for all BFPTs using this method can be found in Table 3 below

Table 3: Mean Error for all BFPTs using Method 2

Agreeableness	9.46
Openness to Experience	10.54
Neuroticism	15.63
Conscientiousness	12.54
Extraversion	15.11

Discussion

- From Tables 2 and 3, we can see that Method 2 has a lower mean error for all the BFPTs. Therefore, our application uses Method 2 to determine a person's personality

- We calculated the statistical significance of our experimental data using the Student's t−test [3]. The results for our primary trait, Agreeableness, can be found in Table 4 below

Table 4: Correlations and their Statistical Significance

Trait	Fearful	Happy	Sad	Disgusted	Surprised	Angry	Neutral
Agreeableness	0.28	0.48	0.27	0.38	0.22	−0.01	0.31
Statistical Sig.	92%	99%	90%	97%	86%	52%	94%

Challenges

- Finding pictures that evoke different emotions. Our team had to read literature and do research in order to overcome this

- Determining the AOIs to analyze within those pictures

- Finding a large number of test subjects who would be willing to sit for the experiment, without compensation

Conclusion and Future Work

- Can determine a person's personality using an eye tracking test that is hard to fake

- The accuracy of this test is within a 10% range for our primary trait, Agreeableness

- Hiring managers can use this test to determine if a potential employee would be a good fit for the company

- In the future, eye tracking technology will become more powerful and affordable

- We hope that a project like ours will drive more research into this area with the hope of benefitting society and improving the quality of life

References

[1] Society for Industrial and Organizational Psychology. How many US Companies use Employment Tests [Online]. Accessed February 20, 2016. Available: http://www.siop.org/workplace/employment%20testing/usingoftests.aspx

[2] R.L. Griffith et. Al (2007). Do Applicants Fake? An Examination of the Frequency of Applicant Faking Behavior [Online]. Accessed February 20, 2016. Available: https://www.researchgate.net/publication/235298803_Do_Applicants_Fake_An_examination_of_the_frequency_of_applicant_faking_behavior

[3] Kostadinov (2014). Significance Testing of Pearson Correlations in Excel [Online]. Accessed March 9, 2016. Available: http://fabian−kostadinov.github.io/2014/10/30/significance−testing−of−pearson−correlations−in−excel/

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