APPLICATION OF ARTIFICIAL NEURAL NETWORK IN BIOTECHNOLOGY

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ABSTRACT: Artificial Neural Network was designed to mimic the animal brain network, it is a computational algorithm network which are provided with predefined input to perform a certain task.in the resemblance to the neurons of human brain, ANN is consist of collection of artificial neurons. ANN was designed with a goal to approach and handle any task and situation in a manner similar to human brain. Biotechnology is application of technology in performing biological experiments.in this review paper, it is discussed how Ann can help in designing biological experiments.

1. INTRODUCTION

Dr. Robert Hecht-Nielsen designed the first neurocomputer and he stated the artificial neural network as "...a computing system made up of a number of simple, highly interconnected processing elements, which process information by their dynamic state response to external inputs"[1]. Human brains are composed of neurons which are interconnected by axons. All the external stimuli are accepted by dendrites, creating electrical impulses which travel through neural network and pass the information from one cell to another. Imitating the human brain artificial neural network composed of multiple nodes. The work module of Ann depends on input data, the data is operated and the result is given to us in the form of "activation value". There are two Artificial Neural Network topologies − **Feed Forward** and **Feedback.** Each artificial neuron network is interconnected by edges and all the learning proceeding depends on the weight of the edges [2].

With the increase in availability, processing and accessibility of computational system with the novel areas of research, expands its area of application and research, the interest is in automation of various field which is less tedious and requires less man power [3].Ann is extremely efficient in accurate characterization of extremely complex systems. Biotech is a very wide field involving different researches with complex biological factors having large scale applications in industrial and medical field. Artificial neural networks have been applied to problems ranging from speech recognition to prediction of protein secondary structure, classification of cancers and gene prediction [4].

2. USE OF ANN IN BIOTECHNOLOGY

2.1 DNA sequencing

For the detail representation of molecule as an input, an intensive computational method is required. Therefore Ann competes and exceeds other statistical method in molecular mechanics and is successful in sequencing DNA and weighted to improve predictive accuracy [5]. Gene search is done by both gene signal and gene content method. Gene signal is used for the identification of splice site and non-coding regions. Search by gene content methods determine protein-coding potential of sequences.

2.2 Molecular Sequencing Analysis

Molecular sequence problems have been successfully solved by neural network approach. DNA and protein sequencing is a very tedious and challenging molecular biology project. Neural networks are important tolls with improved network designs and sequence encoding methods and thereby is a pragmatic method for solving highly complex pattern classification problems [6].

2.3 Spectra interpretation

A spectrum is a sequential array of continuous-value data that proximate a function. Any particular shape or sharp peak at a given position is recognized as a feature in spectrum and recognized at appropriate position at correct time to give correct answer. Networks have been exercised to spectra in four distinct ways: To recognize them, to quantify then, to classify then, and to transform them into a related function. In the first case, the output of network typically epitomize the presence of a known substance. In the second case the output measures concentration. In the third the network observes patterns associated with particular substructures or molecular features and marks these structures or features as output. In the fourth the network generates a function dependent on the entire spectrum [7].

2.4 Soft-sensing

In biochemical process, there are various variables which cannot be measured directly for e.g.:- fermentation process. Using inversion soft – sensing method based on Ann model of the "Assumed Inherent Sensor (AIS)", is developed The inputs of the AIS are the directly immeasurable variables to be estimated, while the outputs are the directly measurable variables[8]. Improved version of AIS model is developed based on Birol model.

2.5 Data Mining

Experiments that requires a great amount of resources and which produce ambiguous results due to its complexity and which require repeating or extensive analysis in order to obtain useful results. High demands of research is needed due to the massive volume and complexity of the information encoded in DNA and RNA [9]. Sometimes, required sequence information is not available for the organism being studied in that case information from other organisms is retrieved and correlated.

3. Neural-network contributions in biotechnology.

3.1 In bioprocess state estimation

Artificial neural networks are used for the estimation and prediction of bioprocess variables which exploits the environmental and physiological information available from on-line sensors, to estimate concentration of species in the bioreactor [10].

3.2 An artificial neural network for biomass estimation from automatic pH control signal

ANN can be used for the estimation of various parameter during fermentation process [11].various algorithms are used for the optimization of network structure. A check on growth of microorganisms in a fermentation broth can be kept.

3.3 Development and design of biochemical processes

Artificial intelligence is used in three areas of biotechnology: exploration of new production routes for various bio products, design of mammalian cell biofermentors and synthesis of downstream processing schemes for the separation and purification of proteins [12]. The 'prototype intelligent system' is used and an attempt is made by simple projections on the use of artificial intelligence in biotechnology.

3.4 Drug discovery

Diagnostic tests are very expensive due to their one time use, the provide kit can be used only for a single time [13]. ANN immediately uses the true facts to improve the diagnostic test. It can be used in diagnostic which can be digitized, and allows the algorithm to determine the correct "features" to embed them into its final decision-making process. AI is used in the identification of targets and ligands in early stage drug development, Promises to make drug discovery cheaper and quicker, effectively reduces the time for drug discovery.

3.5 Gene editing

A biotech startup, Desktop Genetics has invented a novel platform to design gene editing constructs using CRISPR which works through AI and follows the entire gene editing process, from selecting proper shRNA molecules to analyzing the data of the experiment.

4. Conclusion

There is now a very disparate range of applications for using neural networks in biotechnology. Neural networks have gained most attention for use in the control and optimization of fermentation systems. The essential edge that neural networks offer biotechnology is that the dynamics of complex biological systems can be captured without the need for clearly defined rules to be anticipate by the investigator. The future of neural networks in biotechnology looks very promising and is set to expand in the near future.

5. References

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