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Prediction of Warehouse Demand Using Various Time Series Method

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ABSTRACT:
A time series is a sequential set of data points, measured typically over successive times. The measurements taken during an event in a time series are arranged in a proper chronological order.A time series containing records of a single variable is termed as univariate, and more than one variable a multivariate.Here in this research paper we have collected the data of time square mall and predict the sale forecast for the ten new time steps. Here we have used ARMA and ARIMA model which are robust statistical tools.Because it is the human spirit expectations and demand for uncertain environment, and the volatile dynamic that has mass. Here wetry to make the best advice that is, if possible, to reduce uncertainty in the business or to eliminate it.
Keywords: Demand forecast, ARIMA, Auto ARIMA, Statistical model, Test and Training.

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I. INTRODUCTION

Demand forecasting is the result of a predictive analysis to determine what demand will be at a given point in the future. Forecasts are determined with complex algorithms that analyze past trends, historic sales data, and potential events or changes that could be factors in the future. Demand forecast bias can improve warehouse capacity planning and labor efficiency. It presents an empirical methodology to detect and implement forecast bias. Like many other companies in the industry, CVS Health uses time series-based, forward-looking forecasting for demand planning and inventory management. Such methods usually forecast demand at the retailer store and SKU level before aggregating demand to the supplier and distribution center level. The aggregated demand is a key indicator for supply chain operations: it helps distribution centers plan activities, and make financial decisions. To leverage the store and SKU level forecast, we examined the key drivers of distribution center operation and management. The ultimate goal of this thesis project is to evaluate the potential use of translating the demand forecast into expected activities in the warehouse. We start from the first market force that is demand, and when we define demand this is basically a relation Therefore, if we look at one or no income, or the market situation whether it is or whether it is a prediction [1, 2] The price, as some say when it comes to all other variables to demand rushed the product of all other remaining variables constant and the amount of goods and the relationship between the quantity carrots may be to be the typical or typical time is usually required.

Therefore, if they look to the definition of, there are two points, no one will be able to buy, and the other to the work of wishing to buy.

On the first that comes to individual demand, the market [3], the amount of the benefit of each and every thing indeed is willing, and able to buy it from their own particular a price between what is defined is to be granted is the time of return, or in sense of taste and the price from the other things, as an alternative to individual demand [4, 5, 6]. Complements products available in the market. For this reason, a hotel, or otherwise for any period of time which he has willed the price of the price of the level of demand for the ability of each, for the most part. The supply chain can be represented by the following diagram.

II. METHODOLOGY

There are various methods for prediction or future forecast. Some of them are moving average (MA),Autoregressive Moving Average (ARMA), Autoregressive Integrated Moving Average (ARIMA) and many more. Here we are using ARMA and ARIMA methods for the forecast of demand of time square mall. A time series is a sequential set of data points, measured typically over successive times.It is mathematically defined as a set of vectors x(t), t = 0,1,2,... where t represents the time elapsed.The variable x(t) is treated as a random variable.The measurements taken during an event in a time series are arranged in a proper chronological order.A time

series containing records of a single variable is termed as univariate, and more than one variable a multivariate. 'Pmdarima' is essentially a Python wrapper of several different statistical and machine learning libraries (statsmodels and scikit-learn), and operates by generalizing all ARIMA models into a single class.

Autoregressive Moving Average (ARMA)

- **Number of AR (Auto-Regressive) terms (p):** p is the parameter associated with the auto-regressive aspect of the model, which incorporates past values i.e lags of dependent variable. For instance if p is 5, the predictors for x(t) will be x(t-1)….x(t-5).
- **Number of MA (Moving Average) terms (q):** q is size of the moving average part window of the model i.e. lagged forecast errors in prediction equation. For instance if q is 5, the predictors for x(t) will be e(t-1)….e(t-5) where e(i) is the difference between the moving average at ith instant and actual value.

Autoregressive Integrated Moving Average (ARIMA)

In an ARIMA model there are 3 parameters that are used to help model the major aspects of a times series: seasonality, trend, and noise. These parameters ar

e labeled p,d,and q.

Number of AR (Auto-Regressive) terms (p): p is the parameter associated with the auto-regressive aspect of the model, which incorporates past values i.e lags of dependent variable. For instance if p is 5, the predictors for x(t) will be x(t-1)….x(t-5).

Number of Differences (d): d is the parameter associated with the integrated part of the model, which effects the amount of differencing to apply to a time series.

Number of MA (Moving Average) terms (q): q is size of the moving average part window of the model i.e. lagged forecast errors in predictionequation. For instance if q is 5, the predictors for x(t) will be e(t-1)….e(t-5) where e(i) is the difference between the moving average at ith instant and actual value.

III. DATA COLLECTION AND MODEL PREPARATION

We have collected the data from Time Square mall. Sample size of the data is 89290. Data is collected for the duration of 31/1/2016 to 2/3/2018. There are at most 130 different items. The feathers of the various categorical items are

- Year
- Session
- Day
- Week
- Class of item and
- Sales

Firstly the data was processes and then use the ARIMA model for time series prediction. ARIMA is an auto regressive moving average model.

IV. EXPERIMENTAL SETUP

Experimental testing requires dataset

Dataset

Dataset having the following features.

- There are 737 total sample for each class of items
- Training samples: 600
- Testing samples: 135
- ARIMA Model is used for Training
- A performance criterion is MSE.

The data set is showing in Fig. 3. The task has done in python programming.

V. RESULTS AND DISCUSSION

The evaluation metric which was used in measuring the errorrate is MAPE. Equation 1 shows how to calculate MAPE value

$$\text{MAPE} = \frac{100}{\text{N}} \sum_{\text{i}=1}^{\text{N}} |\text{P}_\text{i} - \text{Q}_\text{i}|$$

WhereP_i is actual value and $Q_i$is forecasting value.The predicted and the actual results are shown in Fig.1

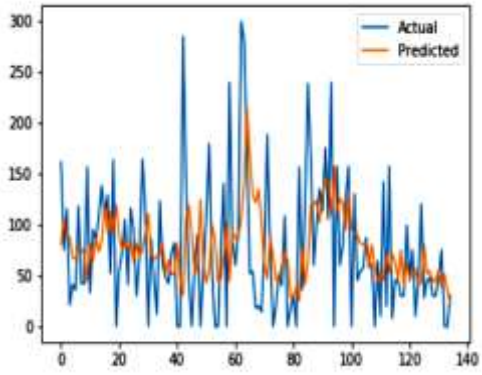

Fig.1 Comparison of actual and predicted data ARIMA Model

Here in this research paper we have collected the data of time square mall and predict the sale forecast for the ten new time steps. Here we have used ARIMA model which is a robost statistical tool. We have got the exact foot print of the trend of the data and the value of MSE is 4576. This value is not scaled that's why it is high.

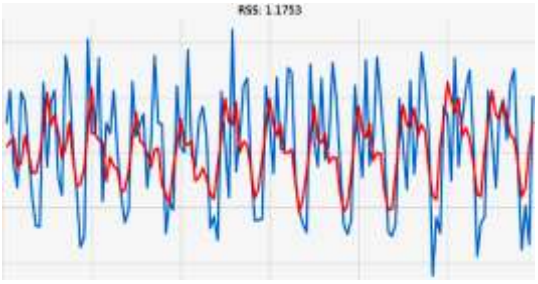

Fig.2 Comparison of actual and predicted data ARMA Model

Fig, 2 is showing the result of ARMA MODEL. The MSE of ARMA model is 4849. Which is slightly higher than the ARIMA model.

VI. CONCLUSION

A time series is a sequential set of data points, measured typically over successive times. The measurements taken during an event in a time series are arranged in a proper chronological order.A time series containing records of a single variable is termed as univariate, and more than one variable a multivariate. Here in this research paper we have collected the data of time square mall and predict the sale forecast for the ten new time steps. Here we have used ARMA and ARIMA model which are robust statistical tools.We have got the exact foot print of the trend of the data and the value of MSE is 4576. This value is not scaled that's why it is high.

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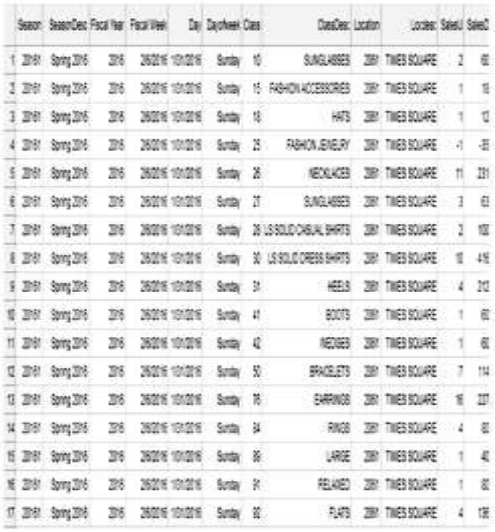

	Season	SeasonDesc	Fiscal Year	Fiscal Week	Day	DayofWeek	Class	ClassDesc	Location	Locales	SalesU	SalesD
1	20191	Spring 2019	2019	26/2019	1/01/2019	Sunday	10	SUNGLASSES	2001	TIMES SQUARE	2	60
2	20191	Spring 2019	2019	26/2019	1/01/2019	Sunday	15	FASHION ACCESSORIES	2001	TIMES SQUARE	1	15
3	20191	Spring 2019	2019	26/2019	1/01/2019	Sunday	16	HATS	2001	TIMES SQUARE	1	12
4	20191	Spring 2019	2019	26/2019	1/01/2019	Sunday	25	FASHION JEWELRY	2001	TIMES SQUARE	-1	-35
5	20191	Spring 2019	2019	26/2019	1/01/2019	Sunday	26	NECKLACES	2001	TIMES SQUARE	11	231
6	20191	Spring 2019	2019	26/2019	1/01/2019	Sunday	27	SUNGLASSES	2001	TIMES SQUARE	3	63
7	20191	Spring 2019	2019	26/2019	1/01/2019	Sunday	28	LS SOLID CASUAL SHIRTS	2001	TIMES SQUARE	2	100
8	20191	Spring 2019	2019	26/2019	1/01/2019	Sunday	30	LS SOLID DRESS SHIRTS	2001	TIMES SQUARE	10	410
9	20191	Spring 2019	2019	26/2019	1/01/2019	Sunday	31	HEELS	2001	TIMES SQUARE	4	212
10	20191	Spring 2019	2019	26/2019	1/01/2019	Sunday	41	BOOTS	2001	TIMES SQUARE	1	60
11	20191	Spring 2019	2019	26/2019	1/01/2019	Sunday	42	WEDGES	2001	TIMES SQUARE	1	60
12	20191	Spring 2019	2019	26/2019	1/01/2019	Sunday	50	BRACELETS	2001	TIMES SQUARE	7	114
13	20191	Spring 2019	2019	26/2019	1/01/2019	Sunday	76	EARRINGS	2001	TIMES SQUARE	16	227
14	20191	Spring 2019	2019	26/2019	1/01/2019	Sunday	84	RINGS	2001	TIMES SQUARE	4	80
15	20191	Spring 2019	2019	26/2019	1/01/2019	Sunday	99	LARGE	2001	TIMES SQUARE	1	40
16	20191	Spring 2019	2019	26/2019	1/01/2019	Sunday	91	RELAXED	2001	TIMES SQUARE	1	60
17	20191	Spring 2019	2019	26/2019	1/01/2019	Sunday	92	FLATS	2001	TIMES SQUARE	4	136

Fig.3 Data set

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