

Pupil Analysis



Overview

Our Pupil Detection and Measurement System offers an innovative approach to measuring pupil size and detecting neurological conditions, such as Parkinson's disease and dizziness, by analyzing changes in pupil diameter. Designed to work seamlessly on smartphones with 4K resolution front-facing cameras, this browser-based application provides an accessible and non-invasive solution for the early detection of these conditions. The system processes pupil data after video recording, delivering results in a short duration to ensure quick feedback.



Technical Solutions

- **Pupil Size Measurement:** By analysing changes in pupil diameter, the system provides valuable insights into the potential development of diseases such as Parkinson's and dizziness.
- **Disease Prediction:** The application uses AI algorithms to correlate pupil size data with disease symptoms, enabling early-stage detection.
- **Post-Processing:** The platform processes pupil measurements quickly after recording, ensuring users receive feedback promptly.
- **Cross-Platform Accessibility:** The web app works seamlessly on both iOS and Android devices, supporting 4K resolution front-facing cameras.
- **Data Export:** Results are provided in structured CSV files, which can be analyzed further or shared with healthcare professionals for deeper insights.

USPs of the Platform

- **AI-Driven Pupil Detection:** Utilizes advanced computer vision models to capture pupil size from recorded frames precisely, ensuring accuracy across diverse environments.
- **Health Insights:** Tracks subtle changes in pupil behavior to generate predictive indicators for neurological conditions, supporting preventive healthcare.
- **Guided User Flow:** A clean, step-by-step interface helps users complete recordings correctly, reducing errors and improving reliability.
- **Structured Data Output:** Automatically compiles measurement results into standardized formats such as CSV, simplifying review, storage, and integration with external systems.



Achievement

The platform was presented at the “Mayo Week in Rochester,” where it won the pitch contest, marking a strong validation of the platform’s usefulness in the healthcare industry and its impact on patients.

Moreover, collaborating with one of the world’s leading medical institutions not only reinforces the credibility of our technology but also highlights its potential to transform early neurological disease detection on a global scale.

The Mayo Clinic team recognized the promise of our solution in supporting patients worldwide, affirming the founder's vision of making preventive healthcare more accessible to all.



Overcoming Development Challenges

- **Boundary Detection:** We recognized the importance of developing a system that works without an IR camera/lens, enabling maximum accessibility and benefit for users. This allows the system to reach a broader audience.
- **Accurate Distance Measurement:** Finding the correct distance between the user and the camera was essential for precise pupil size measurement, and we implemented a calibration system to address this challenge.
- **Web App vs Native App:** Transitioning from a native mobile app to a web app posed unique challenges in ensuring smooth performance across devices, but we successfully optimized it for a seamless cross-platform experience.
- **Manual Annotation for Model Training:** Annotating the training data for model development was a labor-intensive task, but it was essential to ensure the system's high accuracy and reliability.

Overcoming Development Challenges

- **Optimal Camera Resolution:** To ensure maximum pupil visibility, we focused on determining the optimal resolution for mobile cameras, guaranteeing high-quality results across different devices.
- **Lighting Optimization:** We optimized illumination intensity and environmental conditions to maintain pupil visibility in different settings, ensuring accurate and consistent measurements.



01 Core Development Areas

Image Enhancement and Device Compatibility:

- Research mathematical image reconstruction or enhancement methods to improve clarity for low-resolution or older smartphone cameras (up to 15 years old).
- If it is feasible then we will conduct comparative testing across device categories to maintain consistent results regardless of hardware capabilities or ambient lighting.
- Currently, pupil detection requires 4K-level camera quality, but with this platform, users with cameras as low as 2 megapixels will be able to accurately detect their pupils.



02 Feature Additions

Health Record and Symptom Tracking:

- Introduce a user-facing interface/form to record and compare symptoms, checkup results, prescriptions, and medication purchase history.
- Integrate OCR-based document scanning for extracting data from printed prescriptions and health records, with multilingual and multi-format support.

HRV and Illness Correlation:

- Establish a graph for pupil size variability using csv data and Heart Rate Variability (HRV) using the third-party API to enable predictive health insights and illness trend detection.

