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Title of Thesis: STUDY AND INVESTIGATION OF HARDWARE ASPECTS OF NEURAL NETWORK AND ITS APPLICATIONS

ABSTRACT

The present research work is specifically on application of artificial neural network in medical field specially in the diagnosis of infectious disease like TB using ANN electronic nose, as I think this is the best and very useful application of artificial neural network. Major portion of research has been devoted to the application of ANN in disease diagnosis.

Artificial neural networks (ANNs) are computer system developed to mimic the operations of human brain by mathematically modeling its neurophysiological structure (i.e., nerve cells and the network of interconnections between them). The basic unit of both, the mammalian nervous system and of ANN is the neuron. In the case of mammalian systems, each neuron collects input stimuli and triggers and sends the output to the next neuron in the assembly.

In the past few years, neural networks have gained more acceptances in medical diagnostic field than in any comparable field. The reason is its accuracy and versatility. We can use ANN in medical field as a tool for diagnoses of various type of diseases which needs early detection like various types of cancer ,TB,HIV etc. Now a days research is going on in allover the world in different field of medical specially in the diagnoses of TB and HIV because both are infectious and dangerous in nature.

In the present thesis, we use ANN as an instrument to diagnose infectious disease like TB(in which direct human involvement is dangerous and fatal) in the form of ANN based e-nose or

ANN Enose as commonly used in this thesis by us. An ANN electronic nose is generally composed of a chemical sensing system (e.g., **sensor array or spectrometer**) and a pattern recognition system (e.g., ***artificial neural network***). We are developing electronic noses for the automated identification of volatile chemicals for environmental and medical applications. In this thesis, we briefly describe neural networks, ANN electronic nose & show some results from a prototype ANN electronic nose.

The usual method of diagnosing TB in low-income countries is by detection of acid-fast bacteria in sputum by direct microscopy. When done properly, 60 to 70% of all adults with pulmonary TB can be identified using the Ziehl-Neelsen (ZN) staining procedure, followed by microscopic examination. However, in areas of endemicity, laboratories are often overloaded with samples for smear examination. Therefore, a new simple and rapid diagnostic test should directly replace microscopy with similar specificity and sensitivity. In the past, research was mainly focused on the development of either antibody/antigen detection assays or the development of nucleic acid amplification reactions.

Against this background, we have investigated the potential of a ANN based gas sensor array ("ANN electronic nose" [EN]) to detect *M. tuberculosis* in culture and sputum.

In our thesis we used TGS-822 sensor manufactured by Figaro company used in Enose. The sensing element of TGS-822 is a tin oxide (SnO2) semiconductor which has low conductivity in clean air.

The aim of this study was to investigate the potential of an ANN electronic nose (which is the one of the most useful application of artificial neural network in present days) to detect *Mycobacterium tuberculosis* and other pathogens in both culture and patients' sputa as a first step toward simple breath analysis for the specific, rapid, and noninvasive diagnosis of diverse lung infections.