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A

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CERTIFICATE

Certified that this seminar report titled **Seminar Title** is the bonafide record of the work done by **Name of Student** (Reg. No: 13141432) of B.Tech. Electronics and Communication Engineering, towards the partial fulfillment of the requirement for the award of the Degree of Bachelor of Technology, by the APJ Abdul Kalam Technological University, in the year 2021.

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The Student is free to acknowledge all those he/she feels he/she should acknowledge on the basis of the guidance and help provided during the seminar

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ABSTRACT

Each year about 19,000 people in the United States are diagnosed with primary brain cancers. The risk of developing brain cancer increases with age. Cancers of the brain are the consequence of abnormal growths of cells in the brain. The increased use of CT (Computed Tomography), correlates with the increased incidence trends, and represents a greater tendency of physicians to aggressively pursue brain diagnoses in older patients. CT has become a commonly performed procedure which is a noninvasive, safe, and well-tolerated one. The brain CT examines the various structures of the brain to look for a mass, stroke, area of bleeding, or blood vessel abnormality. It provides a highly detailed look at many different parts of the body. We develop a novel Computer Aided Diagnosis(CAD) system for tumour detection and classification in brain image based on the Fuzzy Support Vector Machine. The system follows the basic steps of CAD system such as preprocessing, segmentation, feature extraction and selection and classification. The classified results are then evaluated using five measurements such as accuracy, sensitivity, specificity, positive predictive value and negative predictive value. The system thus developed will be an effective and accurate approach in the diagnosis of Brain Tumour.

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Chapter 1

Introduction

Cancers of the brain are the consequence of abnormal growths of cells in the brain. Any brain tumour is inherently serious and life-threatening because of its invasive and infiltrative character in the limited space of the intracranial cavity. Each year about 19,000 people in the United States are diagnosed with primary brain cancers. Imaging plays a central role in the diagnosis of brain tumours. Computed Tomography (CT) has become a commonly performed procedure which is a noninvasive, safe, and well-tolerated one. The brain CT examines the various structures of the brain to look for a mass, stroke, area of bleeding, or blood vessel abnormality. Patients with benign gliomas may survive for many years, while survival in most cases of glioblastoma multiforme is limited to a few months after diagnosis if treatment is ignored (do nothing option), but cases are known of glioblastoma multiforme that have survived over 20 years and have a good quality of life after successful treatment. Earlier we diagnosis the disease, better will be the progress of the treatment

Computer-aided diagnosis (CAD) systems can help radiologists in interpreting brain CT for tumour detection and classification. The combination of CAD scheme and experts' knowledge would greatly improve the detection and classification accuracy. This paper focuses on developing a novel CAD system for automatic tumour detection and classification using brain CT images, which involves four stages:

- Preprocessing: Sometimes the images are in low contrast. Image preprocessing suppresses noise and enhances the contrast between the suspicious areas and tissue background.

- Segmentation: Segmentation is the process of dividing an image into nonoverlapping regions, such that each region is homogeneous but the union of any two neighbouring

regions is inhomogeneous. In this paper, the Markov random field segmentation algorithm is adopted to locate the suspicious region from the preprocessed ROI (Region Of Interest) in stage 1.

- Feature extraction and selection: In the proposed CAD system, we analyze and extract three kinds of features (textural, fractal and histogram-based features) from the suspicious areas and ROIs. Usually, a large amount of features are extracted and we need to select the significant ones from them. In this paper, we apply the stepwise regression method to select an optimal subset of features.

- Classification and evaluation: In this paper we propose a novel membership function and apply the resulted fuzzy support vector machine (FSVM) as the classification tool.

Based on the optimal subset of features selected from step 3, the suspicious is classified as benign or malignant. Five objective measurements (accuracy, sensitivity, specificity, positive predictive value, and negative predictive value) are used to evaluate the classification results. The higher the five measurements are, the more reliable and valid the CAD system is.

Chapter 2

Materials and methods

Medical images such as CT scans of brain are collected from the archives of hospitals that routinely screen patients for cancer. Around 180 cases are used for the work.

2.1 Preprocessing and segmentation

Here, we only briefly describe the preprocessing and segmentation methods of the proposed CAD system [2]. Image enhancement is one of the most important issues in low-level image processing. The underlying principle of the enhancement is to enlarge the intensity difference between objects and surroundings without both the over enhancement and under enhancement. A lot of enhancement methods have been developed that can mainly be divided into two classes: local and global methods. We employ the previously developed Multi-peak GHE (Generalized Histogram Equalization) method due to its effectiveness in enhancing the image and its textures. By changing the order of the gray levels in the image, the enhancement procedure is made completely controllable. Image segmentation can be considered as a labelling problem wherein the solution is to assign a set of labels to image pixels. The algorithm based on Markov Random Field (MRF) is adopted in this paper. It makes the system more consistent with the global model. Therefore, it is more tolerant to noise, and requires less iteration to converge [1].

shows the flowchart of the proposed approach. Fig 2.1 show the original image and its multi-peak histogram equalized image.

Figure 2.1: An example graph

2.2 Feature extraction and selection

A key stage of tumour detection and classification by Computer-Aided Diagnosis (CAD) schemes is feature analysis and extraction. The most important issue in feature analysis is that the selected features should be able to represent the characteristics of the tumours, and based on these features, the malignant can be discriminated from the benign ones.

2.2.1 Textural features

Textural features are based on co-occurrence matrices of the texture information. All textural features are derived

Figure 2.2: river

Chapter 3

Environments

This chapter will show how different environments can be used within latex

3.1 Table

This section will show how a table3.1 can be created

Table 3.1: Example of table

cell1	cell2	cell3
cell4	cell5	cell6
cell7	cell8	cell9

3.2 equation

LaTeXallows two writing modes for mathematical expressions: the inline mode and the display mode. The first one is used to write formulas that are part of a text. The second one is used to write expressions that are not part of a text or paragraph, and are therefore put on separate lines.

3.2.1 inline

Let's see an example of the inline mode:

The well known Pythagorean theorem $x^2 + y^2 = z^2$ was proved to be invalid for other exponents. Meaning the next equation has no integer solutions:

$$x^n + y^n = z^n$$

Let's see another example of the inline mode:

In physics, the mass-energy equ ivalence is stated by the equation $E = mc^2$, discovered in 1905 by Albert Einstein.

Let's see another example of the inline mode:

In physics, the mass-energy equ ivalence is stated by the equation $E = mc^2$, discovered in 1905 by Albert Einstein.

3.2.2 displayed mode

The displayed mode has two versions: numbered and unnumbered.

The mass-energy equivalence is described by the famous equation

$$E = mc^2$$

discovered in 1905 by Albert Einstein. In natural units ($c = 1$), the formula expresses the identity

$$E = m \tag{3.1}$$

3.3 matrix

this section will describe how to write a mtrix

$$\begin{bmatrix} x_{11} & x_{12} & x_{13} & \dots & x_{1n} \\ x_{21} & x_{22} & x_{23} & \dots & x_{2n} \\ \dots & \dots & \dots & \dots & \dots \\ x_{d1} & x_{d2} & x_{d3} & \dots & x_{dn} \end{bmatrix} = \begin{bmatrix} x_{11} & x_{12} & x_{13} & \dots & x_{1n} \\ x_{21} & x_{22} & x_{23} & \dots & x_{2n} \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ x_{d1} & x_{d2} & x_{d3} & \dots & x_{dn} \end{bmatrix} \tag{3.2}$$

the equation3.1

3.4 points

3.4.1 bulleted

- Preprocessing: Sometimes the images are in low contrast. Image preprocessing suppresses noise and enhances the contrast between the suspicious areas and tissue background.
- Segmentation: Segmentation is the process of dividing an image into nonoverlapping regions, such that each region is homogeneous but the union of any two neighbouring regions is inhomogeneous. In this paper, the Markov random field segmentation algorithm is adopted to locate the suspicious region from the preprocessed ROI (Region Of Interest) in stage 1.
- Feature extraction and selection: In the proposed CAD system, we analyze and extract three kinds of features (textural, fractal and histogram-based features) from the suspicious areas and ROIs. Usually, a large amount of features are extracted and we need to select the significant ones from them. In this paper, we apply the stepwise regression method to select an optimal subset of features.
- Classification and evaluation: In this paper we propose a novel membership function and apply the resulted fuzzy support vector machine (FSVM) as the classification tool.

3.4.2 numbered

1. Preprocessing: Sometimes the images are in low contrast. Image preprocessing suppresses noise and enhances the contrast between the suspicious areas and tissue background.
2. Segmentation: Segmentation is the process of dividing an image into nonoverlapping regions, such that each region is homogeneous but the union of any two neighbouring regions is inhomogeneous. In this paper, the Markov random field segmentation algorithm is adopted to locate the suspicious region from the preprocessed ROI (Region Of Interest) in stage 1.
3. Feature extraction and selection: In the proposed CAD system, we analyze and extract three kinds of features (textural, fractal and histogram-based features) from the

suspicious areas and ROIs. Usually, a large amount of features are extracted and we need to select the significant ones from them. In this paper, we apply the stepwise regression method to select an optimal subset of features.

4. Classification and evaluation: In this paper we propose a novel membership function and apply the resulted fuzzy support vector machine (FSVM) as the classification tool.

References

[1] Michel Goossens, Frank Mittelbach, and Alexander Samarin. *The LaTeX Companion*. Addison-Wesley, Reading, Massachusetts, 1993.

[2] Albert Einstein. *Zur Elektrodynamik bewegter Körper*. (German) [*On the electrodynamics of moving bodies*]. Annalen der Physik, 322(10):891–921, 1905.

[3] Knuth: Computers and Typesetting,
`http://www-cs-faculty.stanford.edu/~uno/abcde.html`

Appendices

Appendix A

First appendix

A.1 Verbatim

```
Text enclosed inside \texttt{verbatim} environment
is printed directly
and all \LaTeX{} commands are ignored.
\textbf{seminar}
```

A.2 Second section

Appendix B

Second appendix

B.1 First section

B.2 Second section