



UNDERGRADUATE THESIS

NON-INVASIVE LIVER FIBROSIS DETECTION FROM ULTRASOUND IMAGES USING CONVNEXT V2 TINY WITH CORAL-BASED ORDINAL CLASSIFICATION

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FACULTY OF COMPUTER SCIENCE
INFORMATICS STUDY PROGRAM
SURABAYA
2026**

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ABSTRACT

Student Name / NPM: Ananda Putra Wahyu Riyanto / 22081010038
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Ultrasound Images Using Convnext V2 Tiny with
CORAL-Based Ordinal Classification
Advisor: 1. Dr. Faisal Muttaqin, S.Kom, M.T
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Liver fibrosis is a progressive liver condition that requires accurate staging, while biopsy as the reference standard remains invasive and less suitable for repeated assessment. This study develops a non-invasive deep learning model for F0-F4 liver fibrosis staging from B-mode ultrasound images using ConvNeXt V2 Tiny with CORAL-based ordinal classification. The public “Liver Histopathology (Fibrosis) Ultrasound Images” dataset was audited and deduplicated using MD5 hashing to improve evaluation reliability. The proposed model uses ConvNeXt V2 Tiny as the backbone, with a CORAL ordinal head for F0–F4 staging and an additional binary head for advanced fibrosis risk ($F \geq 3$). Compared with the nominal softmax baseline, CORAL improved QWK from 0.7991 to 0.8133, reduced MAE from 0.4026 to 0.3680, and increased adjacent accuracy from 0.8788 to 0.9091. In the final holdout evaluation, the model achieved QWK = 0.8520, MAE = 0.3333, macro-F1 = 0.7584, adjacent accuracy = 0.9221, AUC = 0.9258, and sensitivity = 0.9565 for advanced fibrosis detection. Temperature scaling improved the Brier score from 0.1192 to 0.1174, while MC Dropout estimated prediction uncertainty. The model was implemented in the FibrosisRisk website prototype to present fibrosis stage, class probabilities, and advanced/non-advanced fibrosis status. Overall, this study shows that ConvNeXt V2 Tiny with CORAL ordinal classification provides a structured and interpretable framework for ultrasound-based liver fibrosis staging.

Keywords: liver fibrosis, ultrasound image, ConvNeXt V2 Tiny, CORAL, ordinal classification, advanced fibrosis, probability calibration

ACKNOWLEDGEMENTS

Praise be to Allah SWT for all His graces, guidance, and gifts to the author so that the thesis proposal with the title **"Non-invasive Liver Fibrosis Detection from Ultrasound Images Using Convnext V2 Tiny with CORAL-Based Ordinal Classification"** can be completed properly.

The author would like to thank Mr. Dr. Faisal Muttaqin, S.Kom, M.T as Supervisor I and Mrs. Eva Yulia Puspaningrum, S.Kom., M.Kom as Supervisor 2 who are willing to take their time to provide guidance, advice and motivation to the author. In addition, during the preparation of the thesis proposal, the author also received a lot of assistance from various parties. For this the author would like to thank the:

1. Mrs. Prof. Dr. Ir. Novirina Hendrasarie, M.T. as the Dean of the Faculty of Computer Science, National Development University "Veteran" East Java
2. Mrs. Dr. Intan Yuniar Purbasari, S.Kom., M.Sc. as the Coordinator of the Informatics Study Program, Faculty of Computer Science, National Development University "Veteran" East Java.
3. The author would like to express sincere gratitude to Mrs. Fetty Tri Anggraeny, S.Kom., M.Kom., as the author's academic advisor, for her guidance, encouragement, support, and attention throughout the author's academic journey.
4. The author would also like to express sincere gratitude to Dr. Rizky Parlika, S.Kom., M.Kom., and Achmad Junaidi, S.Kom., M.Kom., as the thesis examiners, for their valuable assessments, constructive suggestions, and meaningful input during the examination process. Every correction and direction given has greatly helped the author improve the quality, structure, and clarity of this thesis.
5. All lecturers of the Informatics Study Program, National Development University "Veteran" East Java, for their knowledge, guidance, valuable experiences, and life lessons throughout the author's education.
6. The author would like to express deepest gratitude to the author's beloved family, especially the author's parents and sister, whose love, prayers,

sacrifices, and support have been the greatest source of strength throughout this journey. Their endless encouragement, both emotionally and financially, has given the author the courage to keep moving forward even in difficult moments. Thank you for always being a safe place to return to, a source of comfort, and the reason the author was able to reach this stage. This achievement is humbly dedicated to them with the greatest respect and love.

7. A special appreciation is dedicated to the friends who have colored the author's university journey with support, laughter, loyalty, and unforgettable moments. Their presence has made many difficult days feel lighter and many achievements feel more meaningful. Through every discussion, encouragement, advice, and shared struggle, this friendship has become one of the most valuable parts of the author's life during university. The author is truly grateful to Muhammad Fajar Saputra, Cinta Ramayanti, Dela Ayu Putri Mayona, Ade Rizky Panjaitan, Rhimba Aulia, and Habib Nurrohmad Sugiharto for every memory and kindness shared along the way. May success, happiness, and good opportunities always be with each of you, BTS.
8. The author would also like to express heartfelt appreciation to the author's junior high school friends, Rico, Herlina, Eka, Marcella, and Reisyah, who have been part of a friendship known as babi kleb and have remained close until today. Although meetings have become less frequent due to time and distance, every gathering has always been filled with laughter, warmth, and happiness. The author truly values this long-lasting friendship and is grateful for every memory, support, and togetherness shared along the way. May this friendship continue to last, and may success and happiness always accompany each of you.
9. The author would also like to thank the author's friends from Ganesha Operation, Arza, Widi, Fathur, Hani, and Surya, who are warmly remembered as bangku belakang. Some of them have been friends with the author since elementary school, while the friendship grew closer during high school. Every moment spent with them has always been enjoyable, filled with laughter, random stories, and exciting conversations that make each meeting feel memorable. The author is truly grateful for this friendship and for the warmth

that has remained until today. May this friendship continue to last, and may success and happiness always be with each of you.

10. The author would also like to thank the author's gaming friends, Alek, Dito, and Fras who are part of a friendship known as grup serbaguna. Thank you for accompanying the author through many gaming sessions, shared laughter, casual conversations, and moments spent together. Their presence has brought joy and comfort during the author's busy and tiring days. The author is truly grateful for every fun memory, support, and togetherness that has been shared. May this friendship continue to last, and may success and happiness always be with each of you.
11. The author is also grateful to the members of HIMATIFA for every experience, lesson, support, and moment of togetherness shared throughout the author's college years. Their presence has given the author many valuable memories and helped shape the author's growth during university life.
12. The author would also like to express sincere gratitude to all parties who have contributed to the completion of this thesis, both directly and indirectly. Thank you for every form of help, support, encouragement, and kindness given throughout this journey. The author truly appreciates every contribution that has helped make this thesis possible. May all the kindness given be rewarded with goodness, happiness, and success.

The author realizes that in the preparation of the following thesis there are many shortcomings. For this reason, constructive criticism and suggestions from all parties are highly expected for the perfection of writing the following thesis. Finally, with all the limitations that the author has, hopefully the following report can be useful for all parties in general and the author in particular.

Surabaya, 07 July 2026



Author

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