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Research on the Optimization of Biological Education Model in the Environment of Artificial Intelligence

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***Abstract*:** The recent technological growth has opened the doors for incorporating new-age technology such as artificial intelligence in every field. Biological Education is a system for training biologists to work in natural science research facilities and as educators in biological fields of study. Educational optimization is a technique for making something as flawless, functional, and effective as possible. This paper presents the design and implementation of a Convolution Neural Network (CNN) for the Optimization of the Biological Education Model in the AI environment. The study proved that the suggested model has provided an efficiency of 92%.

Keywords: *Artificial intelligence, Biological education, CNN, Optimization*

1. Introduction

The concept of artificial intelligence (AI) is not new. According to Greek mythology, which dates the event to 700 B.C., the bronze giant Talus was produced, not born, to protect Europa, the mother of King Minos in Crete. The author admitted that technology has been the main impediment to the creation of intelligent machines ever since he raised questions about machines, behaviour, and awareness and used discrete processes to model continuously operating nervous systems. a computer architecture in which random-access memory is used to store both data and programme instructions. [1] Although the fast microprocessor was developed before AI was actually applicable, this architecture served as a paradigm for the modern computer. Since its inception as a subject of research and development in 1956, artificial intelligence (AI) has seen changes and setbacks, and it wasn't until the early years of the twenty-first century that it truly blossomed with useful applications in industry and academia. AI attracted significant investment and grew in popularity as a result of the accessibility of cutting-edge techniques, potent computers, and vast data sets. [2]

The symbolic technique, which involves computer coding complex rules to allow robots to perform a coordinated set of actions, is no longer the most advanced method for studying biology. The game of chess, which has extremely simple rules but a broad range of potential outcomes with the move of one piece, is a good example of symbolic AI. [3] Since the rules are known in this situation, a computer can be designed to weigh each option before choosing the one that produces the best result. Garry Kasparov, the reigning world chess champion, was defeated by IBM's Deep Blue computer in 1997, and this victory is regarded as one of the most significant examples of symbolic AI in action. A trained human brain could not be surpassed by a machine until the development of Deep Blue. [4] To use a modern smartphone as an example, the Deep Blue's processing performance is equivalent. Symbolic AI, despite its immense potential, is only effective for systems that follow unambiguous rules, which is not often the case in the reality of live systems. Furthermore, there are significant functional distinctions between biological intelligence and symbolic AI. Symbolic AI is only capable of making judgments that follow a predetermined set of rules. However, biological intelligence is able to make decisions based on knowledge learned from, for example, experience and perception of the world. [5] Machine learning (ML) and artificial neural networks (ANNs), which were modelled after the networked neurons in the biological brain, introduced a similar property. For instance, it is well known that the strength of the synapses, or connections, between neurons, affects the biological brain's process for memory. We now understand a lot more about how neurons use associative memory to process information thanks to the amazing Hopfield network model. The Hopfield model assigns each node a binary unit and uses weights to express the degree of connections between nodes. It has been employed successfully in many different applications, including boosting the network's coding and information retrieval capabilities. [6]

Artificial intelligence's Hidden Markov Model (HMM) is important to stochastic processes that take place in systems with non-repeating fixed patterns of behaviour. It has been used, for instance, in molecular sequences where the rates of evolution at various sites are uneven and unknown, and the HMM allows for rate differences between sites and correlations between neighbouring site rates. [7] A important advancement in AI is machine learning (ML), which includes giving the computer samples of data on an interest topic with different but related patterns. Then, using qualities that identify between several types

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of pattern representations, the computer looks for characteristics that are shared by all of the various categories in order to learn about those patterns. The computer's goal after this level of learning is to categorise a novel pattern that is presented to it or to forecast future behaviour of the system being researched. Reservoir Computing has expanded the ML network to incorporate layers of connections, which improves the process' efficiency. [8] Deep Learning (DL), which consists of many processing layers in artificial neuronal networks meant for pattern recognition and modelling intricate connections between input and output, has been largely responsible for recent advancements in AI. As a result of DL, there is also more potential to use computer-assisted discovery in the identification of macromolecular targets for pharmaceuticals, molecular design, and protein structure prediction. [9] It's crucial to bring biology back into AI. In the scientific literature, protests against the division of biology into specialised subdisciplines and calls for its reunification have long been heard. But thus far, a complete union has eluded us. The main cause of biology's first division was human intellectual constraints in terms of gathering data, integrating data, and testing theories across many subdisciplines. Without overcoming these barriers, reintegration won't be possible. [10] Or, to put it another way, it is impossible for humans to fully understand the most fundamental biological processes and the knowledge that goes along with them in order to start a widespread, human-driven reintegration. People argue that the best possibility of overcoming human cognitive constraints, which have led to biology being separated into ever-more-specialized subdisciplines, is the progress of AI methodology and technology. The plan for reintegrating biology takes into account the huge potential of modern AI methods to speed up biological research. The methods and approaches for data integration can yet be improved, even though current AI and ML techniques are already having an impact on biology. [11] Hardware processing speeds have drastically increased thanks to technological advancements, but when working with enormous amounts of data, poor input/output performance can seriously hinder overall operation. It is anticipated that new AI toolkits will make it possible to research biology at scales never before possible and might even be inspired by biological processes.

Biology is an extremely tough subject to teach and understand because most of the structures and processes it entails are interrelated and complex. Humans use their senses to understand reality and their environment, with vision serving as the most varied source of information about our surroundings. The use of visualisation and object manipulation in teaching and learning is extremely beneficial. Visualization tries to activate the 50% of our neurons that are associated to vision. [12] Though quite capable, human senses have some inherent limitations. For instance, it is difficult to see and understand intricate and dynamic biological concepts and processes, especially at the microscopic level. Concepts whose subject matter deals with processes demand more than what can be provided by conventional teaching techniques. Like all other areas of science instruction, biology instruction and practise heavily rely on illustrations of the connections between anatomical structure and biological processes. [13] Simulation-based visualisations aid students in understanding abstract ideas, intricate procedures, and building mental models. This explains Gross's statement that "knowledge of essential biological ideas rests in part on students' capacity to aggregate quantitative notions and the qualitative means of expressing and utilising data" (from the cellular to the planetary scales). Students typically have preconceived notions and false assumptions that they use to frame their understanding of the world when they arrive to class. Many topics are the subject of misconceptions, including photosynthesis and cellular respiration. For comprehending science, prior knowledge and ideas are crucial. Due to their complexity, abstract character, and/or conflict with common sense and experience, many scientifically accepted theories are challenging for students to understand. When pupils encounter new material, they modify it in light of their prior understanding. Retained false beliefs obstruct learning and distort it. Therefore, it should be clear that if people are interested in good teaching and learning, they should take into account the misconceptions of the students. It is necessary to design new strategies for knowledge building and misperception correction. [14] The teaching process necessitates that educators have access to a variety of teaching resources so they can create new methods of biology instruction and meet the growing demand. Students who use these technologies have access to a medium that broadens and deepens their experiences, participates effectively in the educational process, and ultimately builds knowledge. According to their respective qualities and characteristics, each teaching tool aids in the learning process overall and helps reveal the subject matter's various facets. Many facets of challenging biological concepts and events can be revealed via images, movies, models, microscopes, and experiments. [15] Although biology effectively uses these tools to demonstrate key ideas, a significant drawback of traditional teaching methods is that they restrict self-action. As they learn in the third person and not through direct experience, students frequently remain passive information consumers with no direct contact and feedback. Since the introduction of information and communication technologies (ICT), extensive research has been done to support science teaching and learning in classrooms by integrating technology. A new collection of instructional tools has been developed that make use of simulations and visualisations, which are crucial for creating mental and/or visual representations and solving problems. [16] This paper presents the optimization of biological educational model using artificial intelligence.

2. Materials and Methods

Fig. 1 shows how AI might be used to optimise biological education is depicted visually. A field of computer science called artificial intelligence (AI), also referred to as computer intelligence, focuses on developing novel concepts and systems that can make decisions and complete tasks without human intervention. Artificial intelligence (AI) refers to any type of software or technology that supports machine learning (ML), machine vision, natural language understanding (NLU), and natural language processing (NLP).

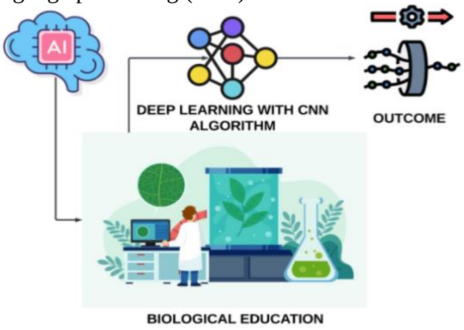

Figure 1. Graphical representation of AI in optimization of biological education.

Methods like deep learning and machine learning are used in artificial intelligence. Given that the terms machine learning (ML) and deep learning (DL) are commonly used interchangeably, it is essential to understand the differences between them. As was already mentioned, ML is a subfield of DL, and vice versa. Machine learning (ML), a branch of artificial intelligence (AI), allows computer programmes to develop increasingly accurate predictors without ever being told to. Machine learning algorithms forecast new output values using historical data as input. Machine learning is essential because it enables companies to create new products by giving them insights into customer behaviour trends and significant operational patterns. For many businesses, machine learning has grown to be a key competitive differentiation. The machine learning field of deep learning uses a lot of data to train artificial neural networks (ML). Layers of neural networks, which are algorithms modelled after how human brains work, underlie deep learning (DL). The neurons of the neural network are built through training with a large amount of data. The result is the creation of a DL model that, after training, can handle new data. DL models quickly and automatically take data from a variety of sources and analyse it without the need for human interaction. Since they can conduct multiple calculations at once, graphics processing units (GPUs) are ideal for deep learning model training. [17]

Biological Education is a system for preparing biologists for positions in natural science research facilities and as educators in biological fields of study. Biology is taught to professionals in medicine, agricultural production, pedagogy, and other fields that require specialized natural science education. Biology is a required school subject in general-education schools. Biological education has philosophical value; it aids in the development of materialist concepts of animate nature as well as the fight against religious prejudices. [18] Higher education in biology is provided in the USSR through biology and biology-soil departments of universities and departments of natural science; biology-chemistry and biology-geography divisions of pedagogical institutes; and medical, agricultural, veterinary, ichthyologic, and a few other higher education institutions. Reduce production costs or increase production efficiency could be the only design goal in design optimization. An optimization algorithm is a process that evaluates alternative solutions repeatedly until an ideal or workable option is identified. Since the development of computers, optimization has been included into computer-aided design processes. Today's most popular optimization algorithms fall into two categories. They are stochastic algorithms and deterministic algorithms, respectively. In an effort to improve higher education and make it more responsive to industry needs, advancements have given rise to a number of educational methods, including face-to-face learning, online classrooms, and blended learning. None of these, however, have made better educational decisions using the vast amounts of student data collected throughout learning.

Deep Learning's capacity to handle massive volumes of data has proven to make it a particularly effective tool. In terms of popularity, hidden layers have surpassed traditional techniques, particularly in pattern recognition. Convolutional neural networks are among the most often used deep neural networks. The activation that occurs when a filter is applied to an input is all that a convolution is. When the same filter is applied to an input repeatedly, a feature map is produced. The location and durability of a recognised feature in an input, such as an image, are displayed.

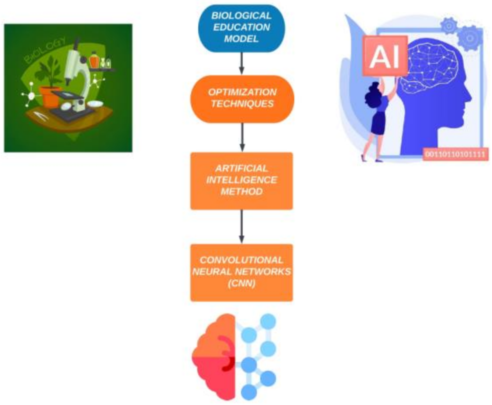

Figure 2. Flowchart on CNN in biological education.

A CNN's convolutional layer serves as its structural base and is where the majority of computation occurs. Data input, a filter, and a feature map are some of the elements that are required. Consider a scenario where the input is a colour image made up of a 3D pixel matrix. Height, width, and depth, which stand for the RGB colour space in an image, will therefore be the three dimensions of the input. Moving across the image's receptive fields is a feature detector, also known as a kernel or filter, which looks for the presence of the feature. Convolution is the term used to describe this.

The reunification of biology will be aided by Artificial Intelligence (AI) technology designed expressly for biological sciences. We will be able to gather, link, and analyse data at previously unheard-of scales thanks to AI technology, and we will also be able to create multidisciplinary prediction models. They will make it possible to make both targeted and random discoveries. AI for biology will be a game-changing technology that will advance all facets of biological study.

$x = (x_1, x_2, \dots . x_n)$ represents the observable CNN model. With in equation below, the resemblance between the x and also the dataset of students in the ||x| is proven.

$$\|x\| = \sqrt{x_1^2 + x_2^2 + \dots + x_n^2} \qquad (1)$$

Here, w represents the functioning of the human wants, and $x = (x_1, x_2)$ represents the perception of tasks in educational systems, including biological education.

$$w = \left[\frac{x_1}{\|x\|}, \frac{x_2}{\|x\|}\right] \qquad (2)$$

If designers look at $\cos(\theta) = \frac{x_1}{\|x\|}$ *and* $\cos(\alpha) = \frac{x_2}{\|x\|}$, we could see that they will be equal. As a result, the w orientation vector can also be expressed as

$$w = (\cos(\theta), \cos(\alpha)) \qquad (3)$$

$$x.y = \|x\|\|y\| \cos(\theta) \qquad (4)$$

As you can see $\theta = \beta - \alpha$, Then we'll be able to get:

$$\cos(\theta) = \cos(\beta - \alpha) = cos\,\beta\, cos\,\alpha + sin\,\beta\, sin\,\alpha = \frac{x_1}{\|x\|}\frac{y_1}{\|y\|} + \frac{x_2}{\|x\|}\frac{y_2}{\|y\|} = \frac{x_1 y_1 + x_2 y_2}{\|x\|\|y\|} \qquad (5)$$

As shown in the equation below, it CNN framework's biological learning centralized repository seems to be an educational framework it relates with identifying the illogical evolution of such an information age that has forgotten its fundamental place within life learning.

$$x.y = \|x\|\|y\| \frac{x_1y_1 + x_2y_2}{\|x\|\|y\|} = x_1y_1 + x_2y_2 \quad (6)$$

The goal is to teach people using a methodical and simple approach to combine educated preconceived values and behaviour, which are suitable for particular automatic ideas, from instructional techniques to the present level to select convolutional techniques by applying the equation.

The competition's goal is to assist us in developing the best model feasible so that we may tie molecular information to a biological response as accurately as this data allows.The data has been given in comma separated values (CSV) format. Each molecule is represented by a row in this data collection. The first column provides experimental data describing a real biological response; either the chemical was seen to trigger this response (1), or it was not (0). The following columns are molecular descriptors (d1 to d1776), which are calculated parameters that can capture some of the molecule's features, such as size, shape, or elemental composition. The matrix of descriptors has been standardized.

3. Result and Discussion

The CNN algorithm seems to be a deep data analysis technology and modifies data frame to extract the maximum value as from data processing. Because data analysis is often more advanced and the quantity of free information is relatively huge, deep learning techniques struggle to find patterns in the data.

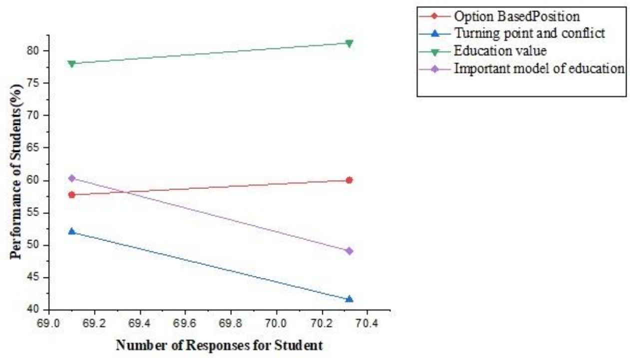

Figure 3. The assumption rate for college student information (per 10,000 data points).

Fig. 3 shows students believe education is the objective, and also that education includes not only education but it also aid, growth, appreciation, knowledge, service, among cooperation, all of which help students attain their full potential. Related to behavioral product evaluation, learned biology in the classroom and optimizes the efficiency of the undergraduate framework for inspiring kids both intellectually and physically. While adopting the DL-IPL approach, various college students dispute regarding the IPL of inventive tactics and also the ultimate trend. Table 1 shows the outcome.

Table 1. The assumption rate of college student recordings (per Record 10,000 datas)

The total number of responses	Conflict and the turning point	Position based on options	The importance of education	Learning is an essential model
20	68.32	65.75	86.23	70.43
40	55.18	67.88	87.53	65.87
60	48.51	70.22	90.44	55.55
80	64.62	67.42	93.76	88.32
100	55.74	73.78	91.77	72.55

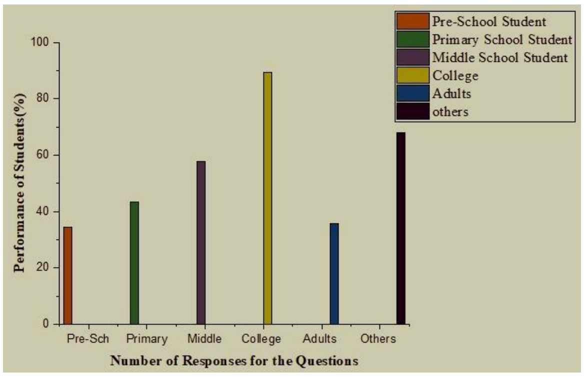

Figure 4. Student biological education management from high school to college was compared using the CNN Algorithm.

A few questions and replies from an online poll of college students at two different universities were used in Fig. 4 to validate the DL-based Biological education technique. The student's capacity to attend class is significantly impacted by the physical quality improvement. Political behaviour focuses only on the crucial tasks of cognition education because it is knowledge in the sense of ethical processes dealing with the specific personality of biological education, creative approaches, and linkages to values. Topics such affect approach position, definitive moment, conflict, and educational value are all included in DL-based biology education.

Table 2. Compares student biological education management using the CNN Algorithm (from elementary school to college)

School and college	Convolutional neural network	
	Performance analysis(%)	
Pre-school student	Accuracy (%)	45
Primary-school student		54
Middle-school student		69
College		92
Adults		45
Others		73

Table 2 displays the rate of adaptation. According the biological and methodological model, people have resulted in intellectual and social training of ideas, a specific form of growth, as well as thinking. Academic scientific theory, therefore biological education, and also the practice of links that connections were merged into practical teaching methods of the academic and cultural education framework.

4. Conclusion

Recent technological advancements have made it possible to use cutting-edge technology, such artificial intelligence, in every industry. A system called biological education prepares biologists to work in institutions that conduct natural science research and to instruct students in biological disciplines of study. Making something as perfect, useful, and efficient as you can is known as educational optimization. The optimization of the biological education model in the context of artificial intelligence is presented in this research together with the design and construction of a convolution neural network (CNN). The analysis showed that the proposed model has a 92% efficiency.

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