

ABSTRAK

FINE-TUNING MODEL FACENET BERBASIS PYTORCH UNTUK FACE RECOGNITION PADA SISTEM ABSENSI DIGITAL DI LABORATORIUM TEKNIK KOMPUTER UNIVERSITAS LAMPUNG

Oleh

Budi Cahyono

Pengelolaan administrasi laboratorium komputer di Universitas Lampung masih dilakukan secara manual, sehingga berisiko terhadap kehilangan data dan pencatatan yang kurang efisien. Kondisi ini menimbulkan kebutuhan akan sistem digital yang mampu meningkatkan akurasi dan transparansi proses absensi. Penelitian ini bertujuan untuk mengembangkan sistem absensi berbasis face recognition dengan pendekatan fine-tuning pada model FaceNet menggunakan PyTorch. Dataset penelitian terdiri dari 2.700 citra wajah dari 30 kelas mahasiswa yang telah melalui tahap preprocessing berupa deteksi, cropping, dan resize. Penggunaan triplet loss pada model FaceNet dengan arsitektur InceptionResNetV1 menghasilkan embedding wajah yang lebih representatif. Evaluasi dilakukan menggunakan cosine similarity untuk penentuan threshold, serta metrik performa berupa akurasi, confusion matrix, ROC-AUC, dan visualisasi t-SNE. Hasil pengujian menunjukkan threshold optimal sebesar 0,70. Model fine-tuned mencapai akurasi 99,66%, lebih tinggi dibandingkan model pre-trained yang hanya 98,99%. Pada uji coba langsung menggunakan kamera terhadap lima mahasiswa, model fine-tuned berhasil mengenali wajah dengan akurasi 100%, sedangkan model pre-trained hanya mencapai 86,67%. Visualisasi t-SNE juga memperlihatkan bahwa klaster wajah pada model fine-tuned lebih jelas dan terpisah. Hasil penelitian ini menunjukkan bahwa penerapan triplet loss pada model FaceNet dapat meningkatkan keakuratan dan keandalan sistem face recognition, sehingga layak digunakan untuk mendukung digitalisasi absensi di Laboratorium Teknik Komputer Universitas Lampung.

Kata Kunci: Absensi Digital, Face Recognition, FaceNet, PyTorch, Fine-Tuning

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FINE-TUNING MODEL FACENET BERBASIS PYTORCH UNTUK FACE RECOGNITION PADA SISTEM ABSENSI DIGITAL DI LABORATORIUM TEKNIK KOMPUTER UNIVERSITAS LAMPUNG

By

Budi Cahyono

The administrative management of the computer laboratory at the University of Lampung is still conducted manually, making it prone to data loss and inefficient record-keeping. This situation highlights the need for a digital system that can enhance the accuracy and transparency of the attendance process. This study aims to develop a face recognition-based attendance system using a fine-tuning approach on the FaceNet model implemented with PyTorch. The dataset consists of 2,700 facial images from 30 student classes that have undergone preprocessing stages, including detection, cropping, and resizing. The application of triplet loss on the FaceNet model with the InceptionResNetV1 architecture produces more representative facial embeddings. The evaluation was performed using cosine similarity to determine the optimal threshold, along with performance metrics such as accuracy, confusion matrix, ROC-AUC, and t-SNE visualization. The experimental results show that the optimal threshold is 0.70. The fine-tuned model achieved an accuracy of 99.66%, which is higher than the pre-trained model's 98.99%. In real-time testing using a camera with five students, the fine-tuned model successfully recognized faces with 100% accuracy, while the pre-trained model achieved only 86.67%. The t-SNE visualization also demonstrates that the facial clusters in the fine-tuned model are clearer and more distinct. These results indicate that applying triplet loss to the FaceNet model improves the accuracy and reliability of the face recognition system, making it suitable for supporting the digitalization of attendance in the Computer Laboratory at the University of Lampung.

Keywords: Digital Attendance, Face Recognition, FaceNet, PyTorch, Fine-Tuning