Ind. J. Res. Methods Pharm. Sci. 2023; 2(1):28-31
ISSN (Online): 2583-3804

MINI REVIEW ARTICLE

REVIEW ON ARTIFICIAL NEURAL NETWORKS IN PHARMACEUTICAL ANALYSIS

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Received: 07 January 2023/ Accepted in revised form: 15 January 2023 / Published online: 18 January 2023

ABSTRACT:

Artificial neural networks (ANNs) are a type of machine learning model that are inspired by the structure and function of the human brain. In pharmaceutical analysis, ANNs can be used for a variety of tasks, including the identification of active ingredients in a drug and the prediction of side effects. Artificial neural networks (ANNs) have been applied to a many pharmaceutical issues, including design of drugs, identification of drug targets, and toxicity prediction. The most common type of ANNs are feedforward neural networks, where the output of one layer is not connected to the input of the same layer again. Artificial neural networks (ANNs) can achieve high levels of accuracy and precision in tasks such as drug discovery and drug design, as well as in the analysis of large and complex datasets. They can also be used to analyze large-scale genomic and proteomic data, which can aid in the discovery of new drug targets and biomarkers. Artificial neural networks (ANN) have been applied to pharmaceutical analysis with a great deal of success. By using ANNs in pharmaceutical analysis, we can improve accuracy and reliability while reducing the overall cost of drug development. Artificial neural networks have become an invaluable tool for advanced data analytics in the field of pharmacy.

Keywords: *Drug Design, Drug Development, Artifical neural networks, ANN, Pharmaceutical Analysis*

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INTRODUCTION:

Artificial neural networks (ANNs) are a type of machine learning methodology that can be trained to interpret and classify data [1]. In the world of pharmaceutical analysis, ANNs are incredibly useful tools for detecting patterns in large amounts of data. In this article, we'll be reviewing how artificial neural networks work and their applications in the field of pharmaceutical analysis. We'll also discuss some potential advantages and drawbacks of utilizing ANNs in drug development. Finally, we'll take a look at some current industry examples that demonstrate how ANNs can be used to improve accuracy in drug testing and analysis.

WHAT ARE ARTIFICIAL NEURAL NETWORKS?

Artificial Neural Networks (ANNs) are basically machine learning systems that are modelled ontowards the function of the human brain. They consist of layers of interconnected units called "neurons," which process and transmit information. The connections between these units are optly named by "synapses," which can be adjusted to change the weight of the connection between neurons. ANNs are usually trained with a training dataset, and the target is to adjust the position of synapses so that the network can accurately yield a predicted result, such as image identification or language interpretation. ANNs are capable of learning and generalizing from examples, which makes them useful for a wide range of applications such as image processing, natural language processing, speech recognition, and even drug discovery.

HOW DO ARTIFICIAL NEURAL NETWORKS WORK?

Artificial neural networks (ANNs) are a type of machine learning model that are based roughly on structure and function of the human brain. They consist of layers of interconnected units aptly called "neurons," which process and transmit information [3].

The basic building block of an ANN is the artificial neuron, also known as a perceptron. A perceptron takes in multiple inputs, applies a set of weights to each input, and then applies an activation function to the weighted sum of the inputs. The output of the perceptron is then passed on to the next layer of neurons [2,3].

In a typical ANN, the input layer receives the raw input data, and this is then passed through one or more hidden layers, where the neurons process and transform the data. The final layer is the output layer, which produces the final output of the network.

The weights of the neurons are adjusted during the training process, so that the network can learn to produce the desired output for a given input. This is done using a process called backpropagation, which involves using the error between the predicted output and the actual output to adjust the weights in the network [1].

The most common type of ANNs are feedforward neural networks, where the information flows in one direction from the input layer to the output layer. In this type of networks, the output of one layer is not connected to the input of the same layer again. Another type of ANNs are Recurrent Neural Networks (RNNs) where information can flow in a cyclic way, allowing the network to use information from the past to inform the present [2].

The complexity of ANNs can vary depending on the number of layers, the number of neurons per layer, and the type of activation function used. The greater the complexity, the more powerful the network becomes, but also the more data and computational resources are required for training [3].

APPLICATIONS OF ARTIFICIAL NEURAL NETWORKS IN PHARMACEUTICAL ANALYSIS:

Artificial neural networks (ANNs) have been applied to a wide range of tasks in the pharmaceutical field, including drug design, target identification, and toxicity prediction. In recent years, ANNs have also been used for the analysis of pharmacokinetic and pharmacodynamic data.

There are several applications of artificial neural networks (ANNs) in pharmaceutical analysis, including [4,5]:

1. Drug discovery: ANNs can be used to predict the biological activity of chemical compounds, which can aid in the discovery of new drugs.

2. Drug design: ANNs can be used to optimize the properties of existing drugs and design new drugs with improved efficacy and safety.
3. Virtual screening: ANNs can be used to screen large numbers of chemical compounds for potential drug candidates.
4. Protein-ligand binding: ANNs can be used to predict the binding affinity of small molecules to proteins, which is important in drug design.
5. Toxicology: ANNs can be used to predict the toxicity of chemical compounds, which is important in drug development.
6. ADME prediction: ANNs can be used to predict the pharmacokinetics and pharmacodynamics of drugs, which is important in drug development.
7. Genomics and Proteomics: ANNs can be used to analyze large-scale genomic and proteomic data, which can aid in the discovery of new drug targets and biomarkers.
8. Medical imaging: ANNs can be used to analyze medical images, such as MRI, CT scans, and X-rays, to detect disease and assist in diagnosis and treatment planning.
9. Medical diagnosis: ANNs can be used in medical diagnosis to predict the likelihood of a disease based on patient data, and can help to identify patients that are at risk of developing a particular condition.

ADVANTAGES AND DISADVANTAGES OF USING ARTIFICIAL NEURAL NETWORKS IN PHARMACEUTICAL ANALYSIS:

Advantages of applying artificial neural networks (ANNs) in pharmaceutical analysis can be given as follows [1]:

1. High accuracy and precision: ANNs can achieve high levels of accuracy and precision in tasks such as drug discovery and drug design, as well as in the analysis of large and complex datasets.
2. Handling complex data: ANNs can handle large, complex, and noisy datasets, which is often the case in pharmaceutical analysis.
3. Handling non-linear relationships: ANNs can discover non-linear relationships in data, which is important in understanding the relationships between chemical compounds and their biological activity.
4. Handling missing data: ANNs can handle missing data, which is often the case in pharmaceutical analysis.

DISADVANTAGES OF USING ANNS IN PHARMACEUTICAL ANALYSIS INCLUDE [3]:

1. High computational cost: ANNs require a significant amount of computational resources, which can be a disadvantage in some applications.
2. Black-box nature: ANNs are often considered as a "black-box" model, meaning that it is difficult to understand how the model arrived at a particular decision.
3. Overfitting: ANNs are prone to overfitting, which can lead to poor generalization performance.
4. Data requirement: ANNs require large amount of data to be trained, which can be difficult to obtain in some situations.
5. Lack of interpretability: ANNs are not interpretable like traditional statistical models, which can make it hard to understand how the model arrived at a particular decision.

CONCLUSION:

In conclusion, artificial neural networks have been applied to pharmaceutical analysis with a great deal of success. By using ANNs in pharmaceutical analysis, we can improve accuracy and reliability while reducing the overall cost of drug development. Furthermore, ANNs allow us to optimize drug design processes by exploring alternative parameter combinations quickly and accurately. Artificial neural networks have become an invaluable tool for advanced data analytics in the field of pharmacology and are likely to continue gaining popularity in this area as well as others fields such as medical diagnosis or machine learning research.

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