Medical Image Analysis with an Innovative Intelligent Computer Program

K. P. P. S. Pathirana and B. A. K. Dissanayake

Uva Wellassa University, Sri Lanka.

The objective of the research is computer aided desicion making by analyzing color images captured from a medical instrument called TEM (Transmission Electron Microscope) with an Artificial Intelligence (AI) enabled computer program. When the images are analyzed specifically, viruses can be recognized by their optical patterns.

The final outcome of the research is an intelligent computer program with Graphical User Interfaces (GUI) to analyze Transmission Electron Micrographs (TEM), to recognize the viruses and generate automated reports (Interpretation). The technique optical pattern recognition and classification, one of the major applications of Artificial Neural Networks (ANN or NN) was applied as the key algorithm of the computer program. Since NN is a mathematical model of complicated human brain, the application derived from NN is integrated with Al and produces intelligent decisions regarding the specified trained task, TEM analysis.

This Al enabled system has many significant advantages compared to traditional non-Al image analysis software, such as recognizing mutated forms of viruses, ability to analyze even distorted images, dynamically expanding knowledgebase (self-improving knowledge)etc. In other words, the final outcome of this research is a Virtual Virologist — specialist in human blood viruses, known as an expert system in Al field.

Furthermore, the feasibility of using Genetic Algorithms (GA) to enhance the efficiency of NN was also exprimented. The training algorithm of NN was optimized with an innovative GA, tested and obtained reports verifying that the GA behaves even better than expected and reduces the output error.

The system developed was tested with large number of relevant images and has produced expected results.

Key words: Genetic algorithm, Artificial neural networks, Transmission electron micrograph, Artificial intelligence