

INTISARI

Analisis Kombinasi Convolutional Neural Network dan Algoritma Tradisional pada Klasifikasi Citra Luka Bakar

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Luka bakar memerlukan penilaian tingkat keparahan yang cepat dan akurat, sehingga sistem klasifikasi otomatis berbasis citra menjadi solusi untuk mengurangi subjektivitas penilaian manual. Penelitian ini membandingkan pendekatan hybrid yang mengombinasikan Convolutional Neural Network (CNN) sebagai ekstraktor fitur dengan algoritma klasifikasi tradisional, terhadap pendekatan full CNN end-to-end dalam klasifikasi citra luka bakar multi-kelas. Empat arsitektur CNN, yaitu MobileNetV2, VGG16, ResNet50, dan EfficientNetB3, dikombinasikan dengan Support Vector Machine (SVM), K-Nearest Neighbor, dan Decision Tree, serta diuji pada dataset Skin Burn dan BIP_US. Hasil menunjukkan bahwa pendekatan hybrid memberikan performa yang lebih stabil dan efisien dibandingkan full CNN. Pada dataset Skin Burn, model hybrid EfficientNetB3 + SVM mencapai akurasi 0,89583 dan F1-score macro 0,90448, lebih tinggi dibandingkan model full CNN terbaik dengan akurasi 0,86806 dan F1-score macro 0,86798. Pada dataset BIP_US yang berukuran lebih kecil, model hybrid ResNet50 + SVM mencapai akurasi 0,90323 dan F1-score macro 0,90661, melampaui full CNN terbaik dengan akurasi 0,83871 dan F1-score macro 0,82971. Selain itu, pendekatan hybrid menunjukkan efisiensi komputasi yang lebih baik dengan waktu pengujian yang jauh lebih cepat. Secara keseluruhan, pendekatan hybrid CNN + ML terbukti lebih andal dan efisien, terutama pada skenario data terbatas, sehingga lebih sesuai untuk aplikasi medis yang membutuhkan klasifikasi cepat dan akurat.

Kata kunci: Luka bakar, klasifikasi citra, *Convolutional Neural Network* (CNN), *Support Vector Machine* (SVM), *k-Nearest Neighbors* (k-NN), *Decision Tree*.

ABSTRACT

Analysis of Convolutional Neural Network and Traditional Algorithm Combinations for Burn Image Classification

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Burn injuries require fast and accurate severity assessment; therefore, automated image-based classification systems offer a promising solution to reduce subjectivity in manual clinical evaluation. This study compares a hybrid approach that combines Convolutional Neural Networks (CNNs) as feature extractors with traditional machine learning classifiers against a full end-to-end CNN approach for multi-class burn image classification. Four CNN architectures MobileNetV2, VGG16, ResNet50, and EfficientNetB3 are integrated with Support Vector Machine (SVM), K-Nearest Neighbor, and Decision Tree classifiers and evaluated on the Skin Burn and BIP_US datasets. The results demonstrate that the hybrid approach consistently provides more stable and efficient performance than full CNN models. On the Skin Burn dataset, the EfficientNetB3 + SVM hybrid model achieves an accuracy of 0.89583 and a macro F1-score of 0.90448, outperforming the best full CNN model, which attains an accuracy of 0.86806 and a macro F1-score of 0.86798. On the smaller BIP_US dataset, the ResNet50 + SVM hybrid model achieves an accuracy of 0.90323 and a macro F1-score of 0.90661, surpassing the best full CNN model with an accuracy of 0.83871 and a macro F1-score of 0.82971. In addition, the hybrid approach demonstrates significantly better computational efficiency with substantially shorter inference times. Overall, these results confirm that the hybrid CNN + machine learning approach is more reliable and efficient, particularly under limited data conditions, making it more suitable for medical applications that require fast and accurate classification.

Keywords: Burn wounds, image classification, Convolutional Neural Network (CNN), Support Vector Machine (SVM), K-Nearest Neighbors (K-NN), Decision Tree.