

ABSTRAK

Katarak adalah penyebab utama kebutaan di dunia, termasuk Indonesia, yang terjadi akibat lensa mata keruh, menghambat cahaya, dan menyebabkan gangguan penglihatan. Deteksi dini sangat penting, namun aksesibilitas dan akurasi diagnosis masih menjadi tantangan. Penelitian ini mengembangkan model *Convolutional Neural Network* (CNN) untuk mendeteksi katarak dengan akurasi tinggi melalui pengujian *hyperparameter*. Model CNN dirancang untuk klasifikasi biner menggunakan dataset sebanyak 600 citra mata dari Kaggle, terdiri dari 300 citra normal dan 300 citra katarak. Data diproses dengan *resizing* menjadi 224×224 piksel dan augmentasi menggunakan *ImageDataGenerator*. Arsitektur model mencakup tiga *convolutional layer*, tiga *pooling layer*, dan dua *fully connected layer*. Pelatihan dilakukan menggunakan *5-Fold Cross-Validation* dan optimasi *hyperparameter*, meliputi *optimizer* Adam dan RMSprop, *learning rate* 0.001 dan 0.0001, *batch size* 32 dan 64, serta *epoch* 10, 30, dan 50. Kombinasi terbaik ditemukan dengan *optimizer* Adam, *learning rate* 0.001, *batch size* 32, dan 50 *epoch*, menghasilkan akurasi pelatihan sebesar 95.7% dan akurasi validasi 94.9%. Evaluasi model pada data pengujian menunjukkan akurasi sebesar 97.27%, *precision* 94.83%, *recall* 100%, dan *F1-score* 97.35%, dengan hanya tiga kesalahan prediksi dari 110 data uji. Penelitian ini menunjukkan potensi besar CNN untuk deteksi dini katarak, yang dapat mendukung sistem diagnostik medis yang lebih cepat dan akurat.

Kata Kunci: *Convolutional Neural Network* (CNN), Katarak, Deteksi Citra Mata

ABSTRACT

Cataract is the leading cause of blindness in the world, including Indonesia, which occurs when the lens of the eye clouds, blocks light, and causes visual impairment. Early detection is crucial, but accessibility and accuracy of diagnosis remain a challenge. This study develops a Convolutional Neural Network (CNN) model to detect cataracts with high accuracy through hyperparameter testing. The CNN model was designed for binary classification using a dataset of 600 eye images from Kaggle, consisting of 300 normal and 300 cataract images. The data was processed by resizing to 224×224 pixels and augmentation using ImageDataGenerator. The model architecture includes three convolutional layers, three pooling layers, and two fully connected layers. Training was performed using 5-Fold Cross-Validation and hyperparameter optimization, including Adam and RMSprop optimizers, learning rates of 0.001 and 0.0001, batch sizes of 32 and 64, and epochs of 10, 30, and 50. The best combination was found with Adam optimizer, learning rate 0.001, batch size 32, and 50 epochs, resulting in training accuracy of 95.7% and validation accuracy of 94.9%. Evaluation of the model on test data showed a test accuracy of 97.27%, precision of 94.83%, recall of 100%, and F1-score of 97.35%, with only three prediction errors out of 110 test data. This research shows the great potential of CNNs for early cataract detection, which can support a faster and more accurate medical diagnostic system.

Keyword: *Convolutional Neural Network (CNN), Cataract, Eye Image Detection*