

SEVERITY-BASED CLASSIFICATION OF DIABETIC RETINOPATHY USING MOBILENETV3

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ABSTRACT

Diabetic retinopathy is a retinal complication of diabetes mellitus that can lead to vision loss if not detected early. This study aims to design and evaluate a severity-based diabetic retinopathy classification scheme using the MobileNetV3 architecture. The main dataset used was the Indian Diabetic Retinopathy Image Dataset (IDRiD), supported by controlled external-data experiments using DiaRetDB and APTOS. Several experimental schemes were tested, including direct RGB classification, CLAHE-based class balancing, MobileNetV3-Small and MobileNetV3-Large comparison, offline MobileNet feature classification, dual-backbone RETFound–MobileNetV3 feature fusion, and external-data addition. The model performance was evaluated using accuracy, Quadratic Weighted Kappa, macro AUC, macro F1-score, and weighted F1-score. The best experimental model was the Gated Feature Fusion model with All-Grade APTOS external augmentation at ratio 2.0, achieving an accuracy of 0.6505 and QWK of 0.7790. However, the CLAHE-Balanced RGB MobileNetV3-Large model was selected for mobile prototype implementation because it supports a single end-to-end image-to-prediction pipeline. This model achieved an accuracy of 0.6699 and was successfully converted into TensorFlow Lite and integrated into a Flutter-based Android prototype. The prototype demonstrates the feasibility of local preliminary diabetic retinopathy severity classification, although further clinical validation and device testing are required.

Keywords: diabetic retinopathy, MobileNetV3, severity classification, TensorFlow Lite, Flutter

KLASIFIKASI TINGKAT KEPARAHAN RETINOPATI DIABETIK MENGUNAKAN MOBILENETV3

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ABSTRAK

Retinopati diabetik merupakan komplikasi diabetes melitus pada retina yang dapat menyebabkan kehilangan penglihatan apabila tidak terdeteksi sejak dini. Penelitian ini bertujuan untuk merancang dan mengevaluasi klasifikasi tingkat keparahan retinopati diabetik menggunakan arsitektur MobileNetV3. Dataset utama yang digunakan adalah IDRiD, dengan tambahan eksperimen terkontrol menggunakan DiaRetDB dan APTOS. Beberapa skema diuji, yaitu klasifikasi citra RGB, penyeimbangan kelas berbasis CLAHE, perbandingan MobileNetV3-Small dan MobileNetV3-Large, klasifikasi fitur offline, fusi fitur RETFound–MobileNetV3, serta penambahan data eksternal. Evaluasi dilakukan menggunakan akurasi, Quadratic Weighted Kappa (QWK), AUC makro, F1-score makro, dan F1-score berbobot. Model terbaik adalah Gated Feature Fusion dengan augmentasi APTOS rasio 2,0, yang memperoleh akurasi 0,6505 dan QWK 0,7790. Namun, MobileNetV3-Large berbasis CLAHE dipilih untuk prototipe karena mendukung alur end-to-end, dengan akurasi 0,6699. Model berhasil dikonversi ke TensorFlow Lite dan diintegrasikan ke aplikasi Android berbasis Flutter. Hasil menunjukkan bahwa klasifikasi awal retinopati diabetik pada perangkat bergerak layak diterapkan, meskipun masih memerlukan validasi klinis dan pengujian lebih lanjut.

Kata kunci: retinopati diabetik, MobileNetV3, klasifikasi tingkat keparahan, TensorFlow Lite, Flutter