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To Detect Deep Vein Thrombosis From CT Scan Images Using Modern Neural NetworkTechnique

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Abstract

These days Machine Learning has been very much useful in Healthcare sector. In particularly, our proposed framework focuses on one of the most common condition known as Deep Vein Thrombosis(DVT). Deep vein blood clots typically form in your thigh or lower leg, but they can also develop in other areas of your body. Deep vein thrombosis (DVT) is a blood clot commonly found in deep veins of the lower extremities. Deep vein thrombosis (DVT) is a serious condition that occurs when a blood clot forms in a vein located deep inside your body.A blood clot is a clump of blood that's turned to a solid state. Every year, 60,000-100,000 Americans die of complications arising from DVT. Patients who get CT scans are frequently discharged before a radiologist looks at the scan. Early and automated detection is critical for lowering fatalities and in regions with few radiologists. In our proposed system, the input image is trained through several layers. Initially, the input image is subjected to canny feature detector. After feature detection the feature mapissent to the convolution layer where Rectified Linear Unit (ReLu) activation function is used. The second layer which we use is the max pool layer where the maximum value from each of the feature map obtained from previous layer is detected. The third layer is the flatten layer where the feature map is reduceto 1D. The feature maps obtained through all these layers are connected in the final layer which is Fully Converted layer. Also Dropout layer is used to avoid over fitting. Unet architecture is found to give more accuracy than any other traditional models and also it is oneof the modern architectures employed in Machine Learning Domain.

1. Introduction

Overview

Deep vein thrombosis (DVT) is a serious condition that occurs when a blood clot forms in a vein located deep inside your body. Patients who get CT scans are frequently

discharged before a radiologist looks at the scan. Early and automated detection is critical for lowering fatalities and in regions with few radiologists. In our proposed system, the input image is trained through several layers. Unet architecture is found to give more accuracy than any other traditional models and also it is one of the modern architectures employed in Machine Learning Domain. In Future enhancement, this model can be improved with high precision to be used by radiologists.

Application of the Project

The project is found to be very much useful in the field of Healthcare and Sciences. It is especially useful for the Radiology department, where the radiologists identify the scan images to find whether DVT is present or not manually. Since, our proposed system focuses on automated detection of DVT , it would reduce manual cost and time. So our proposed system is found to be very much helpful for the radiologists as well as haemotologists.

2. Literature Survey

[1] presents a two-stage CNN for automated detection of pulmonary embolisms (PEs) on CTPA images.A study have been Conducted to examine the impact of each component in the proposed system.The appearance of all possible PEs could vary significantly on the three cross-section is one of the disadvantages. [2] the system, this is the first time that this approach is used to predict VTE/DVT in ovarian cancer patients, dealing with data imbalance. Proposed segmentation method outperforms the other conventional segmentation. The disadvantage is that no previous evidence that MLR and NLR are predictors of thrombotic events.[3] System is aiming to relate the blood clot structure to its age, its formation cause and PE risk. It gives a accuracy 76% on average.Not secure and not efficient. The proposed system [4] is an analysis of the ability of the Wells score to identify DVT/PE events in athletes through a review of published case reports. It first report to critically analyze application of the Wells score to diagnosis DVT/PE among athletic population. Less efficient and less accuracy.
The device is designed to assist the blood flow in a natural mechanism to improve venous outflow.T he device is expected to improve the blood flow in the lower limb and possibly make a difference in the field of prophylaxes. There is no evidence that the peak venous velocity produced by a system is a valid measure of medical performance[5]

3. SYSTEM ANALYSIS

EXISTINGSYSTEM

Images acquired using under loosely-controlled environmental conditions
may be subject to various distortions, and this makes melanoma detection more difficult. Second, processing performed on a subject to stringent computation and memory constraints.

PROPOSEDSYSTEM

The first algorithm to automatically segment scaling directly from normal image in 3D Digital images. The approach is to reduce the problem of segmentation of affected area from consideration and then classifying the remaining pixels as either skin pixels or scaling pixels. The feature space used in the classification is derived from the color contrast between scaling and affected area and the image texture describing the roughness of scaling which is determined by the aggregated result from a bank of Gabor filters. The segmentation is achieved by using one of the modern Convolutional Neural Network(CNN) architecture. The proposed system focuses on providing a cost and time effective model to detect Deep Vein Thrombosis(DVT) with more accuracy. The model used in the proposed framework is one of the modern architectures in Machine Learning, Unet. In the proposed framework several layersare used to build and train the model which will give us the output with more accuracy.

4. MODULES

MODULE INTRODUCTION

- A modular design reduces complexity, facilities change (a critical aspect of software maintainability), and results in easier implementation by encouraging parallel development of different part of system. Software with effective modularity is easier to develop because function may be compartmentalized and interfaces are simplified. Software architecture embodies modularity that is software is divided into separately named and addressable components called modules that are integrated to satisfy problem requirements.
- Modularity is the single attribute of software that allows a program to be intellectually manageable. The five important criteria that enable us to evaluate a design method with respect to its ability to define an effective modular design are: Modular decomposability, Modular Comps ability, Modular Understandability, Modular continuity, Modular Protection.

- The following are the modules of the project, which is planned in aid to complete the project with respect to the proposed system, while overcoming existing system and also providing the support for the future enhancement.

MODULES IMPLEMENTATION

- Feature Extraction
- Image Preprocessing
- Image Segmentation
- Image Classification

Feature Extraction:

In image processing, feature extraction starts from an initial set of measured data and builds derived values (features) intended to be informative and non-redundant, facilitating the subsequent learning and generalization steps, and in some cases leading to better human interpretations. Feature extraction is related to dimensionality reduction.

When the input data to an algorithm is too large to be processed and it is suspected to be redundant (e.g. the same measurement in both feet and meters, or the repetitiveness of images presented as pixels), then it can be transformed into a reduced set of features (also named a features vector). This process is called feature selection. The selected features are expected to contain the relevant information from the input data, so that the desired task can be performed by using this reduced representation instead of the complete initial data.

General

Feature extraction involves reducing the amount of resources required to describe a large setof data. When performing analysis of complex data one of the major problems stems from the number of variables involved. Analysis with a large number of variables generally requires a large amount of memory and computation power, also it may cause a classification algorithm to over fit to training samples and generalize poorly to new samples. Feature extraction is a general term for methods of constructing combinations of the variables to get around these problems while still describing the data with sufficient accuracy.

The best results are achieved when an expert constructs a set of application- dependent features, a process called feature engineering. Nevertheless, if no such expert knowledge is available, general dimensionality reduction techniques may help.

Image processing

One very important area of application is image processing, in which algorithms are used to detect and isolate various desired portions or shapes (features) of a digitized image or video stream. It is particularly important in the area of optical character recognition.

Edge Detection

Edge detection is an image processing technique for finding the boundaries of objects within images. It works by detecting discontinuities in brightness. Edge detection is used for image segmentation and data extraction in areas such as image processing, computer vision, and machine vision. Common edge detection algorithms include Sobel, Canny, Prewitt, Roberts, and fuzzy logic methods.

The purpose of detecting sharp changes in image brightness is to capture important events andchanges in properties of the world. It can be shown that under rather general assumptions for an image formation model, discontinuities in image brightness are likely to correspond to:

In the ideal case, the result of applying an edge detector to an image may lead to a set of connected curves that indicate the boundaries of objects, the boundaries of surface markings as well as curves that correspond to discontinuities in surface orientation. Thus, applying an edge detection algorithm to an image may significantly reduce the amount of data to be processed and may therefore filter out information that may be regarded as less relevant, while preserving the important structural properties of an image. If the edge detection step is successful, the subsequent task of interpreting the information contents in the original image may therefore be substantially simplified. However, it is not always possible to obtain such ideal edges from real life images of moderate complexity. Edges extracted from non-trivial images are often hampered by fragmentation, meaning that the edge curves are not connected,missing edge segments as well as false edges not corresponding to interesting phenomena in the image – thus complicating the subsequent task of interpreting the image data. Edge detection is one of the fundamental steps in image processing, image analysis, image pattern recognition, and computer vision techniques.Edge detection is a well-developed field on its own within image processing.

Region boundaries and edges are closely related, since there is often a sharp adjustment in intensity at the region boundaries. Edge detection techniques have therefore been used as the base of another segmentation technique. The edges identified by edge detection are often disconnected. To segment an object from an image however, one needs closed region boundaries. The desired edges are the boundaries between such objects or spatial-taxons. Spatial-taxons are information granules, consisting of a crisp pixel region, stationed at abstraction levels within hierarchical nested scene architecture. They are similar to the Gestaltpsychological designation of figure-ground, but are extended to include foreground, object groups, objects and salient object parts. Edge detection methods can be applied to the spatial- taxon region, in the same manner they would be applied to a silhouette. This method is particularly useful when the disconnected edge is part of an illusory contour.

Canny Edge Detector

The Cannyedge detector is an edge detection operator that uses a multi-stage algorithm todetect a wide range of edges in images. It was developed by John F Canny in 1986. Canny also produced a computational theory of edge detection explaining why the technique works.

Canny edge detection is a technique to extract useful structural information from different vision objects and dramatically reduce the amount of data to be processed. It has been widely applied in various computer vision systems. Canny has found that the requirements for the application of edge detection on diverse vision systems are relatively similar. Thus, an edge detection solution to address these requirements can be implemented in a wide range of situations.

5. Result

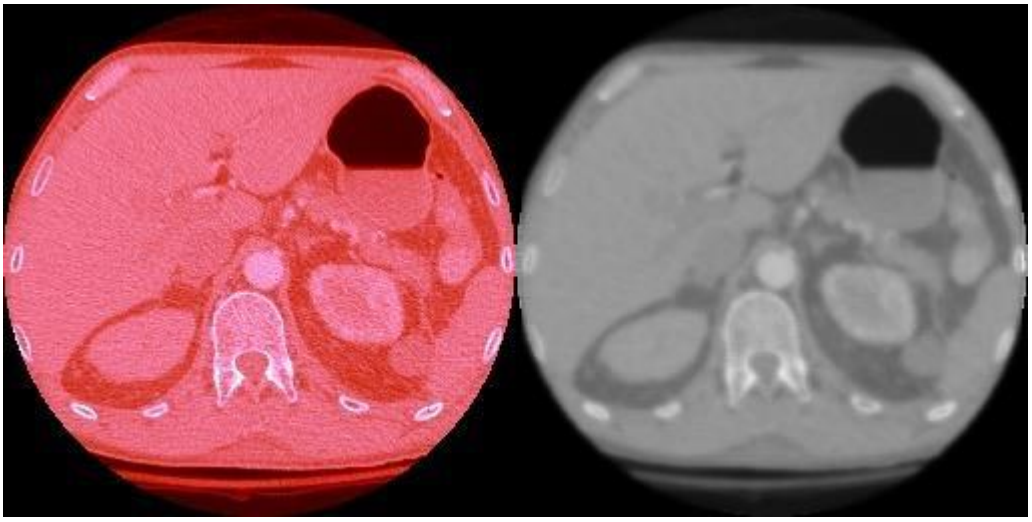

Fig. 1 Input Image and Gaussian Blur

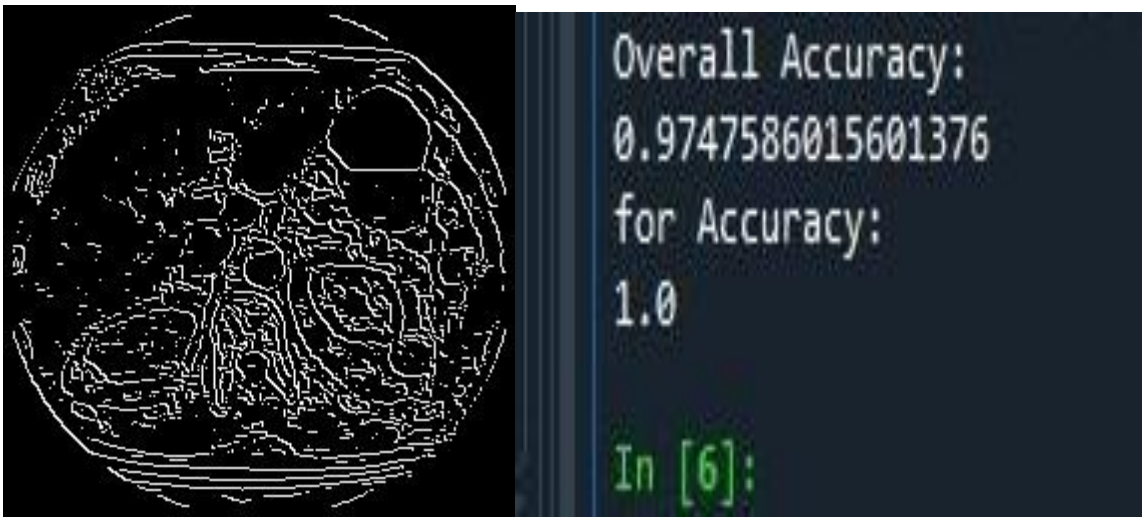

Fig. 2 Canny Edge Detection output Image

6. Conclusion

Thus Deep Vein Thrombosis (DVT) detection from CT scan images has been done successfully using Unet architecture. Hence, the proposed system works well and gives an accuracy of 97% . Thus, the proposed system works efficiently and this can be used in real time environment.

Future Enhancements

The discussion surrounds certain parameters like, Future work includes investigate the performance of our system on cross-center CTPA images and data. Also can be used to detect thrombosis in artries. Embolism can also be detected using the same technique. This could be very much useful in preventing Pulmonary Embolism.

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