EyeMyWay

—Leveraging Digital Phenotyping to Support Patients with Visual Field Loss—

Team Members: Emily Ayala, Luis Diego Badillo, Devin Chang, Paul El-Hosni, Lisette Gonzalez, Gilberto Lopez, Pierce Nance, Sahis Neupane, William Reynoso Hernandez, David Tabor, Xihao Wang
Faculty Advisors: Dr. Navid Amini, Jooeun Jeon
David Geffen School of Medicine, University of California, Los Angeles Liaisons:
Drs. Sajad Besharati, Kouros Nouri-Mahdavi
Department of College of Engineering, Computer Science, and Technology
California State University, Los Angeles

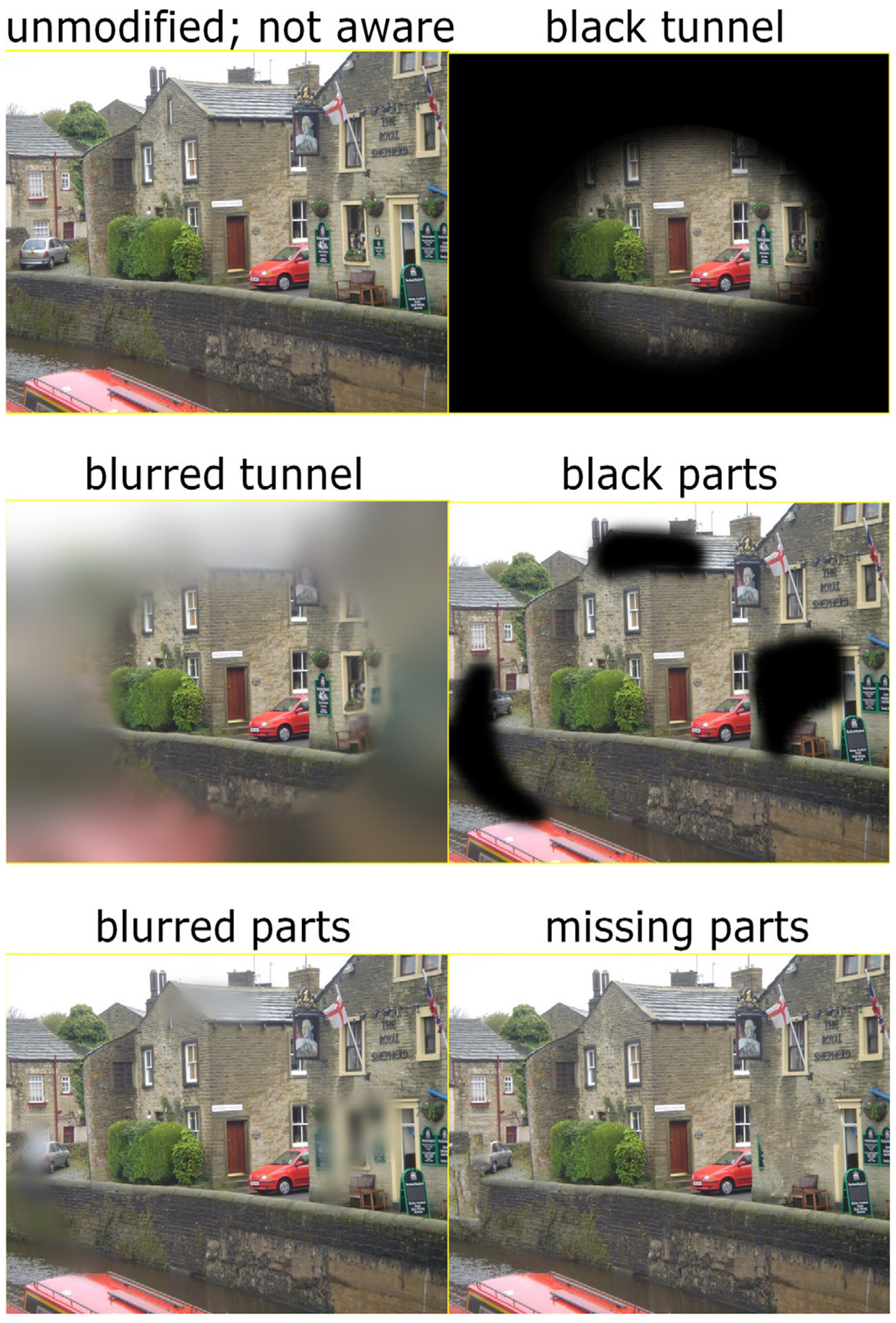
Motivation & Background

Our mission is to utilize digital phenotyping to detect and monitor glaucoma by analyzing driving behaviors through a mobile application that leverages smartphone sensors to characterize driving events. The collected data will be used to monitor the severity of glaucoma and provide reports on the condition to patients, doctors, and the Department of Motor Vehicles (DMV).

Problem Statement

Glaucoma can have severe implications for individuals, impacting their vision and daily lives. Currently, there is no known cure, making early detection and monitoring crucial for managing the condition. Digital phenotyping offers a promising approach in this regard.

Glaucoma



Glaucoma is a group of eye conditions that damages the optic nerve, causing vision loss and blindness. Symptoms of glaucoma can start slowly and can be so gradual that symptoms remain undetected before prevention and treatment can be administered.

Digital Phenotyping

Digital phenotyping uses data from personal devices to track and analyze behavior patterns [4].

Glaucoma and Driving Events

There exists a well-documented relationship between driving habits and glaucoma presence and severity. Glaucoma is negatively correlated with overall driver performance in both on-road (i.e., driving a predetermined course) and off-road (e.g., simulated driving or questionnaires) assessments.

Significant Drive Metrics

Metric	Expected Patient Pattern
Acceleration	Abrupt accelerations/decelerations
Brakes	Sudden braking due to missed road signs
Cornering	Jerky cornering due to peripheral vision loss
Speeding	Cautious driving under speed limit
Phone usage	Slower reaction times during phone usage

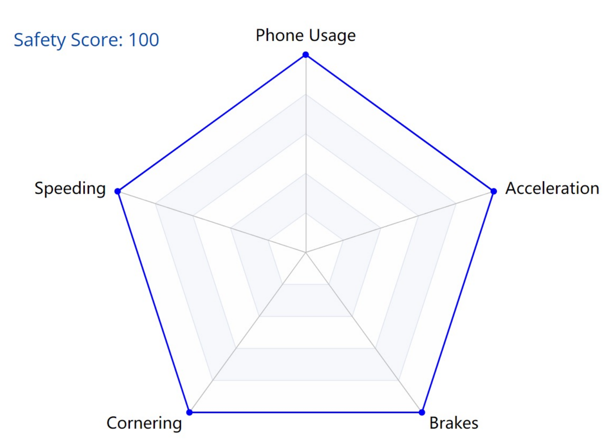
Research Question

Q1: Can digital phenotyping be utilized to leverage the relationship between glaucoma and driving events as a tool to monitor glaucoma?

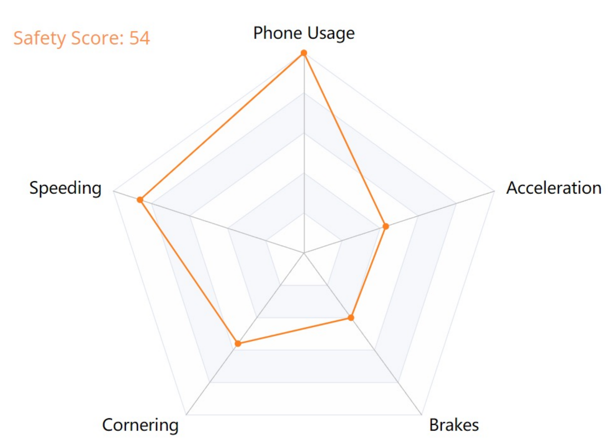
Methods

Dart
Programming language with cross-platform capability, to reduce time and make our application accessible on both Android and iOS devices.
Damoov's Telematics SDK
Provided the infrastructure to detect and automatically track driving events and process driving data.
Firebase
Secure backend service for user authentication, user role assignment, and enabling the SDK for smartphone drive monitoring.

Processed Driving Events



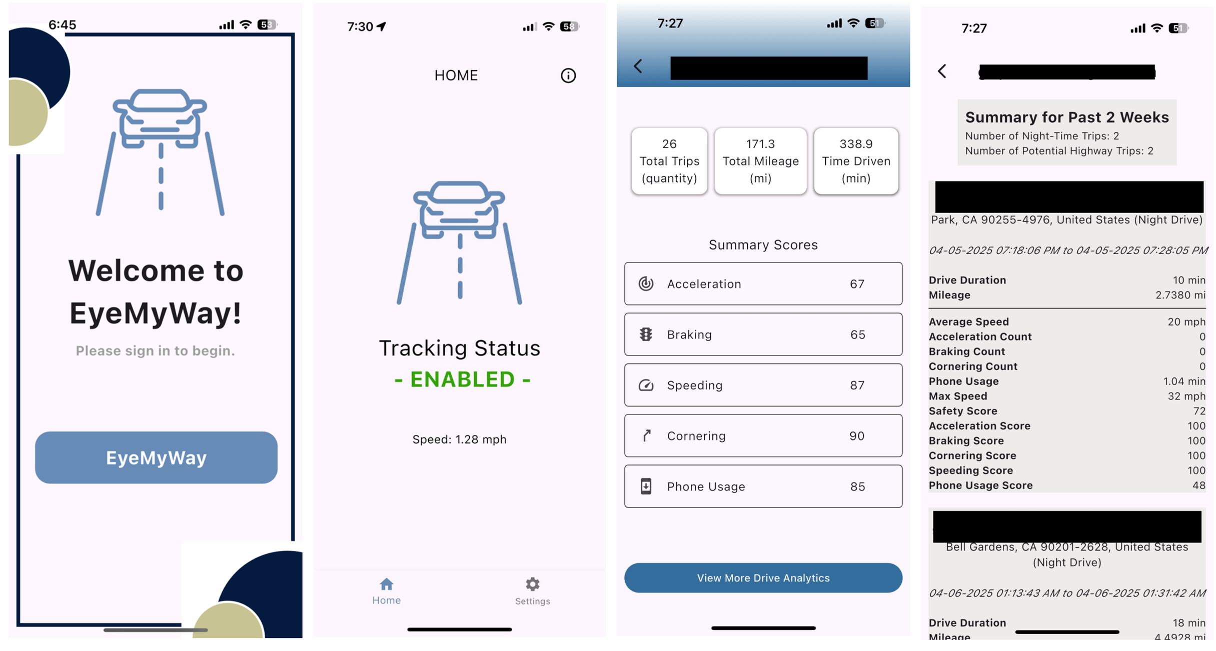
Safe Trip



Unsafe Trip

Safety Score is calculated by the weighted sum of each trip factor penalty

Results



Participants:

- 5 individuals diagnosed with glaucoma
- 6 individuals without glaucoma

Data spans ~4000 miles over 3 months

Discussion & Future Work

Impact
To the authors' knowledge, this application is the first digital phenotyping software to monitor glaucoma through an individual's driving habits. This application will also contribute insights to the relationship of driving habits and glaucoma severity through the vast longitudinal driving data collected from its user base.

Future Work
— Stage 02
Continue to recruit beta testers to collect additional data.
— Stage 03
Data analysis should focus on temporal relationships, analyzing how driving behavior is affected over time.
— Stage 04
Finally, a machine learning algorithm should be implemented and integrated with the application to determine glaucoma severity through an individual's driving habits.

Conclusion

By providing a platform to monitor glaucoma and longitudinally collect driving data, the application contributes to the early detection and further scientific understanding of glaucoma.

References

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Affiliations

1 Department of Computer Science, California State University–Los Angeles
2 David Geffen School of Medicine, University of California, Los Angeles * corresponding author
3 United States Department of Education
4 National Institutes of Health

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