

## **MVI-Wise GAN: Synthetic MRI to Improve Microvascular Invasion Prediction in Hepatocellular Carcinoma**

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MRI is crucial for the diagnosis of HCC patients, especially when combined with CT images for MVI prediction, richer complementary information can be learned. Many studies have shown that whether hepatocellular carcinoma is accompanied by vascular invasion can be evidenced by imaging examinations such as CT or MR, so they can be used as a multimodal joint prediction to improve the prediction accuracy of MVI. However, it is high-risk, time-consuming and expensive in current clinical diagnosis due to the use of gadolinium-based contrast agent (CA) injection. If MRI could be synthesized without CA injection, there is no doubt that it would greatly optimize the diagnosis. Based on this, this paper proposes a high-quality image synthesis network, MVI-Wise GAN, that can be used to improve the prediction of microvascular invasion in HCC. It starts from the underlying imaging perspective, introduces K-space and feature-level constraints, and combines three related networks (an attention-aware generator, a convolutional neural network-based discriminator and a region-based convolutional neural network detector) Together, precise tumor region detection by synthetic tumor-specific MRI. Accurate MRI synthesis is achieved through backpropagation, the feature representation and context learning of HCC MVI are enhanced, and the performance of loss convergence is improved through residual learning. The model was tested on a dataset of 256 subjects from Run Run Shaw Hospital of Zhejiang University. Experimental results and quantitative evaluation show that MVI-Wise GAN achieves high-quality MRI synthesis with a tumor detection accuracy of 92.3%, which is helpful for the clinical diagnosis of liver tumor MVI.