Intelligent System for High Resolution Computed Tomography (HRCT) Image Analysis: A Concept

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Respiratory system diseases are becoming more and more common in human beings with the increasing air pollution due to industrial growth. In order to ensure the well-being of the general population of a country, early detection of such diseases is critical. Performing a High Resolution Computed Tomography (HRCT) imaging of the lungs is one of the key methodologies in diagnosing for such diseases. The accuracy of the diagnosis of a disease highly depends on the recognition of the number, specific combinations or patterns and the distribution of abnormal findings. Even with the increasing availability of such scanning modules, the limiting factor is the scarcity of medical experts who can identify all these artifacts and map them to the relevant diagnosis. On top of the scarcity of such experts, this process is also tedious and time consuming, which reduces the number of patients one expert can cater for in a given period of time. This is more critical in developing countries such as Sri Lanka where medical facilities and experts are extremely limited. So to overcome all these drawbacks, we propose a remotely accessible intelligent system with Machine Learning (ML) capabilities to aid the medical expert to arrive with the diagnosis in a shorter period of time.

The initial stage of the implementation of the proposed system will consist of a data collection process, where multiple medical experts will observe HRCT scan images and input the recognized abnormalities and their distribution to the system through a web interface, along with the diagnosis.

Once sufficient amount of datasets are available, the proposed system will analyze the data and identify combinations and patterns, while linking them with probable list of diseases. One of the feasible learning algorithms, would be a basic Naïve Bayes Classifier. The knowledge available in the textbooks related with the procedures of diagnosing can also be utilized to improve the above model. The output of the system will outline a set of most likely diseases along with their probabilities.

The last phase of the implementation will consist of a set of image analysis algorithms to automate or facilitate the process of identifying the artifacts present in the HRCT images, while drastically reducing the time taken by an expert to make a diagnosis.

Furthermore, a large collection of datasets from numerous of medical experts, will pave the way to perform datamining and discover correlative effects of some of the diseases with either the artifacts present in the images or the demographical data of the patients. Therefore it can be concluded that the future positive ramifications of such a system is extensive and crucial to the well-being of the population.

Keywords: HRCT Image Analysis, Biomedical Imaging, Machine Learning