BAB V

SIMPULAN DAN SARAN

5.1 Simpulan

Berdasarkan hasil penelitian, implementasi teknis, serta evaluasi melalui *User Acceptance Testing (UAT)* terhadap sistem klasifikasi otomatis kualitas hasil cetakan printer laser berbasis *Convolutional Neural Network (CNN)* dan *transfer learning*, dapat disimpulkan hal-hal berikut:

1. **Model CNN Berbasis Klasifikasi Tiga Kelas**

   Penelitian ini berhasil membangun model klasifikasi citra hasil cetak ke dalam tiga kategori utama: normal, habis, dan bocor. Model CNN yang digunakan memanfaatkan dua lapisan konvolusi dan pooling serta satu lapisan dense dengan fungsi aktivasi *softmax*, yang mampu mengklasifikasikan citra dengan akurasi validasi sebesar 93%. Hal ini menunjukkan performa model yang kuat dalam mendeteksi perbedaan halus pada hasil cetakan.

2. **Dataset Representatif dari Cetakan Nyata**

   Dataset yang digunakan diperoleh dari pemindaian hasil cetakan printer asli di lingkungan produksi PT XYZ. Gambar telah melalui proses pra-pemrosesan dan augmentasi untuk meningkatkan kemampuan generalisasi model. Jumlah data terbagi menjadi 80 gambar untuk pelatihan dan 50 gambar untuk validasi. Hal ini menjadikan model lebih adaptif terhadap kondisi nyata di lapangan.

3. **Validasi Lapangan**

   Evaluasi UAT yang melibatkan 11 responden dari berbagai departemen di PT XYZ menunjukkan rata-rata skor sebesar 81.12%, yang berarti sistem diterima tanpa revisi. Ini membuktikan bahwa sistem tidak hanya unggul secara teknis, tetapi juga praktis dan mudah diterapkan oleh pengguna akhir.

4. **Implementasi Aplikasi Web yang Responsif dan Interaktif**

Sistem berhasil diintegrasikan dalam bentuk aplikasi web berbasis Flask, dengan desain antarmuka yang dibangun menggunakan Tailwind CSS. Fitur unggulan meliputi: unggah gambar, preview citra, serta tampilan hasil klasifikasi dan confidence score yang terintegrasi secara real-time. Aplikasi dirancang mobile-friendly sehingga dapat diakses secara fleksibel oleh operator QC di berbagai perangkat.

5. **Relevansi dan Manfaat Sistem dalam Konteks Industri**

Sistem yang dikembangkan memiliki relevansi tinggi terhadap kebutuhan industri manufaktur, terutama dalam inspeksi kualitas cetakan dan diagnosis dini terhadap kondisi toner. Meningkatkan efisiensi, serta meminimalkan risiko human error. Dengan demikian, teknologi ini memberikan nilai tambah dalam proses kerja nyata di PT XYZ dan layak dikembangkan lebih lanjut menuju otomatisasi penuh dan integrasi ke sistem IoT atau edge computing.

5.2 Saran

Berdasarkan hasil implementasi sistem klasifikasi otomatis kualitas cetakan printer laser serta evaluasi performa dan penerimaan pengguna, berikut beberapa saran untuk pengembangan dan pemanfaatan sistem ke depan:

1. **Perluasan Dataset dan Diversifikasi Kondisi Cetakan**

Untuk meningkatkan akurasi dan kemampuan generalisasi model, disarankan untuk menambah jumlah dataset, khususnya pada kategori citra dengan kondisi cacat minor atau variasi cacat lainnya seperti *blur*, *smudge*, atau *banding*. Hal ini dapat memperluas cakupan deteksi dan memperkaya klasifikasi model terhadap kondisi dunia nyata yang lebih kompleks.

2. **Penggunaan Arsitektur CNN yang Lebih Dalam atau Berbasis Attention**

Pengembangan sistem dapat diarahkan pada eksplorasi arsitektur CNN yang lebih kompleks, seperti EfficientNet, InceptionV3, atau model berbasis Vision Transformer (ViT) yang lebih adaptif dalam menangani variasi visual pada data cetak. Hal ini berpotensi meningkatkan ketepatan klasifikasi, terutama pada kelas "bocor" yang saat ini menunjukkan performa relatif lebih rendah.

3. **Penerapan Edge Deployment**

Agar sistem dapat digunakan secara langsung di area produksi tanpa tergantung koneksi server/cloud, disarankan dilakukan konversi model ke format ringan (seperti TensorFlow Lite atau ONNX) untuk dapat dijalankan pada perangkat edge, seperti Raspberry Pi atau Jetson Nano.

4. **Integrasi dengan Sistem Maintenance atau ERP**

Sistem klasifikasi hasil cetakan dapat dikembangkan lebih lanjut untuk terhubung dengan sistem perawatan printer atau sistem ERP perusahaan. Dengan begitu, hasil klasifikasi tidak hanya menjadi informasi pasif, tetapi juga memicu notifikasi perawatan otomatis atau rekomendasi penggantian toner ke departemen terkait.

5. **Peningkatan Antarmuka dan Aksesibilitas Pengguna**

Dari hasil UAT, sebagian pengguna memberikan masukan terkait tampilan hasil klasifikasi dan pemahaman terhadap confidence score. Disarankan untuk menambahkan elemen visual yang lebih informatif seperti grafik trend hasil cetak, warna indikator status, serta tooltip edukatif untuk membantu pemahaman operator non-teknis.

DAFTAR PUSTAKA

Ahmed, A. A., & Agunsoye, G. (2021). A Real-Time Network Traffic Classifier for Online Applications Using Machine Learning. In *Algorithms* (Vol. 14, Issue 8). https://doi.org/10.3390/a14080250

Ahmedy R. M. AU3 - Fotovvatikhah, F., I. A.-N. (2025). A Systematic Review of AI-Based Techniques for Automated Waste Classification. *Sensors (Basel)*. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC12115937/

Belotti, G. (2023). *Development of technologies for in-room image guidance in hadron therapy* [Politecnico di Milano]. https://www.politesi.polimi.it/handle/10589/219996

Benradi, H., Chater, A., & Lasfar, A. (2023). A hybrid approach for face recognition using a convolutional neural network combined with feature extraction techniques. *International Journal of Artificial Intelligence*. https://www.academia.edu/download/105021949/21655-43219-1-PB.pdf

Bensakhria, A. (2023). *End-to-End MLOPS Pipeline for Object Detection using TensorFlow 2 and Flask*. https://doi.org/10.13140/RG.2.2.29418.08644/1

Bhandarkar, V. V., Das, B., & Tandon, P. (2025). Real-time remote monitoring and defect detection in smart additive manufacturing for reduced material wastage. *Measurement*, *252*, 117362. https://doi.org/10.1016/J.MEASUREMENT.2025.117362

Brandon, C., Singh, A., & Margaria, T. (2023). Model driven development for AI-based healthcare systems: a review. *International Conference on Bridging the Gap between AI and Reality*, 245–265.

Chaudhuri, A. (2023). Enhancing cross-team collaboration using structured visual models.

Journal of Systems Engineering, *26*(2). https://doi.org/10.1049/syen.2023.0045

Chen, J. (2022). *Deep Learning for Printed Image Quality* [ProQuest Dissertations Publishing]. https://search.proquest.com/openview/927f40cb5e4fd3f688ed06d219249248

Chen, J., Li, Y., & Zhang, H. (2021). An effective CNN-based approach for surface defect classification in industrial applications. *IEEE Transactions on Industrial Informatics*, *17*(7), 4600–4608. https://ieeexplore.ieee.org/document/9445426

Chen, L., Yuan, S., Wang, H., Zhu, Y., Fu, D., & Li, Z. (2021). Spherical Polydopamine-Modified Carbon-Felt Cathode with an Active Indole Structure for Efficient Hydrogen Peroxide Electroproduction. In *Applied Sciences* (Vol. 11, Issue 12). https://doi.org/10.3390/app11125371

Choudhary, D., Kaithwas, S., Kamlesh, Sharma, R. K., Mishra, A., Singhai, S., Powar, S., & Singh, A. (2024). Recycling of waste toner derived from exhausted printer cartridges as adsorbent for defluoridation of water. *Environmental Technology & Innovation*, *34*, 103572. https://doi.org/10.1016/J.ETI.2024.103572

Efendi, Y., Tashid, T., Yenni, H., Rio, U., & Muzawi, R. (2021). Redesign Web Sekolah Metode User Centered Design. *Building of Informatics, Technology and Science (BITS)*, *3*(3), 317–324. https://doi.org/10.47065/bits.v3i3.1098

Elgohary, A. A., Hamdy, R. A., & Mordi, A. A. (2024). Optimizing Thermal Image Classification and Fault Detection for Electrical Distribution Transformer Room components using ResNet and VGG16. *2024 25th International Middle East Power System Conference (MEPCON)*, 1–8. https://doi.org/10.1109/MEPCON63025.2024.10850417

Elngar, A. A., Arafa, M., Fathy, A., Moustafa, B., Mahmoud, O., Shaban, M., & Fawzy, N. (2021). Image Classification Based On CNN: A Survey. *Journal of Cybersecurity and Information Management*, *6*(1), PP. 18-50. https://doi.org/10.54216/jcim.060102

Farhan, R. I., Maolood, A. T., & Hassan, N. F. (2020). Performance analysis of flow-based attacks detection on CSE-CIC-IDS2018 dataset using deep learning. *Indonesian Journal of Electrical Engineering*. https://www.researchgate.net/publication/344905847

Fedullo, T. (2023). *Industrial Internet of Things for Smart and Innovative Measurement Systems* [Università degli Studi di Padova]. https://www.research.unipd.it/handle/11577/3478318

Forlizzi, J. (2023). Ergonomic Interface Design for Adaptive Frontend Frameworks. *SAGE Human-Computer Interaction Journal*, *47*(2), 112–130. https://journals.sagepub.com/home/hci

Ghalavand, H., Shirshahi, S., Rahimi, A., Zarrinabadi, Z., & Amani, F. (2024). Common data quality elements for health information systems: a systematic review. *BMC Medical Informatics and Decision Making*, *24*(1). https://doi.org/10.1186/s12911-024-02644-7

Gholami, H., & Stewart, A. (2023). Low-Level Optimization in Image Processing Pipelines. *ACM Journal on Emerging Technologies in Computing Systems*, *19*(2), 1–15. https://doi.org/10.1145/3593109

Ghose, P., & Jamil, H. M. (2025). BrainView: A Cloud-based Deep Learning System for Brain Image Segmentation, Tumor Detection and Visualization. *Biomedical Journal*, 100871. https://doi.org/https://doi.org/10.1016/j.bj.2025.100871

Grigera, J., Espada, J. P., & Rossi, G. (2023). AI in User Interface Design and Evaluation. *IT Professional*, *25*(2), 20–22. https://doi.org/10.1109/MITP.2023.3267139

Gupta, J., Pathak, S., & Kumar, G. (2022). Deep Learning (CNN) and Transfer Learning: A Review. *Journal of Physics: Conference Series*, *2273*(1), 0–10. https://doi.org/10.1088/1742-6596/2273/1/012029

Gupta, K. K., Hirani, H., & Muzakkir, S. M. (2023). Online gear wear particle detection and categorization using a convolutional neural network algorithm integrated with cascade classifier. *Tribology in Industry*. http://www.tribology.rs/journals/2023/2023-2/3-1442.pdf

Gyawali, A., Adhikari, H., Aalto, M., & Ranta, T. (2024). From simple linear regression to machine learning methods: Canopy cover modelling of a young forest using planet data. *Ecological Informatics*, *82*, 102706. https://www.sciencedirect.com/science/article/pii/S1574954124001124

Haque, R., Al Sakib, A., Hossain, M. F., Islam, F., Ibne Aziz, F., Ahmed, M. R., Kannan, S., Rohan, A., & Hasan, M. J. (2024). Advancing Early Leukemia Diagnostics: A Comprehensive Study Incorporating Image Processing and Transfer Learning. In *BioMedInformatics* (Vol. 4, Issue 2, pp. 966–991). https://doi.org/10.3390/biomedinformatics4020054

Jamwal, A., Agrawal, R., & Sharma, M. (2022). Deep learning for manufacturing sustainability: Models, applications in Industry 4.0 and implications. *International Journal of Information Management Data Insights*, *2*(2), 100107. https://doi.org/https://doi.org/10.1016/j.jjimei.2022.100107

Joshi, S., Saxena, S., & Khanna, N. (2024). Source printer identification from document images acquired using smartphone. *Journal of Information Security and Applications*, *84*, 103804. https://doi.org/10.1016/J.JISA.2024.103804

Jou, Y.-T., Putra, V. P., Silitonga, R. M., Sukwadi, R., & Inderawati, M. M. (2025). Enhancing Integrated Circuit Quality Control: A CNN-Based Approach for Defect Detection in Scanning Acoustic Tomography Images. In *Processes* (Vol. 13, Issue 3). https://doi.org/10.3390/pr13030683

Journal, P. R. (2025). *SMART INSECT DETECTION AND REMEDIES FOR FARMERS WITH MACHINE LEARNING*. 594–603.

Kayali, D. (2025). *Multiple Filter Embedded Custom CNN Architecture on Optimized Detection and Classification of Face Mask* [Near East University]. https://docs.neu.edu.tr/library/9779818454.pdf

Keerthi, P., Y, S. S. S., & I., S. (2025). Lung Cancer Classification Using Deep Neural Networks. *2025 AI-Driven Smart Healthcare for Society 5.0*, 1–6. https://doi.org/10.1109/IEEECONF64992.2025.10963162

Khan, H. A., Bhatti, U., Kamal, K., Alkahtani, M., Abidi, M. H., & Mathavan, S. (2023). Fault Classification for Cooling System of Hydraulic Machinery Using AI. In *Sensors* (Vol. 23, Issue 16). https://doi.org/10.3390/s23167152

Kilickaya, O. (2024). *Deep Learning-Based Mineral Classification Using Pre-Trained VGG16 Model with Data Augmentation: Challenges and Future Directions*. 22–30.

Kim, D., Kang, Y., Lee, J., & Park, S. (2023). A deep learning-based inspection system for industrial defect detection. *IEEE Access*, *11*, 21567–21578. https://ieeexplore.ieee.org/document/10058531

Kłosowski, G., Kulisz, M., Lipski, J., Maj, M., & Białek, R. (2021). The use of transfer learning with very deep convolutional neural network in quality management. *European Research Studies*, *24*, 253–263.

Kolthoff, K., Kretzer, F., Bartelt, C., Maedche, A., & Ponzetto, S. P. (2025). *GUIDE: LLM-Driven GUI Generation Decomposition for Automated Prototyping*. http://arxiv.org/abs/2502.21068

Komar, M., Savchyshyn, R., Lipianina-Honcharenko, K., & Osolinskyi, O. (2023). Intelligent Method for Counting Cars from Satellite Images. *CEUR Workshop Proceedings*, *3538*, 295–303.

Kristiani, E., Liu, P. Y., & Yen, N. Y. (2022). Binary and multi-class assessment of face mask classification on edge AI using CNN and transfer learning. *Human-Centric Computing and Information Sciences*. http://hcisj.com/data/file/article/2022110003/12-53.pdf

Kumar, S. P., & Mugilan, N. (2025). Exploring the synergy of python programming in single point incremental forming. *International Journal on Interactive Design and Manufacturing (IJIDeM)*. https://doi.org/10.1007/s12008-025-02232-7

Li, C., Xu, X., Du, W., Lu, J., & Jin, S. (2022). A novel CNN-based method for classification of industrial images with small datasets. *Neural Networks*, *150*, 252–265. https://www.sciencedirect.com/science/article/pii/S089360802100113X

Liu, B., Song, C., Wang, Q., Zhang, X., Chen, J., Sehgal, P., Sharma, D., Jain, R., Sahu, A., Shorten, C., Khoshgoftaar, T. M., Khan, H. A., Bhatti, U., Kamal, K., Alkahtani, M., Abidi, M. H., Litjens, G., Kooi, T., Bejnordi, B. E., … Silitonga, R. M. (2022). A novel lightweight CNN model for industrial defect detection with high accuracy. *Applied Soft Computing*, *121*(1), 109239. https://doi.org/10.1016/j.asoc.2022.109239

Luo, Y., Liu, W., Zhang, J., & Liu, X. (2020). Defect classification of magnetic tiles based on transfer learning and CNN. *Applied Sciences*, *10*(9), 3146. https://www.mdpi.com/2076-3417/10/9/3146

Maolood, A. T., & Das, P. (2023). ADAMAX optimizer and categorical_crossentropy loss function-based CNN method for diagnosing Lung cancer. *International Journal on Emerging Smart Computing Technologies*. https://ieeexplore.ieee.org/abstract/document/10126046/

Mercy, T., Azeez, D., Anthony, S., & Oluwatobi, V. (2025). *Python ' s Indispensability in Artificial Intelligence and Machine Learning : A Review*. *11*(4), 266–308. https://doi.org/10.56201/ijemt.vol.11.no4.2025.pg266.308

Nazir, M., Shakil, S., & Khurshid, K. (2021). Role of deep learning in brain tumor detection and classification (2015 to 2020): A review. *Computerized Medical Imaging and Graphics*, *91*, 101940. https://doi.org/https://doi.org/10.1016/j.compmedimag.2021.101940

Noh S. G. AU3 - Pham, Q. V., D. I. A.-J. (2022). Signal preprocessing technique with noise-tolerant for RF-based UAV signal classification. *IEEE Transactions*. https://ieeexplore.ieee.org/document/9998502

Paneru, B., Thapa, B., & Paneru, B. (2025). Sentiment analysis of movie reviews: A flask application using CNN with RoBERTa embeddings. *Systems and Soft Computing*, *7*, 200192. https://doi.org/https://doi.org/10.1016/j.sasc.2025.200192

Pendke, V., Gawate, E., Wasule, S., Khadatkar, G., Gupta, V., & Keote, M. (2024). ECG VisionSense: A Cloud-Deployed, Flask-Based Intelligent Cardiovascular Disease Diagnosis System. *2024 2nd International Conference on Advancement in Computation & Computer Technologies (InCACCT)*, 577–582. https://doi.org/10.1109/InCACCT61598.2024.10550993

Pereira, A. C. P. (2024). *Deep Learning Techniques Applied To The Diagnostic Of Focal*

Cortical Dysplasia MRI.

Pereira, A. G., Barbosa, G. F., Filho, M. G., Shiki, S. B., & Silva, A. L. d. (2025). Quality Control in Extrusion-Based Additive Manufacturing: A Review of Machine Learning Approaches. *IEEE Transactions on Cybernetics*, *55*(6), 2522–2534. https://doi.org/10.1109/TCYB.2025.3558515

Poudel, O., & H. Assaad, R. (2025). A Real-Time Intelligent Acoustic IoT-Enabled Embedded Construction Site Monitoring and Alert System: Integrating Deep Learning–Based Machine-Listening Algorithms, Edge Computing, and Cloud Computing. *Journal of Construction Engineering and Management*, *151*, 4025071–4025075. https://doi.org/10.1061/JCEMD4.COENG-15938

Reiss Harris, D. (2020). PrototypeML: A Neural Network Integrated Design and Development Environment. *ArXiv E-Prints*, arXiv-2007.

Research, M. (2023). Optimizing Real-Time Notification Systems in Industrial Web Monitoring. *Microsoft Systems Journal*, *18*(3), 45–60. https://www.microsoft.com/en-us/research/people/

Rinaldi, G., Theodorakos, K., Crema Garcia, F., Agudelo, O. M., & De Moor, B. (2025). DSS4EX: A Decision Support System framework to explore Artificial Intelligence pipelines with an application in time series forecasting. *Expert Systems with Applications*, *269*, 126421. https://doi.org/https://doi.org/10.1016/j.eswa.2025.126421

Sahu, M., & Dash, R. (2021). *A Survey on Deep Learning: Convolution Neural Network (CNN) BT - Intelligent and Cloud Computing* (D. Mishra, R. Buyya, P. Mohapatra, & S. Patnaik (eds.); pp. 317–325). Springer Singapore.

Sehgal, D., Kaur, I., Sharma, V., Gautam, B., Singh, A., & Kumar, N. (2024). AI-Driven

Early Diabetes Prediction. *2024 IEEE 3rd World Conference on Applied Intelligence and Computing (AIC)*, 40–48. https://doi.org/10.1109/AIC61668.2024.10730970

Semitela, Â., Pereira, M., Completo, A., Lau, N., & Santos, J. P. (2025). Improving Industrial Quality Control: A Transfer Learning Approach to Surface Defect Detection. *Sensors*, *25*(2). https://doi.org/10.3390/s25020527

Shorten, C., & Khoshgoftaar, T. M. (2021). A survey on Image Data Augmentation for Deep Learning. *Journal of Big Data*, *8*(1), 1–48. https://doi.org/10.1186/s40537-019-0197-0

Singh, J., & Singh, G. (2025). A Streamlined Method for Detecting Strawberry Leaf Diseases Utilizing Deep Learning Techniques. *2025 3rd International Conference on Intelligent Data Communication Technologies and Internet of Things (IDCIoT)*, 2020–2025. https://doi.org/10.1109/IDCIOT64235.2025.10914818

Terras, N., Pereira, F., Ramos Silva, A., Santos, A. A., Lopes, A. M., Silva, A. F. da, Cartal, L. A., Apostolescu, T. C., Badea, F., & Machado, J. (2025). Integration of Deep Learning Vision Systems in Collaborative Robotics for Real-Time Applications. *Applied Sciences (2076-3417)*, *15*(3).

Waheed, M. F., Bernadin, S., Hassan, A., & Francois, J. (2025). Real Time Fault Detection in 3D Printers Using Convolutional Neural Networks and Acoustic Signals. *SoutheastCon 2025*, 1294–1299. https://doi.org/10.1109/SoutheastCon56624.2025.10971647

Wang Y., X. A.-Z. (2025). Construction of Multi-Scale Fusion Attention Unified Perceptual Parsing Networks for Semantic Segmentation of Mangrove Remote Sensing Images. *Applied Sciences*. https://www.mdpi.com/2076-3417/15/2/976

Wang, S., & Zhang, R. (n.d.). *A Deep Learning Approach to Interface Color Quality Assessment in HCI*.

Waqas, M., Sohail, M., Anwer, S., Kazmi, M., & Raza, B. (2025). Microstructural characterization and analysis of gray cast iron material using deep learning-based object detection and localization techniques. *International Journal of Computational Materials Science and Engineering*, 2540003. https://doi.org/10.1142/S2047684125400032

WebAIM. (2023). *The WebAIM Million: State of Web Accessibility Report*. WebAIM. https://webaim.org/projects/million/2023

Westphal, E., Seitz, H., & Chen, J. (2021). A machine learning method for defect detection and visualization in selective laser sintering based on convolutional neural networks. *Additive Manufacturing*, *47*, 102233. https://search.proquest.com/openview/927f40cb5e4fd3f688ed06d219249248

Yadav, P., Rishiwal, V., Yadav, M., Alotaibi, A., Maurya, V., Agarwal, U., & Sharma, S. (2024). Investigation and Empirical Analysis of Transfer Learning for Industrial IoT Networks. *IEEE Access*, *12*, 173351–173379. https://doi.org/10.1109/ACCESS.2024.3499741

Zhai, Y., Yao, Y., Qingfeng, G., Xun, L., Xia, L., Yongting, P., Hanqiu, Y., Zehao, Y., & and Zhou, J. (2020). Simulating urban land use change by integrating a convolutional neural network with vector-based cellular automata. *International Journal of Geographical Information Science*, *34*(7), 1475–1499. https://doi.org/10.1080/13658816.2020.1711915

Zhang X. AU3 - Chen, Y., Q. A.-C. (2023). A comprehensive deep learning library benchmark and optimal library selection. *IEEE Transactions on Parallel and Distributed Systems*. https://dsg.tuwien.ac.at/~sd/papers/Zeitschriftenartikel_2024_SD_A_Comprehensive.pdf

Zhang, H., Kim, Y., Cui, L., Moon, S. K., & Choi, J. P. (2025). AI-Driven Process

Optimization Framework for Enhancing Print Quality in Aerosol Jet Printing. *International Journal of Precision Engineering and Manufacturing-Green Technology*, *12*(3), 853–867. https://doi.org/10.1007/s40684-025-00721-4

Zhang, L., Liu, Y., & Han, J. (2024). Modular AI Workflow Design for Quality Control. *IEEE Transactions on Systems, Man, and Cybernetics*, *54*(1), 88–101. https://doi.org/10.1109/TSMC.2024.3278176

Zhou, Z., Zhang, J., Xu, C., & Liu, D. (2023). Visual classification of printing defects using CNN-based models. *Engineering Applications of Artificial Intelligence*, *120*, 105858. https://www.sciencedirect.com/science/article/pii/S0952197623000171

Zhuang, F., Qi, Z., Duan, K., Xi, D., Zhu, Y., Zhu, H., & He, Q. (2020). A comprehensive survey on deep transfer learning. *Proceedings of the IEEE*, *109*(1), 43–76. https://www.researchgate.net/publication/342512353_A_Comprehensive_Survey_on_Deep_Transfer_Learning

DAFTAR RIWAYAT HIDUP

Data Pribadi

Nama Lengkap	: Rangga Baranta
NIM	: 20211000015
Tempat, Tanggal Lahir	: Tangerang, 16 April 2003
Jenis Kelamin	: Laki – Laki
Alamat Lengkap	: Perumahan Grand Duta Tangerang,Blok Garnet G2,No 96 RT 003/RW023
Agama	: Kristen
No. Kontak	: 0859-5958-2182
Email	: ranggabaranta00@gmail.com

Pendidikan Formal

2009 – 2015	: Sekolah Dasar Negeri Pondok Makmur
2015 – 2018	: Sekolah Menengah Pertama PGRI Jatiuwung Tangerang
2018 – 2021	: Sekolah Menengah Kejuruan Negeri 7 Kota Tangerang

Pengalaman Kerja

2022 – Sekarang	: IT Support, PT.SATYAMITRA KEMAS LESTARI TBK

Tangerang, 5 Agustus 2025

Rangga Baranta

LAMPIRAN

PT. SatyamitraKemasLestari Tbk
Your Packaging - Solutions Partner

Tangerang, 06 Mei 2025

No. : 057/HRD/SKL/JWB-PKL/IV/2025
Lamp. : -
Hal : Jawaban Permohonan Penelitian

Kepada Yth.
Ketua BAA
Universitas Buddhi Dharma
di tempat

Dengan hormat,

Menindaklanjuti surat permohonan dari Universitas Buddhi Dharma No. 016/Perm./BAA/IV/2025, bersama ini kami sampaikan kepada Bapak / Ibu bahwa permohonan tersebut dapat kami terima. Adapun mahasiswa/i yang diizinkan untuk melakukan penelitian adalah sebagai berikut:

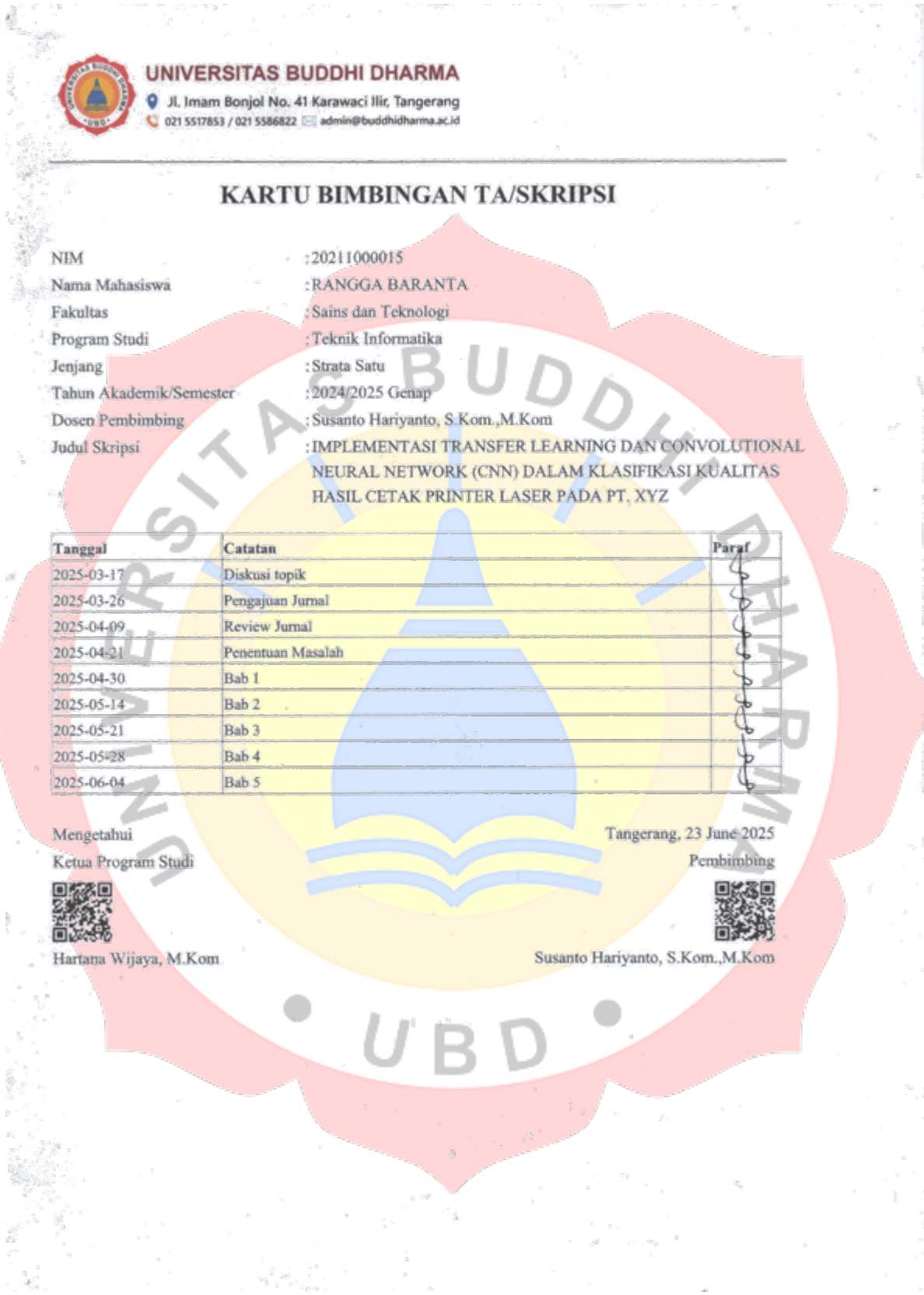
NO.	NAMA	NIM	PRODI
1	Rangga Baranta	20211000015	Teknik Informatika

Demikian balasan ini kami sampaikan, untuk digunakan sebagaimana mestinya. Atas kerja samanya yang baik, kami ucapkan terima kasih.

Tangerang, 06 Mei 2025
PT Satyamitra Kemas Lestari Tbk
a.n.
PT. SATYAMITRA KEMAS LESTARI TBK
TANGERANG
AHMAD FAUZI, SE.MM
IER & GA MANAGER

Office & Factory :
Kawasan Industri Benua Permai Lestari Kav. L, Jl. Raya Serang Km 25,6 Desa Cisereh, Tigaraksa - Tangerang 15720, Banten - Indonesia
Phone : +62.21.5950988 (Hunting) Fax : +62.21.5950089 Website : www.satyamitra.com
E-mail : satyamitra@satyamitra.com

Lampiran 1 Surat Izin Penelitian Skripsi



UNIVERSITAS BUDDHI DHARMA
Jl. Imam Bonjol No. 41 Karawaci Ilir, Tangerang
021 5517853 / 021 5586822 admin@buddhidharma.ac.id

KARTU BIMBINGAN TA/SKRIPSI

NIM :20211000015
Nama Mahasiswa :RANGGA BARANTA
Fakultas :Sains dan Teknologi
Program Studi :Teknik Informatika
Jenjang :Strata Satu
Tahun Akademik/Semester :2024/2025 Genap
Dosen Pembimbing :Susanto Hariyanto, S.Kom.,M.Kom
Judul Skripsi :IMPLEMENTASI TRANSFER LEARNING DAN CONVOLUTIONAL NEURAL NETWORK (CNN) DALAM KLASIFIKASI KUALITAS HASIL CETAK PRINTER LASER PADA PT. XYZ

Tanggal	Catatan	Paraf
2025-03-17	Diskusi topik	
2025-03-26	Pengajuan Jurnal	
2025-04-09	Review Jurnal	
2025-04-21	Penentuan Masalah	
2025-04-30	Bab 1	
2025-05-14	Bab 2	
2025-05-21	Bab 3	
2025-05-28	Bab 4	
2025-06-04	Bab 5	

Mengetahui
Ketua Program Studi

Hartana Wijaya, M.Kom

Tangerang, 23 June 2025
Pembimbing

Susanto Hariyanto, S.Kom.,M.Kom

Lampiran 2 Kartu Bimbingan Skripsi