

**SISTEM KLASIFIKASI JENIS PENYAKIT MATA DENGAN
MENGUNAKAN METODE *FEATURE LEARNING*
CONVOLUTIONAL NEURAL NETWORK (CNN) DAN *EXTREME*
GRADIENT BOOSTING (XGBOOST)**

SKRIPSI



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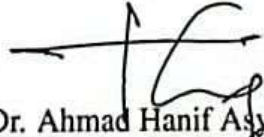
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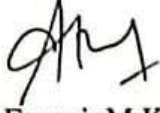
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ABSTRAK

SISTEM KLASIFIKASI JENIS PENYAKIT MATA DENGAN MENGUNAKAN METODE *FEATURE LEARNING* *CONVOLUTIONAL NEURAL NETWORK (CNN)* DAN *EXTREME* *GRADIENT BOOSTING (XGBOOST)*

Penyakit pada mata dapat menyebabkan keterbatasan dalam melakukan aktivitas sehari-hari. Beberapa penyakit mata yang dapat menyebabkan kebutaan antara lain *glaucoma*, *cataract*, dan *diabetic retinopathy*. Penelitian ini bertujuan mengembangkan sistem klasifikasi jenis penyakit mata yang mampu membantu dokter dalam mendiagnosis penyakit mata menggunakan citra fundus. Metode yang digunakan yaitu menggabungkan *Convolutional Neural Network (CNN)* dengan arsitektur ResNet50 untuk proses ekstraksi fitur dan *eXtreme Gradient Boosting (XGBoost)* untuk proses klasifikasinya. Setiap citra diekstraksi menggunakan ResNet50 melalui lapisan *Global Average Pooling* sehingga menghasilkan vektor fitur berdimensi 2048, yang selanjutnya diklasifikasikan menggunakan XGBoost dengan uji coba kombinasi parameter. Pembagian data menggunakan *K-Fold Cross Validation*, kemudian dievaluasi kinerja sistemnya menggunakan akurasi, sensitivitas, spesifisitas, dan efisiensi waktu komputasinya. Hasil uji coba menunjukkan bahwa performa terbaik pada $K = 10$ dengan $n_estimators = 300$, $learning_rate = 0.1$, $max_depth = 5$, $min_child_weight = 1$, $gamma = 0$, $lambda = 0$. Rata-rata akurasi yang diperoleh yaitu 91.10%, sensitivitas 90.93%, spesifisitas 97.04%, dan efisiensi waktu komputasinya 457.39 detik. Model terbaiknya didapat pada *fold 2* yaitu tingkat akurasinya sebesar 93.13%, sensitivitas 92.98%, spesifisitas 97.71%, dan efisiensi waktu komputasinya 478.14 detik. Jika dibandingkan dengan sistem klasifikasi jenis penyakit mata menggunakan ResNet50 mendapatkan akurasi terbaiknya yaitu 93.11%, spesifisitas 97.73%, sensitivitas 92.86, dan waktu komputasinya 2556.99 detik pada *fold 5*. Berdasarkan hasil tersebut, terbukti bahwa model gabungan ResNet50-XGBoost efektif dalam mengklasifikasikan jenis penyakit mata secara akurat dan efisien, serta berpotensi diterapkan sebagai sistem pendukung dalam diagnosis jenis penyakit mata.

Kata kunci: Penyakit mata, Citra Fundus, CAD, ResNet50, XGBoost

ABSTRACT

CLASSIFICATION SYSTEM FOR TYPES OF EYE DISEASES USING THE FEATURE LEARNING CONVOLUTIONAL NEURAL NETWORK (CNN) AND EXTREME GRADIENT BOOSTING (XGBOOST) METHODS

Eye diseases can cause limitations in performing daily activities. Some eye diseases that can lead to blindness include glaucoma, cataracts, and diabetic retinopathy. This study aims to develop an eye disease classification system capable of assisting doctors in diagnosing eye diseases using fundus images. The method employed combines a Convolutional Neural Network (CNN) with the ResNet50 architecture for feature extraction and eXtreme Gradient Boosting (XGBoost) for classification. Each image is processed using ResNet50 through a Global Average Pooling layer, resulting in a 2048 dimensional feature vector, which is then classified using XGBoost with parameter tuning. Data is split using K-Fold Cross Validation, and the system's performance is evaluated using accuracy, sensitivity, specificity, and computational time efficiency. The results of the experiments show that the best performance is achieved at $K = 10$ with $n_estimators = 300$, $learning_rate = 0.1$, $max_depth = 5$, $min_child_weight = 1$, $gamma = 0$, $lambda = 0$. The average accuracy obtained is 91.10%, sensitivity 90.93%, specificity 97.04%, and computational time efficiency 457.39 seconds. The best model was obtained in fold 2, with an accuracy of 93.13%, sensitivity of 92.98%, specificity of 97.71%, and computational time efficiency of 478.14 seconds. When compared to an eye disease classification system using ResNet50, the best accuracy was 93.11%, specificity 97.73%, sensitivity 92.86%, and computational time 2556.99 seconds on fold 5. Based on these results, it is evident that the ResNet50-XGBoost hybrid model is effective in accurately and efficiently classifying eye disease types and has the potential to be applied as a support system in the diagnosis of eye diseases.

Keywords: CAD, Eye Disease, Fundus Image, ResNet50, XGBoost

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