Colorectal Cancer Imaging and Classification - A Deep Learning Approach to Classify Histopathological Images

Ravidath, Shyam (School: Sunset High School)

Colorectal cancer is the second leading cause of cancer-related deaths, and early detection is critical. However, traditional pathology is time-consuming, expensive, and dependent on subjective human interpretation. My project applies deep learning to classify colorectal cancer from histopathological images, aiming to create a fast, accurate, and accessible diagnostic tool. I trained a Convolutional Neural Network (CNN) using the CRC-VAL-HE-7K dataset, which contains 7,180 H&E-stained image patches from 50 patients. These images span nine tissue classes, including benign (e.g., adipose, lymphocytes) and malignant (e.g., adenocarcinoma epithelium, cancer-associated stroma) samples. Data augmentation techniques, such as rotation and zooming, improved generalization and reduced overfitting. The final model achieved 93% training accuracy and 94% validation accuracy. To increase accessibility, I developed a Streamlit-based web app where users can upload images and receive real-time predictions, including tissue class, malignancy status, and confidence score. I also tested the model using images captured through a Foldscope, demonstrating that low-cost imaging tools can be integrated into AI-driven diagnostics. This project shows how machine learning can support digital pathology, especially in underserved areas. Future work includes expanding to prognostic modeling and integrating clinical data to improve diagnostic precision and impact.

Awards Won: