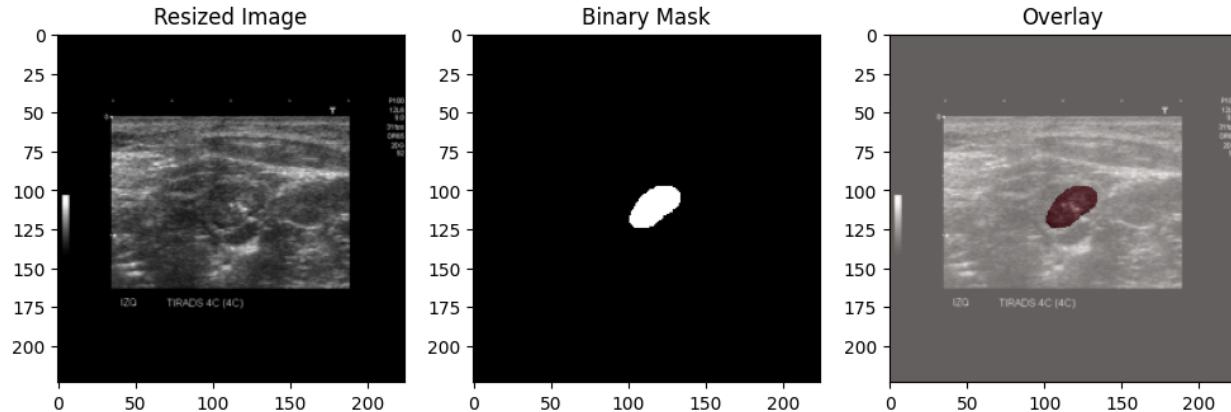


## Executive Summary

This project is about using deep learning to analyze thyroid ultrasound images and predict TI-RADS scores for nodules so doctors can focus on the high-risk cases. The dataset included the images, annotated nodule regions, and metadata like patient age, sex, and nodule features.



We built a CNN architecture that looks at both the images and the metadata to make predictions. At first, we tried predicting all seven TI-RADS categories, but the model struggled because some categories had very few examples. After we grouped the labels into three clinically meaningful categories, benign, low-risk, and high-risk, the CNN performed much better with **85% test accuracy**. It also did a great job **identifying high-risk nodules**, getting **56 out of 57 correct**, which is critical for patient health.

We also tried transfer learning with a pretrained DenseNet model, but it did not adapt well to these ultrasound images even after consolidation. This showed that a custom model trained specifically on the dataset worked better for this kind of medical imaging.

Overall, this project shows that a well-designed CNN can help radiologists catch dangerous thyroid nodules faster and more consistently standardizing readings across clinicians . It also highlights where the model struggles and where future improvements could go.