UNDERGRADUATE THESIS

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

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APPROVAL SHEET

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ABSTRACT

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Thesis Title:	Non-invasive Liver Fibrosis Detection from Ultrasound Images Using Convnext V2 Tiny with CORAL-Based Ordinal Classification
Advisor:	1. Dr. Faisal Muttaqin, S.Kom, M.T 2. Eva Yulia Puspaningrum, S.Kom., M.Kom

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

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Surabaya, 07 July 2026

Author

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