ABSTRAK

MODEL DEEP LEARNING YOLO V11 UNTUK DETEKSI OBJEK REAL-TIME SEBAGAI ALAT BANTU NAVIGASI TUNANETRA

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Penyandang tunanetra sering mengalami kesulitan dalam mengenali rintangan saat bergerak di lingkungan sekitar, yang dapat memengaruhi keselamatan dan kemandirian mereka. Penelitian ini mengembangkan aplikasi navigasi *real-time* berbasis Android yang dilengkapi deteksi objek menggunakan model *You Only Look Once* versi 11 (YOLOv11) dan umpan balik suara melalui *Text-to-Speech.* Sistem dirancang untuk menginformasikan keberadaan objek di sekitar pengguna secara langsung. Dataset terdiri atas lima kelas objek yang relevan dengan kebutuhan navigasi, yaitu manusia, kursi, meja, pintu, dan tangga. Proses penelitian meliputi *preprocessing* data, pelatihan model, dan evaluasi menggunakan metrik *Precision, Recall, F1-Score,* dan *mean Average Precision* pada ambang *Intersection over Union* 0,5 dan 0,5-0,95. Hasil pengujian menunjukkan nilai *Precision* 0,908, *Recall* 0,905, mAP50 0,942, dan mAP50-95 0,782. Nilai tersebut menunjukkan model mampu melakukan deteksi objek dengan tingkat akurasi tinggi dan kinerja yang stabil pada perangkat bergerak. Sistem yang dikembangkan mampu memberikan deteksi objek secara *real-time* serta menyampaikan informasi melalui suara dengan jelas, sehingga dapat membantu pengguna bernavigasi dengan lebih aman dan mandiri. Penelitian ini menawarkan solusi praktis dan terjangkau untuk mendukung mobilitas penyandang tunanetra serta selaras dengan tujuan pembangunan inklusif dan pengurangan kesenjangan sosial.

Kata kunci: YOLOv11, Deteksi Objek, Tunanetra, *Hyperparameter Tuning*, *Random Search, Text-to-Speech*

ABSTRACT

DEEP LEARNING MODEL YOLO V11 FOR REAL-TIME OBJECT DETECTION AS AN ASSISTIVE NAVIGATION SYSTEM FOR THE VISUALLY IMPAIRED

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Visually impaired individuals often experience difficulties in recognizing obstacles while navigating their surroundings, which may affect their safety and independence. This study develops a real-time navigation application for the Android platform, equipped with an object detection system using the You Only Look Once version 11 (YOLOv11) model and voice feedback through Text-to-Speech. The system is designed to provide immediate auditory information about objects in the user's environment.The dataset used consists of five object classes relevant to navigation needs, including human, chair, table, door, and stair. The research process involves data preprocessing, model training, and performance evaluation using Precision, Recall, F1-Score, and mean Average Precision at Intersection over Union (IoU) thresholds of 0.5 and 0.5–0.95. The experimental results show that the YOLOv11 model achieved a Precision of 0.908, Recall of 0.905, mAP50 of 0.942, and mAP50–95 of 0.782, demonstrating high detection accuracy and stable performance on mobile devices.The developed system is capable of performing real-time object detection and delivering clear voice output, allowing users to navigate more safely and independently. Overall, this study provides a practical and affordable technological solution to support the mobility of visually impaired individuals and aligns with inclusive development efforts to reduce social inequality.

Keywords: *YOLOv11, Object Detection, Visually Impaired, Hyperparameter Tuning, Random Search, Text-to-Speech*