

# Colon Cancer Detection using Deep Learning

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**Abstract :** Colon cancer is called as colorectal cancer is one of the world's deadliest cancer disease at high mortality rate which affecting people of all age and gender. In the change of atmosphere, climate, and lifestyle it puts the people health at risk. For diagnosing the colon cancer computed tomography scans are very useful. The main goal of the study is to detect colon nodules and distinguish colon images. The deep learning approaches use to detect the position of cancerous colon nodule and we incorporate properly educate this approach for detect and classification of clinical CT images that this technique is long been discovered to identify and convinced medical field. Each of the computer tomography slice segment from the radiologist markings. This project compares the output of deep learning techniques with computer aided diagnosis method. In multi-stage system detects nodules in 3D colon CAT scans, decide whether or not each nodule is malignant, and assigns a cancer likelihood based on the findings. The proposed model helps to extract the grater accurate image features and signifies improvement of overall accuracy of classification. If histopathologist is not well trained it generates wrong diagnosis. For getting better result, histopathology images can help to identify malignant tumors and cancer subtypes. The model trains separately with various images and partitioned in 80% in train phase and 20% in test phase.

**IndexTerms -** Colon cancer, Deep Learning, Computed Tomography, Computer-Aided Diagnosis, Histopathology images.

## I. INTRODUCTION

Colorectal cancer is known as colon and bowel cancer which as world second and third most frequently diagnosed and high-mortality rate with have millions of cases and death cases records a year. Clinical experienced retrospective research shows multilayer of colon cancer formation have majority of cancer beginning as adenomatous polyps. Colon cancer identification can be done various screening methods. The rate of adenoma detection of colonoscopist represents the capability of detect adenomas which is the important predictors in efficiency of colonoscopy. Computer-aided diagnosis is a technology based on computer that beings applied for breast cancer, brain tumors and lung nodules to minimize and streamline clinician's workloads. The artificial intelligence technology has the ability polyp detection while the procedure of colonoscopy and where largely based on conventional techniques of machine learning, which highly depend on image preprocessing and extraction of feature by humans. Deep learning is a type of machine learning techniques based on data that significantly increase start of art in computer vision. The advantages is able to study the characteristics automatically at huge sets of training without having techniques on specific characteristics which opposed for conventional machine learning strategies. The method of transferring characteristics of CNN from non-medical to domain of medical and used to train a support vector machine classifier to identification and classification polyps. since the sample sizes were limited, the sets of training and sets of testing are separated vital labelled images of medicine could not be used. During this work, deep neural network-based uses for increasing algorithm and segment unique polyps of adenomatous on RGB images obtained through traditional white-light endoscopy. Models are extract multi-stage classification from a huge number of images of colonoscopy and create a leftover connection that are centralized within a single contingent block enhances multi-layer representation at a granular level.

## II. LITERATURE SURVEY

### 2.1 Colon Cancer

Colon cancer is a cancer type generates at large intestine and spread all over body. Is situation at last section of gastrointestinal tract. Commonly occurred on old people and strike any age. Polyp is a tiny size and noncancerous cell clumps growth in colon. The colon is also called large intestine and situated where body extracts water and salt from the solid waste passes through rectum before exciting the body through anus. The cancer grows in colon cancer over time. The physician's advices a routine screening tests helps to avoid colon cancer by detecting reducing the polyps until they became cancerous. Colon cancer is also known as colorectal cancer and the concepts that combination of colon cancer and rectal cancer which starts from rectum. Colorectal cancer includes both colon and rectal cancer are very common. The rectum where the last few inches in large intestine nearest to anus where the rectal cancer begins.

The some of the side effects of colon cancer are constipation, diarrhea, pain in abdominal, cramping, bloating, gas, weakness and fatigue, weight loss unexplained, blood syndrome irritations, anemia. The extent and location of the cancer in your large intestine would most likely influence your symptoms. The colon cancer causes the cancerous generates when DNA cells are damaged. It grows inside the large intestine walls. Via the blood and lymph systems, the spreading of cancerous cell from malignant tumours to other part of body. In a process known as metastasis, cancer cells may spread and encroach healthy tissue near and across the body.

The complication increases of colon cancer when colorectal cancer or polyp in past, inflammatory bowel disease, colon cancer runs inside family, a high-fat and low-fiber diet, sedentary way of life of inactive people, easily resistance in diabetes people, obesity, tobacco use, alcohol, and cancer radiation n therapy.

The preventions of colon cancer are consuming greater number of fruits, vegetables and whole grains, vitamins, minerals, fiber and antioxidants, etc., drinking of alcohol in modernization, smoking is prohibited, doing exercises, body balance mass index maintenance. The diagnosis techniques of colon cancer to detect cancer are colonoscopy, blood test, double contrast barium enema, etc. the treatments which benefits are most probable depends on your distinct personality circumstances, such as the cancer position, stages and other issues of health you might have. Colon cancer based on the tumor size for removing the cancer.

The other therapies for colon cancer are chemotherapy, radiation therapy, targeted drug therapy, immunotherapy, palliative care, etc.

### 2.2 Deep Learning

Deep learning is a better choice than other techniques like regular Machine learning algorithms because efficiency improves as the data scales. As the amount of data in applications of machine learning like support vector machines, Random Forest, and others grows, their output plateaus. My colon cancer detection project benefits from Deep learning Neural Network because the large dataset and can involvement grow larger as large number of people adds new data which resulting for results improvement.

### 2.3 Convolutional Neural Network

The use of Deep learning with Computer Vision is what Convolutional Neural Networks is all about. Consider a architecture of neural network and how it applied to visual tasks, such as images and videos, to gain an understanding of this. Convolutional Neural Network have aided in the development of facial recognition, self-driving cars, and other applications.

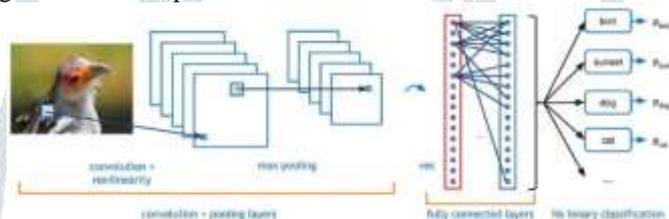
Figure-1 Examples of convolutional neural network



(a) Detection of objects (b) lane finding detection in a self-driving car

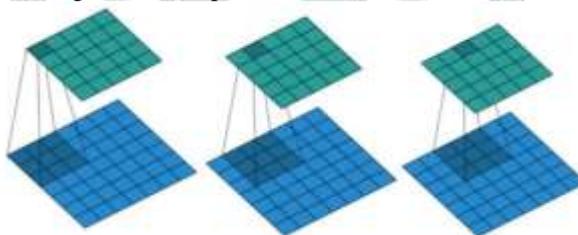
A traditional convolutional neural network, like a network of neural, made up many hidden layers are called convolutional layers, where the functions of linearity computes strided convolutions over images features must be extracted. It contains a pooling layer which computes another element such as maximum pool and average pool, to reduce the size of the image in the neuron and computes the speed. It accomplishes this by extracting the characteristics of neuron picture and ignores rest, resulting in a more stable network. Here the complete connection of layer which functions similarly to function of hidden layer in neural network, with number of each layers levelled outputs and value of each serving an input of each layer and follows the function of activation and the output.

Figure-2 An example of a convolutional neural network architecture



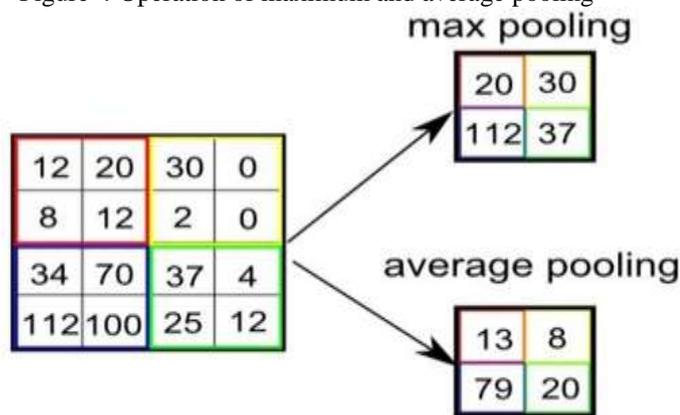
CONVOLUTIONAL LAYER - It is the linear classification that used in convolutional neural network. Using image processing feature detectors, where particular nodes in hidden layer extracts different features. For example, the first node in the first layer could extract an images horizontal edges, while the second node could extract vertical edges, and so on. A kernel is used to extract these features. The original image is at the bottom, and the performance of the convolutions is at the top. It also worth noting that the convolutions contribution reduces the original image's dimension.

Figure-3 Example of strided convolution



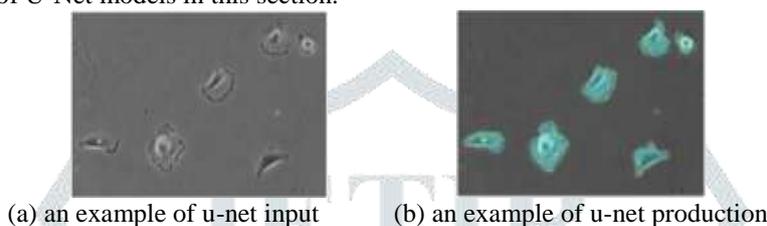
POOLING LAYER - After the convolutional layer, the pooling layer is typically computed. The aim of pooling is to reduce the boundaries of convolutional layers even further removes the characteristics in order to make dependable model. Pooling can be achieved in two ways: maximum pooling and average pooling. The average pooling use to calculate the average pixel value that to take out, and maximum pooling use to extract the maximum pixel value from a function.

Figure-4 Operation of maximum and average pooling



**2.4 U-net Model**

A Convolutional Neural Network is also known as U-net model. It is a variant of a convolutional neural network. This is mostly used for biomedical image segmentation, but also shows the segment regions of interest in a number of ways. The author discusses the different types of U-Net models in this section.



**III. PROPOSED ALGORITHM**

Colorectal cancer is one of the most common cancers and leading causes of cancer-related death worldwide. The key obstacle to be overcome in both tasks in intense inter-dataset and inter-class variability is a natural feature of histological imaging. We focus on the automated classification task in this paper, focusing on three different histological groups which are most important for diagnosis of colorectal cancer: (i) Healthy tissues, (ii) Adenocarcinoma, and (iii) Tubulovillous adenoma.

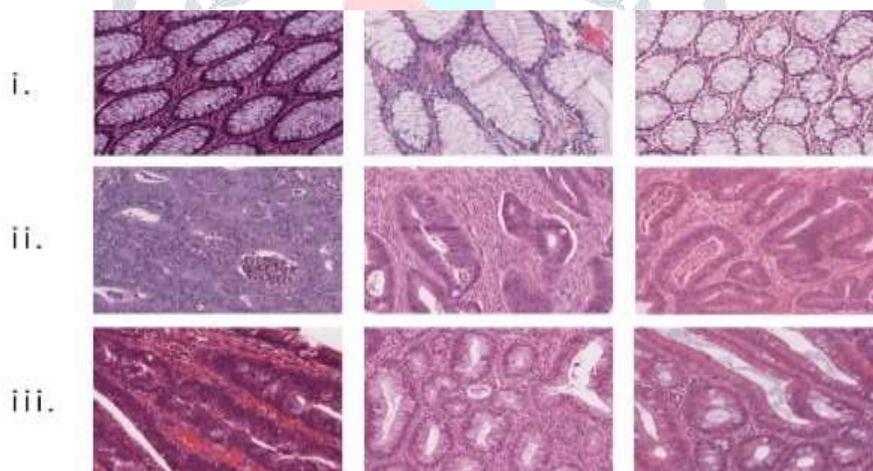


Figure-5 Histological H&E images of colorectal tissues (cropped patches). i) Healthy tissue; ii) Adenocarcinoma; iii) Tubulovillous adenoma

The body of knowledge on automated classification in histological images grown in recent years, with applications in areas except the colon like brain, breast, prostate, and lungs. The results of these limitations, architecture of deep learning, specifically convolutional neural networks have a major trend in recent years. Selection of features best for classification is learned by backpropagation on CNNs by number of convolutional and pooling layers, prevents extraction of description of handcrafted texture.

Transfer learning appears a promising solution of a problem which yet to be thoroughly investigated the classification of colorectal cancer. The CNN-based uses to approach automatically distinguished tubulovillous adenomas and healthy tissues from samples of cancerous in this study, it is a difficult task in images of histological analysis. It will do by thoroughly training CNN in a wide range of samples of colorectal and evaluates accuracy on separate testing set. The technique compares the two distinct transfer learning techniques which depend on a CNN that has been pretrained on a distinct image dataset. First method employs on pretrained CNN derives collection on features of discriminative that are fed into separate SVM classifier. The final stage of the pretrained CC is fine-tuned on CRC histological images in the second method.

Figure-6 Approaches to transfer learning (a) CNN act as fixed feature generator than has been pre-trained (b) Fine-tuning of a CNN that has already been educated

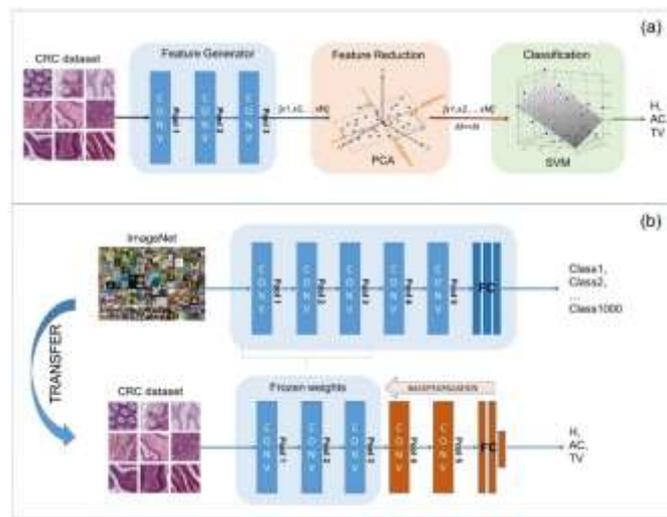
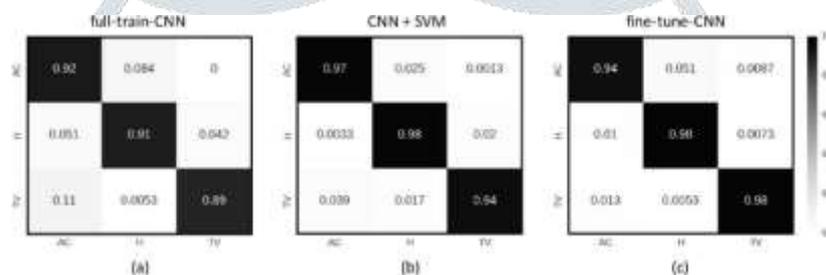


Figure-7 Confusion matrices of (a) full trained CNN on CRC samples (b) SVM pre-trained CNN as fixed features generator, and (c) pre-trained CNN with stages fine-tuning after pool block.

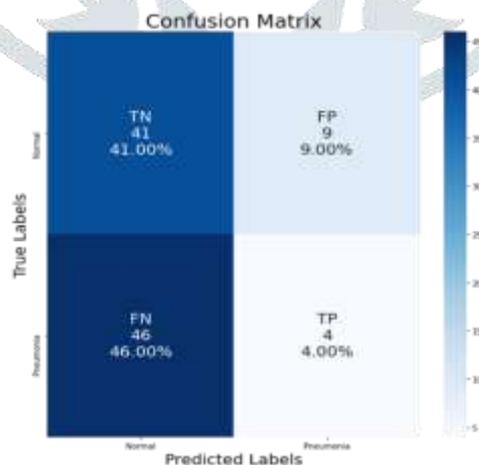


Pattern of score value patch indicates when the CNN is fine-tuned after pool3, the maximum accuracy is reached, confirming the qualitative results of t-SNE. Furthermore, can see that fully network training produces results that are similar to training only at last fully-connected level. It demonstrates CNN can be used for effectively migrate learned feature of ImageNet.

#### IV. RESULTS AND DISCUSSION

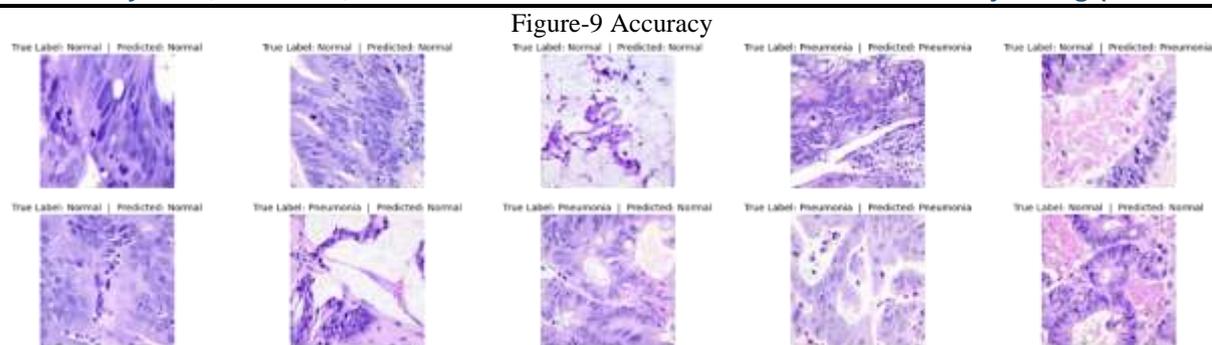
The uncertainty matrix for frame classification tasks with important and negligible frames. According to the result showed in the fine -tuned VGG19 models shows the high satisfactory output with the decrease rate of loss and increases the accuracy's point. The term 'r model' refers to a model with a low loss value and high accuracy.

Figure-8 Confusion Matrix



Using the coefficient of dice on the trained set, models achieve a 65 percent accuracy. At the trained set the smaller the dice coefficient but the uncertainty matrix produces an excellent worth and false positive rate on both positive and negative sample set. This shows the model is very good at differentiating between CT scans slices that do not contain cancer nodules and those with cancer nodules. I assume that accuracy could be improved with more hyperparameter tuning and model preparation.

Test Loss: 0.670385  
Test Accuracy: 65.0%



In this work, we suggested and investigated an integrated CNN- based CAD method for CRC diagnosis based on cutting-edge in deep-neural network architecture. This procedure used to detect adenomatous colorectal polyp at colonoscopy photographs. We used 500 images to test our framework for colon adenoma detection recommends the US multi-society task force recommendations for CRC risk evaluation and monitoring. The results indicate the colorectal polyps can be detected and diagnosed using methods of deep learning in CAD systems. Regardless of positive results larger multicenter trials were required for confirmation the capacity of the proposed system to increasing ADR and reduces the interval of CRC probability. The current complementary gives existence for a better classification techniques and data of exceptional quality, that intends for further validate method in the future by investigating of best backbone structure and collects a huge collection of exception quality colorectal polyp data.

#### IV. ACKNOWLEDGMENT

On the very outset of this report, i would like to extend my sincere and heartfelt obligation towards all the personages who have helped me in this endeavor. Without their active guidance, help, cooperation and encouragement, i would not have made headway in the project.

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