PENGEMBANGAN MODEL THERMAL RESIDUALNET-128 UNTUK DETEKSI OBJEK DALAM CITRA TERMAL MENGGUNAKAN PEMBELAJARAN RESIDUAL

SKRIPSI

Diajukan untuk memenuhi sebagian syarat untuk memperoleh gelar Sarjana Teknik pada Program Studi Sistem Telekomunikasi

Oleh:
Miftahul Falah
2104755

PROGRAM STUDI SISTEM TELEKOMUNIKASI
KAMPUS UPI DI PURWAKARTA
UNIVERSITAS PENDIDIKAN INDONESIA
2025

LEMBAR HAK CIPTA

Pengembangan Model Thermal ResidualNet-128 untuk Deteksi Objek dalam Citra Termal menggunakan Pembelajaran Residual

Oleh:
Miftahul Falah

Sebuah skripsi yang diajukan untuk memenuhi salah satu syarat memperoleh gelar Sarjana Teknik pada Program Studi Sistem Telekomunikasi

LEMBAR PENGESAHAAN

Miftahul Falah

2104755

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Disetujui dan disahkan oleh pembimbing:

Pembimbing I:

Galura Muhammad Suranegara, S.Pd., M.T.

NIP. 920190219920111101

Pembimbing II:

Ichwan Nul Ichsan, S.T., M.T.

NIP. 920200119900330101

Mengetahui,

Ketua Program Studi Sistem Telekomunikasi

Galura Muhammad Suranegara, S.Pd., M.T.

NIP. 920190219920111101

ABSTRAK

Deteksi objek untuk kendaraan otonom menghadapi tantangan dalam kondisi pencahayaan rendah. Citra termal menawarkan solusi yang efektif, namun arsitektur *Convolutional Neural Network* (CNN) konvensional sering mengalami penurunan performa pada jaringan dalam. Penelitian ini bertujuan mengembangkan dan mengevaluasi model Thermal ResidualNet-128 (TRNet-128), arsitektur CNN dengan mekanisme pembelajaran residual untuk mendeteksi objek manusia dan pengendara sepeda motor. *Dataset* yang digunakan terdiri dari 1.008 gambar citra termal *grayscale*. Performa model TRNet-128 dievaluasi menggunakan metrik *accuracy*, *precision*, *recall*, *F1-score*, *confusion matrix,* dan *mean Average Precision* (mAP), serta dibandingkan dengan model CNN sederhana tanpa *residual block*. Hasil menunjukkan model TRNet-128, setelah augmentasi data untuk mengatasi *overfitting*, mencapai akurasi validasi 99,86% dan mAP 0,99977, jauh lebih tinggi dibandingkan model CNN sederhana yang hanya 0,99652. Kesimpulannya, integrasi *residual blocks* pada TRNet-128 secara efektif meningkatkan akurasi klasifikasi dan ketepatan deteksi objek dalam citra termal.

Kata Kunci: Deteksi Objek, Citra Termal, *Convolutional Neural Network*, Pembelajaran Residual, TRNet-128

ABSTRACT

Object detection for autonomous vehicles faces challenges in low-light conditions. Thermal imagery offers an effective solution; however, conventional Convolutional Neural Network (CNN) architectures often experience performance degradation in deep networks. This study aims to develop and evaluate the Thermal ResidualNet-128 (TRNet-128) model, a CNN architecture equipped with a residual learning mechanism to detect human and motorcycle rider objects. The dataset used consists of 1,008 grayscale thermal images. The performance of the TRNet-128 model is evaluated using metrics such as accuracy, precision, recall, F1-score, confusion matrix, and mean Average Precision (mAP), and compared to a simple CNN model without residual block. Results show that the TRNet-128 model, after data augmentation to mitigate overfitting, achieved a validation accuracy of 99.86% and an mAP of 0.99977, significantly outperforming the simple CNN model, which only reached 0.99652. In conclusion, the integration of residual blocks in the TRNet-128 architecture effectively enhances classification accuracy and object detection precision in thermal images.

Keywords: *Object Detection, Thermal Imagery, Convolutional Neural Network, Residual Learning, TRNet-128.*

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