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Early Detection of Common Ct Imaging Signs of Lung Diseases

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Abstract : *Frequently appearing image signs in lung CT images are used in diagnosing lung diseases. Pre-Processing is done using Gradient Anisotropic Diffusion Image Filter and Segmentation is done using Region Growing Filters. The features are extracted using Gray Level Co-occurence Matrix (GLCM).The feature values are classified using classifiers like Support Vector Machine(SVM), Neuro Fuzzy, Extreme Learning Machine (ELM).Optimal feature selection is done using Linear Discriminate Analysis.*

I. Introduction

Machine learning is a type of Artificial intelligence (AI) that provides computers with the ability to learn without being explicitly programmed. Machine learning focuses on the development of computer programs that can teach themselves to grow and change when exposed to new data.

The goal of machine learning, closely coupled with the goal of AI, is to achieve a thorough understanding about the nature of learning process (both human learning and other forms of learning), about the computational aspects of learning behaviours, and to implant the learning capability in computer systems.

Machine learning studies computer algorithms for learning to do stuff. We might, for instance, be interested in learning to complete a task, or to make accurate predictions, or to behave intelligently. The learning that is being done is always based on some sort of observations or data, such as examples, direct experience, or instruction. So in general, machine learning is about learning to do better in the future based on what was experienced in the past.

The emphasis of machine learning is on automatic methods. In other words, the goal is to devise learning algorithms that do the learning automatically without human intervention or assistance. The machine learning paradigm can be viewed as "programming by example." Often we have a specific task in mind, such as spam filtering. But rather than program the computer to solve the task directly, in machine learning, we seek methods by which the computer will come up with its own program based on examples that we provide.

Although a subarea of AI, machine learning also intersects broadly with other fields, especially statistics, but also mathematics, physics, theoretical computer science and more.

II. Implementation Techniques

2.1 Supervised Learning

Where the algorithm generates a function that maps inputs to desired outputs. One standard formulation of the supervised learning task is the classification problem: the learner is required to learn (to approximate the behaviour of) a function which maps a vector into one of several classes by looking at several input-output examples of the function.

2.2 Unsupervised Learning

No labels are given to the learning algorithm, leaving it on its own to find structure in its input. Unsupervised learning can be a goal in itself (discovering hidden patterns in data) or a means towards an end.

2.3 Semi-Supervised Learning

This combines both labeled and unlabeled examples to generate an appropriate function or classifier.

2.4 Reinforcement Learning

Where the algorithm learns a policy of how to act given an observation of the world. Every action has some impact in the environment, and the environment provides feedback that guides the learning algorithm

2.5 Transduction

Similar to supervised learning, but does not explicitly construct a function instead, tries to predict new outputs based on training inputs, training outputs, and new inputs.

2.6 Learning To Learn
Where the algorithm learns its own inductive bias based on previous experience

III. Literature Survey

3.1 M. J. Gangeh, L. Sørensen, S. B. Shaker, M. S. Kamel, andM. D. Bruijne,"Multiple classifier system in texton-based approach for the classificationof CT images of lung," Med. Comput. Vis., vol. 6533, pp. 153–163, Feb.2011.

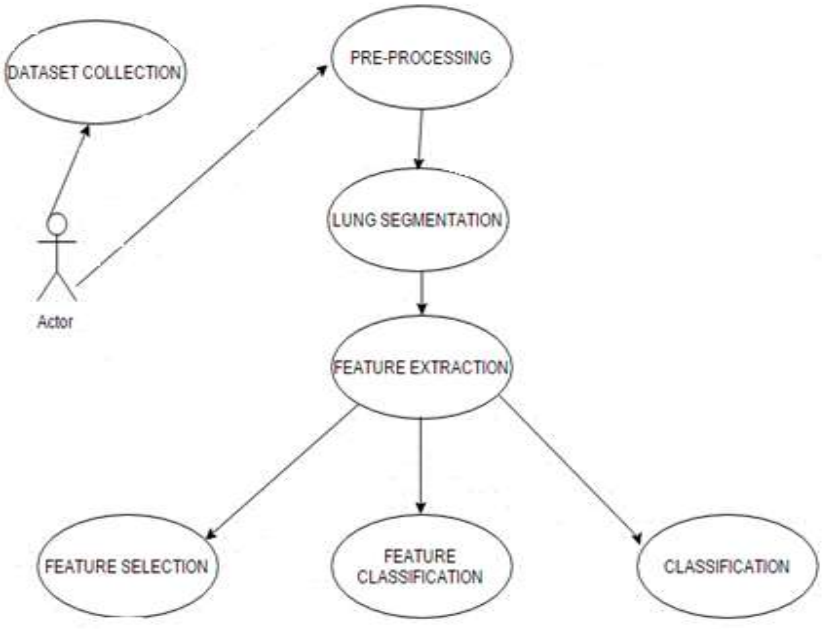
In this paper, Texture-based pixel classification in computed tomography (CT) images of the lung analysis of lung diseases such as emphysema, one of the main components of chronic obstructive lung disease Texton signatures based on raw pixel representation along with a parallel multiple classifier system for the classification of emphysema in computed tomography images of the lung. The multiple classifier system is composed of support vector machines on the texton signatures as base classifiers and combines their decisions using product rule. The approach is tested on 168 annotated regions of interest consisting of normal tissue, centrilobular emphysema, and paraseptal emphysema. Texton based approach in texture classification mainly has two parameters, i.e., texton size and k value in k-means. The results show that while aggregation of single decisions by SVMs over various k values using multiple classifier systems helps to improve the results compared to single SVMs, combining over different texton sizes is not beneficial. The performance of system, with an accuracy of 95%, is similar to a approach based on local binary patterns, which performs almost the best among other approaches in the literature.

3.3 A.Ozcift, "SVM feature selection based rotation forest ensemble classifiers to improve computer-aided diagnosis of parkinson disease," J. Med. Syst., vol. 36, no. 4, pp. 2141–2147, Aug. 2012.

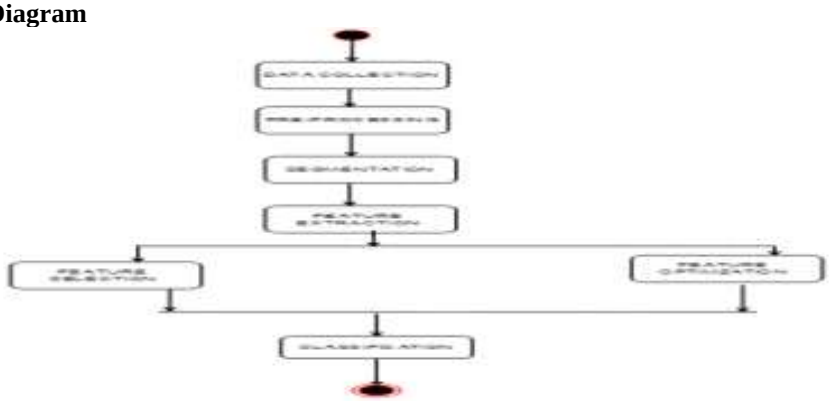
In this paper, Parkinson disease (PD) is an age-related deterioration of certain nerve systems, which affects movement, balance, and muscle control of clients. PD is one of the common diseases which affect 1% of people older than 60 years. A classification scheme based on support vector machine (SVM) selected features to train rotation forest (RF) ensemble classifiers is presented for improving diagnosis of PD. The diagnosis model first makes use of a linear SVM to select the most relevant features. As a second step of the classification model, six different classifiers are trained with the subset of features. Subsequently, at the third step, the accuracies of classifiers are improved by the utilization of RF ensemble classification strategy. The results of the experiments are evaluated using three metrics; classification accuracy, Kappa Error and Area under the Receiver Operating Characteristic Curve.

IV. System Design

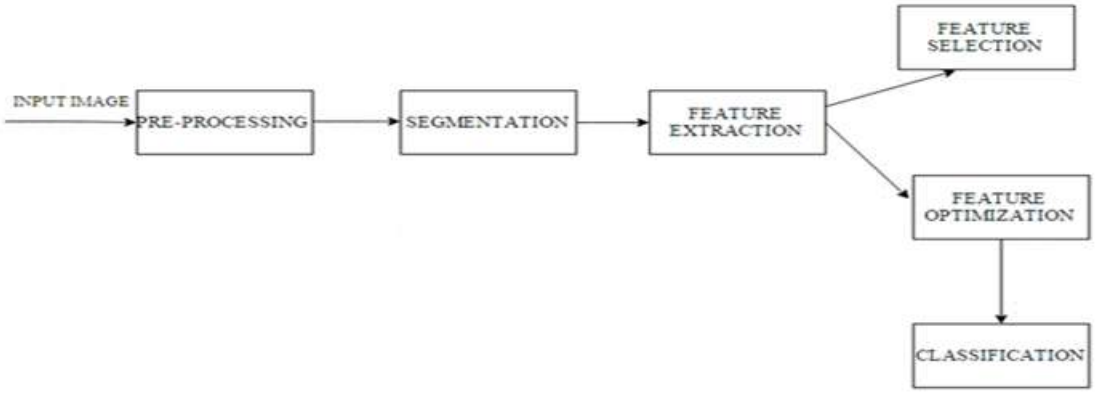
4.1 Use Case Diagram



4.2 Activity Diagram



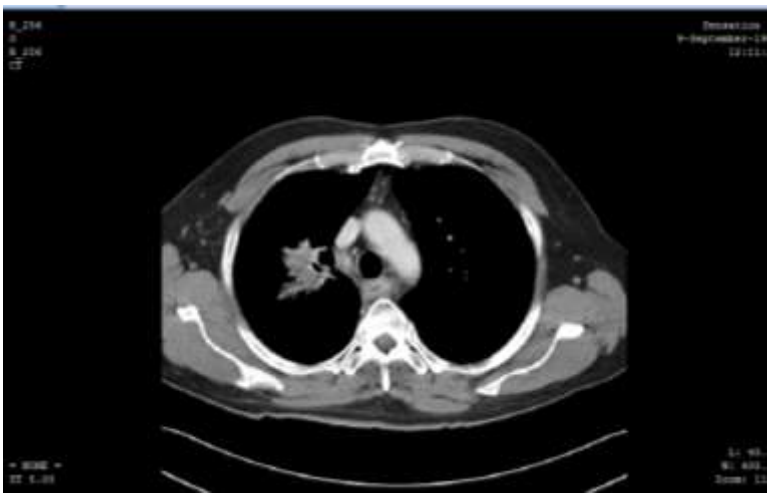
4.3 Data Flow Diagram



V. Module Description

5.1 Data Set

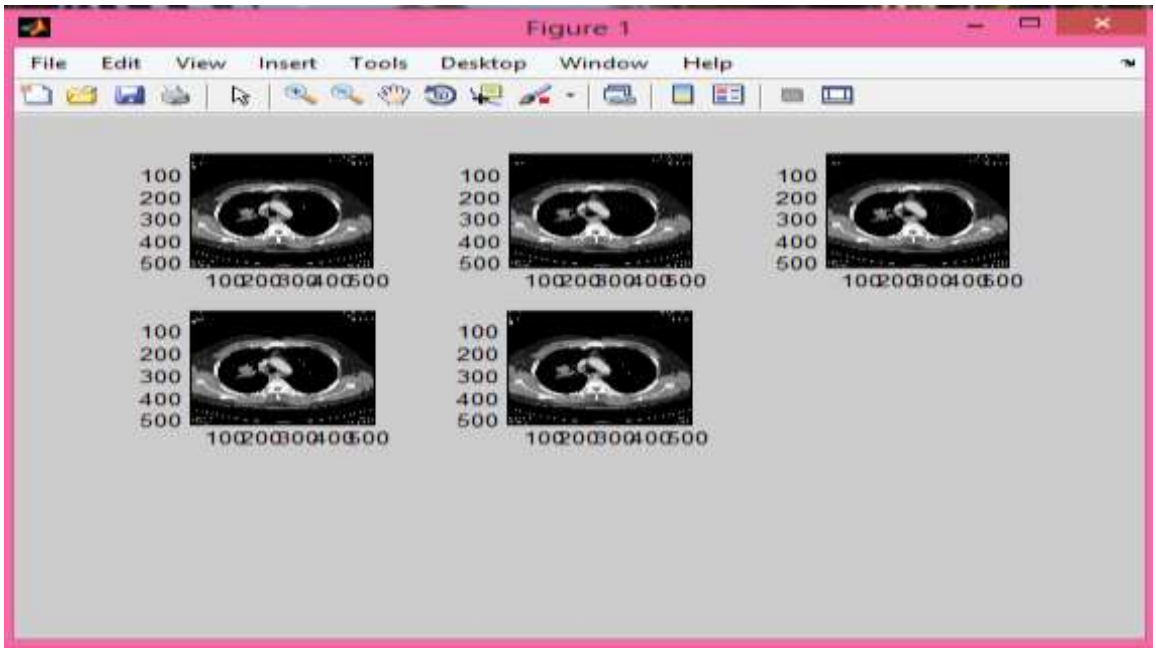
In this module, collection of lung CT scans of various patients is collected for analysis to recognize common signs of lung diseases.



5.2 Pre-Processing

Gradient Anisotropic diffusion Image Filter is a technique aiming to reduce image noise without removing significant parts of the image content i.e., edges, lines or other details that are important for the interpretation of the image. Anisotropic diffusion can be used to remove noise from digital images without blurring edges.

It checks whether the intensity is in proper order in all directions i.e. north, south, west, and east and finally returns the maximum information view of the given input image.



5.3 Image Segmentation

Image segmentation is the process of partitioning a digital image into multiple segments. The goal of segmentation is to simplify and/or change the representation of an image into something that is more meaningful and easier to analyze.

In our work, Region based segmentation is used segments an image based on similarity of intensity values between spatially adjacent pixels. Here we use fuzzy connectedness and region growing segmentation technique.

5.4 Region Growing Segmentation

Region growing is a simple region-based image segmentation method. It is also classified as a pixel-based image segmentation method since it involves the selection of initial seed points. This approach to segmentation examines neighbouring pixels of initial seed points and determines whether the pixel neighbours should be added to the region. The process is iterated on, in the same manner as general data clustering algorithms.

5.5 Fuzzy Connectedness Segmentation

These filters segments an image based on fuzzy connectedness principles. It starts with one or more seed points and grows regions around these seed points based on fuzzy affinity.

5.6 Feature Extraction

In our work we use Gray Level Co-Occurrence Matrix to extract the feature value from the image.

A statistical method of examining texture that considers the spatial relationship of pixels is the gray-level co-occurrence matrix (GLCM), also known as the gray-level spatial dependence matrix. The GLCM functions characterize the texture of an image by calculating how often pairs of pixel with specific values and in a specified spatial relationship occur in an image, creating a GLCM, and then extracting statistical measures from this matrix.

VI. Conclusion

The common signs of lung diseases that have been working on i.e. Ground Grass Opacity, Lobulation, Cavity and Vacuoles (CV), Spiculation, Pleural Indentation, Obstructive Pneumonia (OP), Calcification, Air Bronchogram (AB), Bronchial Mucus Plugs (BMP) are to be identified. Pre-processing has been successfully completed for lung CT Images other approaches are yet to be done. Hybrid approach is to be introduced for classification of lung diseases in order to increase the success rate and to reduce the false identification.

Acknowledgements

In future enhancement many more signs of lung diseases can also be introduced and these techniques can be used for recognizing various organ diseases in kidney, heart, brain, etc.

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