CONVOLUTIONAL FEATURE OPTIMIZATION FOR LUNG DISEASE CLASSIFICATION ON IMAGE DATA

THESIS REPORT

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INFORMATICS ENGINEERING STUDY PROGRAM
FACULTY OF COMPUTER SCIENCE
MERCU BUANA UNIVERSITY
JAKARTA
2025

CONVOLUTIONAL FEATURE OPTIMIZATION FOR LUNG DISEASE CLASSIFICATION ON IMAGE DATA

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Submitted as one of the requirements to obtain a bachelor's degree

INFORMATICS ENGINEERING STUDY PROGRAM
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JAKARTA

2025

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It was successfully defended at the hearing on January 19th, 2025, and accepted as part of the requirements necessary to obtain a Bachelor's degree in the Informatics Engineering Study Program, Faculty of Computer Science, Mercu Buana University.

Approved by:
Supervisor

Dr. Hadi Santoso, S.Kom., M.Kom.
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Jakarta, 26th January 2026
Knowing,

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PREFACE

All praise and gratitude are due to Almighty God Jesus Christ, whose grace and guidance have enabled the author to complete this thesis proposal entitled **"Convolutional Feature Optimization for Lung Disease Classification on Image Data."** This proposal is prepared as one of the academic requirements for obtaining a bachelor's degree in the S-1 International Class Study Program, Department of Informatics, Faculty of Computer Science, Universitas Mercu Buana Jakarta.

The author fully realizes that, as a human being with limited knowledge and experience, this thesis proposal is not free from weaknesses and limitations. Throughout the preparation process, various challenges were encountered, yet they became valuable learning experiences that contributed to both academic and personal growth. The completion of this proposal would not have been possible without the guidance, encouragement, and support received from many parties during the research and writing process. Special gratitude is extended to **Dr. Hadi Santoso, S.Kom., M.Kom.,** my supervisor, for providing invaluable guidance, advice, and encouragement throughout this journey. On this occasion, I express gratitude to all those who contributed to the successful completion of this research, with special mention to:

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2. Dr. Bambang Jokonowo, S.Si., MTI as the Dean of the Faculty of Computer Science,
3. Dr. Hadi Santoso, S.Kom., M.Kom as the Head of the Department of Informatics Engineering,
4. Dr. Hadi Santoso, S.Kom., M.Kom., as the Thesis Advisor who has dedicated time, effort, and priceless counsel has been a cornerstone for my journey in completing this thesis and also as the lecturer in charge of the Research Methodology Major.
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6. Ilham Nugraha S.Kom, M.Cs, as Secretary of International Department of Informatics Engineering, Universitas Mercu Buana.
7. I am also deeply thankful to my parents who have provided support and consistently offered prayers to the author.
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9. I would also like to acknowledge and thank the various parties and individuals who have given motivation and beneficial knowledge to the author.

The author humbly recognizes the imperfections in this thesis proposal, acknowledging the limitations in knowledge and experience. The author openly welcomes suggestions, feedback, and constructive criticism for the improvement of this thesis proposal. It is hoped that this work can contribute positively to the development of knowledge, particularly in the field of image classification and deep learning applications. The author sincerely apologizes for any shortcomings contained in this proposal and hopes it may be of benefit to readers and future researchers.

Jakarta, 12th January 2026

David Ginola Guterres

PUBLICATION CONSENT STATEMENT PAGE FOR FINAL PROJECT IN THE UMB REPOSITORY

As a member of the academic community at Universitas Mercu Buana, I the undersigned below :

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Thesis Title	:	Convolutional Feature Optimization for Lung Disease Classification on Image Data

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ABSTRAK

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Judul Tugas Akhir	:	Convolutional Feature Optimization For Lung Disease Classification on Image Data
Pembimbing	:	Dr. Hadi Santoso, S.Kom., M.Kom.

Penyakit paru-paru seperti pneumonia, tuberkulosis, dan penyakit paru obstruktif kronis (PPOK) merupakan tantangan kesehatan global yang signifikan, yang memerlukan metode diagnostik yang akurat dan efisien. Jaringan Saraf Konvolusional (CNN) telah menunjukkan kemampuan luar biasa dalam analisis gambar medis, terutama dalam klasifikasi penyakit menggunakan sinar-X dada dan pemindaian tomografi komputer (CT). Studi ini mengeksplorasi optimasi model CNN untuk klasifikasi penyakit paru-paru dengan menerapkan teknik prapemrosesan canggih, penyesuaian hiperparameter, dan augmentasi dataset. Menggunakan dataset yang tersedia secara publik, berbagai arsitektur CNN, termasuk ResNet50, Efficient Net, dan Retina Net, dievaluasi untuk menentukan efektivitasnya dalam membedakan antara kategori penyakit paru-paru yang berbeda. Studi ini mencapai akurasi optimal hingga 98,89%, menunjukkan potensi pembelajaran mendalam dalam membantu tenaga medis dalam deteksi dini dan akurat penyakit paru-paru. Arah penelitian masa depan meliputi integrasi model hibrida, seperti CNN-LSTM dan teknik pembelajaran ensambel, untuk lebih meningkatkan akurasi dan ketahanan klasifikasi.

Kata Kunci : (CNN), Sinar-X, Pemindaian Tomografi Terkomputasi (CT), ResNet50, EfficientNet, RetinaNet, CNN-LSTM.

ABSTRACT

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Research Proposal Title	:	Convolutional Feature Optimization For Lung Disease Classification on Image Data
Supervisor	:	Dr. Hadi Santoso, S.Kom., M.Kom.

Lung diseases such as pneumonia, tuberculosis, and chronic obstructive pulmonary disease (COPD) present significant global health challenges, requiring accurate and efficient diagnostic methods. Convolutional Neural Networks (CNNs) have shown remarkable capabilities in medical image analysis, particularly in disease classification using chest X-rays and computed tomography (CT) scans. This study explores the optimization of CNN models for lung disease classification by implementing advanced preprocessing techniques, hyperparameter tuning, and dataset augmentation. Using publicly available datasets, various CNN architectures, including ResNet50, Efficient Net and Retina Net are evaluate to determine their effectiveness in distinguishing between different lung disease categories. The study achieves an optimized accuracy of up to 98.89%, demonstrating the potential of deep learning in assisting medical professionals with early and precise lung disease detection. Future research directions include integrating hybrid models, such as CNN-LSTM and ensemble learning techniques, to further improve classification accuracy and robustness.

Keywords : (CNNs), X-rays, Computed Tomography (CT) scans, ResNet50, EfficientNet, RetinaNet, CNN-LSTM.

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