# EyeSpy Diagnosis: Developing a Smartphone-Based Non-Invasive Intelligent Device and Application for the Accurate and Affordable Diagnosis of Eye Fundus Anomalies via Machine Learning

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Diabetic retinopathy (DR) is the leading cause of preventable blindness in the world. Due to the necessity of expensive ophthalmoscopic equipment and a trained professional, the screening process is inaccessible to millions of people. The goal of this work was to develop an end-to-end solution for triaging DR in an accessible, non-invasive, timely, and affordable manner. First, a machine learning (ML) model was developed for image analysis using convolutional neural networks and feature extraction with the Keras framework in Python. The model was trained with 44,000 images from an open-source, annotated dataset to ensure its validity over a wide range of fundus images. Second, a smartphone application was programmed to take images and house the ML model. Finally, a versatile smartphone lens attachment was 3D printed to seamlessly integrate with the application and provide testable DR classification results within minutes. The ML model was tested on 36,000 images and obtained statistically comparable results to those of an ophthalmologist in a clinical setting. With the addition of the app and attachment, these promising results were supported upon actual user testing. The applications of this project are twofold: first, this presents a novel solution to grading the severity of DR, and second, this approach can be easily adapted to diagnose other retina-related conditions. The project was deemed successful as the EyeSpy system is an intuitive and affordable tool for accurately diagnosing DR and has the potential to mitigate the vision impairment issues faced by 18% of the global population.

**Awards Won:**

Second Award of $1,500