COLONOSCOPY STAGE WISE DETECTION USING DEEP LEARNING TECHNIQUES

[1]**Gaurav D Saxena**

Department of Computer Science, Kamla Nehru Mahavidyalaya, Nagpur, Maharashtra, India

E-mail: gauravsaxena@kamlanehrucollege.ac.in

[2]**Dr. SHAIK JUMLESHA**
Professor, Department of CSE, Annamacharya institute of
technology and science, Tirupathi, CHITTORE (DT), AP-517501. E-mail: ahmedsadhiq@gmail.com

[3]**K.Susmitha**
Assistant professor, Department of CSE, Annamacharya institute of technology and sciences, Tirupathi, CHITTORE (DT), AP-517501. E-mail: susmitha.karanam10@gmail.com

[4]**Mekala R**
Assistant Professor, Department of Information Science and Engineering, Bannari amman Institute of Technology, Sathyamangalam, Erode district-638401, Tamilnadu
Email: mekalars@gmail.com

[5]**ABHAY R. SHIRODE**
ASSISTANT PROFESSOR,
BHARATI VIDYAPEETH'S COLLEGE OF PHARMACY NAVI MUMBAI.
E-mail: shirodeabhayr@gmail.com

[6]**Dr. Amit Chauhan**
Assistant professor, Department of Life sciences, CHRIST (Deemed to be university), Bangalore, Karnataka-560029, India. E-mail: amit_chauhan777@yahoo.in

[7]**Mr. Shailendra Singh Bhadauria**

Assistant Professor, Faculty of Pharmaceutical Sciences, Rama University, Rama City Mandhana, Bithoor Road, Kanpur, Uttar Pradesh 209217. E-mail: shailendrabhadauria17625@gmail.com

ABSTRACT
Colorectal cancer is a well-known tumour that affects both men and women across the world and is quite common. According to a study published by the World Health Organization in 2018, colon cancer ranked third, with 1.80 million people afflicted. To be more specific, it is the cancer that comes after it that is the second most frequent cause of cancer in women and the third most common cause of cancer in men. Colorectal cancer is thought to be caused by a lack of control over the integrity of epidermal cells, which may occur in the intestine or during a malignancy. A reliable method of detecting colon cancer at an early

stage, followed by intensive treatment, has the potential to significantly lower the mortality rates that result. A Gastroenterologist may resort to cancer diagnostic tests for pathological pictures in order to do Screening of Morphology of Malignant Tumor Cells in the Colon during a colonoscopy. Due to the unlimited number of glands in the gastrointestinal system, any Histology procedure will require a large amount of time, and the results may be incongruous. By diagnosing using computer algorithms, it is possible to get practical and beneficial outcomes.. In order to get trustworthy and useful morphological imaging data, correct gland segmentation is a critical pre-processing step that must be completed first. In recent years, researchers have used deep learning algorithms to pathological image analysis in order to improve the accuracy of cancer illness detection. According to our findings, diagnostic test characteristics that are provided as input to a deep learning architecture that is utilized in conjunction with a semantic segmentation algorithm may provide results that are more accurate than those produced by conventional picture segmentation methods. This paper presents an in-depth examination of deep learning architectures used for semantic segmentation on histological pictures of the colon, as well as their applications.

Key Words: Colorectal Cancer, Deep Learning, Gland Semantic Segmentation, SegNet, Histological Images

INTRODUCTION

The incidence of colorectal cancer, as well as the mortality rate associated with it, has significantly grown in recent years. More often than not, a pathologist's diagnosis is based on pathology reports of pictures and biopsies, which offer information on the progression of cancer via the lymphatic system and other organs of the body, among other things. This method not only takes a significant amount of time and money, but it is also quite inconvenient. However, it seems to have certain limitations as well. According to the findings of the research study, the analysis of diverse pathologists contains even more substantial inconsistencies. In this case, the primary reason for the incongruity is that the pathologic medical diagnostic process is subjective and readily impacted by the surrounding environment. Using computer-based algorithms to diagnose photographs, it is possible to maintain the medical diagnosis in an effective manner. As seen in Figure 1, the gut is a collection of hollow organs that are connected by a long, twisting tube that begins at the duodecaval junction.
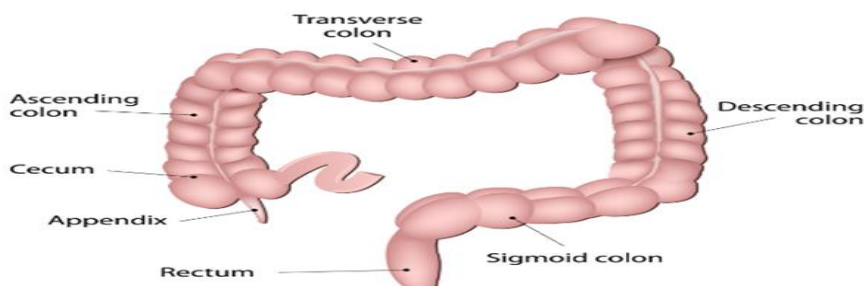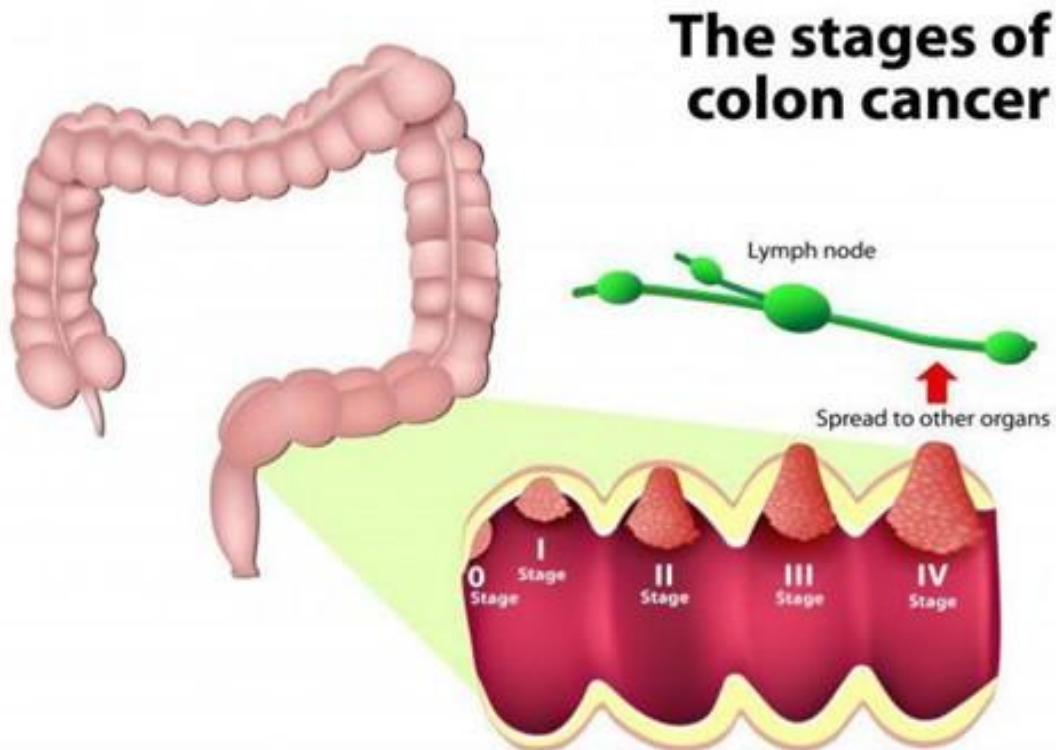

Figure 1: Anatomy of the large intestine[4].

Figure 2: Stages of the colon or rectal cancer[7].

In addition to absorbing fluids and electrolytes3, it also forces solid waste to the rectum together with the anus for purgation and excretion. Polyps, which are abnormal growths of cells on the inner lining (mucosa) of the proximal colon or maybe the distal colon, can be either cancerous or benign in nature.. However, being over the age of 50, having a family history of colorectal cancer, having a personal history of uterine, breast, or ovarian cancer, and having a personal experience of ovarian cancer all increase the likelihood of being affected by colorectal cancer. Exposure to carcinogen chemicals in the environment. The stage of the illness defines how far it has progressed, and the grading stage of cancer aids in the selection of the most appropriate therapy. Figure 3 illustrates the steps by using a number from zero to four as a reference. The signs of colon cancer, such as changes in feculence and its habits, may help us predict the disease. The following symptoms: a feeling of non-emptiness immediately after feculence, blood traces in the egesta that darken the stool, bright-colored red blood noticed from the rectum, bloating, and some form of pain in the abdominal region. The feeling of heaviness in the stomach, which leads to a refusal to eat for a period of time, as well as unexplained weight loss Males with unexplained iron deficiency, or maybe females after menopause, are at risk. Perhaps virtually all of these indicators might also indicate the presence of additional probable reasons in addition to those listed above. If these symptoms persist for more than four weeks, it is recommended that you consult with a doctor about them. It has been shown that there are even more stages in colon cancer than the four that are now recognized. Nonetheless, the primary goal of colorectal cancer screening is to detect irregular growths

particular type of cancer, or perhaps with inflammatory sort of disease of the intestines, ought to take regular screenings.

Risk Factors
Factors which take a person to a higher risk for developing colorectal cancer include various factors like[9]
Older age: Age plays a specific aspect in the predisposition to colon cancer. The statistics show that the age group near fifty is more prone to diagnosed. Sporadically could happen in young people. The average age of people who develop the disease is sixty-two years.
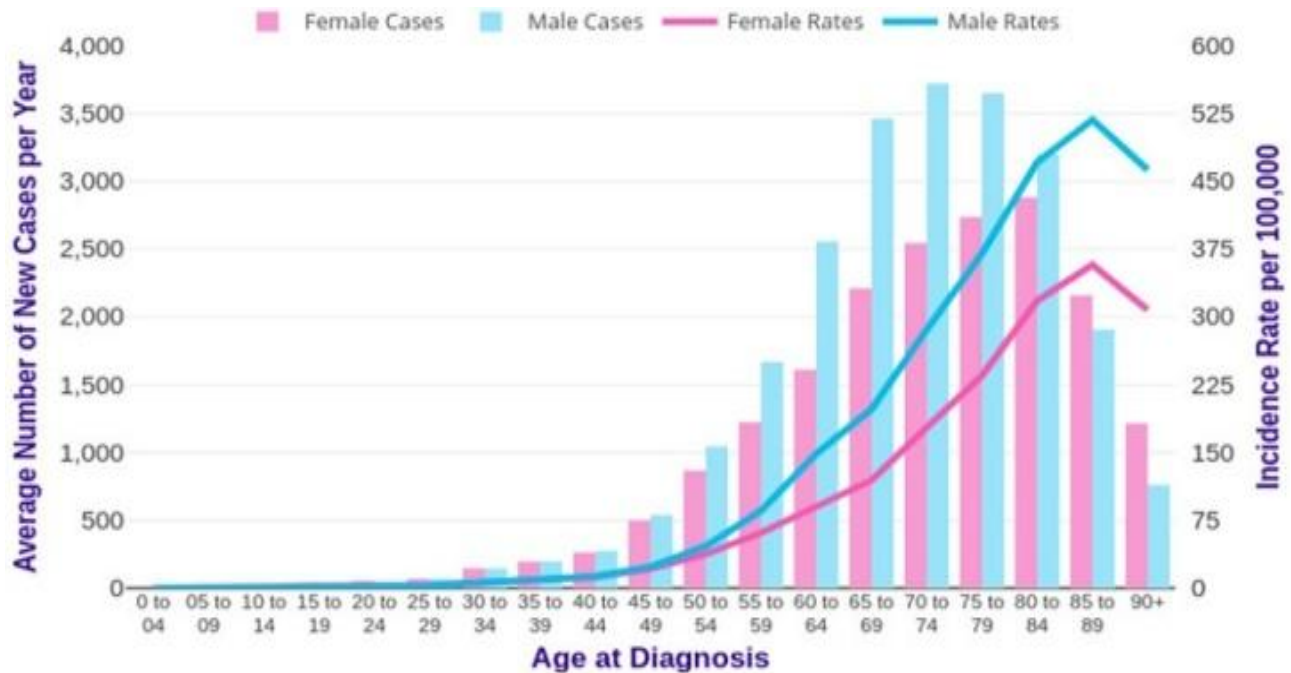

Figure 3: Age-specific incidence of colorectal cancer in females and males[10].
Above figure 3 represents the intensity of colon cancer depend upon the ages, which particularly highlights that the older age people are affected with colon cancer.
African-American race: Greater African-Americans are more likely than persons from other parts of the globe to be diagnosed with colon cancer, according to recent research.
Malignant growth(Polyps): Dangerous polyps are removed in the past, there is a risk of colon cancer developing in the future.
Inflammation in entrails: Ulcerative colitis, chronic inflammatory disease of the intestines, and other types of inflammatory disease of the intestines are all increasing the likelihood of developing colon cancer.
Hierarchical Cause: Having parents, siblings, or maybe a child who has colon cancer increases a person's risk of developing the illness further. If the diagnostic returns positive results for many numbers, the danger is quite high.
High-fat, low-fibre diet: Diet that is low in fibre and heavy in calories and fat (non-vegetarian with a lot of meat).
Indiscipline lifestyle: Colon cancer is much more common in those who have an inactive or dormant

Obese individuals: Obesity causes an escalated peril of colorectal cancer and also increases the death rate with bowel cancer when compared to individuals who are with a healthy weight.
Smoking: Smokers are more prone to occur with colorectal cancer.
Alcohol: Frequent consumption of alcoholic beverages enhances the risk of Colon Cancer.
Radiology Medicine: Radiotherapy, which utilizes high doses of radiation to kill previous malignant cells and shrink tumours at the abdomen, raises the chance of rectal and colon cancer.

DIAGNOSIS

In addition, early diagnosis of colon cancer in its early stages increases the likelihood of a successful treatment outcome. Screening may detect polyps before they become malignant. Listed here are the most effective diagnostic techniques for colorectal cancer, as well as the most effective screening strategies.

Test for occult blood in faeces
Sample of faeces collected from the patient. Furthermore, to test for occult blood to suspect colorectal cancer, but which takes a long process.

A DNA test on faeces
To test the presence of pre-cancerous polyps, discarded in the faeces, DNA mutations are examined and analyzed. Un- like an occult blood test, this gives results accurately, which distinguishes from cancer from polyps but fails to indicate a particular tumour is present.

Flexible Sigmoidoscopy
Screening is done through a sigmoidoscope, which is a thin tube with a light attached in the end to provide light inside the colon and rectum to observe a patient's colon. If some polyps recognized, then they are removed through colonos- copy after microscopic examination.

X-ray with Barium enema
The patient's trails are induced some amount of barium in the form of an enema, and X-ray is performed, which produces double contrast. Barium dye, used in the trails sticks to the inner lining of the bowel, producing more precise images of X-ray. Small polyps missed by the barium enema X-ray, rec- ognized by flexible Sigmoidoscopy.

Colonoscopy
As represented in Figure 4, a colonoscope is similar to a sig- moidoscope rather have more length, and it is a slim tube with an electronic camera affixed at one end, to capture an inward view of the colon, and then displayed. During the test, if any polyp seems to be abnormal, biopsies, or tissue samples are taken. A colonoscopy is painless, but sometimes mild sedative is given to some patients not to feel pain while performing the colonoscopy. Before the colonoscopy, laxative fluid is given to the patients to clean the colon.
CT Colonography
Although colonoscopy is the best way for diagnosis of polyps and other abnormalities, in which some risks already analyzed. Perforation of inward tissues may result in bleeding and other complications. Hence, CT Colonoscopy is introduced. The patient put into the C.T. scanner and required observations made out using ultra-violet radiation passing through the body.

Scan and Imaging techniques
Ultrasound (Magnetic Resonance Imagining) scans can show the diffusion of cancer in the body. The

waves can be penetrated inside the body and do not harm the internal tissues. Even though we may not get the best results, but some can deduce**.**
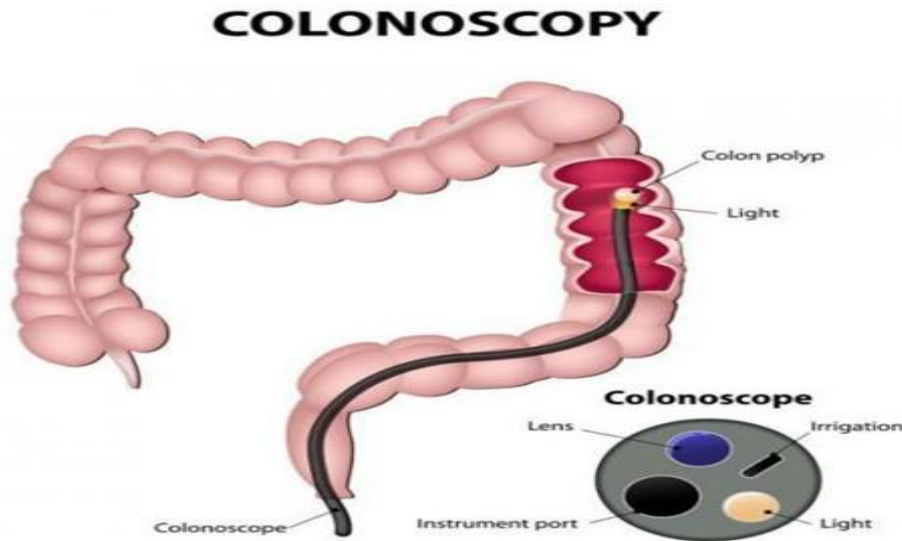

Figure 4: Colonoscopy.[12]

TREATMENT FOR COLON CANCER

The best treatment for colon cancer is finding and removal of polyps at an early stage by applying the screening. If the polyps are not cancerous, that means it does not consist of any nerves so that the patient will not feel pain during the removal process. If a polyp leads to cancer, it needs surgery or chemotherapy to kill the malignant tumour cells.
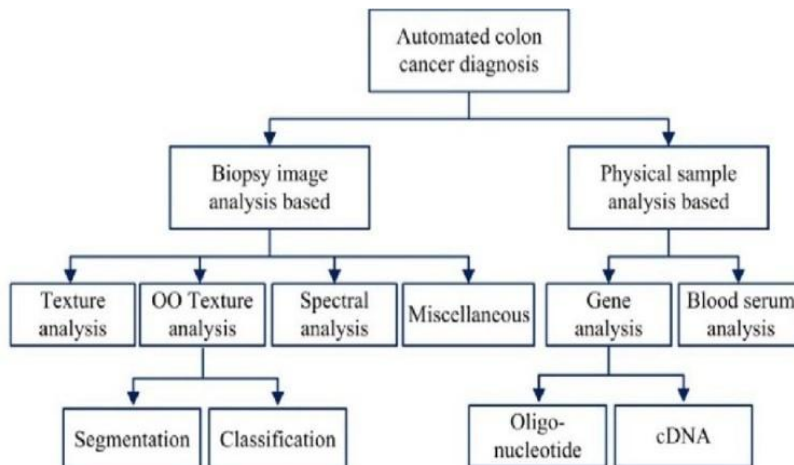

Figure 6: Classification of Colon Cancer Detection[15].

A unique DCAN given by Chen et al. deals with a multi- task learning framework,[16]yields accurate polyp detection, and segmentation in the colon. Multi-level contextual features are discovered depend upon an FCN, which can identify the contours of polyps in colon histopathological images very accurately. Aparna R et al. defined a novel algorithm to detect the polyps from colonoscopy images, by performing linear thresholding and Markovian Random Field to identify the saturated regions, segment the image depth-wise.[17] Then they used an SVM classifier to predict the condition of the disease by the help of colon correlogram vector and texture vector.

Deep learning methods, such as Deep Convolutional Neural Networks (DCNNs), have recently been widely employed in the area of computer vision, particularly in the identification of objects in figures. 13,14 When compared to standard feature-based object recognition methods, deep learning architectures can recognize a wide range of items with high accuracy, as seen in Figure 5.
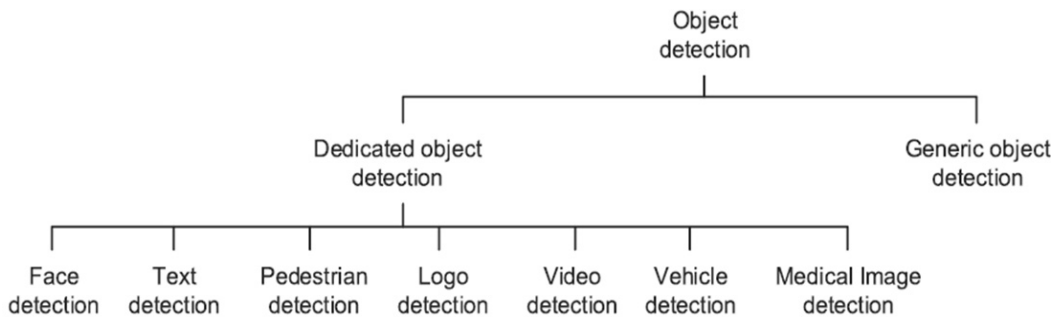

Figure 5: Dedicated and generic Object detection techniques.[13]

By the survey conducted by Stalin david et al., discussed several classification strategies, depending upon the spatial evaluation of colorectal biopsy images, and where they pro- vide an in-depth summary of techniques in each classification. Where each classification includes spectral, gene, texture, serum, and O.O. Texture types of analysis.[15]Figure 6 describes the step by step procedure to detect colorectal. Among the various neural network models, CNN based
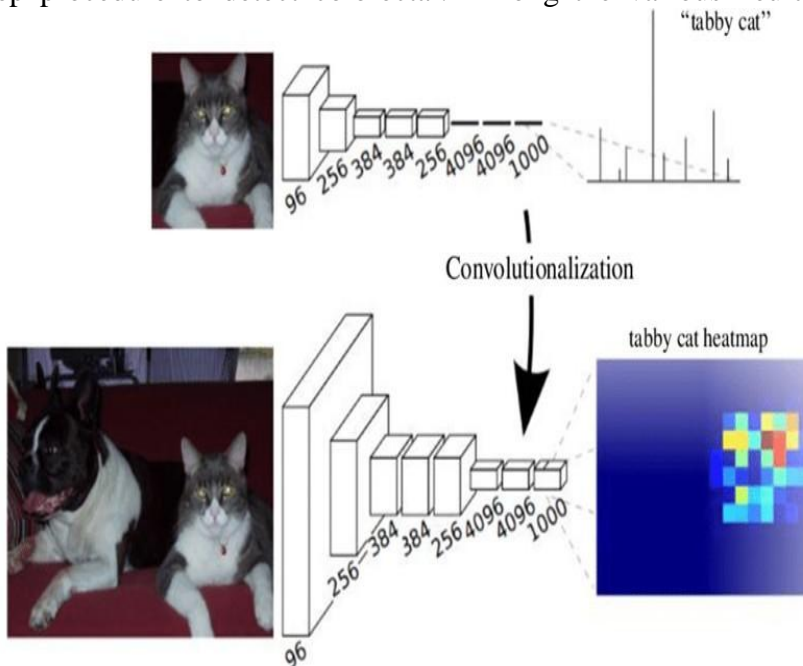
semantic segmentation models,[18] FCN, is quite successful because of its accuracy results. One of the best models is VGG-16, which includes various techniques like bipolar interpolation used for up sampling the feature maps, to transfer the spatial level information, multiple skip connections are established. The conversion process of FCL to CNN is de- scribed in Figure 7.

Figure 7: Converting-FCL of-CNN-to-convolutional-layers-2018

A fully connected CRF attached to the final segment of DCNN [19] which can overcome the poor localization property of deep networks. H.Noh et al. pro- posed a model named Deconvnet,[20] in which semantic segmentation performed by learning from a deconvolution network, in which the topmost layers(convolutional) considered from the VGG 16-layer network. The deconvolution network is composed of deconvolution as well as un pooling layers, used to perform semantic segmentation.

In the year 2012, AlexNet, a deep learning architecture pro- posed and which is one of the best architecture.[21] AlexNet is the champion of the ILSVRC.[21] The AlexNet, which contains a sequence of five convolution layers, and three fully con- nected dense layers associated with a softmax classifier used for image classification. In the year 2018, M Akbari et al. introduced a segmentation technique of polyps using CNN, in which a novel picture patch option technique performed in the training phase of the network. Moreover, in the period of testing, reliable post- processing on the chance map is done, which produced by the network.[22] U-Net has a diminishing pathway as well as an expanding pathway. During the shrinking pathway, the function data is raised, while spatial information lowered. The expansive path is a combination of the features and spatial information, which gives more ac- curate segmentation.

In the year 2017, Juan Jose Granados-Romero et al. pro- posed a review work on CCR, where they reported the factors increasing the CCR in humans and listed various type describes the results generated by various architectures by considering the measures mAP, FCS, and trained and tested on various Deep learning architectures.

CONCLUSION

In the current article, an effort has been made to offer numerous study results that have been produced by a number of writers and researchers in order to detect Colorectal Cancer, with the goal of increasing awareness. Based on the past research, it is clear that it is always preferable to detect cancer at an earlier stage in order to have the best chance of recovering from it. Following a thorough investigation of these conventional techniques for diagnosing Colorectal Cancer, it was discovered that the accuracy of identification and the time required to diagnose the illness were both increased. It has also been found in prior research that the outcomes obtained via the use of deep learning processes are not very promising. Results acquired using typical feature- based analysis approaches were previously covered in the previous section of the present paper. Based on the findings obtained before, we concluded that the use of deep learning methods in conjunction with a semantic segmentation approach will be the most effective strategy for obtaining excellent results in terms of illness identification. As part of our future work, we are also attempting to prepare for the implementation of hybrid deep learning models for improved detection of illness in its early phases.

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