Original Article

# Development of Novel Convolutional Neural Network-Based Model for Sales Forecast in an Electronic Retail Store during Festive Seasons and Comparison of Prediction Accuracy with Deep Belief Network

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## Abstract

**Aim:** The aim of this paper is to implement a Novel Convolutional Neural Network based has model for Sales forecast in an Electronic Retail Store during Festive seasons and a comparison of prediction accuracy with a Deep Belief Network. **Materials and Methods:** Deep Belief Network (N=10) and Novel Convolutional Neural Network algorithm (N=10), n is iterated at different times for predicting the accuracy percentage of accidents that happened. Two sample groups are taken into consideration and tested, G-power is a calculation that contains two different groups, alpha (0.05), and power (80%). **Results:** It was observed that the Deep Belief Network algorithm obtains an accuracy of 77.14% and the Novel Convolutional Neural Network has 84.86%. This Deep Belief Network appears to have a significance of p=0.019 than the Novel Convolutional Neural Network, that is p<0.05 using an independent sample forT-test analysis. **Conclusion:** The Deep Belief Network technique appears to have more significance than the Novel Convolutional Neural Network algorithm. The analysis generally works in a variety of end-use industries, and the results demonstrate that this strategy is important. The result proves that the Novel Convolutional Neural Network approaches to predict the retail sales store prediction.

**Keywords:** Retail Store, Prediction, Neural Network, Sales, Novel Convolutional Neural Network, Deep Belief Network.

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## INTRODUCTION

This paper is Used for monthly data, this paper forecasts retail electricity sales. Electricity sales have a notable seasonal trend, according to this projection.(Wilde 2000). Three units are models that have been developed this use this pattern and all have been shown to work with cyclical data (Han, n.d.). Because the energy retail sales data has a significant seasonal pattern, we'd like to capture it as well as other trends (Çoker et al. 2022). Three-time series models with dummy variables, the current and lagged value of the average retail price of electricity, population, and the industrial output index were built to predict retail electricity sales (Hedrick et al. 2022). The forecast shows the results that are also compared to the actual value in many aspects for each sector Information mining techniques are extraordinarily hit gadgets.

In IEEE Xplore, 53 relevant publications were published, while in Google Scholar, 68 associated articles were published (Nicasio 2014). These troubles might be beaten by way of means of using extraordinary data mining techniques. In this paper, we anticipated specified forecast income prediction (Welwean et al. 2022). The extraordinary techniques and measures for deal expectancies are portrayed withinside the later piece of the exploration work (Blackwell et al. 2022). Stock forecasting has a big effect on the achievement and overall performance of companies. Specifically, in the retail and consumer organized ventures, just like the digital marketplace or the fashion enterprise, particular gauges are fundamental (Cho and Kim 2020).
Our institution is passionate about high quality evidence based research and has excelled in various fields (Parakh et al. 2020; Pham et al. 2021; Perumal, Antony, and Muthuramalingam 2021; Sathiyamoorthi et al.

2021; Devarajan et al. 2021; Dhanraj and Rajeshkumar 2021; Uganya, Radhika, and Vijayaraj 2021; Tesfaye Jule et al. 2021; Nandhini, Ezhilarasan, and Rajeshkumar 2020; Kamath et al. 2020).The existing system has issues and major parts (Zhu et al. 2021). Business enterprise faces excessive problems to understand a precise data mining manner and effective prediction methodology (Maingi 2015) due to the first-rate improvement of the giant extent of data applied on the internet primarily based totally on enterprise exchanges. The capacity to be expecting growth in income from someday to the following could on my own be a beneficial reference in overcoming and controlling the product show and in-keep marketing and Expectation on the following day (Berg 2014).

## MATERIALS AND METHODS

This study was gathered in the Open Source laboratory, Department of Computer Science and Engineering, in Saveetha School of Engineering, Affiliated with Saveetha Institute of Medical and Technical Sciences, Chennai. It is considered that two groups of classifiers are used, namely, Deep Belief Network and Novel Convolutional Neural Network algorithms, which are used to recommend them for sales forecasting and prediction (Çoker et al. 2022). Group 1 is the Deep Belief Network algorithm has a sample size=10 and the Novel Convolutional Neural Network algorithm in group 2 with a sample size of 10 For determining the best method, they are compared for better accuracy and precision score values. Clinical.com was used to create the pre-test analysis, which had a G power of 80% and a which has a threshold of 0.05%, CI of 95% mean, and standard deviation. The nutrition dataset was used in the study. This data was obtained from the open-source kaggle website. In this study, the Deep Belief Network method was used, and it was compared to the Novel Convolutional Neural Network algorithm (Welwean et al. 2022). The fundamental aspects of offering capacities are identifiable evidence of object property, price preoccupation, and the internet offers acknowledgment and delivery of recent goods. Deals data study faces a number of challenges.

**Deep Belief Network**

The first step in the Deep Belief Network is to study a layer of functions from the seen devices, the use of the Contrastive Divergence (CD) algorithm. Then, the following step is to deal with the activations of formerly educated functions as seen devices and study functions in a 2nd hidden layer (Wang et al. 2022). Finally, the entire Deep Belief Network is educated whilst getting to know the very last hidden layer is achieved.

**Algorithm**

1. Bring the data into the code.
2. Examine the information and the dataset in its current form.
3. Process for facts to accurate
4. With two functions find the facts of attributes and labels
5. Check out the facts and divide education
6. Deep Belief Network trains the data

**Novel Convolutional Neural Network**

A supervised learning method is used in the Algorithm for Regression. Based on the similarities with other recent examples, it forecasts the target. The distance metric is used to calculate the accuracy, with Euclidean distance being the most popular method (Timberlake et al. 2021). Predictions are formed by searching the whole dataset for the N most comparable cases, i.e., the testing point's neighbors. Predicting sales is a regression challenge rather than a time series one. In comparison to time series methods, practice demonstrates that using regression procedures may often produce better results. Patterns in time series can be discovered using machine-learning methods. (Davies 1973). Applying supervised machine-learning approaches, we may identify complex patterns in sales dynamics. Tree-based machine-learning algorithms are among the most used.

**Algorithm**

1. Datasets to import from kaggle which was Downloaded
2. The data and analyze the dataset and how it looks.
3. Prework on the datasets to be done
4. Splitting in the dataset for attributes and labels
5. Divide and conquer the data which has training and testing sets
6. Novel Convolutional Neural Network trains the data
7. Make some recommendations.

**Statistical Analysis**

IBM SPSS version 21 was used for the statistical analysis. The statistical software program that is used to evaluate data. 10 iterations with a maximum of 20 samples were performed for each proposed and present algorithm, and the anticipated accuracy was utilized to analyze accuracy for each generation. The Independent variables are rating, Product cost, Discounts, and dependent or retail price. The charge was calculated based on the Independent Sample T-test iterations that were completed.

## RESULT

The Convolutional Neural Network and comparison of the Deep Belief Network is taken as accuracy for sample size N=10 per group. Because of its efficient classification feature based on the Deep Belief Network, the algorithm outperforms theConvolutional Neural Network.

Table 1 shows the comparison of groups namely DBN and Novel Convolutional Neural Network for the sample 10, it achieved 84.86% and 77.14% accuracies respectively.

The outcome of the independent sample T-test is presented in Table 2, the frequency of 3.66 at the time of 18 the significance received as 0.019 for the alpha 0.05, and the confidence interval is 95%.

Figure 1 represents the performance accuracy of DBN and Convolutional Neural Network, where the X-axis scales the accuracy and Y-axis scales the algorithms used. The error bar is classified for the CI as 95 % and SD +/- 1.

## DISCUSSION

The significance was established using an independent sample t-test of 0.019 with a less than 0.05 significance level. For this experimental investigation, this demonstration demonstrates the presence of importance in groups. The group's analysis yields a mean accuracy of 84.86% for the Novel Convolutional Neural Network and 77.14% in the Deep Belief Network, which indicates the Novel Convolutional Neural Network is better than the Deep Belief Network.

For constructing numerous profit forecasting paradigms, many statistical procedures in conjunction with regression, Auto-Regressive Integrated Moving Average, and the Auto-Regressive Moving Average, have been applied. However, profit forecasting is a difficult task that is supported by the resource of using external elements in addition to internal factors, and there are significant downsides to the statistical technique, as recommended by the resource of using A. S. Weigend(Lohse and Spiller 2006). Recognized artwork withinside the location of sale forecasting changed into completed (Webber et al. 2018) They did profits forecasting on newly published books in a bit of writing about an enterprise manipulating the environment via using computational methods. Artificial Neural Networks are also used withinside the profit forecasting location (Wang et al. 2022; Silva, Villa, and Cabrera 2020). Fuzzy Neural Networks were brought with an aim to beautify the prediction of normal overall performance more, Radial Basis Function Neural Network is a concept that has an extremely good capacity for the prediction of profits (Kaneko and Yada 2016). Holiday income accounts for a massive part of the annual sales for plenty of retail businesses. Understanding the browsing and buying styles in the course of such every year buying festivals. The hastily developing retail region is e-Commerce on cellular gadgets, contributed through increasingly more cellphone proprietors who are getting acquainted with cellular purchases. Mobile has already grown to be a number one platform via which online traffic gets the right of entry to buying web websites instead of computing device computers. According to ComScore, 63% are online.

This paper theoretically elaborates on the connection between the sought information and the income quantity and builds a theoretical framework for the proposed system. Since with the limitations, the hour of execution was tremendous, and overseeing an arrangement of records is complicated. A portion of the records was disposed to be worked on forecast retaining, it can be worked properly during the examination stage for better accuracy.

## CONCLUSION

For retail shop sales prediction, Novel Convolutional Neural Network, and Deep Belief Network were used in the experiment. Various statistical methods are used to compare the results. Finally, it is concluded that Novel

Convolutional Neural Network (84.86%) accuracy is more than Deep Belief Network (77.14%) and performs better.

## DECLARATION

### Conflicts of Interest

No conflict of interest in this manuscript.

### Authors' Contributions

Author BR was involved in data collection, data analysis, and manuscript writing. Author SPC was involved in the conceptualization, guidance, and critical review of the manuscript.

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## TABLES & FIGURES

**Table 1.** Statistical analysis of Novel Convolutional Neural Network and Deep Belief Network. Mean data transmission speed value, for Standard deviation and Standard Error Mean for Novel Convolutional Neural Network and Deep Belief Network algorithms. It is observed that the Novel Convolutional Neural Network has a better data transmission speed than the Deep Belief Network algorithm.

| | Algorithm | N | Mean | Std.Deviation | Std.Error Mean |
|---|---|---|---|---|---|
| Accuracy | Novel Convolutional Neural Network | 10 | 84.8690 | .57853 | .18295 |
| | Deep Belief Network | 10 | 77.1490 | .51490 | .16283 |

**Table 2.** Independent sample test for significance and standard error determination. The significance p-value = 0.019 is $p<0.05$ considered as the statistically significant and 95% is the confidence interval that will be calculated.

| Independent Sample T-test | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Leven's Test for Equality of Variances | | | | T-test for Equality of Mean | | | | | 95% Confidence Interval of the Difference | |
| | | F | Sig | t | df | Sig (2-tailed) | Mean Difference | Std. Error Difference | Lower | Upper |
| Accuracy | Equal Variance assumed | .366 | .019 | 17 | 36 | .000 | 7.72000 | .24491 | 7.20546 | 8.23454 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Equal Variance not assumed | | | 17 | 35.2 | .000 | 7.72000 | .24491 | 7.20496 | 8.23504 |

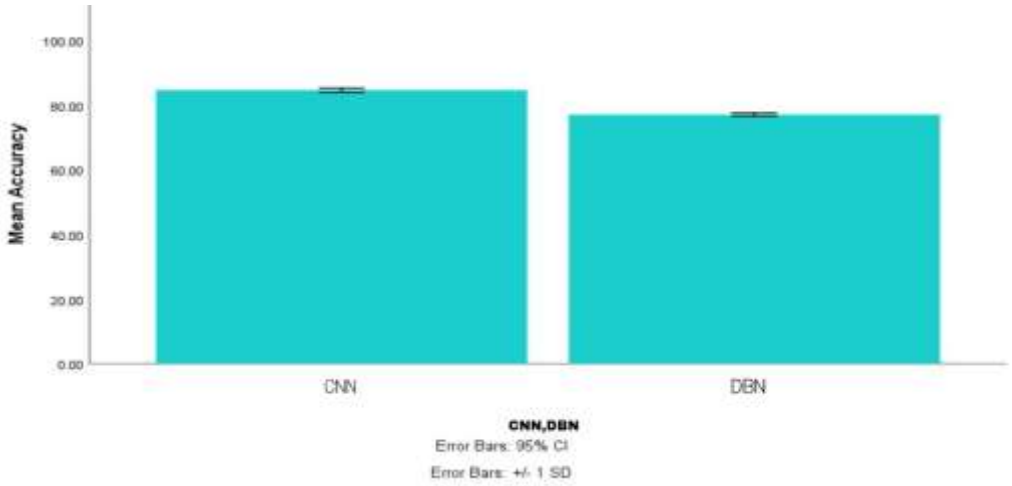


**Fig. 1.** Comparison of Deep Belief Network algorithm and Novel Convolutional Neural Network in terms of mean data transmission speed. The mean data transmission speed of the Novel Convolutional Neural Network is better than Deep Belief Network. The X-axis is CNN vs DBN and the Y-axis is Mean Accuracy. Error bars: +/- SD