

Intelligent Brain Hemorrhage Diagnosis Using Artificial Neural Networks

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Abstract—Brain hemorrhage is a type of stroke which is caused by an artery in the brain bursting and causing bleeding in the surrounded tissues. Diagnosing brain hemorrhage, which is mainly through the examination of a CT scan enables the accurate prediction of disease and the extraction of reliable and robust measurement for patients in order to describe the morphological changes in the brain as the recovery progresses. Though a lot of research on medical image processing has been done, still there is opportunity for further research in the area of brain hemorrhage diagnosis due to the low accuracy level in the current methods and algorithms, coding complexity of the developed approaches, impracticability in the real environment, and lack of other enhancements which may make the system more interactive and useful. Additionally many of the existing approaches address the diagnosis of a limited no of brain hemorrhage types.

This project investigates the possibility of diagnosing brain hemorrhage using an image segmentation of CT scan images using watershed method and feeding of the appropriate inputs extracted from the brain CT image to an artificial neural network for classification. The output generated as the type of brain hemorrhages, can be used to verify expert diagnosis and also as a learning tool for trainee radiologists to minimize errors in current methods. The prototype developed using Matlab can help medical students to practice the related concepts they learn using an image guide with examples for surgeries and surgical simulation. System was evaluated by the domain experts, like radiologists, intended users such as medical students as well as by technical experts. The prototype developed was successful since it was being evaluated as credible, innovative and useful software for the students in the field of radiology while 100% of the evaluators mentioned the diagnosis accuracy is acceptable.

Keywords; Medical Image Processing, Neural network, Watershed, fuzzy c means, Intelligent Brain Hemorrhage Diagnosis

I. INTRODUCTION

Brain hemorrhages; also termed cerebral hemorrhages, intracranial hemorrhages or intracerebral hemorrhages by their types; is a type of a stroke which is caused by an artery in the brain bursting and causing bleeding in the surrounded tissues. . “The Dana guide to Brain Health”[1] states, in each year cerebral hemorrhages are affecting 7 people out of every 100,000 in the west while 220 out of every 100,000 in Asia. The statistics have shown that there is a higher risk for brain hemorrhages to Africans, Asians and Hispanics in the United States than the Whites. It also says that women tend

to be affected more than men by a ratio of 3 to 2. High blood pressure, alcohol usage, and smoking are known risk factors while heredity also plays a major role in causing brain hemorrhage. Additionally more than 80% of people are suffering due to being born with weak spots in their major brain arteries. [1].

However according to medical specialists’ early diagnosis of the condition and obtaining immediate and relevant treatment can be a lifesaver for affected patients. The main techniques and tools which help in diagnosing of this disease is the human brain Computed Tomography [CT] image obtained from the CT scan and an expert such as an experienced doctor who will be able to extract the important symptoms of the disease from the image by naked eye.

Aim of this research is to design, develop and evaluate an easy to use, intelligent and accurate system which enables users like radiologists or medical students as well as doctors to feed brain CT images and to diagnose whether there is a hemorrhage and specify the type of hemorrhage if one exists using Fuzzy C means and Watershed Algorithm along with neural network for hemorrhage classification.

II. CURRENT METHODS

Manual Systems

Computerized Tomography [CT] or Computerized Axial Tomography [CAT] will be used to obtain the CT images. This is based on a combination of X-rays as they can be passed through the different parts of a patient’s body. Varying amount of X-rays will be passed through and exit the body depending on the amount that can be absorbed in a particular tissue such as a muscle or lung. During conventional X-ray imaging, the existing X-ray will interact with a detecting device, which contains X-ray film or other image receptors to provide a two dimensional image of the required part of the patient’s body. CT will use a rotating X-ray device and detectors to make a slice. [2]. Magnetic resonance imaging [MRI] is based upon signals resulting from water molecules, which contains between 70% and 80% of the average human brain. There are two types of MRI scanners.

- T1 [anatomical] which is fast to acquire, with excellent structural detail [e.g. white and gray matter].