

Figure 1: Healthy tissue maintains organized blood flow, whereas tumor vasculature exhibits chaotic pathways.

We partnered with Karczmar Lab, a breast imaging research lab at the University of Chicago, to investigate whether early changes in breast-tumor vasculature could predict which patients will be cancer-free at surgery. Currently, this can only be confirmed after months of treatment. Earlier predictions would allow clinicians to escalate treatment for patients who need it and de-escalate for those likely to respond well.

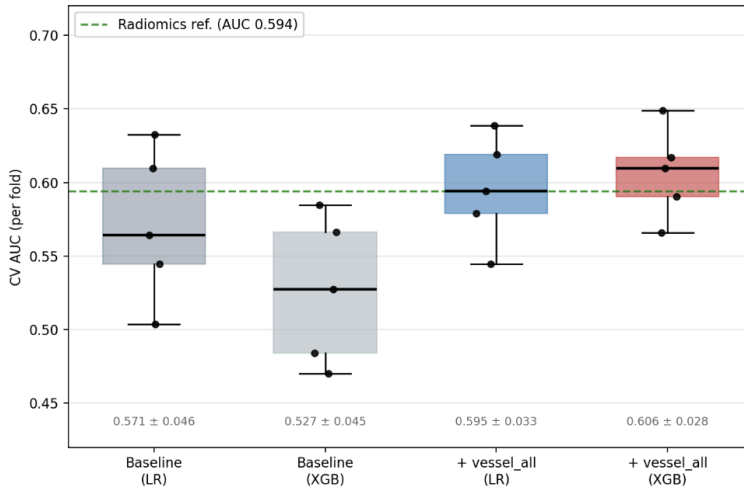


Figure 2. Increase in Predictive Effects From Adding Vessel Features in Tabular Modeling

We pursued two complementary approaches to predict breast cancer treatment response from MRI-derived vascular patterns. One approach used summary-based prediction models built from clinical factors, tumor size, and vessel measurements. The other approach lets a point-level neural network learn directly from vessel points near each tumor without first compressing each patient into a few summary values.

Vessel-related features showed a modest predictive signal. The strongest summary-based model reached about 0.61 AUC, where 0.5 is random guessing and 1.0 is perfect. This suggests a modest signal, but not a clinical-ready predictor. The point-level neural network improved to about 0.57 AUC. Vessel patterns may help earlier response prediction, but the current signal is modest and needs feature quality checks and validation before clinical use.