Chapter 28
Computer Intelligence in Healthcare

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ABSTRACT

Low cost solutions for the development of intelligent bio-medical devices that not only assist people to live in a better way but also assist physicians for better diagnosis are presented in this chapter. Two such devices are discussed here, which are helpful for prevention and diagnosis of diseases. Statistical analysis reveals that cold and fever are the main culprits for the loss of man-hours throughout the world, and early pathological investigation can reduce the vulnerability of disease and the sick period. To reduce this cold and fever problem a household cooling system controller, which is adaptive and intelligent in nature, is designed. It is able to control the speed of a household cooling fan or an air conditioner based on the real time data, namely room temperature, humidity, and time for which system is active, which are collected from environment. To control the speed in an adaptive and intelligent manner, an associative memory neural network (Kramer) has been used. This embedded system is able to learn from training set; i.e., the user can teach the system about his/her feelings through training data sets. When the system starts up, it allows the fan to run freely at full speed, and after certain interval, it takes the environmental parameters like room temperature, humidity, and time as inputs. After that, the system takes the decision and controls the speed of the fan.

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INTRODUCTION

Blood related invasive pathological investigations play a major role in diagnosis of diseases. But in India and other third world countries there are no enough pathological infrastructures for medical diagnosis. Moreover, most of the remote places of those countries have neither pathologists nor physicians. Telemedicine partially solves the lack of physicians. But the pathological investigation infrastructure can't be integrated with the telemedicine technology. Here an intelligent system has been designed for automatic detection and counting of different types of white blood cells. This system can be deployed in the remote area as a supporting aid for telemedicine technology and only high school education is sufficient to operate it.

During transition of seasons, that means summer to rainy season, autumn to winter, and winter to spring; the environmental temperature changes very rapidly and people starts feeling cold. When people feel hot then their internal biological body cooling system starts working i.e. sweating, to enhance its effect to feel comfort and people uses some external cooling system like fan, air conditioner.

When environment temperature goes down then the internal body cooling process stops and people feel cold and then people switch off the fan. But when people are in deep sleep most of the time there is no provision to switch of the fan. As a result body temperature goes down and due to that body hormone and enzymes characteristic changes which causes infection in the body. Finally, they have a cold and fever. To protect body from cold an adaptive intelligent controller for household cooling system, that is able to control the speed of the fan, is required.

Air conditioner system (Lee 1999) is able to keep the room temperature constant but they are costly and consume much power than a fan, these are the major problem in third world countries. Air conditioner works in a closed room. If door or window is opened for long time air conditioning system will not be able to control the room environment, but household cooling fans are free from this type of problem.

To design a controller for this purpose one need to acquire different environmental parameters like temperature, humidity, time etc and a decision is to be taken by fusing them. The heading "Adaptive Intelligent Controller for Cooling Systems" will discuss the detail of the system along with the results.

Another system, which will be discussed in the heading of "Intelligent device to recognize different WBC from microscopic images", will automate the white blood cell counting from the microscopic images. Before going to the discussion, a brief introduction on basics of the white blood cell is given.

White blood cells(WBCs) are classified into five major categories, like Lymphocyte, Monocytes, Neutrophils , Eosinophil and basophil (MedlinePlus). Neutrophils, basophils, and eosinophils have a multi-lobed nucleus. These are differentiated based on the color of the cytoplasm, size and the color of the nucleus. The white blood cell count provides information about various illnesses and also helps to monitor the patient's recovery after initiation of treatment. One measure, the differential blood count, indicates the type of blood cells which are most affected. The normal white blood cell count is between 4500 and 10000 cells per micro-litre depending on the sex and age of the individual with a composition (HighWBC) of Neutrophils: 50 – 70%; Lymphocytes: 25 – 35%; Basophils: 0.4 – 1%; Eosinophils: 1 – 3%; Monocytes: 4 – 6%.

A high white blood cell count (above 30000 cells per micro-litre) does not indicate any specific disease but indicates infection, systemic illness, inflammation, allergy, leukemia and tissue injury caused due to burns (MedHelp). The count of white blood cells also increases when certain medicines like antibiotics or anti-seizure drugs are applied. Smoking and too much of mental