

Color, Shape and Texture Based Segmentation and Classification on Colon Cancer Images

AISHWARYA.G¹, KANIMOZHI.R.²,

¹PG Scholar, Ece, Annamalai University, Tamil Nadu.

²Assistant Professor, Ece, Annamalai University, Tamil Nadu

Abstract: High incidence of biological human body interior organs tract related diseases are common nowadays, which leads to cancer. It is not possible to detect these kind of diseases in earlier stage itself. This makes the researchers to develop an automated screening technique for early detection, many modalities are employed to view the human body interior organs tract but complete visualization is not possible. Pills camera is a modern modality which helps to view the complete human body interior organs tract; The pill camera image is visually examined by the physician for detection and diagnosis of human body interior organs tract tumor. The accurate determination of tumor is quite impossible. To avoid that, this project uses computer aided method for segmentation and detection of human body interior organs tumor. This method allows the segmentation of tumor tissue in accurate manner when compared to manual segmentation. The time taken for analysis is reduced. At the end of the process the tumor is extracted from the human body interior organs tract image. After performing, the artificial neural network (ANN) based feature extraction classify the type of tumor. Computational image analysis and machine language learning techniques help to identify abnormalities in these images. In this work, we present and evaluate MIAS 3.0, which aims to study analyze colon tissue images. the image features are extracted first and then classified into normal and abnormal images using MIAS was quantitatively assessed by its application. MIAS also assists the domain experts with minimum knowledge in informatics to conduct a more complete study in medical images, by identifying patterns regarding different abnormalities.

Keywords— Computational image analysis, Machine learning techniques.

1. INTRODUCTION

A Colonoscopy can help the doctor find the cause of symptoms, such as bleeding from the anus, changes in the bowel activity, pain in the abdomen and unexplained weight loss. Doctors also use colonoscopy as a screening tool colon polyps and cancer. Colonoscopy exam images are useful to identify diseases such as colorectal cancer, which is one of the most common cancer in the worldwide. Capsule endoscopy is a new diagnostic tool that permits a direct visual examination of small intestine. The normal pill camera is around 26*11mm It is made up of specially sealed biocompatible material that is resistant to stomach acid and powerful digestive tract. It takes pictures and transmits the same to the receiver of the computer for analysis of our digestive system. This process helps in tracking of any kind of

disease related to our digestive system. It mainly helps in detecting any digestive disease at an early stage. Screening is testing for diseases when there are no symptoms. Screening may find diseases at an early stage when the doctor has a better chance of curing the disease.

We have made a great progress in manufacturing products. Looking back where we stand now, we started with flint knives and stone tools and reached the stage where we make such tools with more precision than ever. . We know that all the products which are manufactured are made from atoms. Their properties depend on the arrangement of atoms. In the medical field, the digital image processing techniques are used to enhance the contrast or transform the intensity levels into color for easier interpretation of bio medical image.

2. COLON CANCER

2.1. Colon cancer:

Colon cancer is a cancer that affects the colon and the rectum. Colon cancer is one of the third most common types of cancer in the world wide. This disease may develop from the age of 50 onwards. A colonoscopy is used to diagnose the colorectal cancer. Tissue samples can be taken from any areas that exhibit apprehensive changes. Most colorectal cancers develop from polyps. Removal of colon polyps can prevent colorectal cancer.. Colon polyps and early colon cancer have no



symptoms Smaller colorectal polyps can be removed during the colonoscopy. If detected early it can be treated by removing the tumor through surgery. This kind of surgical treatment is only possible if the tumor has not grown into the colon and does not affects any other organs. In an advanced stage, it is treated with surgery combined with radiotherapy. Regular screening is important. It reduces the mortality rate.

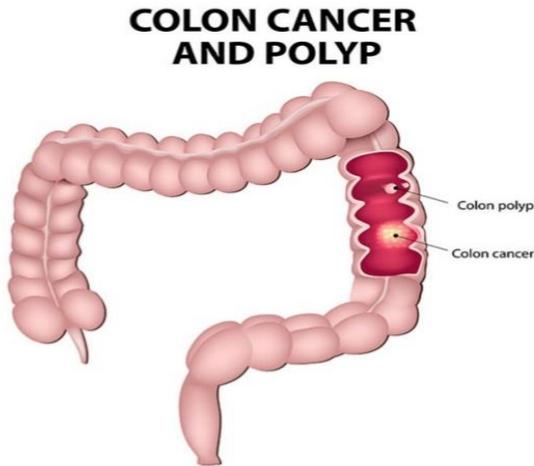


Fig 2: Structure of colon cancer and polyp

2.2. Stages of colon cancer:

- Stage 0: This is the earlier stage when the cancer is present within the mucosa or inner layer of the colon or rectum.
- Stage 1: Cancer has grown through the external lining of the colon or rectum but does not spread beyond the colon wall or rectum.
- Stage 2: Cancer has grown into the colon or rectum wall but does not spread to nearby lymph nodes.
- Stage 3: Cancer has violated nearby lymph node.
- Stage 4: In this stage, cancer may spread to other organs of the human body.

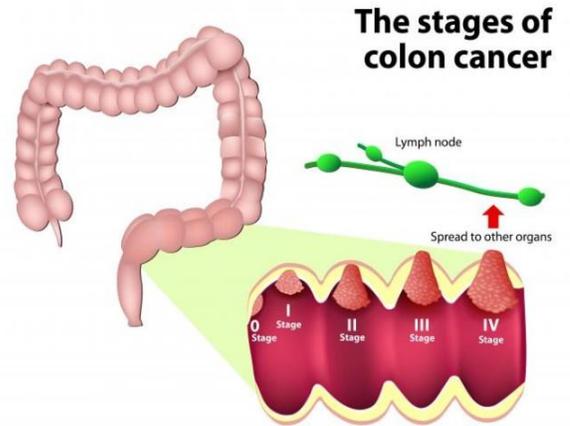


Fig 3: Stages of colon cancer

2.3. Survival rate of colon cancer:

- Stage I: 80-95%
- Stage II: 55-80%
- Stage III: 40%
- Stage IV: 10%

2.4. Risk factors

- Polyps in the colon.
- Fatigue.
- Very little exercise.
- Smoking.
- High alcohol consumption.
- The family history of colon cancer.

2.5. Symptoms:

- Blood in the stool.
- Constipation and diarrhea.
- Long, thin, pencil-like stool.
- Fatigue and weakness.
- Abdominal pain.
- Unexplained weight loss.
- Changes in the bowel habits.

2.6. Diagnosis:

- Colonoscopy
- Biopsy
- Molecular testing of the tumor
- Blood tests

2.7. Treatment:

The treatment based on the size, location and how long cancer has spread.

2.7.1. Surgery for early-stage colon cancer

- Removing polyps during a colonoscopy
- Endoscopic mucosal resection
- Minimally invasive surgery

2.7.2. Surgery for invasive colon cancer

- Partial colectomy
- A surgery is required to create a way for disposal of waste from our body.
- Lymph node removal

2.7.3. Surgery for advanced cancer

- Chemotherapy
- Radiation therapy
- Targeted drug therapy
- Immunotherapy

2.8. Other Screening tests:

- Annual fecal occult blood tests
- Stool DNA testing
- Flexible sigmoidoscopy every 5 years
- CT colonography for every 5 years

2.9. Prevention :

- Maintaining a healthy weight
- Exercising
- Consuming plenty of fruits, vegetables, and whole grains
- Decreasing saturated fat and red meat intake
- Avoid alcohol consumption and smoking

3. METHODOLOGY

The proposed method is developed to segment and detect colon cancer. This method starts by analyzing an image, followed by preprocessing and the image is segmented using clustering technique. The clustered image is selected and further processed. The proposed method consist of three main steps:

- Image selection and pre-processing
- Feature selection
- Segmentation
- Classification

3.1. Existing system:

- Computational systems that combine these methods with ML(machine learning) techniques can assist domain experts in the study of medical images in different domains, such as colonoscopy.
- This system makes available feature extraction techniques based on texture, using representation in gray-level co-occurrence matrices (GLCM)

3.2. GLCM:

The Image directory visualization allows the user to explore directories in a computer to select images. The Image listing allows the user to view selected data from the previous images module and Image viewing allows the user to view two

images(one normal and one abnormal) through a graphical interface and Feature extraction module allows the system to extract image features by the GLCM representation.

3.3. Disadvantage:

Instance based learning techniques (e.g. nearest neighbor)

- Take up a lot of memory to run (storing all the instances)
- Work well for a small number of dimensions, but not a high number of dimensions

Decision trees and divide-and-conquer algorithms

- May over fit data
- May get stuck in local minima so need ensembles to help reduce the variance

SVM

- Picking/identifying the right kernel can be a challenge
- Results/output are incomprehensible

4. PROPOSED SYSTEM

. The proposed system uses Artificial neural networks (ANN) techniques which reduces the mortality rate with early diagnosis and treatment. Currently, the survival rate helps to predict a patient's diagnosis. The patient may get affected by this disease if his other first-degree or other degree relatives have been affected by this type of cancer before the age of 60 or at any age. There are several methods for detecting colorectal cancer, such as the guaiac test, immunochemical test of stool, DNA stool test, colonoscopy. The stage in which the cancer is detected determines the survival and treatment of the patient. Hereby we provide a review about generalities, genetic basis, risk factors, preventive measures, diagnostic methods, therapy and survival in colorectal cancer. The learning performance was evaluated according to error rates, F-Measures, and receiver operating characteristic (ROC) surface. This system was found that the classifiers built using RP features achieved best values for these measures. The output performance will depend upon the trained parameters and the data set relevant to the training set.

4.1. IMAGE CLASSIFICATION:

- Aims to study new colon tissue images through classification models generated with tool
- Classification model loading:
- Enables the system to load classification models built using the tool
- Image loading: enables the system to load new images from colonoscopies not previously classified.

4.2. IMAGE TEXTURE ANALYSIS:

Aims to assist the users with the feature extraction process in colon tissue images enables the system to load multiple images. Uploaded images are initially represented in thumbnail format.

Proposed flow diagram

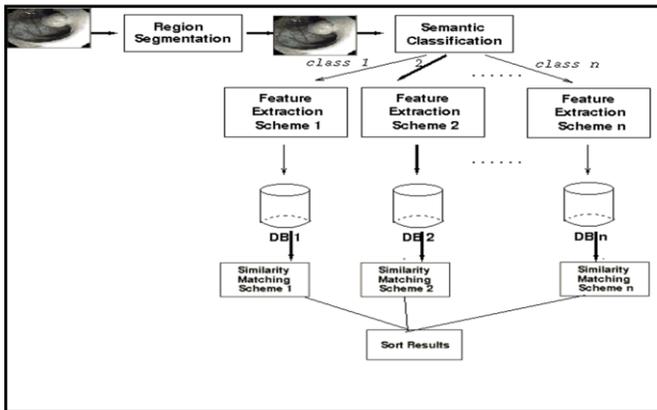


Fig 4: Flow diagram of proposed system

4.3. ALGORITHMS DESCRIPTION:

4.3.1. K-Means Algorithm:

Clustering is the process of partitioning a group of points into a small number of clusters. K means clustering aims to find the positions $\mu_{i=i=k}$ of the clusters that minimize the distance from the data points to the cluster.

The Lloyd's algorithm mostly known as K-Means algorithm.

First decide the number of clusters k.

Step 1: Initialize the center of the clusters.

Step 2: Mark the closest cluster to each data point.

Step 3: Assign the position of each cluster to the mean of all data points belonging to that cluster.

Step 4: Repeat steps 2-3 until convergence.

4.3.2. Artificial Neural Network:

An artificial neural network receives input, change this internal state (activation) according to that input and produces an output dependent on the input and activation. The input layer is followed by one or several hidden layers and an output layer. It includes number of connected processing units that work together process information. The artificial neural network takes data samples rather than entire data sets to arrive at solutions. The main theme of the ANN approach was to solve problems in the same way that a human brain would.

4.3.3. Advantage:

- Training large amount of data sets.
- The output performance will depend upon the trained parameters and the data set relevant to the training set.

5. SOFTWARE DESCRIPTION

MATLAB stands for Matrix Laboratory. According to the Math works, its producer, is a "technical computing environment". We will take the more mundane view that it is a

programming language but by no means all.

MATLAB variable names are normally case sensitive. MATLAB is designed to simplify the implementation of numerical linear algebra routines and it is used to implement numerical algorithms for a large number of applications. The basic language used is very similar to standard linear algebra notation, but there are a few extensions that will likely cause some problems at first.

A basic introduction on how to define and employ vectors in Matlab. The numbers are stored and accessed in Matlab.

- Matrices: We explained to create matrices and how to access parts of a matrix.
- Vector operations: The real power of Matlab is that the basic operations defined in linear algebra can be carried out with similar notation and a minimal number of programming steps.
- Loops: We introduce the basic loop used in Matlab and define a for loop and provide an example to solve a problem.
- Plots: A general overview of the basic plotting commands are given. This is a very basic idea given to demonstrate some of the ways to plot the data.
- Executable Files: It describes how to define files that contain command, that Matlab can execute as if they had been typed in at the command prompt.
- Subroutines: Explanation about subroutines is given. Generic arguments are passed forward and backward through the command line.
- If statements: The basic and foremost control structure in Matlab is the "if" statement which allows for conditional execution of certain parts of a code. This is useful to check conditions before deciding what actions should be taken.
- Data files: Matlab provides a number of ways to access data files. The different ways to save a particular matrix, and C style read-write statements are examined. The diary command is examined to demonstrate to give a text copy of session can be saved.

6. CONCLUSION

In this project, colorectal cancer diagnosis using feature extraction classification system using some image processing techniques. Here neural network algorithm was used to detect the affected area and ROI algorithm was used in preprocessing for extract the disease regions. The ANN was implemented to classify the disease affected area.

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