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"GastroAid"

A Semi-Supervised Learning Approach to Gastrointestinal Tract Image Classification

A Dissertation by

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Abstract

Gastrointestinal disorders are a public health problem which occur in the gastrointestinal (GI) tract of a person. The diseases range from acute conditions such as constipation and diarrhea to severe disorders such as colorectal cancer, inflammatory bowel disease and gastric cancer. Endoscopy is the medical procedure which is used in examining these deadly digestive disorders and it is crucial in early detection as it could increase the survival rate of the patient. Most of these digestive cancers initially starts with a growth inside the GI tract which is called as a polyp and it has been found out that due to reasons such as human error and not having proper experience, there can be a significant chance of misidentification of these polyps.

As a solution researchers have tried out different types of computer-aided pathology detection systems but due to lack of labelled medical data most of these models were not used for practical use. Though some existing work show high performance, most of the models are difficult to be reproduced or does not show the same accuracies in real-time images as they have been trained using small-scaled datasets. Apart from that, using of imbalanced datasets and not using proper data augmentation and preprocessing techniques before training has led most of the models to show less generalizability nature.

This study is focused on developing a semi-supervised learning approach for pathology detection in the GI tract as a solution for lack of annotated data. In this approach, a hybrid ensemble deep learning architecture which utilizes ResNet50 and InceptionResNetV2 as sub-models embedded inside a neural network is used for training purposes. The experiments were carried out by performing hyperparameter tuning, changing architecture layers and applying different augmentations techniques. Finally, an initial F1 score of 0.79 and final F1-score of 0.84 was obtained for the proposed model providing 5% overall improvement. To validate generalizability, the model was tested with Kvasir and Kvasir-Capsule datasets which gave F1 scores of 0.82 and 0.93 respectively. This study has proven that the proposed methodology outperforms several existing approaches in respect to overall performance and generalizability.

***Keywords**: Artificial Intelligence, Deep Learning, Image Classification, Endoscopy, Gastrointestinal Tract*