DESIGNING COPTAS AS A COFFEE LEAF DISEASE DIAGNOSTIC APPLICATION BASED ON MACHINE LEARNING

THESIS

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STATEMENT OF WORK'S ORIGINALITY

Except where references is made in the text of the thesis, this thesis contains no material published elsewhere or extracted in whole or in part from a thesis or any other degree or diploma.

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All project procedures reported in this thesis were approved by the projecter's advisors and did not break any faculty or university project ethics.

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Caku

MOTTO

“There is no success without hard work. There is no success without togetherness. There is no ease without prayer.”

Ridwan Kamil

"Change lives.
Change organizations.
Change the world"

Stanford's Graduate School of Business

No dream is too high. No dream should be underestimated. Soar as high as you want and reach as high as you can.

Maudy Ayunda

DEDICATION

In the name of the Father, Son, and Holy Spirit, all praise and gratitude are due to Him, who has given strength, patience, and perseverance in completing this thesis. All praise and thanks are due to the Lord Jesus Christ.

This thesis is dedicated to:

First, the writer dedicates this thesis to beloved parents, Father Paulus Aban and Mother Margarita Awi. Secondly, the writer extends heartfelt gratitude to the entire extended family, who consistently provide unwavering support in all endeavours.

ABSTRACT

Caku. Designing Coptas As A Coffee Leaf Disease Diagnostic Application Based On Machine Learning. Thesis. English Language Education Study Program of STKIP Persada Khatulistiwa. Advisor I: Sijono, M.Pd. Advisor II: Tuti, M.Pd.

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COPTAS is a machine learning-based application designed to diagnose coffee leaf diseases such as rust, miner, and phoma, and identify healthy leaf conditions. In addition, COPTAS provides appropriate treatment recommendations based on the diagnosis results. The development of this application uses the ADDIE model, which consists of five stages: Analysis, Design, Development, Implementation, and Evaluation. This application aims to improve accuracy in the diagnosis of coffee leaf diseases while overcoming the limitations of manual methods that are time-consuming and prone to human error. Evaluation was conducted through two stages: internal testing by the development team and external testing through presentations in front of mentors and other teams at Bangkit Academy. Based on the evaluation results, COPTAS proved effective in analyzing coffee leaf diseases and providing accurate diagnosis results. Overall, the app functions well and is reliable. Further development is recommended, especially in improving the user interface and expanding the scope of disease types that can be diagnosed, so that the benefits for coffee farmers are optimized.

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REFERENCES

Ángel C, C., Marín-Ramírez, G., & Maldonado, C. (2023). Genome sequence of Hemileia vastatrix Berk. and Br. (Race I), the. *Journal of Clinical Microbiology Journal Homepage*, 1-4.

Santiago, M. S., Viveros, G. S., Adame, L. H., Contreras, J. C., Castro, A. S., & Contreras, R. G. (2023). Essential Oils and Antagonistic Microorganisms as. *MDPI*, 2-15. Retrieved from https://doi.org/10.3390/

Amuthachenthiru, K. M., Kaliappan, M. D., & Vimal, S. D. (2024). *Futuristic Trends in Artificial Intelligence Volume 3 Book 3.* IIP Series. doi:https://www.doi.org/10.58532/V3BKAI3P3CH8

Aparecido, L. E., Lorençone, J. A., Lorençone, P. A., Torsoni, G. B., Lima, R. F., Chiquitto, A. G., . . . Rolim, G. d. (2023). Climate Change and Phoma spp. Leaf Spot of Arabica Coffee: A CMIP6 Modeling Approach. *Revista Brasileira de Meteorologia*, 2-25. Retrieved from http://dx.doi.org/10.1590/0102-77863810041

Badawi, A., & Ramadhan, K. F. (2023). Analisis Dempster Shafer Dalam Mendiagnosa Penyakit Coffea Canephora (Kopi Robusta). *Journal of Information System Project (JOSH)*, 1. doi:10.47065/josh.v4i4.3818

Branch, R. M. (2008). *Instructional Design: The ADDIE Approach.* New York: Springer.

Chandigarh Group of Colleges, Jhanjeri, Mohali, Punjab. (n.d.). *homepage*. Retrieved from Crop Doctor: www.cropdoctor.in

Dantas, J., Motta, I., Vidal, L., Bilio, J., Pupe, M. J., Veiga, A., . . . Albuquerque, É. V. (2020). A comprehensive review of the coffee leaf miner Leucoptera coffeella (Lepidoptera: Lyonetiidae), with special regard to neotropical

impacts, pest management and control. *Preprints*, 2-25. Retrieved from https://doi.org/10.20944/preprints202010.0629.v1

dos Santos, M. P., Neto, B. M., Neto, M. S., Cardoso, A. C., Santos, L. D., Coelho, B. S., . . . Castellani, M. A. (2023). Natural parasitism of the coffee leaf miner: climate factors, insecticide, and landscape affecting parasitoid diversity and their ecosystem services in coffee agroecosystems. *ProjectGate*, 2-15. doi: 10.1017/S0007485323000482

Haben, S., Voss, M., & Holderbaum, W. (2023). *Core Concepts and Methods in Load Forecasting.* Springer Cham. doi:10.1007/978-3-031-27852-5_4

Huatangari, L. Q., Zúñiga, C. L., Castillo, A. E., Jacinto, R. E., Pino, M. E., Julcapoma, M. R., . . . Cabrera, A. P. (2022). Detection of Rust Emergence in Coffee Plantations using Data. *OnLine Journal of Biological Sciences*, 158-164. doi:10.3844/ojbsci.2022.157.164

Medina, D. P., Cabrera, I. M., Cruz, R. A., Arzuaga, L. G., Portal, S. C., & Bianchini, M. (2024). A Mobile App for Detecting Potato Crop Diseases. *MDPI*, 2-12. Retrieved from https://doi.org/ 10.3390/jimaging10020047

Motta, I. O., Dantas, J., Vidal, L., Bílio, J., Pujol-Luz, J. R., & Albuquerque, É. V. (2021). The coffee leaf miner, Leucoptera coffeella (Lepidoptera: Lyonetiidae):. *Revista Brasileira de Entomologia*, 2-7. Retrieved from https://doi.org/10.1590/1806-9665-RBENT-2020-0122

Müller, A. C., & Guido, S. (2017). *Introduction to Machine Learning with Python.* United States of America: O'Reilly Media, Inc.

Naqa, E. I., Li, R., & Murphy, M. J. (2015). *Machine Learning in Radiation Oncology.* Switzerland: Springer Cham.

Nigam, D., Patil, A., Murari, P., & Padiya, P. (2022). Plant Disease Identification – A portable mobile application. *ITM Web of Conferences*, 2-5. Retrieved from https://doi.org/10.1051/itmconf/20224403067

PEAT GmbH. (2015). *homepage*. Retrieved from Plantix: https://plantix.net/id/

Saillog LTD. (2019). *homepage*. Retrieved from agrio: agrio.app

Suhaman, J., Kamandanu, K., Aulianti, D., Adhi, M., & Amartiwi, U. (2023). Smart Plant: A Mobile Application for Plant Disease Detection. *ProjectGate*, 52-57. doi:10.53889/gmpics.v2.173

Zambolim, L., Caixeta, E. T., Filho, O. G., Sera, G. H., Sera, T., Pereira, A. A., . . . Ramalho, A. R. (2024). *Breeding Programs Against Coffee Leaf Rust in Brazil: A Review.* Brazil: Canadian Center of Science and Education. doi:doi:10.5539/jas.v16n5p61