Segmenting Kidney Tumors

Link to GitHub Repo: https://github.com/ali-rn/DS4002-CS3/

Context: AI-powered medical imaging is a rapidly growing field aimed at leveraging machine learning's image processing capabilities to automate and standardize common medical image problems, such as segmentation, classification, and registration. In radiation oncology, deep learning models are used to segment tumors and organs at risk in treatment plan images, particularly in hard to identify cancers, such as pancreatic, prostate, cervical, and brain cancer. These technologies significantly relieve physician burden and standardize treatments across patients.

Motivation: You are a data scientist working for a radiation oncologist at MD Anderson Cancer Center who spends hours of his valuable time monotonously outlining planning CT images of his kidney cancer patients. This is an extremely taxing process for him as he has to be careful to maintain accuracy and consistency. Any mistake could lead to potentially irreversible healthy organ damage. He needs your help to automate this process. Your work has the potential to alleviate your clinician's and many others' work loads, allowing them to focus their time and energy on providing the best care to their patients.

Deliverable: The oncologist has tasked you with building him a deep learning model that can automate this process for him and has given you his past patient image data and manual labels to train the model. The dataset contains 589 planning CT scans with manual labels. You will build a convolutional neural network (CNN) model to segment the kidneys, tumor, cyst, and background (n=4 classes). You will then visualize your results using different metrics, such as dice similarity coefficient (DSC), precision, and recall.