ABSTRAK

Pengenalan tulisan Braille secara otomatis merupakan salah satu tantangan dalam bidang pengolahan citra karena karakteristiknya yang unik berupa pola titik timbul berukuran kecil dan berkontras rendah. Berbagai penelitian sebelumnya telah berupaya mengatasi tantangan tersebut dengan menerapkan metode seperti *Convolutional Neural Network* (CNN), *Gabor Wavelet,* dan *Support Vector Machine* (SVM). Pendekatan berbasis CNN menunjukkan akurasi tinggi hingga 97,6% dalam mengenali karakter tunggal, namun masih terbatas pada deteksi individual dan sensitif terhadap variasi pencahayaan. Metode Gabor Wavelet dan SVM juga menghasilkan akurasi tinggi pada citra hasil pemindaian, tetapi kurang representatif untuk citra hasil kamera di kondisi nyata. Kesalahan deteksi dan klasifikasi yang masih terjadi sering menyebabkan hasil translasi tidak akurat.

Penelitian ini bertujuan untuk mendeteksi dan mengenali karakter Braille menggunakan metode YOLOv8 serta menerapkan *Spelling Correction* Peter Norvig untuk memperbaiki kesalahan hasil translasi. Model YOLOv8 dilatih menggunakan 959 citra Braille, yang terdiri dari data primer hasil pengambilan langsung dan data sekunder dari Roboflow, mencakup 28 kelas karakter, termasuk huruf A–Z serta simbol penanda seperti kapital dan angka. Proses pelatihan model dilakukan dengan tiga kombinasi parameter, yaitu variasi optimizer (AdamW, SGD, RMSProp), dua nilai *learning rate*, dan dua variasi jumlah *epoch* (30 dan 60), untuk menentukan konfigurasi terbaik berdasarkan metrik precision, recall, dan mAP50.

Hasil penelitian menunjukkan bahwa optimizer SGD dengan learning rate 0,01 dan epoch 60 memberikan performa terbaik, dengan precision 96,2%, recall 98,4%, dan mAP50 98,1%. Model mampu mendeteksi seluruh karakter Braille sekaligus (multi-objek), tahan terhadap variasi pencahayaan, dan menghasilkan deteksi yang akurat pada jarak 10–20 cm, sedangkan pada jarak lebih jauh (30–40 cm) beberapa karakter tidak terdeteksi akibat citra buram dan ukuran titik yang mengecil. Penerapan Spelling Correction berhasil meningkatkan akurasi translasi hingga 90,5%, sehingga sistem mampu mengenali dan menerjemahkan karakter Braille secara lebih tepat dan komprehensif dibandingkan metode sebelumnya.

Kata Kunci: Braille, YOLOv8, Deteksi Objek, Koreksi Ejaan, Penerjemahan

ABSTRACT

Automatic recognition of Braille writing is one of the challenges in the field of image processing due to its unique characteristics, consisting of small raised dot patterns with low contrast. Previous studies have attempted to address these challenges using methods such as Convolutional Neural Networks (CNN), Gabor Wavelet, and Support Vector Machines (SVM). CNN-based approaches have shown high accuracy of up to 97.6% in recognizing individual characters, but they are still limited to single-character detection and sensitive to variations in lighting conditions. Gabor Wavelet and SVM methods also achieve high accuracy on scanned images but are less representative for camera-captured images in real-world conditions. Detection and classification errors often lead to inaccurate translation results.

This study aims to detect and recognize Braille characters using the YOLOv8 method and applies Peter Norvig's Spelling Correction algorithm to correct translation errors. The YOLOv8 model was trained using 959 Braille images, consisting of primary data obtained directly and secondary data from Roboflow, covering 28 character classes, including letters A–Z and symbols such as capitalization and numbers. The model training was conducted using three parameter combinations, namely variations of optimizer (AdamW, SGD, RMSProp), two learning rates, and two epoch settings (30 and 60), to determine the best configuration based on precision, recall, and mAP50 metrics.

The results show that SGD optimizer with a learning rate of 0.01 and 60 epochs achieved the best performance, with precision of 96.2%, recall of 98.4%, and mAP50 of 98.1%. The model is capable of detecting all Braille characters simultaneously (multi-object), robust to variations in lighting conditions, and produces accurate detection at distances of 10–20 cm, whereas at longer distances (30–40 cm), some characters are not detected due to blurred images and smaller dot sizes. The application of Spelling Correction increased the translation accuracy to 90.5%, allowing the system to recognize and translate Braille characters more accurately and comprehensively compared to previous methods.

Keywords: *Braille, YOLOv8, Object Detection, Spelling Correction, Translation*