

# A Hybrid Cnn-Vision Transformer Approach for Pancreatic Disease Classification Using CT Imaging

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## Abstract:

Pancreatic cancer poses a major diagnostic challenge owing to its asymptomatic progression in the early stages and subtle visual differences between healthy and pathological tissues in medical images. To support reliable and timely diagnosis, this study presents an explainable hybrid deep learning framework for pancreatic disease classification using CT imaging data. The proposed approach integrates convolutional neural networks for localized feature extraction with vision transformer models to capture global contextual dependencies. Multiple CNN architectures, including ResNet, EfficientNet, InceptionV3, and DenseNet, were evaluated alongside transformer-based models, such as ViT-B/16, DeiT, and Swin Transformer, with hybrid CNN-Transformer configurations explored to enhance classification robustness. The model was developed using TensorFlow/Keras and PyTorch, with image preprocessing handled through OpenCV and performance evaluation performed using standard metrics. Explainable artificial intelligence techniques, including gradient-based visualization and attention analysis, were incorporated to improve interpretability and clinical trust. The framework was deployed as a scalable web-based system, and the experimental results demonstrated reliable diagnostic performance with transparent decision support.

## Keywords:

Pancreatic cancer detection, Deep learning, Convolutional neural networks, Vision transformers, Explainable artificial intelligence, Medical image analysis.