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Detection of Lung Carcinoma using Fuzzy and ACO Techniques

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Abstract: Lung carcinoma is a disease that occurs because of uncontrolled cell growth in tissues of the lung. Identifying the lung carcinoma involves lot of steps including the segment verification and hot spot analysis. The detection system will focus on identifying the areas of the cancer on the basis of the trained set. In this paper we will focus on identification process by training the data set on the basis of which classification would be done and the same will be then used for testing using fuzzy logic on the basis of the features extracted and ACO.

Keywords: Lung Cancer, Feature Extraction, Fuzzy Logic, ACO

I. INTRODUCTION

Lung carcinoma is a disease that occurs because of uncontrolled cell growth in tissues of the lung. This growth may lead to metastasis, which is the invasion of adjacent tissue and infiltration beyond the lungs. Treatment and prognosis depend on the histological type of cancer, the stage (degree of spread), and the patient's performance status. Possible treatments include surgery, chemotherapy, and radiotherapy. Survival depends on stage, overall health, and other factors, but on the contrary only 14% of people diagnosed with lung cancer survived 5 years post detection. Symptoms that may suggest lung cancer includes:

1. chronic coughing or change in regular coughing pattern,
2. chest pain or pain in the abdomen,
3. cachexia (weight loss, fatigue, and loss of appetite),
4. dysphonia (hoarse voice),
5. clubbing of the fingernails (uncommon)
6. dysphasia(difficulty swallowing),
7. Pain in shoulder, chest, arm, wheezing,
8. Bronchitis or pneumonia,
9. Decline in Health and unexplained weight loss.

The earlier presented techniques lack the information distribution capability in terms with focusing on how much the user has been affected and what would be survival rate of the patient in that particular scenario. The sole aim in this is to create a database which would emphasize on various parameters like survival rate of the patient in addition to the existing details main focus being on the system accuracy which will be carried out by using sample images of persons being affected by cancer in comparison to normal people. This paper is divided into sections. Section II discusses about the feature analysis, Section III focuses on Methodology and in section IV results and simulations are discussed.

II. FEATURE ANALYSIS

Image features extraction stage is an important stage that uses algorithms and techniques to detect and isolate various desired portions or shapes (features) of a given image. To predict the probability of lung cancer presence, binarization approach is used. For carcinoma detection feature extraction is a vital step and for this purpose there are two techniques available "Binarization approach" and "Gray level co-occurrence matrix" method. In this Gray level co-occurrence matrix has been considered.

A. Binarization Approach

In this technique, number of white pixels is extracted and is checked against threshold for the normal and abnormal lungs.

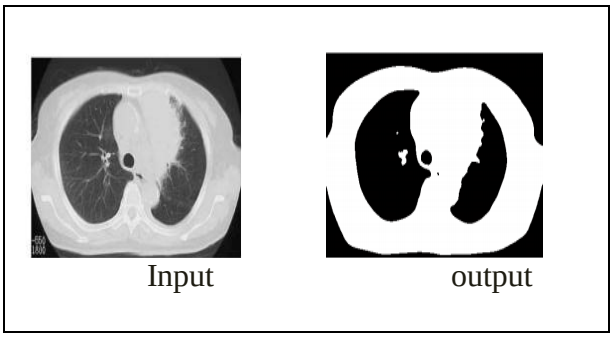

Figure 1: Histogram Equalization on DICOM scan image

If the number of the white pixels of a new image is less than that of the threshold, then it indicates that the image is normal, else, indicates that the image in abnormal.

2. GREY LEVEL CO-OCCURRENCE MATRIX APPROACH

Gray-level co-occurrence matrix is created from images using *graycomatrix* function in MATLAB.

The following features are extracted from various images data base using this method:

- Contrast
- Energy
- Entropy
- Homogeneity
- Maximum Probability
- Correlation
- Cluster shade
- Cluster Prominence
- Dissimilarity
- Autocorrelation
- Sum variance
- Sum Entropy
- Difference Variance
- Entropy

III METHODOLOGY

The first step is the collection of DICOM images (normal and abnormal) from the available database. The next step will be to apply Histogram-Equalization for image enhancement, in order to get the best level of quality. Post enhancing the image, the general features are extracted which gives indication about normal and abnormal image. These features are then compared with the data base. Lastly Fuzzy and ACO techniques are applied for identification of the the stage and to predict the survival rate of the patients.

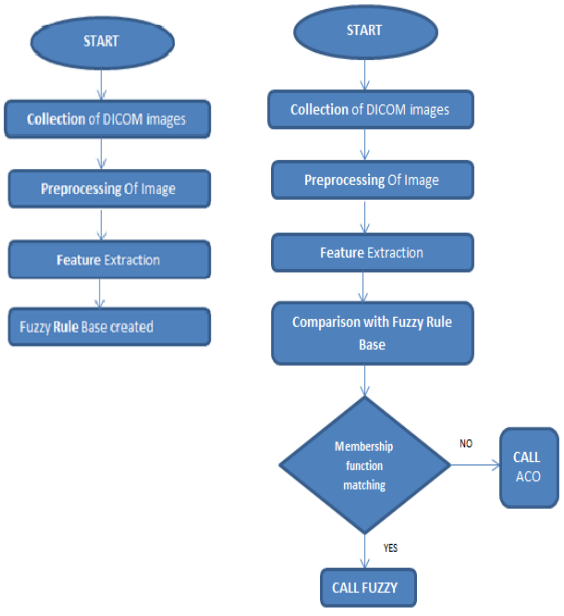

Figure 2: Block Diagram of Project methodology

IV RESULTS AND DISCUSSIONS

a) Algorithm

STEP 1: Upload Image

STEP2: Training using feature extraction

STEP 3: Upload image for classification

STEP 4: Extract Properties

STEP 5: Call fuzzy

STEP 6: If accuracy .parameter~=stable

STEP 7: Call ACO

STEP 8: Publish result

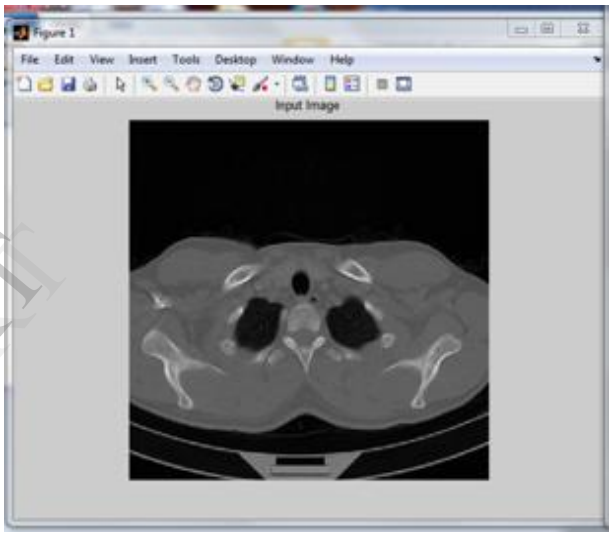

Figure 3: representing uploaded base image

The above figure represents the uploaded image. The figure has all the entire data which is uploaded i.e. the classified and not classified data.

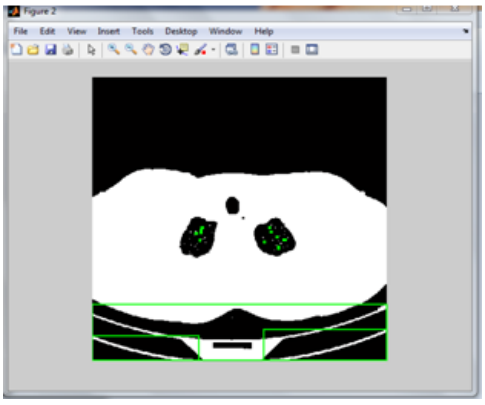

Figure 4: extracted region in the lung cancer image.

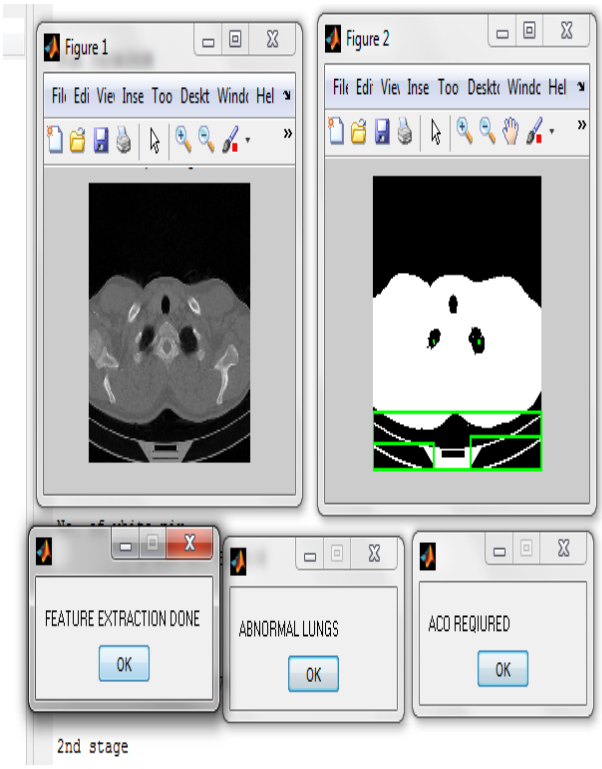

Figure 5: 2nd Stage cancer image with message box

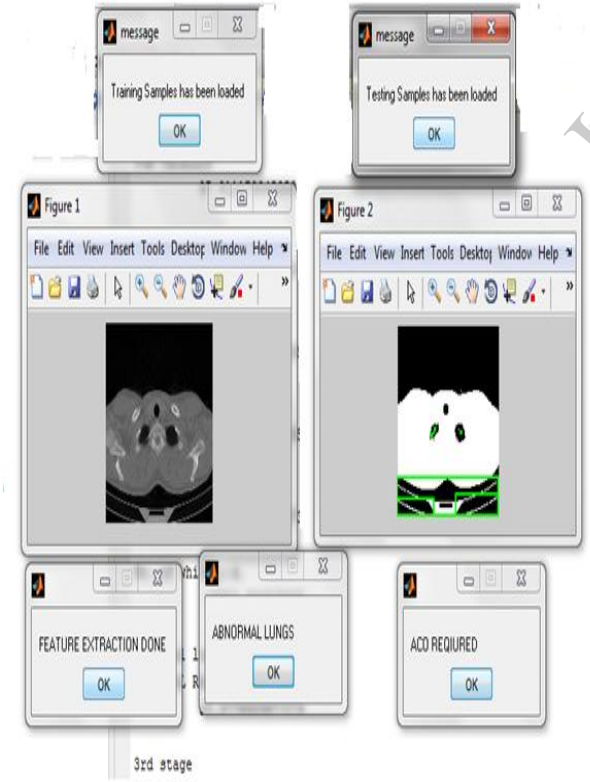

Figure 6: 3rd Stage cancer image with message box

Figure 5 and figure 6 show the 2nd and 3rd stage cancer. In this, image feature extraction is done to detect and isolate various desired portions or shapes (features) of the image. Both the images depict the abnormal lungs. In accordance with the output, Ant colony optimization techniques are further called to detect carcinoma stages.

Table 1: Extracted features of Dicom images

IMAGE NAME/ Parameters	198	199	200
AUTO CORELATION	27.7051125724143	26.9188151041666	27.1906351728355
Contrast	0.8563632630193	0.3633272058824	1.0561332404230
CO RELATION	1.4650878193786	0.8873155830901	1.0860531513365
CLUSTER PROMINENCE	96.5112527186052	95.9424341265417	94.8089211415824
cluster shade	12.2617341423246	11.8022603973000	12.4389719158550
Dissimilarity	1.1329644584046	0.1676470588235	0.6657048804431
Energy	0.9158178502448	0.3703458521578	0.8516315875380
Entropy	1.9053375333561	1.3793255750988	2.2795250054259
Homogeneity	1.1717752103401	0.9408601409314	1.5512801747706
Maximum probility	1.0077281667143	0.5198644301471	1.1380899496375
Sum variance	84.8650513980691	84.1162582574504	84.8068380204825
Sun entropy	1.9472701549438	1.2636747588725	2.0657451604345
Difference variance	0.7632695048843	0.3633272058824	0.9341089237029
Difference Entropy	0.8032365130565	0.4326675448408	0.6124112521290
Information measure	0.3220479106778	-0.6677612754671	-0.4277553649273
No. of white pix.	25273	23170	25713
Abnormal/Normal lungs	Abnormal lungs	Normal Lungs	Abnormal lungs
SURVIVAL RATE	50.9437337189868	64.4875427657525	50.0976067443759
Stage	2nd stage		3rd stage
YEARS	3.7398604829177		2.4697041655367
MONTHS	10.3885516207556		8.5037814370468

Table2:Classification of Survival Rate

IMAGE TYPE	SURVIVAL RATE	CLASSIFICATION
ABNORMAL	45-55%	TRUE
NORMAL	55-90%	TRUE

Table 3: Summarize Result

AUTO CORELATION	CONTRAST	CORELATION	RESULT
<=28	<=0.5	<=1	NO CANCER
>28	>0.5	>1	CANCER

V CONCLUSION

This paper concludes the lung carcinoma detection mechanism. There are two stages of detection. One is called training and another is called testing phase. In the training phase, Feature extraction is done with the help of the gray level co-occurrence method. In the classification stage a combination of two classification methods namely FUZZY and ACO has been used. The result shows the optimum and significant growth. The current research work can be further carried out on different algorithms such as BFO and it may be applied to different types of cancer.

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