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A Review on Efficacy of Artificial Neural Networks in Medical & Business Areas

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Abstract— With rapid pace of technology artificial neural network (ANN) plays vital role in medical as well in business areas. An ANN is an information processing paradigm that is inspired by the way biological nervous systems, such as the brain, process information. The key element of this paradigm is the novel structure of the information processing system. An ANN is configured for a specific application, such as pattern recognition or data classification, through a learning process. This paper explores the efficacy of artificial intelligence and neural networks and provides an overview of the field, where the Artificial Intelligence & Neural Networks are separately used, also where they used together, and discuss the critical role of them in business & medical field like lung cancer scanning system, Protein prediction stroke & heart diseases.
Keywords— AI, Neural networks, Facial animation, Lung Cancer, Face recognition

I. INTRODUCTION

Neural Networks basically aim at mimicking the structure and functioning of the human brain, to create intelligent behavior. Researchers are attempting to build a silicon-based electronic network that is modeled on the working and form of the human brain!.Our brain is a network of billions of neurons, each connected with the other. At an individual level, a neuron has very little intelligence, in the sense that it operates by a simple set of rules, conducting electric signals through its network. However, the combined network of all these neurons creates intelligent behavior that is unrivaled and unsurpassed. How the human brain works, it learns to realize patterns and remembers them. Similarly, the neural networks developed have the ability to learn patterns and remember. This approach has its limitations due to the scale and complexity of developing an exact replica of a human brain, as the neurons number in billions! Currently, through simulation techniques, people create virtual neural networks [2].

II. WORKING OF ARTIFICIAL NEURAL NETWORK

Artificial Neural Networks are relatively crude electronic models based on the neural structure of the brain. The brain basically learns from experience. It is natural proof that some problems that are beyond the scope of current computers are indeed solvable by small energy efficient packages. This brain modeling also promises a less technical way to develop machine solutions. This new approach to computing also provides a more graceful degradation during system overload than its more traditional counterparts.

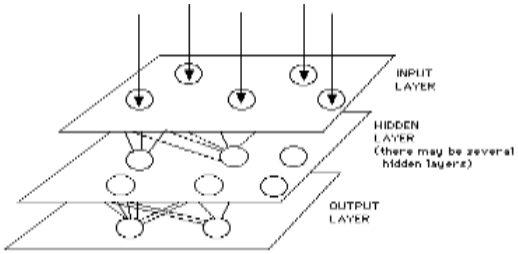

Figure 1:- A Simple Neural Network

These biologically inspired methods of computing are thought to be the next major advancement in the computing industry. Even simple animal brains are capable of functions that are currently impossible for computers. Computers do rote things well, like keeping ledgers or performing complex math. But computers have trouble recognizing even simple patterns much less generalizing those patterns of the past into actions of the future. Now, advances in biological research promise an initial understanding of the natural thinking mechanism. This research shows that brains store information as patterns. Some of these patterns are very complicated and allow us the ability to recognize individual faces from many different angles. This process of storing information as patterns, utilizing those patterns, and then solving problems encompasses a new field in computing. This field, as mentioned before, does not utilize traditional programming but involves the creation of massively parallel networks and the training of those networks to solve specific problems. This field also utilizes words very different from traditional computing, words like behave, react, self-organize, learn, generalize, and forget. Whenever we talk about a neural network, we should more popularly say Artificial Neural Network (ANN), ANN are computers whose architecture is modeled after the brain. They typically consist of hundreds of simple processing units which are wired together in a complex communication network. Each unit or node is a simplified model of real neuron which sends off a new signal or fires if it receives a sufficiently strong Input signal from the other nodes to which it is connected.

III. APPLICATIONS OF NEURAL NETWORKS

3.1 Distribution of Object Trajectories for Event Recognition

This work is about the modeling of object behaviors using detailed, learnt statistical models. The techniques being developed will allow models of characteristic object behaviors to be learnt from the continuous observation of long image sequences. It is hoped that these models of characteristic behaviors will have a number of uses, particularly in automated surveillance and event recognition, allowing the surveillance problem to be approached from a lower level, without the need for high-level scene/behavioral knowledge. Other possible uses include the random generation of realistic looking object behavior for use in Virtual Reality, and long-term prediction of object behaviors to aid occlusion reasoning in object tracking.

Figure 2: Object Trajectories for Event Recognition

The model is learnt in an unsupervised manner by tracking objects over long image sequences, and is based on a combination of a neural network implementing Vector Quantization and a type of neuron with short-term memory capabilities. Models of the trajectories of pedestrians have been generated and used to assess the typicality of new trajectories (allowing the identification of incidents of interest' within the scene), predict future object trajectories, and randomly generate new trajectories.

3.2 Air conditioning system:

Nowadays, air conditioning systems are commonly found in homes and in public enclosed spaces to create a comfortable environment [1]. Air conditioning has developed to be an integrated industry including environment, energy, machinery, electronics, and automatic control technology, so that its several major trends of development would be health, environmental protection, energy saving, intelligence and diversity. Air conditioning is not only a name of the product, but by using the ideas and methods of air conditioning to create comfort and natural living environment while at the same time reduce the ravages of nature and achieve the real sense harmony of human and nature to maximum extent [2]. Air conditioning system is a control system that has complex interactions between physical variables and is too nonlinear. Conventional design methods require the development of a mathematical model of the control system and then use of this model to construct the controller that is described by the differential equations. Mathematical model is an abstraction and cannot perfectly represent all possible dynamics of any physical process. Even if a relatively accurate model of a dynamic system can be developed, it is often too complex to use for development of controller, especially for many conventional design procedures as they require restrictive assumptions for the plant, e.g. linearity. As opposed to conventional control design, fuzzy logic control focus on gaining an intuitive understanding of how to best control the process or plant. Fuzzy logic control appears very useful when linearity and time invariance of the controlled process cannot be assumed, when the process lacks a well posed mathematical model, or when human understanding of the process is very different from its model [4]. Fuzzy logic control provides a formal methodology for representing, manipulating and implementing a human's experience based knowledge about how to control a system [3]. Fuzzy logic uses human knowledge and expertise to deal with uncertainties in the process of control [5]. Fuzzy controller block diagram is shown in Figure 3. It has four main parts: (i) Fuzzification interface, simply modifies and converts inputs into suitable linguistic values so that can be compared to the rules in the rule base. (ii) Rule base, holds the knowledge in the form of a set of rules, of how best to control the system.

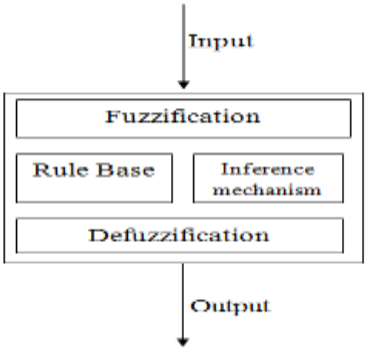

Figure 3: Block diagram of Fuzzy controller

(iii) Inference mechanism, evaluates which control rules are relevant at current time and then decides what the input to the plant should be (iv) Defuzzification interface, converts the conclusions reached by the inference mechanism into crisp ones.The affectivity of the fuzzy models representing nonlinear input-output relationships depends on the fuzzy partition of the input output spaces. Therefore, the tuning of membership functions becomes an important issue in fuzzy modeling. Since this tuning task can be viewed as an optimization problem neural networks offer a possibility to solve this problem [6]. A neuro-fuzzy system is a fuzzy system that uses a learning algorithm derived from or inspired by neural network theory to determine its parameters by processing data samples.

3.3 Face recognition System

For Face Recognition purpose, the learning process of ANN is used with back propagation algorithm. Back Propagation is a feed forward supervised learning network. Neural networks consist of the three layers as input layer, hidden layer and output layer as shown in Figure 4. These layers of

elements make independent computation of data and pass it to another layer. The computation of processing elements is completed on the basis of weighted addition of the inputs. The output is compared with the target value and the mean square error is calculated which is processed back to the hidden layer to adjust its weights. This process is having iteration for each layer to minimize the error by repeatedly adjusting the weight of each layer. Hence, it is called the back propagation. The iteration process carried on until the error falls below the tolerance level. For face recognition, the Eigen faces images of the test face image is intended by feature extraction based on PCA. This Eigen faces image is given to the trained neural network. The tested Eigen faces is compared with the Eigen faces of the trained neural network for finest match result using the Log-sigmoid function values. The minimum distance between the tested Eigen faces image and the trained input Eigen faces image is not as much of as the threshold value.

Figure 4: Grey scale images

Figure 5: Projection of face images

In training part, Artificial Neural Networks are trained with the projected face images that are Eigen faces and the following parameters are set for input, hidden and output layered artificial neural network for complete training and testing purpose. It counts the 500 iterations or epochs having learning rate of 0.03 and the training continuous up to the mean square error reaches at a performance goal set at 0.0001. For the testing purpose these trained neural networks are used. The objective was to develop an artificial neural network based feature extractor or classifier that can be used for authorized user verification in a practical work environment using PCA. Specifically, a back propagation neural network algorithm was implemented. We have applied test image for recognition of face using trained neural network.

3.4 Lung Cancer Detection System

Lung Cancer is the most threatening sort in one of the deadliest malignancies form of cancer. In the last few years the occurrence of harmful tumor has constantly expanded, on the grounds that the cure of the disease depends on its initial judgment. There are two major types of lung cancer, Non-small cell lung cancer (NSCLC) and Small cell lung cancer (SCLC). The lungs are usually large in size hence tumors can grow in them for a long time before they are found. Even when the symptoms such as coughing and fatigue occur, people think they are due to other causes. Hence for this reason, the early-stage lung cancer i.e. stages I and II are difficult to detect. Many people having lung cancer are diagnosed at stages III andIV. Doctors utilize a some methods to diagnose lung tumor, for example, X-rays, CT Scan, PET scan etc. The main objective is to detect the cancer in early stage.Lung cancer is considered to be as the main cause of cancer death worldwide, and it is difficult to detect in its early stages because symptoms appear only at advanced stages causing the mortality rate to be the highest among all other types of cancer.

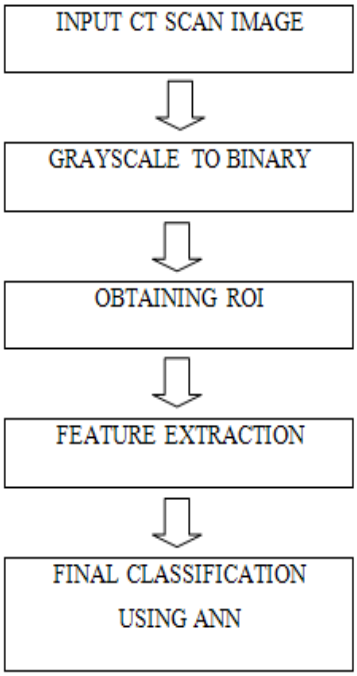

Figure 6: Lung Cancer Scanning System

A total number of 100 data managed to be collected. In which 50 are the cancerous and the remaining 50 are noncancerous. No additional information on the CT scan images are obtained, thus the medical status and the background of the images are left as the task to be analyzed in order to choose the suitable images to be used for the project. This CAD system comprises four stages: pre-processing, evaluating region of interest, feature extraction, final classification using ANN. The pre-processing stage consists of various image enhancement techniques (contrast enhancement, thresh holding, and noise removal) to improve the visibility of tumors in CT scan images. We had taken out the ROI and GLCM matrix is formed from the enhanced image feature is extracted and give them as input to the next stage. We will use artificial neural networks in the classification stage. After training is completed testing will be done in which the same steps will be applied to the testing image and the parameters of it will be compared to the matrix formed after training. A distance will be calculated with each and every row of the matrix this distance will give us the difference and the minimum distance will be the minimum difference and considered as the best match. And final result will be showed that whether the image is cancerous or not.

VI. CONCLUSION

This Paper explained various types of applications in artificial intelligence & neural networks to create intelligent behavior, and how AI and NN is a combination of computer science, physiology and philosophy. There are various advantages of ANN over conventional approaches. Depending on the nature of the application and the strength of the internal data patterns you can generally expect a network to train quite well. This applies to problems where the relationships may be quite dynamic or non-linear. ANNs provide an analytical alternative to conventional techniques which are often limited by strict assumptions of normality, linearity, variable independence etc. Artificial Intelligence is the area of computer science focusing on creating machines that can engage on behaviors that humans consider intelligent. Examples were given to show how artificial intelligence & neural networks are used in applications like Pattern recognition, Autonomous Walker & Swimming Eel, Facial Animation, Artificial Creativity, Computer vision, Virtual reality and Image processing, and Strategic planning, Lung cancer etc.

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