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Exploring the Capabilities and Variants of Integrating Trainable Gabor Filters for Enhanced Biomedical Image Segmentation

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Various approaches for integrating trainable Gabor filters into the U-Net architecture to enhance biomedical image segmentation are investigated. Several implementation strategies are examined: augmenting the network input with Gabor filters (fixed or trainable), embedding a dedicated Gabor-based layer within the encoder or decoder, and employing parameterized convolutions derived from the Gabor function. For each method, advantages (improved extraction of orientation-sensitive features, reduced parameter count, etc.) and limitations (increased architectural complexity, constrained filter flexibility) are analyzed. The findings indicate that Gabor filter integration can improve segmentation accuracy and robustness for complex images, although the selection of an optimal approach must balance feature discriminability against model complexity.

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