

ABSTRAK

Budi. 2026. *Sistem Klasifikasi Penyakit Kanker Paru-Paru Berbasis Citra CT-Scan Menggunakan Convolutional Neural Network (CNN) Terintegrasi Clinical Decision Support*. Skripsi. Program Studi Teknik Informatika, Fakultas Teknik, Universitas PGRI Madiun. Pembimbing (I) Saifulloh, S.Kom., M.Kom. Pembimbing (II) Puguh Jayadi, S.Kom., M.Kom.

Kanker paru-paru merupakan penyebab utama keganasan global yang membutuhkan deteksi dini dan penanganan yang tepat. Tingginya kompleksitas visual citra *CT-Scan* membuat hasil pemindaian sulit dipahami secara langsung oleh pasien awam tanpa penerjemahan dari tenaga ahli, yang dapat memicu kecemasan psikologis selama masa tunggu konsultasi medis. Penelitian ini mengembangkan sistem skrining mandiri cerdas berbasis *web* yang mengintegrasikan model *Convolutional Neural Network (CNN)* dengan *Clinical Decision Support System (CDSS)*. Sistem ini mengadopsi arsitektur ResNet50 dengan strategi *Two-Phase Transfer Learning* melalui pipa inferensi ganda (*dual-pipeline*). Pipa pertama bertugas mengklasifikasikan jenis kanker (*Adenocarcinoma, Large cell carcinoma, Squamous cell carcinoma, Normal*) menggunakan dataset Chest CT-Scan Images dari Mendeley/Kaggle, sedangkan pipa kedua mengklasifikasikan tingkat keparahan (*Malignant, Benign, Normal*) menggunakan dataset IQ-OTH/NCCD. Model dikembangkan menggunakan lingkungan *TensorFlow* dan *Keras* dengan menerapkan teknik augmentasi, *oversampling*, serta penyeimbangan bobot kelas (*class weighting*) untuk mengatasi ketidakseimbangan data. Evaluasi performa model menggunakan *Confusion Matrix* menunjukkan bahwa model klasifikasi tingkat keparahan mencapai *accuracy* 88,69%, *precision* 87,27%, *recall* 88,69%, dan *F1-score* 86,84%. Sementara itu, model klasifikasi jenis kanker memperoleh *accuracy* 81,59%, *precision* 84,63%, *recall* 81,59%, dan *F1-score* 81,78%. Pendekatan *Explainable AI (XAI)* berupa *Grad-CAM* turut diimplementasikan untuk memvisualisasikan *heatmap* pada area anomali paru-paru secara transparan. *Frontend* sistem dibangun menggunakan *React* dan *Tailwind CSS*, sementara *Backend* dikembangkan menggunakan *FastAPI* untuk menangani proses inferensi model secara *real-time*. Hasil pengujian *black-box* menunjukkan tingkat keberhasilan fungsionalitas sebesar 100%, yang membuktikan bahwa sistem ini stabil dan layak digunakan untuk memberikan edukasi, rekomendasi tindakan medis preskriptif, serta pemetaan rujukan fasilitas kesehatan secara komprehensif.

Kata kunci: Kanker Paru-Paru, *Deep Learning*, ResNet50, *CT-Scan*, *Confusion Matrix*, *Clinical Decision Support System*, *React*, *FastAPI*

ABSTRACT

Budi. 2026. *Lung Cancer Classification System Based on CT-Scan Images Using Convolutional Neural Network (CNN) Integrated with Clinical Decision Support*. Thesis. Informatics Engineering Study Program, Faculty of Engineering, Universitas PGRI Madiun. Advisor (I) Saifulloh, S.Kom., M.Kom. Advisor (II) Puguh Jayadi, S.Kom., M.Kom.

Lung cancer is a leading cause of global malignancy that requires early detection and appropriate treatment. The high visual complexity of CT-Scan images makes the scan results difficult for lay patients to understand directly without translation from medical experts, which can trigger psychological anxiety during the waiting period for medical consultation. This research develops a web-based intelligent self-screening system that integrates a Convolutional Neural Network (CNN) model with a Clinical Decision Support System (CDSS). The system adopts the ResNet50 architecture with a Two-Phase Transfer Learning strategy through a dual inference pipeline (dual-pipeline). The first pipeline is tasked with classifying the type of cancer (Adenocarcinoma, Large cell carcinoma, Squamous cell carcinoma, Normal) using the Chest CT-Scan Images dataset from Mendeley/Kaggle, while the second pipeline classifies the severity level (Malignant, Benign, Normal) using the IQ-OTH/NCCD dataset. The models were developed using the TensorFlow and Keras environments by applying Augmentation, oversampling, and class weighting techniques to address data imbalance. Model performance evaluation using a Confusion Matrix shows that the severity classification model achieved an accuracy of 88.69%, precision of 87.27%, recall of 88.69%, and an F1-score of 86.84%. Meanwhile, the cancer type classification model obtained an accuracy of 81.59%, precision of 84.63%, recall of 81.59%, and an F1-score of 81.78%. An Explainable AI (XAI) approach in the form of Grad-CAM was also implemented to transparently visualize the heatmap on lung anomaly areas. The system's frontend was built using React and Tailwind CSS, while the backend was developed using FastAPI to handle the model's real-time inference process. The black-box Testing results showed a functional success rate of 100%, proving that the system is stable and feasible to use for providing education, prescriptive medical action recommendations, and comprehensive health facility referral mapping.

Keywords: Lung Cancer, Deep Learning, ResNet50, CT-Scan, Confusion Matrix, Clinical Decision Support System, React, FastAPI