

Automated Processing of Physiological Responses During Decision Making Under Uncertainty

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Abstract

Can we measure an individual's trust in something?

The premise of our experiment revolves around the measurement of trust by an individual. We simulate situations in which trust is involved through the Iowa Gambling Task. With the presence of chance-based dynamics, this experiment enables us to measure risk-taking behavior of subjects, and whether they "trust" their selection in card deck.

During the experiment, we measure several physiological responses, including pupil diameter, respiration, EDA, ECG, and PPG. Our goal is to identify systematic relations between the functioning of the autonomic nervous system (ANS) and risk-taking behaviors by subjects.

In this presentation, we focus specifically on the automated processing and analysis of these signals. Using our developed dashboard, we demonstrate how to parse, clean, transform, and analyze our experimental data and observe responses on both an individual and group basis.

Preprocessing and Analysis of Individual Trial Data

Pupillometry Processing

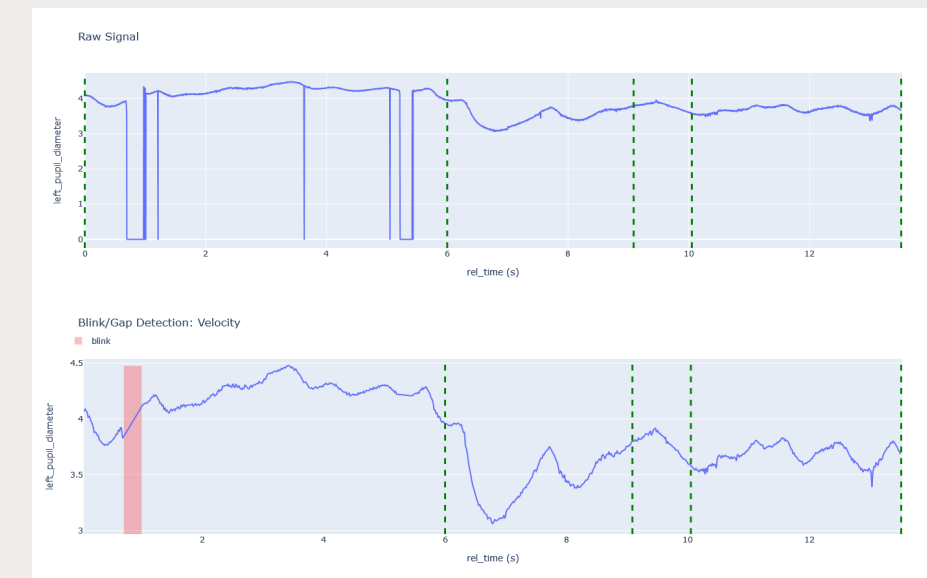


Fig 1: The upper plot depicts the raw pupil diameter signal, and the bottom contains the full processed signal

Analysis of Mouse Movements

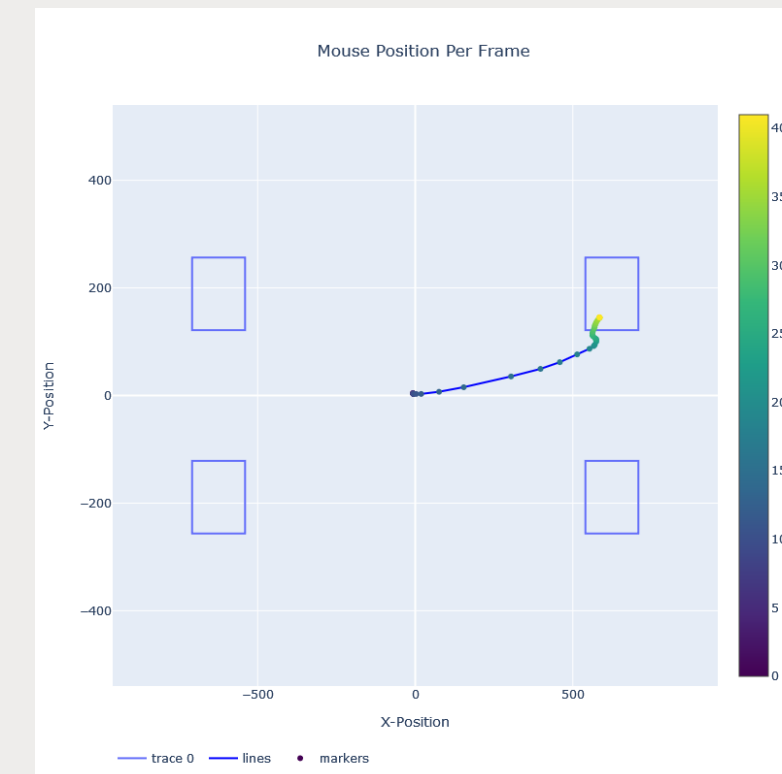


Fig 2: A plot depicting the subject's mouse movements during a single trial. See Kanin Bender's poster.

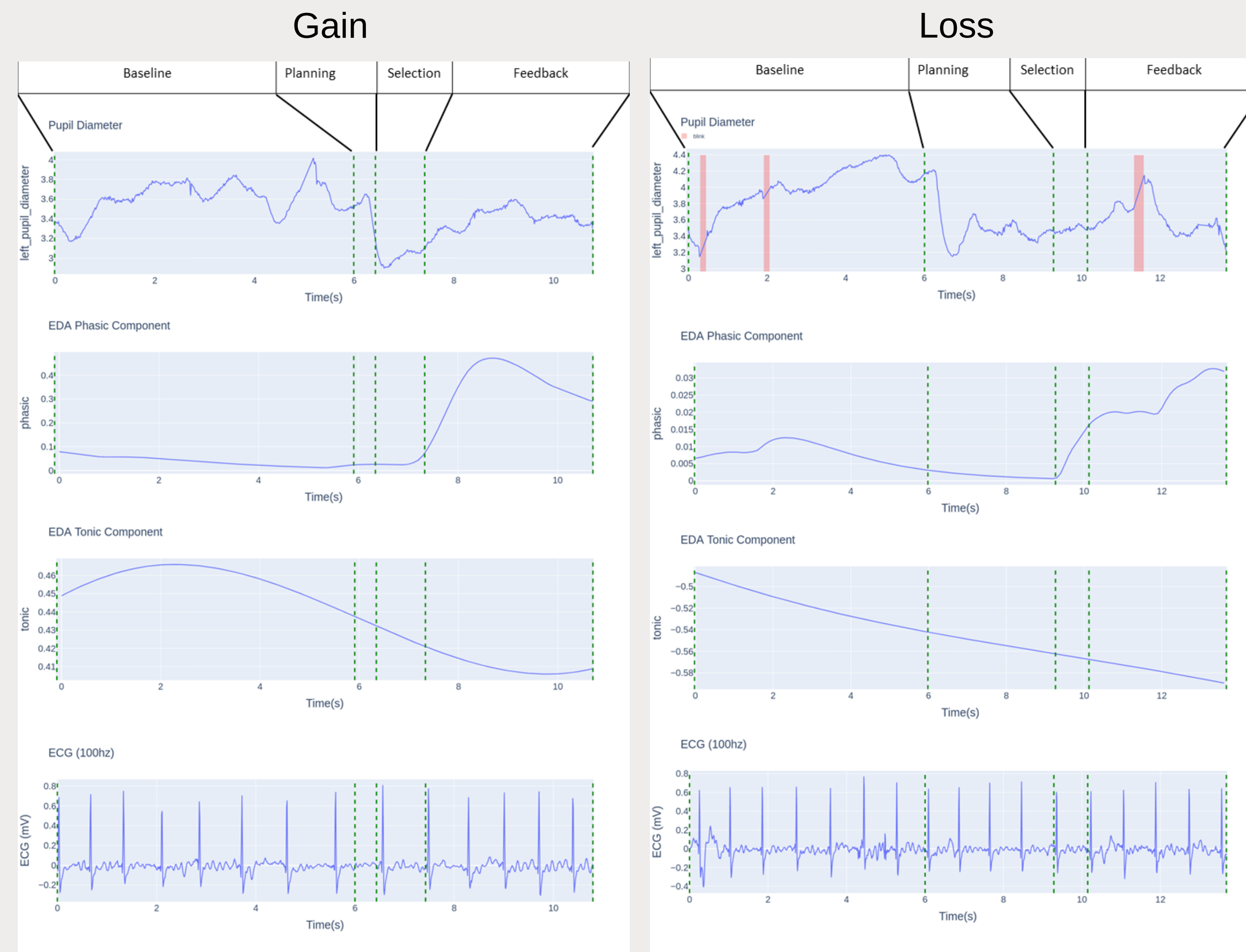


Fig 3: Trial 75 from an IGT subject where the subject received a positive score

Fig 4: Trial 4 from an IGT subject where the subject received a positive score

Future Work

In order to draw reliable conclusions from our experiment, we will need to analyze physiological behavior across all subject. Currently, the pipeline allows us to analyze the data on a trial by trial, and experiment by experiment basis. Therefore, we intend to scale the pipeline up to the intra-subject level to analyze and correlate specific patterns within the signals collected.

Conclusion

With the current pipeline, we can rapidly analyze the results of our experiments with great precision and visualize both responses and results. Based in a browser environment, we can analyze large quantities of data remotely without the need for powerful local compute resources

Using this framework, we will be able to build future analyses tools more quickly, ensure quality within our experimental methods, and rapidly prototype machine learning models with confidence.

References

https://github.com/bci-fnir/trusting_ai
Sources and code can be found at the provided link



Automated Pipeline for Measuring Changes in Pupil Diameter during a Trial:

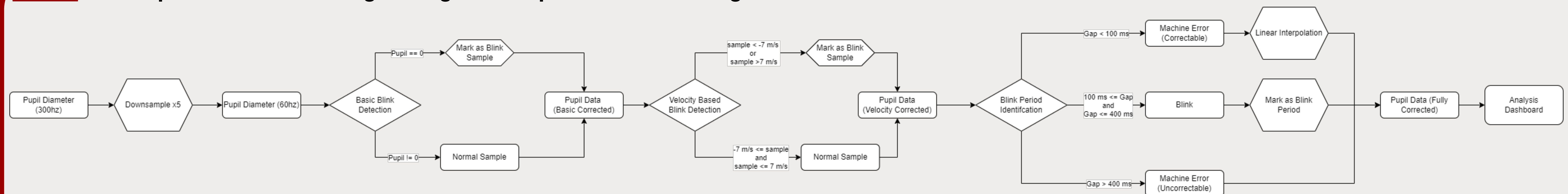


Fig 5: Flowchart of the processing pipeline for pupillometry