Need for Artificial Neural networks in today's world

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Abstract
Artificial Neural Networks (ANNs) are widely used in various fields due to their versatile applications. They are capable of handling complex functions and can adapt to new conditions. Their applications range from data interpretation, drug design, pattern recognition, text translation, credit card fraud detection, medical diagnosis and more. ANNs have become an essential tool in today's world due to their ability to interpret large amounts of data, making them crucial in fields such as medical diagnosis and credit card fraud detection. The versatility of ANNs makes them applicable in many different industries and continues to contribute to their growing popularity. The current work focuses on exploring the wide range of applications of ANNs and their significance in our world today.

Keywords: *(ANN models, Human brain, neural network, Nicosia, DNA, CGM)*

1. Introduction

Human brain consists of many neurons, which perform various functions. Similarly Artificial neural networks (ANN's) work like a human brain.

Artificial neural networks (ANN's) are also biologically similar neuron types as they are the programs used to gather specific data/information like a human brain processes the given data. The Input data is received by the input layer and transmitted to the hidden layer and then transmitted to the Output layer. ANN is being used in all fields of research. It is used to solve the programs by following a sequence of rules. Each connection in the neuron is associated with a numeric number, which can be called as weight**[1]**.

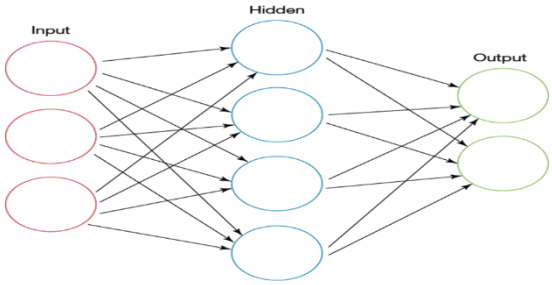

Figure 1.1: Neural network

As the biological neurons connect the brain nerves, similarly neural networks also connect the data/information by collecting the relations or connections in the data.

Its advantage is also that It has the ability to work with insufficient knowledge like if we know input, the output can be easily predicted by using ANN. Sometimes ANN can be forced to make some predictions in many unsuitable conditions.

ANN can also be easy to analyse multi-dimensional input into two dimensional input, so it is used as an alternative for PCA(principal component analysis). Neural networks may take hours or may even take months to train, but time has a very small scope when compared to ANN's vast scope. All visionaries have reached the neural network due to the question "To what extent can the human brain be replicated? If we talk in terms of calculation/computation, the computer network will be more efficient than human brain which takes some time to calculate that the work of normal computer is that it converts input data into output data by means of algorithm or some programming languages. Neural networks learn and train and make improvements in the output data. Finally Neural networks are those which can accept any number of inputs given by the user and will predict two to three outputs which can have 0.005% error in the actual output value. Neural network applications are used in various fields like Engineering, Psychology, Medical, Research field, etc.**[1]**.

Even ANN has found its usage in pharmaceutical research fields like interpretation of data, drug delivery, etc.**[1]**. Now let's see the applications of ANN in the medical field one by one.

2. Applications of ANN in Medical Sector

In the medical field, ANN finds a wide range of applications, it is used to segment some of the infected parts. CT scans are performed to differentiate widespread and well known COVID-19 from other non-covid pneumonia infections**[2]**. It is even used for making urine tests by recognizing urine particles by using some digital and microscopic pictures of urine sediments**[3]**. Neural networks are also used in IoT technologies. ANN are also used in fruit processing and fish processing and also ANN finds its applications in intelligent food processing by checking its quality, ensuring the safety of food and avoiding cases of food poisoning**[4]**. ANN is also developed in the medical field to treat cancer patients, it is used to predict the visiting of emergency departments visiting patients having cancer**[5]**. Even ANN is also used in the predictions of some heart disease and many algorithms are made and also used for heart disease predictions**[6]**. In Surgical research also, artificial neural networks are used **[7]**.

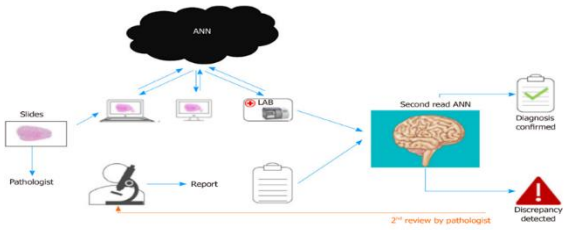

Figure 2.1

Diabetic patients have to track their food intake to maintain their glucose level in their body. CGM (continuous glucose monitoring) is used to predict the amount of glucose in diabetic patients. ANN also finds its development in prediction of diabetes in the initial stage**[8]**. ANN can also be used in the early detection of cardiac arrest. Till now, the number of people who can have cardiac arrest is not clear so it can be prevented by using ANN**[9]**. ANN has also established its fame in dentistry. It also plays a very important role in assisting dental professionals. It performs the tasks within no time. But it has some drawbacks also, like complex mechanisms, high cost, and requires an adequate period of training**[10]**. ANN can also be used to detect kidney diseases. At first, kidney images are classified/identified as normal/abnormal. Abnormal images of kidney are kidney diseases like kidney stones, tumours, etc.. And then ANN sufficient technique is used to solve the abnormal kidney problems by the segmentation of abnormal images of the kidney**[11]**. Even ANN can be used for the estimation of sex i.e. to identify sex as male or female. The sex of the skeleton of some person as male or female can be identified/Predicted using ANN. But it also has some drawbacks like it's expensive, difficult to access and also it requires qualified and experienced personnel and by using ANN, DNA can't be obtained**[12]**. To Diagnose corneal Diseases also, a neural network is used**[13]**. Using neural networks, X-ray images can be taken and it is used to diagnose covid-19 symptoms for a covid-19 patient. It is even used to classify the X-ray images as covid-19 symptoms or pneumonia type symptoms. Similarly X-rays are used to diagnose many chest-related problems also **[14]**.

3. Applications of ANN in Engineering Sector

Using ANN, wastewater treatment can be conducted and even desalination of water can be undertaken. Like this, the modern technique(ANN) is used to save water**[15]**. Even ANN applications are also used to compute the signal strength, that computation will be based on some weather factors like temperature, pressure, speed of the air and also relative humidity, these factors will be used as input for ANN**[16]**. To study micromechanical behaviour of some polycrystalline metals also, ANN is used**[17]**. Even ANN's are used to solve some issues of solid wastes by knowing its causes and by using ANN's applications to solve those issues**[18]**. By using ANN applications, engine behaviours can be studied and it has accuracy more than 95%. It is used to study many uses of biodiesel in many engines without conducting any practical lab experiments, it's applications are used for predicting the engine performance, it's COP(coefficient of performance) and emissions of engines which are fuelled with a diesel which is produced from many waste materials i.e. biodiesel**[19]**. ANN's has the ability to accurately predict upcoming future droughts. The data will be provided as inputs for ANN for predicting droughts. By knowing the upcoming droughts, some methods of its prevention or some control measures could be taken so that it would reduce the harmfulness caused on the population**[20]**. Applications of ANN can even be used for predicting the concentration of acids(of only two types of acids). ANN models can be used for predicting some percentage concentrations of some number of acid samples, maybe of 14 acid samples**[21]**. ANN model can also be used to predict metakaolin-based concrete's compressive strength**[22]**. Artificial neural network(ANN) model can also be used as a data mining tool, it is also used to predict Biochemical Oxygen Demand(BOD) and also to predict the concentration of effluents during waste-water treatment.

ANN is also used as a powerful tool for modelling the removal of pollutants**[23]**. ANN can also be used to predict fuel consumption in vehicles. Fuel consumption of the vehicles depends on many factors like vehicle weight, engine displacement, number of cylinders and valves, driving pressure, tire pressure, etc. ANN is successful in measuring fuel consumption by considering the above factors **[24]**. Air pollution is one of the major pollution affecting almost all the living organisms. ANN is used to predict the concentration of air pollution and some measures can be taken to reduce air pollution and protect the environment. The same was done in a place called Nicosia. The performance of ANN in predicting the concentration of pollutants was satisfactory in Nicosia**[25]**. Artificial Neural Networks is also used for the prediction of quality of water. It can also be used for predicting urban sustainability and contamination of water**[26]**. ANN is also used to predict the heat transfer in soil temperature**[27]**. Artificial Neural Network(ANN) and its applications are also used to detect fraud and its applications can also be used in direct marketing**[28]**. ANN applications are used for wireless communication **[29]**. ANN model was employed to know polycrystalline material behaviour. Even for studying the micromechanical behaviours of polycrystalline metal, ANN is used **[30]**.

Figure 3.1

4. Applications of ANN in Research Sector

The waste management was very concerned because of growing environmental consciousness. ANN is also useful in the minimization of solid waste effluents**[31]**. Using Artificial Neural Network(ANN), we can even forecast road surface conditions especially during the rainy season. By using ANN, the drivers would get the information of unsafe road conditions**[32]**. Even for predicting minimum boiling temperature for some experiments or studies using artificial neural networks**[33]**. Even Artificial Neural Networks(ANN's) are used for optimization and studying COVID-19**[34]**. ANN is also used for the performance analysis of logical gates**[35]**. Even Artificial Neural Networks can be used to recognize some environmental sounds or a little far away noises**[36]**. By using ANN, even many cybercrimes can be detected. One such example is the detection of credit card fraud by using ANN. Credit card fraud is very common nowadays because most people use credit cards to do online payments very frequently. Even credit card fraud can be classified into 10 types. ANN is 100% best suited for detecting any type of credit card fraud**[37]**. Even ANN finds its use in forecasting air compressor load. To reduce the electricity consumption in air compressor systems, therefore ANN can be used as a replacement for electricity and can be used in air compression systems**[38]**. For the management of environmental odour also, ANN can be used. ANN is used to measure odour intensity prediction and its concentration and by knowing all this, management of odour can be done using ANN**[39]**. ANN applications can be used for the prediction of Chemical Oxygen Demand(COD) from wastewater treatment plants**[40]**. Even to manage the heating system of solar water, ANN is used for the optimization purpose. Also, ANN can be used for the design of hot water storage tanks **[41]**. Artificial Neural Networks(ANN's) nowadays are used for the prediction of price of Crude Oil. The advantage of using ANN here is that to know the variation of Crude Oil Prices**[42]**. In rivers, for the quality prediction of water, ANN can be used. Like this, the performance of ANN models could be improved**[43]**. Even ANN shows its impact on crop productivity and human health. For crops, the quality of nutrients and chemicals are applied based on the suggestion of ANN method**[44]**. Biogas can even be produced from the waste food, wastes of fruits and vegetables using artificial neural networks(ANN) **[45]**.

Artificial Neural Networks(ANN's) also play a major role in the minimization of solid waste effluents. ANN if used in papermaking processing steps, it would be a measure to control environmental pollution caused by paper mills**[46]**. Even to predict Vehicular traffic noise, ANN can be used**[47]**. ANN can be used for predicting the relative liking of food even in the presence of background noise**[48]**. Even for the mapping of landslide susceptibility, ANN is used**[49]**. Even in the educational field, ANN applications are widely used. ANN is used to predict the academic performance of students, it could be useful to train academically poor students**[50]**.

Conclusion

Artificial neural networks (ANN's) are similar to biological neurons in that they are programs used to gather specific data/information like a human brain processes the given data. Each connection in the neuron is associated with a numeric number, which can be called a weight. ANN is being used in all fields of research and is used to solve programs by following a sequence of rules. Its advantage is that it has the ability to work with insufficient knowledge and can be forced to make predictions in unsuitable conditions.

Neural networks (ANNs) are used to analyse multi-dimensional input into two-dimensional input, and are an alternative to PCA (principal component analysis). They can take hours or months to train, but time has a very small scope when compared to ANN's vast scope. Neural networks can learn and train and make improvements in the output data, and can accept any number of inputs given by the user and predict two to three outputs which can have 0.005% error in the actual output value. ANN applications are used in various fields like Engineering, Psychology, Medical, Research field, etc., and even in pharmaceutical research fields like interpretation of data, drug delivery, etc. In the medical field, ANN is used to segment some of the infected parts, and CT scans are performed to differentiate widespread and rare diseases.

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