Sales Forecasting Using Machine Learning

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ABSTRACT

The advent of machine learning was an extraordinary phase in the entire existence of software engineering as it provided the skills to deal with numerous problems that were previously considered difficult to solve by a machine. It is a data analysis method that automates the construction of analytical models. This is a branch of artificial intelligence based on the concept that machines can learn from data, spot patterns, and draw conclusions with little or no human input. Due to new computer technologies, machine learning now is not the same as it was in the past the machine learning of the past. Recognizing patter and the idea that computers can learn without being programmed for specific tasks, researchers interested in artificial intelligence wanted to find out whether computers can learn from data. The iterative aspect of machine learning is important because when models are exposed to new data, they can adapt on their own and learn from previous calculations to make reliable and repeatable decisions and results. It is a science that is not new, but has gained new momentum.

1. Introduction

Machine learning is a science that allows computers to work without explicit programming. In the past decade, machine learning has provided us with driverless cars, practical speech recognition, efficient web search, and a great understanding of the human genome. It is so common today that you might use it dozens of times a day without realizing it. Many researchers also believe that this is the best way to move to artificial intelligence on a human scale. In this course, you will learn the most effective machine learning techniques. And get the practice to implement them and make them run by themselves. More importantly, you can not only understand the theoretical basis of learning, but also obtain the practical knowledge needed to apply these technologies to new challenges quickly and effectively. Finally, learn about some of Silicon Valley's best practices.

2. Literature Survey

Intelligent Sales Prediction Using Machine Learning Techniques: This article proposes an idea of intelligent analysis and a decision-making system that requires a combination of decision-making analysis and prediction. Most business organizations rely heavily on knowledge bases and demand forecasts for sales trends. Accurate sales forecasts have a huge impact on the business.

Walmart's Sales Data Analysis - A Big Data Analytics Perspective: This study validated data collected from retail stores and predicted future store management strategies. The impact of different events such as weather conditions and public holidays can change the status of different departments. Therefore, he also checked these effects and checked their impact on sales.

Sales forecasting using multivariate long short term memory network models: In our work, we first introduced the use of historical information (HF) and daily sales value, and then in our improved model 148 we extracted the known future (FF) information from the original model features to 149,175 Such attributes are dates, holidays, inventory status, school holidays, information about the opening/closing of the store 176 and the number of customers.

Annual Automobile Sales Prediction Using ARIMA Model: Use the ARIMA method to predict data from a data set obtained stably from the initial data. To make it stable, we need to find the difference in average sales. Then the converted data is based on the logarithm of the variance, so the final data should have logarithmic transformation values of the mean and variance.

3. Algorithms and Concepts Used

3.1 ARIMA- Autoregressive Integrated Moving Average

The autoregressive integrated moving average (ARIMA) model of time series data can take many types. There are three types of practical value in modelling process-level changes: autoregressive (AR) models, integrated (I) models, and moving average (MA) models. These three classes are dependent linearly on the previous data points. The combination of these ideas led to the autoregressive moving average (ARMA) and autoregressive integrated moving average (ARIMA) models. • Autoregressive Integrated Moving Average (ARIMA) model, Box-Jenkins method is a type of linear model that can represent stationary and transient time series. The ARIMA model primarily relies on data autocorrelation patterns. • The Box-Jenkins ARIMA model is the common type of model used for time series forecasting and can be executed using transformations such as differentiation and lag.

The validity of ARIMA is checked by constructing a confusion matrix, which is created for the temperature dependence of the year. The confusion matrix can help visualize the results of the ARIMA classification algorithm. Here we implement in the programming language Python
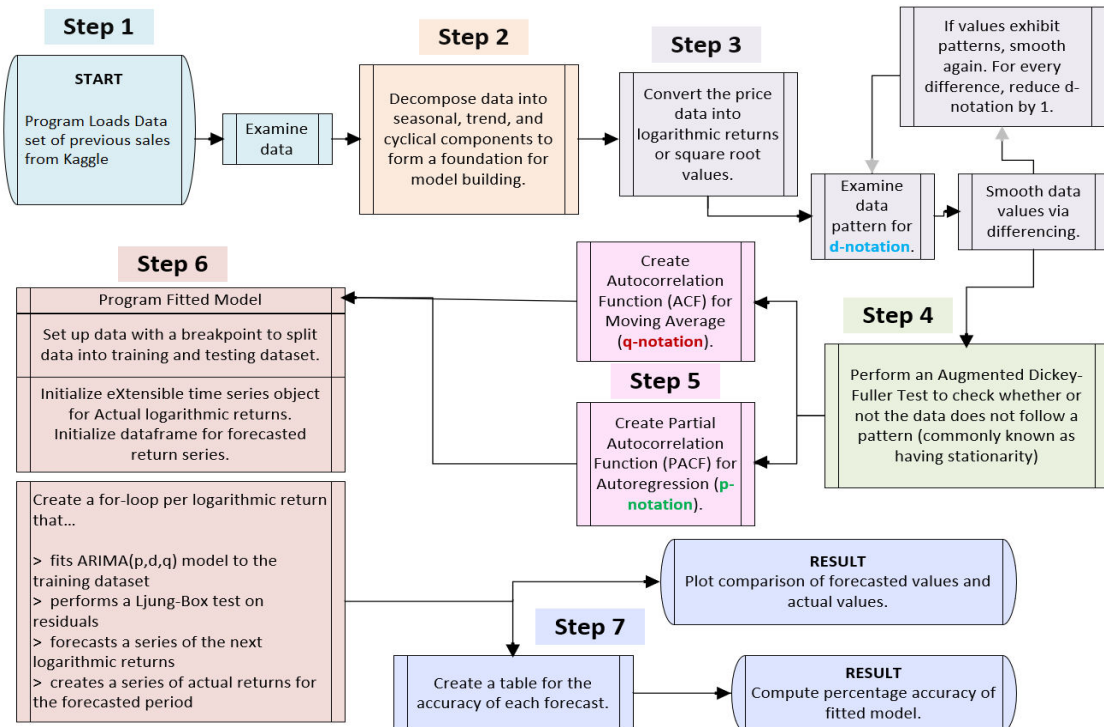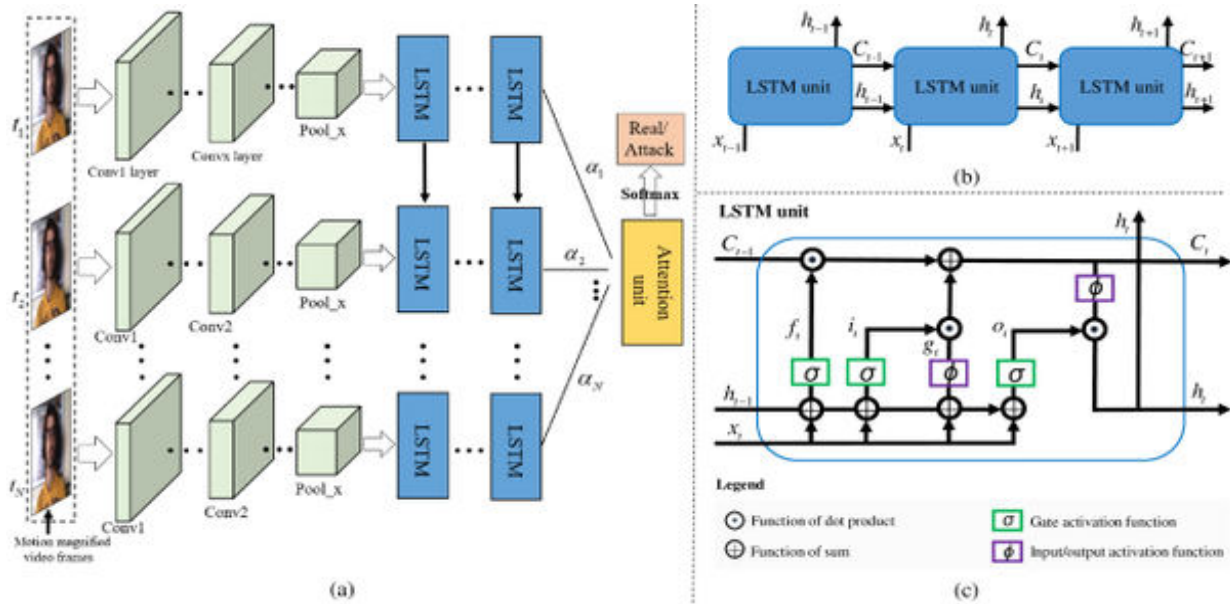
ARIMA Project Process

Illustration of idea behind ARIMA model

3.2 LSTM- Long short-term memory

Long short-term memory (LSTM) is a structure of synthetic recurrent neural networks (RNN) used with inside the area of deep learning. Compared with regular feedforward neural networks, LSTM has feedback. You can't most effective edit person statistics points (including images). There is likewise a whole statistics stream (including voice or video). For example, LSTM may be used for responsibilities including spotting coherent and unsegmented handwriting, speech reputation, and anomaly reputation in community visitors or IDS (Intrusion Detection System). The block includes a room, a front door, a go out door, and an oblivion door. Cells keep values at arbitrary intervals, and 3 gates adjust the float of statistics inside and out of the cell. Classify, process, and forecast primarily based totally on time collection statistics, due to the fact there can be delays of unknown length among the principle occasions with inside the time collection. This may be visible in education conventional RNNs. In many applications, the relative spatial period insensitivity is the gain of LSTM over RNN, hidden Markov version and different series education methods.

4. Proposed Methodology

4.1 ARIMA Model

The time series can be divided into individual components. Time series decomposition is a statistical technique that divides a time series into its components (trend, seasonal, periodic, and random/irregular). Mathematical representation is:

$$Dt = (St, Tt, ICt)$$

Where,

Dt is Time series value of time period t (real data).

St is Seasonal component (index) for period t.

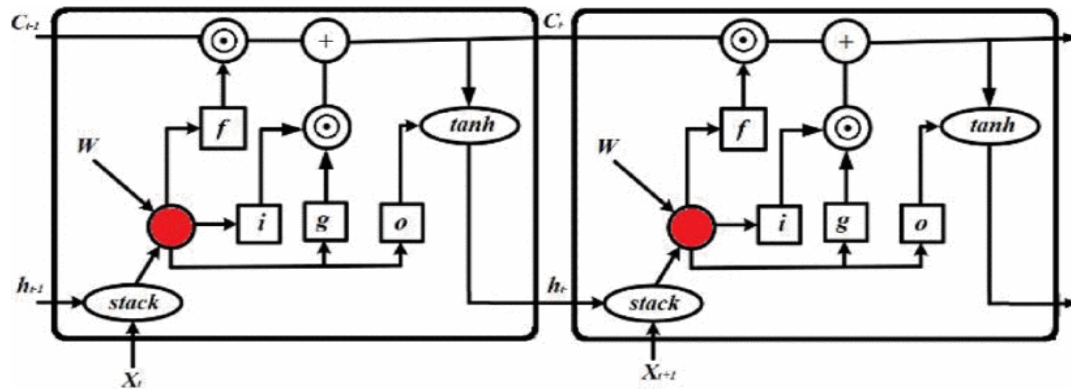Tt is The component of the trend cycle in period t.

ICt is Irregular component (remaining part) during t.

4.2. Long Short-Term Memory (LSTM)

LSTM consists of state boxes receiving the inputs through time. In each time step, an input vector is fed into LSTM, the output is computed according to:

$$ht = fw(ht-1, xt)$$
where xt is the input vector, ht and ht−1 are the state vectors at time t and (t-1), fw is a nonlinear activation function where w are the weight parameters.

5. Advantages

• Machine learning is a predictive method that has been proven to be more accurate than traditional methods such as moving averages.

• With more accurate sales forecasts of future inventory requirements, you can decide how much replenishment you need without guessing.

• Increasing the accuracy of sales forecasts can improve results by increasing revenue, reducing costs, and increasing productivity.

• Driven by consumer demand, competition in the e-commerce field has become increasingly fierce.

• This application is not difficult to utilize.

• An Improved focus for marketing operations.

6. Limitations

• **Expensive Technology Tools -** Manual processes are not technology-oriented, but computer tools such as spreadsheets are widely used. A typical sales organization also uses database software to track ongoing customer relationships.

• **Internal Bias** - A forecast is not always a realistic forecast of expected sales, but a description of expected sales.

• **Time-Intensive Completion-** Since this is a computationally intensive process, it is time-consuming and expensive for the main processor.

7. Conclusion and Future Work

Machine learning helps increase sales conversion rates because it has completely changed the way we sell. Machine learning tools will be able to scale, take action, and complete high-potential sales better than human workers, and proceed at a faster and more scalable speed. As a system for estimating future sales. In particular, it defines how many products will be sold in a certain period in the future, in which market and at what price. Promote and facilitate informed business decisions through forecasting. Sales, this forecasting method is also useful for understanding how the company should manage people, resources, and cash flow. This is essential for the effective allocation of internal resources to benefit from any forecast or trend, and is also a key performance indicator for companies wishing to increase investment capital.

Regarding the data collected over the years, industry trends and the current state of the sales process. With this in mind, it is best to understand these forecasts as a work basis, rather than hard forecasts, and can be used to forecast weekly, monthly, quarterly, or yearly income.

8. References

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