

ABSTRACT

Cataract is a leading cause of blindness worldwide, accounting for 33% of visual impairments and 51% of blindness cases. In Indonesia, limited access to healthcare facilities and ophthalmologist specialists in remote areas poses a major challenge for early cataract detection, where uneven distribution of ophthalmologists with 70% concentrated in major cities causes many regions to lack adequate examination access. Delayed detection can result in economic losses of up to Rp 357.82 billion per year in west lombok. The main research problem is how to develop an accurate and easily accessible automatic cataract detection system to address the shortage of ophthalmologist specialists.

This research develops a deep learning-based cataract detection system using an Android mobile application integrated with cloud computing. The system employs a 5-layer Convolutional Neural Network (CNN) architecture with 5-Fold Cross Validation method to classify fundus eye images into three categories: Normal, Immature, and Mature. The model is implemented using Flask API as backend for deep learning processing, Express.js for application feature management, and PostgreSQL as database, with the mobile application developed using Android Studio featuring gallery image upload, automatic classification, and analysis history storage capabilities.

Test results show the 5-layer CNN model achieves 99.83% accuracy with 0.0031 loss using optimal hyperparameters. The cloud computing system successfully performs classification with confidence scores above 99.98% for all classes with average processing times of 1.51 seconds for Normal, 2.27 seconds for Immature, and 2.86 seconds for Mature. Compatibility testing on various Android devices versions 8-15 shows the application runs stably without errors. The system successfully provides a practical, accurate, and accessible cataract detection solution via smartphone to support early screening of cataract conditions in areas with limited ophthalmologist specialists.

Keywords: Deep Learning, Cataract Detection, CNN, Mobile Application, Cloud Computing