Tumor Detection using Normalized Cross Co-Relation

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Abstract:
Tumor detection is basically used to detect tumors and serve as a helping hand for doctors. There are many techniques to detect the tumor. In few traditional systems patients xray with tumor as well as without tumor was required, that was the basic disadvantage of that systems. This paper there is a detail survey of tumor detection using template matching algorithm.systems Various techniques can be used to detect tumor like Image segmentation using Histogram thresholding, Segmentation Based on Soft Computing , hybrid Genetic Algorithm and Artificial Neural Network Fuzzy Inference System , Digital image processing based on soft computing etc in matlab. After survey the best method is selected. This system is having relatively low false positive rate and false negative rate.

Keywords: *Cancer, Tumor, Tumor detection*

1. Introduction

Cancer can be counted as the most deadliest of diseases. Also tumors in any part of body can prove to be dangerous. There are various biological and medicinal ways to detect tumors, but here in this tumor detection computer is trained to detect tumors. Time can be saved by using this system. Template matching algorithm is used in this system. This system only detects the tumors which are stored in database. Any other type of tumor cannot be detected .Some of the traditional systems needed both the x-ray with tumor as well as the x-ray without tumor and then comparison is done. But this technique doesn't require the same.

2. Tumor Detection System

In Tumour detection system, there are basically four components. These components are listed below. Acquisition: Image acquisition is the first step of this technique. Image acquisition in simple terms means acquiring or getting image. For detecting tumour there has to be an image from which it can be detected. There are several ways for acquiring images like using web cam,

using scanner, or browsing it from internet. But in this system image is acquired manually that is stored in database. Also using imread command in matlab we can acquire an image.

Cropping: This system cannot detect new kind of tumours. So for the first time we have to manually crop the tumor image and store it inside the database. Now if the same kind of tumor occurs the second time then it can be easily found out. So for the first time the image has to be cropped.

Processing: The image acquired may contain large amount of noise which must be removed for smooth processing. Also, if the image is colourful then it must be converted to grey scale image. Coloured image requires a lot of computational time so in order to reduce the same we need to convert it into grey scale image.

Comparing: After pre-processing the last step is to compare our image with the cropped images stored in the database. Using the required algorithm the images are compared and if the result matches then the tumor part will be detected.

3. Literature Survey

3.1 Various Different Techniques

To detect a tumour from different images there are several techniques used. Where, some of them are based on pure comparison, wherein user has to take two inputs. That is an image of a person's x-ray having tumour and another one without tumour. And then based on the comparison between the two of them and the difference which we get, the result is declared whether the tumour is present or absent. Also there are several other techniques specially used for detection of brain tumours. Histogram thresholding is one of them. Human brain is basically symmetrical in shape. Hence it can be assumed that the tumour is either on the left or the right side of the central axis. So based on the comparisons between both the histograms the tumour can be detected.

Template matching is a technique in digital image processing for finding small parts of an image which match a template image. To perform template matching algorithm there are several different concepts in matlab, here we have used normalised cross co relation. In signal processing **cross co relation** is a measure of similarity of two waveforms as a function of a time-lag applied to one of them. This is also known as a sliding dot product or sliding inner-product. It is commonly used for searching a long-signal for a shorter, known feature. Here we have used feature based template matching mechanism using NCC.

4. Implementation

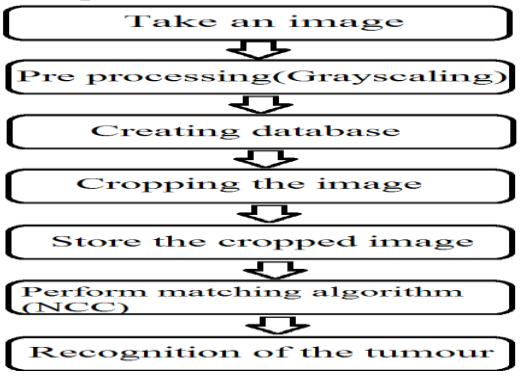

Fig.1 Steps for Implementation

For implementation the tool used is matlab . The steps for implementation are depicted in the figure 1.

4.1 Take an Image

Taking an image simply means acquiring an image for the purpose of detection. For the detection of tumour you must browse an imagewhich needs to be tested . There are various different ways for taking an image ,but here we need to insert an image manually.

4.2 Preprocessing(Gray Scaling)

If the image is a coloured one then it must be reduced to gray scale image. Also, an image can contain lots of noise or some other faults so preprocessing is

used to purify the image and it also reduces it to gray scale image which is important for getting good computational speed. rgb2gray command is used in matlab for conversion in gray scale.

4.3 Creation of Database

Database is the most important thing. If any new tumour is recognised then the image of that particular tumour must be inserted in database so that in future if another similar tumour is there it can be detected fast . There are two folders for database namely target and template.Target database mailny contains the images that needs to be tested. Can be an x-ray image or an MRI image . For example some of the images are shown in below figure.

Fig. 2 X-Ray Image or an MRI Image

Template images: Template databsase basically contains that images which are to be compared with the images in target folder. Basically the images of tumour which are cropped are stored in the template folder. Then template matching algorithm can be used to compare both the images and hence the tumor, if there, can be detected.

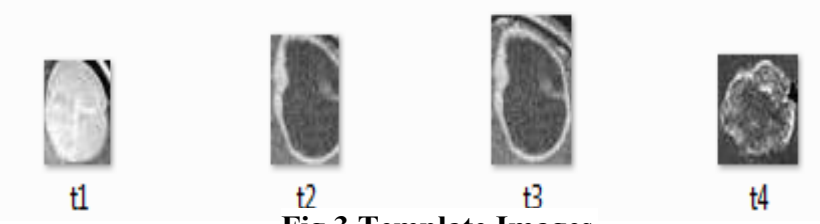

Fig.3 Template Images

4.5 Cropping an Image

If in a particular image the tumor is not detected by this method then the doctors have to detect it by themselves using the medicinal tests. Now after detection tumour the image can be further stored in the datbase so that in future if the same kind of tumour occurs then it can be easily recognised. For that purpose we can use imcrop function in matlab.

4.6 Store the Cropped Image

After applying crop function and cropping the tumour part image , the image further needs to be stored in the template database for the future use. Template image already consists different kind of and different types of tumour images, hence if we get a new kind of tumour then we need to store it in the database.

4.7 Perform Template Matching Algorithm(NCC)

To perform template matching in matlab, we have used the concept of normalized cross co relation. In signal processing, cross-correlation is a measure of similarity of two waveforms as a function of a time-lag applied to one of them. This is also known as a sliding dot product or sliding inner-product. It is commonly used for searching a long-duration signal for a shorter, known feature. For image-processing applications in which the brightness of the image and template can vary due to lighting and exposure conditions, the images can be first normalized. This is typically done at every step by subtracting the mean and dividing by the standard deviation.

4.8 Recognition of Tumour

Finally after performing template matching algorithm using normalised cross correlation tumour can be detected. If the tumour is present it will be depicted using a rectangular box, otherwise if not then image will remain as it is.

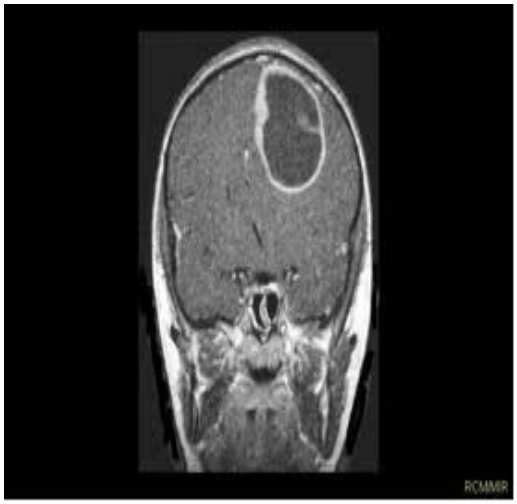

Fig. 4: Original image

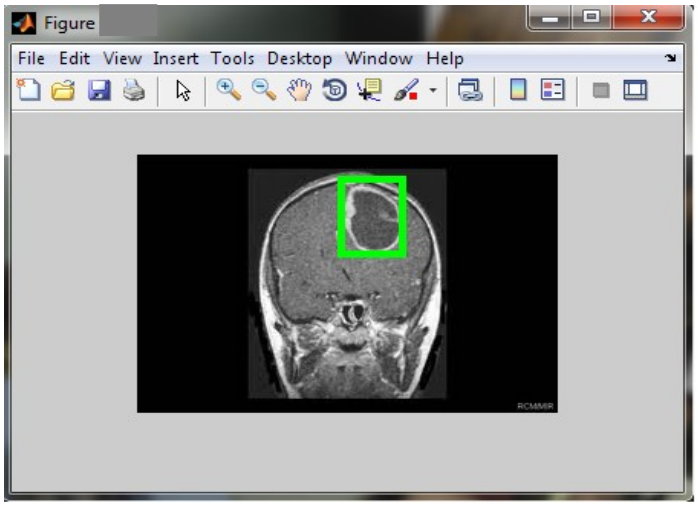

Fig. 5: Tumour Detected

5. Limitations

As we know that every system and algorithm is not 100% efficient. So here our system also has some limitations. Sometimes even that part of an image is detected this is not a tumour as shown in figure 6. This thing happens as there is same type of tumour image in the template database, so even if it is not a tumour it will be detected. This is known as false positive rate.

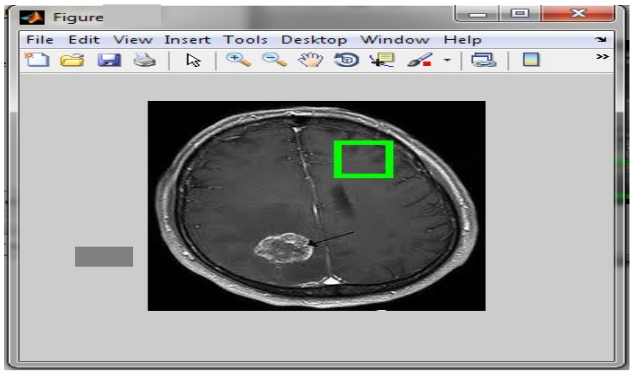

Fig. 6: False Positive Rate

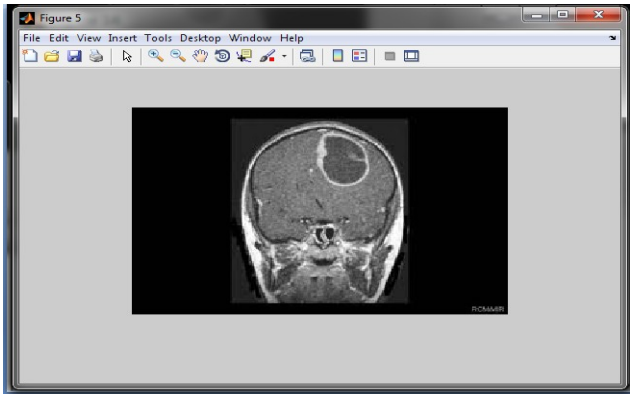

Fig. 5: False Negative Rate

Also it happens sometimes that tumour is present but it does not detect it. No rectangle is displayed. As shown in figure 5.This is known as false negative rate.

Now using the false positive and false negative rates we can calculate the approximate efficiency of the system.

6. Conclusion

Tumour detection system refers to identification of various different kinds of tumours. We have taken various images of different kinds of tumour. Different image processing techniques have been surveyed and implemented for checking purpose. For tumour detection various techniques like histogram thresholding, soft computing etc has been researched .Out of them the best suited technique that we have used is template matching. Also when the image is taken pre processing is done and then images are stored

in databases namely target and template. And then, at last template matching algorithm is applied. For implementation of template matching mechanism normalised cross correlation technique is used over here.

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