Comparative Study on Traditional and Artificial Intelligence-based models/systems

Krovvidi S B Ambika
[1]Assistant Professor
[1]Department of Computer Science and Engineering,
[1]Aditya College of Engineering & Technology, Surampalem, India

Abstract - With the potential to incorporate intelligence and human behaviour into systems or machines, artificial intelligence (AI) has emerged as a prominent technology in this period of the Fourth Industrial Revolution (also known as Industry 4.0 or 4IR). Hence, AI-based modelling is essential for the construction of automated, intelligent, and smart systems that are suitable for modern requirements. The capabilities and intelligence of an application can be improved by the use of a variety of forms of artificial intelligence, including as textual, interactive, functional, analytical, and visual AI, to address problems that occur in the real world. This review paper gives a comparison of the traditional and artificial intelligence -based models.

Index Terms - Artificial Intelligence; Traditional models; Convolutional Neural Networks; Artificial Neural Networks

I. INTRODUCTION

The subfield of computer science called artificial intelligence (AI) is dedicated to the creation of intelligent computers which is having the capability of enabling activities which will generally need the of a human being's intelligence to accomplish [1].To put it another way, we may say that its purpose is to enable computers intelligent and clever by providing them with the capacity to analyse and understand through the use of machines or computer programmes, which means that they can analyse as well as function in the similar method as human beings. AI have the ability to enable people live lives that are highly efficient without requiring them to work as hard, and it also has the potential for managing the huge network of interconnected nations, states, businesses, as well as individuals in a method that is beneficial to people. These are just some of the potential benefits of AI [2]. So, the basic objective of artificial intelligence (AI) is to provide computers and other robots the ability to carry out cognitive tasks such as comprehension, perception, decision-making, and problem-solving of human communication. Because of this, AI-based modelling is the key for enabling smart, intelligent, and automated systems in accordance with the requirements of today.

II. TRADITIONAL METHODS

Regression models (RMs), Time series (TS) models, and grey models are some of the more common types of models that are employed (GMs). Numerous researchers have worked hard for either improving the structure of the models or combining these with similar more modern methodologies in order to obtain a higher level of accuracy in their findings. As a direct result of this, a significant number of upgraded conventional models as well as hybrid conventional models were developed.

a) Time Series Models

TS models are techniques which are constructed on the basis of the data of the object that is being considered. It should not be hard to develop these traditional models since only modest quantities of historical data are needed, and it is not necessary to take into account any external inputs [3,4]. In addition, there is no need to take into account any contemporary variables. The two most common types of classical time series models are the moving average (MA) model and the autoregressive (AR) model.

b) Regression Models

The LogR model was one of the early forms of regression analysis, and it was utilised in a variety of contexts [5]. For modelling the relationship among one or more independent variables and a dependent variable, the linear regression model takes a linear approach to modelling the relationship [6].

Observational data is modelled in Non-Linear Regression models by a function, that is a nonlinear combination of parameters of model and is depending on one or more independent variables. These models do not use linear combinations of model parameters. The level of adaptability and variety offered by NLR models is significantly more than that of TS and RM ones [7].

Gray forecast is a method that can be utilised to make predictions on the behaviour of nonlinear time series. This is a way of predicting that does not rely on statistics, and it is particularly useful in situations in which there is an insufficient amount of data [8].

III. ARTIFICIAL INTELLIGENCE BASED METHODS

Artificial Neural Networks (ANN), Convolutional Neural Networks (CNN), and Long Short-Term Memory (LSTM) are three examples of the many AI-based models that are put to use in a variety of different applications.

a) Convolutional Neural Networks

A CNN, also known as a ConvNet, is a type of neural network that is used to extract characteristics from the data that was entered. It is made up of a variety of layers, with each of them having their own distinct characteristics to obtain important features. At the very end, it assigns categories to the various aspects of the image, as a consequence of which the corresponding recognition was achieved. The CNNS have undergone a transition phase of development during which certain publications have established more effective methods to GPUs should be used to train these networks.

Inside of the convolutional neural network, we have the ability to specify the total number of times it will be trained, as well as the amount of data in each block that will be input into the procedure for training (Bsize) [9].

b) Long Short-Term Memory

Long Short-Term Memory" (LSTM) is an innovative form of recurrent network architecture that, when combined with an appropriate gradient-based learning algorithm, is known as "Long Short-Term Memory." LSTM was developed specifically to address issues related to error back-ow. Even in the presence of noisy, incompressible input sequences, it is capable of learning to bridge temporal spans of more than 1000 steps without suffering a reduction in its small-time lag capabilities. So as to obtain this objective, it is needed to have an effective algorithm which is based on gradients and an architecture that guarantees continuous (and, as a result, either exploding nor vanishing) error flow across the internal states of special units. The long-term error flow will not be affected by this as long as the computation of the gradient is terminated at specified locations that are relevant to the design [10].

c) Artificial Neural Networks

A cluster of nonlinear processing elements that are able to do parallel processing makes up what is known as a neural network. These nonlinear processing units are termed neurons. They have a structure for the handling and processing of information that is dispersed. The input can be accepted by the neural network, and it can serve as a mathematical processor, carrying out the operations that have been described in order to create the output. These can be able for identification of patterns from the data that is provided to them and later completed the later data ranges by simulating the reasoning and pattern matching processes that occur in the human brain. They are also capable of being trained to eliminate noisy data and retrieve accurate information by replicating the processes that occur in the human brain [11].

In terms of modelling, a large amount of research work was done out in the before years for developing the abilities of artificial neural networks. This research has been carried out (ANN). Neurons in artificial neural networks are strongly interconnected with one another. While connected, however, they become powerful enough to tackle complicated issues [12], despite the fact that they exhibit simple behaviour when operating alone.

IV. CONCLUSIONS

In this review study, both traditional models and models based on AI are evaluated and contrasted with one another. According to the research that has been conducted, AI methods have already proven to be important in a huge range of research fields and applications. These fields and applications include cybersecurity, internet of things, smart cities, healthcare, finance, business intelligence, visual recognition, and many others.

V. REFERENCES

[1] Jiang, Y., Li, X., Luo, H., Yin, S., & Kaynak, O. (2022). Quo vadis artificial intelligence?. Discover Artificial Intelligence, 2(1), 4.

[2] Aggarwal, K., Mijwil, M. M., Al-Mistarehi, A. H., Alomari, S., Gök, M., Alaabdin, A. M. Z., & Abdulrhman, S. H. (2022). Has the future started? The current growth of artificial intelligence, machine learning, and deep learning. Iraqi Journal for Computer Science and Mathematics, 3(1), 115-123.

[3] [3] Masini, R. P., Medeiros, M. C., & Mendes, E. F. (2023). Machine learning advances for time series forecasting. Journal of Economic Surveys, 37(1), 76-111.

[4] [4] Petropoulos, F., Makridakis, S., & Stylianou, N. (2022). COVID-19: Forecasting confirmed cases and deaths with a simple time series model. International journal of forecasting, 38(2), 439-452.

[5] [5] Santiago, C., Ortega-Tenezaca, B., Barbolla, I., Fundora-Ortiz, B., Arrasate, S., Dea-Ayuela, M. A., ... & Lete, E. (2022). Prediction of Antileishmanial Compounds: General Model, Preparation, and Evaluation of 2-Acylpyrrole Derivatives. Journal of Chemical Information and Modeling, 62(16), 3928-3940.

[6] [6] Liu, D., Xu, Z., Lu, X., Yu, H., & Fu, Y. (2022). Linear Regression Model for Predicting Allyl Alcohol C–O Bond Activity under Palladium Catalysis. ACS Catalysis, 12(22), 13921-13929.

[7] [7] Bulturbayevich, M. B., & Baxromovna, B. L. (2022, June). APPLICATION OF NONLINEAR REGRESSION MODELS. In Conference Zone (pp. 299-303).

[8] [8] Ding, S., Tao, Z., Zhang, H., & Li, Y. (2022). Forecasting nuclear energy consumption in China and America: An optimized structure-adaptative grey model. Energy, 239, 121928.

[9] [9] Zha, W., Liu, Y., Wan, Y., Luo, R., Li, D., Yang, S., & Xu, Y. (2022). Forecasting monthly gas field production based on the CNN-LSTM model. Energy, 124889.

[10] [10] Zha, W., Liu, Y., Wan, Y., Luo, R., Li, D., Yang, S., & Xu, Y. (2022). Forecasting monthly gas field production based on the CNN-LSTM model. Energy, 124889.

[11] [11] Kurani, A., Doshi, P., Vakharia, A., & Shah, M. (2023). A comprehensive comparative study of artificial neural network (ANN) and support vector machines (SVM) on stock forecasting. Annals of Data Science, 10(1), 183-208.

[12] [12] Gupta, T. K., & Raza, K. (2019). Optimization of ANN architecture: a review on nature-inspired techniques. Machine learning in bio-signal analysis and diagnostic imaging, 159-182.