

# CS-6440: Sprint 5 – Practicum Submission

Joseph Waugh jwaugh6@gatech.edu

## 1 BACKGROUND AND SIGNIFICANCE

The usage of CT colonography scans is a 21<sup>st</sup> century solution for screening patients for colorectal neoplasms. In a recent study concluded in 2009, CT colonography tests among 49 individual case studies proved extremely effective, where “no cancers were missed at CT colonography (scans)” (Pickhardt, et.al.), versus outdated technologies that have proven less effective.<sup>1</sup> While this new technology has proven itself to be very promising, colorectal cancer remains one of the worst types of cancer in terms of mortality rates in the western world.<sup>2</sup> Prior methods involved fecal tests, which have proven effective in terms of reducing mortality rates for individuals diagnosed with colon cancer; however, due to the increased sensitivity of the CT colonography scans, there’s a better possibility for reducing mortality rates, and the technology has proven to be accurate in recent trials, both of which suggest that the new technology should be the path forward in terms of screening.

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## 2 PROBLEM

One of the issues with the current, manual process of reviewing any sort of medical scans, including CT colonography scans, is the presence of false positives and true negatives. These errors are both costly for the patient and provider and minimizing these while still utilizing a manual process will never work as best as it is intended; however, this proves another point, that accuracy in the interpretation of these CT scans needs to be of high importance as well. This leaves two primary ideas to

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<sup>1</sup> Colorectal Cancer: CT Colonography and Colonoscopy for Detection—Systematic Review and Meta-Analysis; Perry J. Pickhardt, Cesare Hassan, Steve Halligan, and Riccardo Marmo; Radiology 2011 259:2, 393-405

<sup>2</sup> Ries, L. A. G. (2000, May 15). The annual report to the nation on the status of cancer, 1973–1997, with a special section on colorectal cancer. American Cancer Society Journals. <https://acsjournals.onlinelibrary.wiley.com/doi/full/10.1002/%28SICI%2910970142%2820000515%2988%3A10%3C2398%3A%3AAID-CNCR26%3E3.0.CO%3B2-I>

solve for: creating a timely, yet accurate solution to identify colon cancer early, by encouraging frequent scans and providing an easy method to complete this action.

### **3 SOLUTION**

To address the issues related to ease of use, encouraging frequent CT colonoscopy testing, and providing accurate results and feedback, the solution is to implement a recurrent neural network model via a web application that allows a user to upload images of their CT scans, and the model will output a binary decision, whether the user is showing signs of colorectal cancer, or if they appear to be healthy of this specific type of cancer, with the contingency being that a particular confidence interval needs to be shared (i.e. these results are 85% accurate, etc.). The model is hosted on the backend, with a trained dataset of colon endoscopic images being fed to the model to train (and test) on.

### **4 COMPLEXITY OR EFFORT**

In terms of project complexity, implementing the solution required that a machine learning model be implemented, and hosted online via a flask-based web application that is run through HTML and Python scripts. The primary issue with this was working through a couple of sample datasets, until a dataset containing accurately defined classes of cancerous and non-cancerous data could be discovered. Building the different web pages for the application did not create any problems, but rather training the neural network took 14 hours for a dataset that was roughly ~1.5 GB.

### **5 REFERENCES**

1. Colorectal Cancer: CT Colonography and Colonoscopy for Detection— Systematic Review and Meta-Analysis; Perry J. Pickhardt, Cesare Hassan, Steve Halligan, and Riccardo Marmo; Radiology 2011 259:2, 393-405
2. Ries, L. A. G. (2000, May 15). The annual report to the nation on the status of cancer, 1997, with a special section on colorectal cancer. American Cancer Society Journals.