

Detection of Bowel and Mesenteric Injuries Using Deep Learning Computer Vision Models

Neal Mahajan¹, Scott D Steenburg^{1,2}, Peter Gunderman^{1,2}, John Burns², Arya Iranmanesh^{1,2}

¹Indiana University School of Medicine; ²Department of Radiology, Indianapolis Indiana

Background/Objective:

While only seen in 1-5% of patients who undergo a CT (computed tomography) scan, blunt bowel and mesenteric injuries (BMI) are associated with significantly increased morbidity and mortality. A significant cause of the increased morbidity of BMI is due to the difficulty of diagnosis from clinical and imaging information which leads to delay in diagnosis. Accurate and timely diagnosis is vital to reduce the morbidity of BMI.

Methods:

For this project, our primary objective is to create a binary prediction model that determines if a patient has BMI based on their abdominal CT scans. Due to the importance of the early and definitive diagnosis of BMI in trauma patients, an extension of this project will seek to introduce explainability into the model to highlight which features on the CT scan caused the model to make its prediction. The patients with BMI were sourced from a trauma registry that recorded trauma cases from IU Health with relevant diagnosis codes. The images from our search will be reduced to the relevant slices for diagnosis of BMI and then used to train an ML model to make a yes/no prediction from the image. Once the model is trained, testing data will be evaluated on the model and the gradient vectors from the model during inference will be used to create a heatmap with GRAD-CAM that illustrates what portions of the image were relevant for the decision made by the algorithm.

Future Directions:

Using the collected abdominal CTs, we can train our machine learning pipeline to detect BMI. Based on the performance of the model, we will determine if we need to collect more data. Then, we can evaluate the explainability of the model using GRAD-CAM and compare performance of the ML model to the performance of expert and trainee radiologists.