

Sales Forecasting using Supervised Machine Learning Methods

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Abstract: Working in sales is not always an easy game. Anyone in the role will tell you that they love it—but often want to pull their hair out. Companies have long struggled with how to include sales team insights into their operations forecasts. Machine learning techniques is a very effective tool in extracting hidden knowledge from an enormous dataset to enhance accuracy and efficiency of forecasting. Traditional forecast systems are difficult in dealing with the accuracy of sales forecasting. In this paper we briefly analysed the concept of sales data and forecasting using various supervised machine learning techniques on the basis of a performance evaluation, a best suited predictive model is suggested for the sales forecast. The results are summarized in terms of accuracy of efficient techniques taken for prediction. The studies found that the best fit model is support vector machine which shows maximum accuracy in forecasting and future sales prediction.

Keywords— sales forecasting, Machine Learning, Support vector machines

I. INTRODUCTION

Sales forecasting can play a major role in your company's success (and in our own career development). According to research from the Aberdeen Group, companies with accurate sales forecasts are 10% more likely to grow their revenue year-over-year[1]. A sales forecast predicts what a salesperson, team, or company will sell weekly, monthly, quarterly, or annually. Managers use reps' sales forecasts to estimate business their team will close.

Directors use entire team forecasts to anticipate department sales. The VP of Sales uses department forecasts to project organization sales. These reports are typically shared with company leadership, along with board members and/or stockholders. sales forecasts allow you to spot all potential issues while there's still time to avoid or mitigate them. You can then figure out what's going on and course-correct. Maybe your competitor has started an aggressive new discounting campaign, or your new sales comp plan unintentionally starts encouraging bad behavior. Suppose your sales forecast predicts a 26% increase in overall opportunities. To make sure you're keeping up with demand, you should start recruiting. If opportunities are predicted to go down, on the other hand, it would be wise to pause your hiring efforts. Simultaneously, look at bumping up marketing spend and investing in prospecting training for your reps. In addition, a sales forecast is a powerful motivation tool. The thing about forecasts is it's not just about sales. It represents the entire operating rhythm of the company. You need machine learning to make your forecasting process more accurate, and also to help your salespeople. It's essential to run a sales organization effectively.

In the existing system Predictions are made using common marketing strategies only. It's a tricky job, because so many different factors can affect future sales: economic downturns, employee turnover changing trends and fashion, increased competition, manufacturer recall and other factors. At present predictions are made using qualitative and quantitative methods, average, drift and judgemental methods, Naive Approach etc.

II. RELATED WORK

Sales Master is a machine learning tool focused on sales prediction implementing different supervised learning techniques. This application can be hosted in cloud or can be used as a plug-in. It is a Business Intelligent software (tool) intended for forecasting sales. This tool is provided with interactive GUI. Insights are drawn effectively as it uses many Intelligent algorithms. It is used by sales team to make good business decisions, to identify potential customers of a business. This tool will help in enhancing CRM. Indeed, the use of such tools and techniques is advantageous. This application is advancement in Sales forecasting. It enables data driven understanding of customers. It replaces all judgmental, qualitative and quantitative methods.

JUDGEMENTAL METHOD: The Judgmental methods for preparing sales-forecasts are basically methods which we cannot describe in much more length and details and generally one or more persons are there for preparing Sales-forecasts.

QUALITATIVE METHODS

This involves having product managers or sales reps developing individual forecasts, and then adding them up.

QUANTITATIVE METHODS

A statistical technique for making projections about the future which uses numerical facts and prior experience to predict upcoming events. The two main types of quantitative forecasting used by business analysts are the explanatory method that attempt to correlate two or more variables and the time series method that uses past trends to make forecasts.

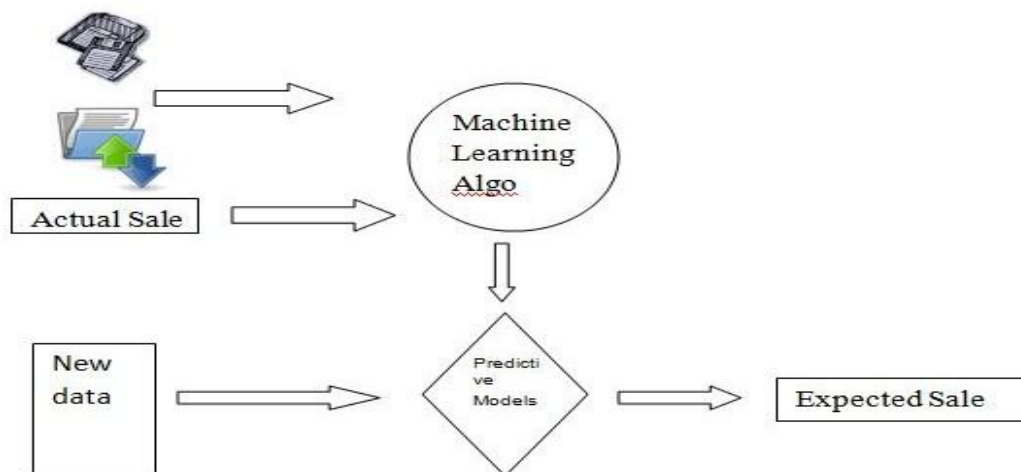


Fig: Block diagram

III. PROPOSED METHODOLOGY

Sales forecasting uses past figures to predict short - term or long - term performance. The proposed system develops a prediction model which forecasts sales for any product, store etc. It makes predictions efficiently using intelligent algorithms. Proposed system uses support vector machines along with kNN, Random forest and Logistic regression for prediction. The experimental results reveal that in most of the cases developed SVM model predicts sales efficiently than the existing system.

K - NEAREST NEIGHBORS

The model for kNN is the entire training dataset. When a prediction is required for a unseen data instance, the kNN algorithm will search through the training dataset for the k-most similar instances. The prediction attribute of the most similar instances is summarized and returned as the prediction for the unseen instance

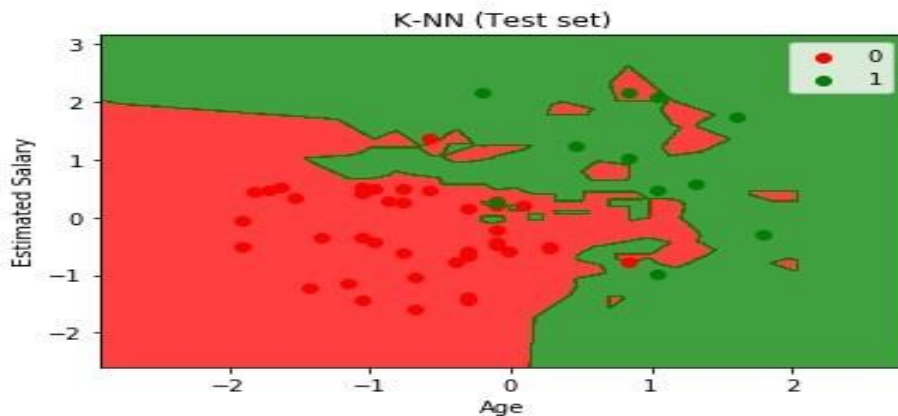


Fig: K-NN Training

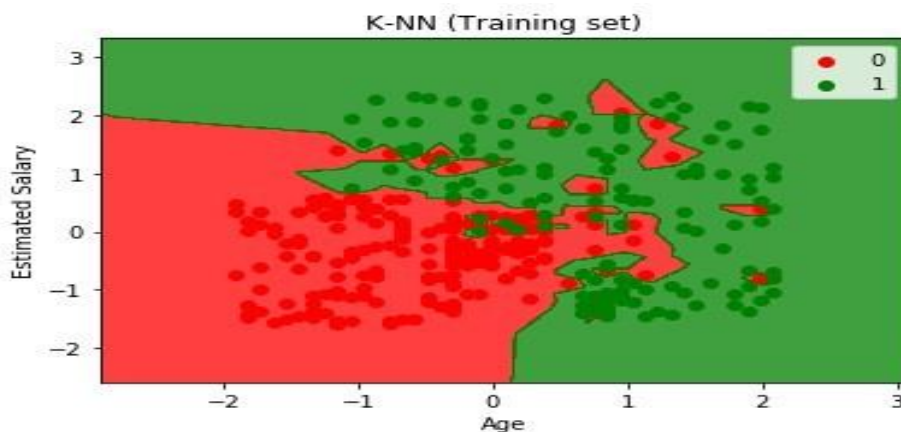


Fig: K-NN Testing

LOGISTIC REGRESSION

The Logistic regression algorithm is the simplest classification algorithm used for the binary classification task, which can also be used for solving the multi-classification problems. In summarizing way of saying logistic regression model will take the feature values and calculates the probabilities using the sigmoid or SoftMax functions



Fig: Logistic Regression Training



Fig: Logistic Regression Testing

RANDOM FOREST

Random Forest is an extension of bagging that in addition to building trees based on multiple samples of your training data, it also constrains the features that can be used to build the trees, forcing trees to be different. This, in turn, can give a lift in performance



Fig: Random Forest Training

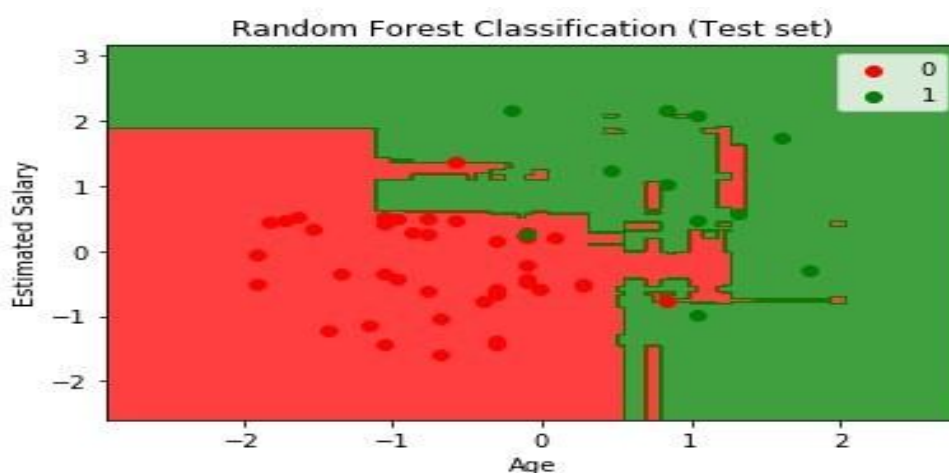


Fig: Random Forest Testing

SUPPORT VECTOR MACHINE

Support vectors are the observations that supports hyperplane on either side. As a point in an n-dimensional space (where n is the number of features) with the value of feature being the value of a particular coordinate. We perform the classification by finalizing the right hyperplane that differs the two classes very well. It is just a line in 2D/3D. SVM help to discover a hyperplane (or separating boundary), which supports two classes of outputs. SVM handles separation of nonlinear data by using a kernel function. The kernel function transforms the data into a higher dimensional feature space to make it possible to perform the linear separation.

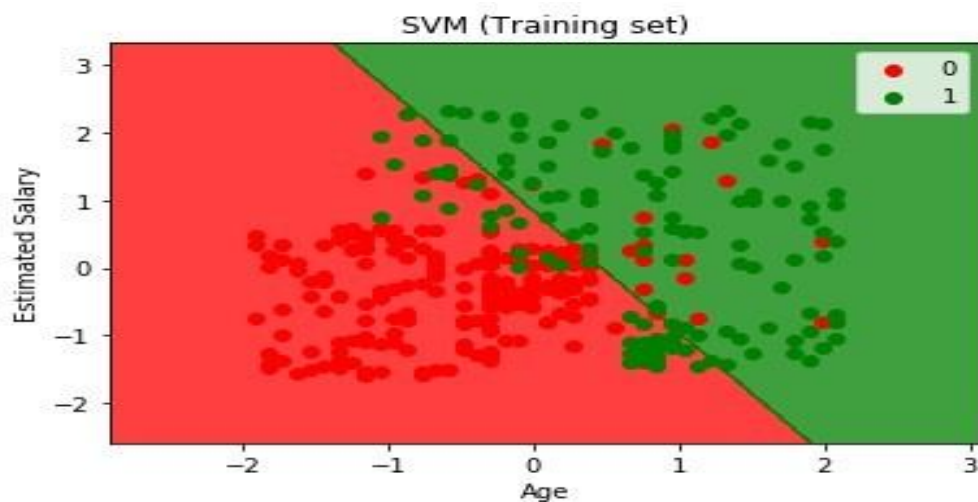


Fig: SVM Training

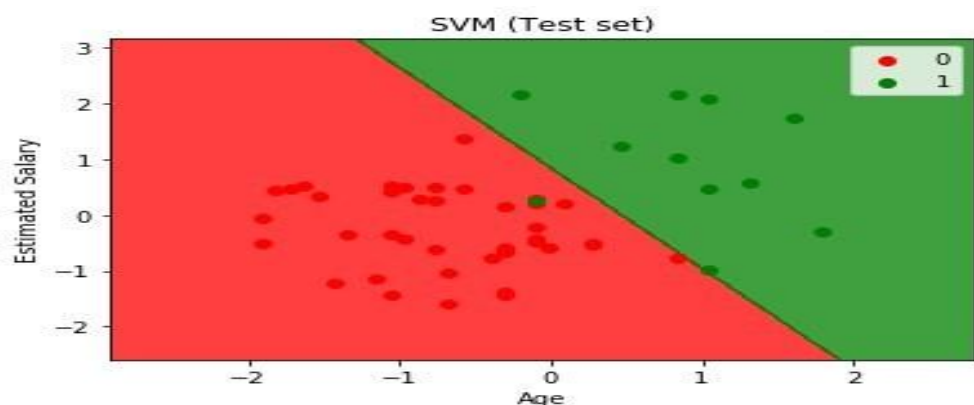


Fig: SVM Testing

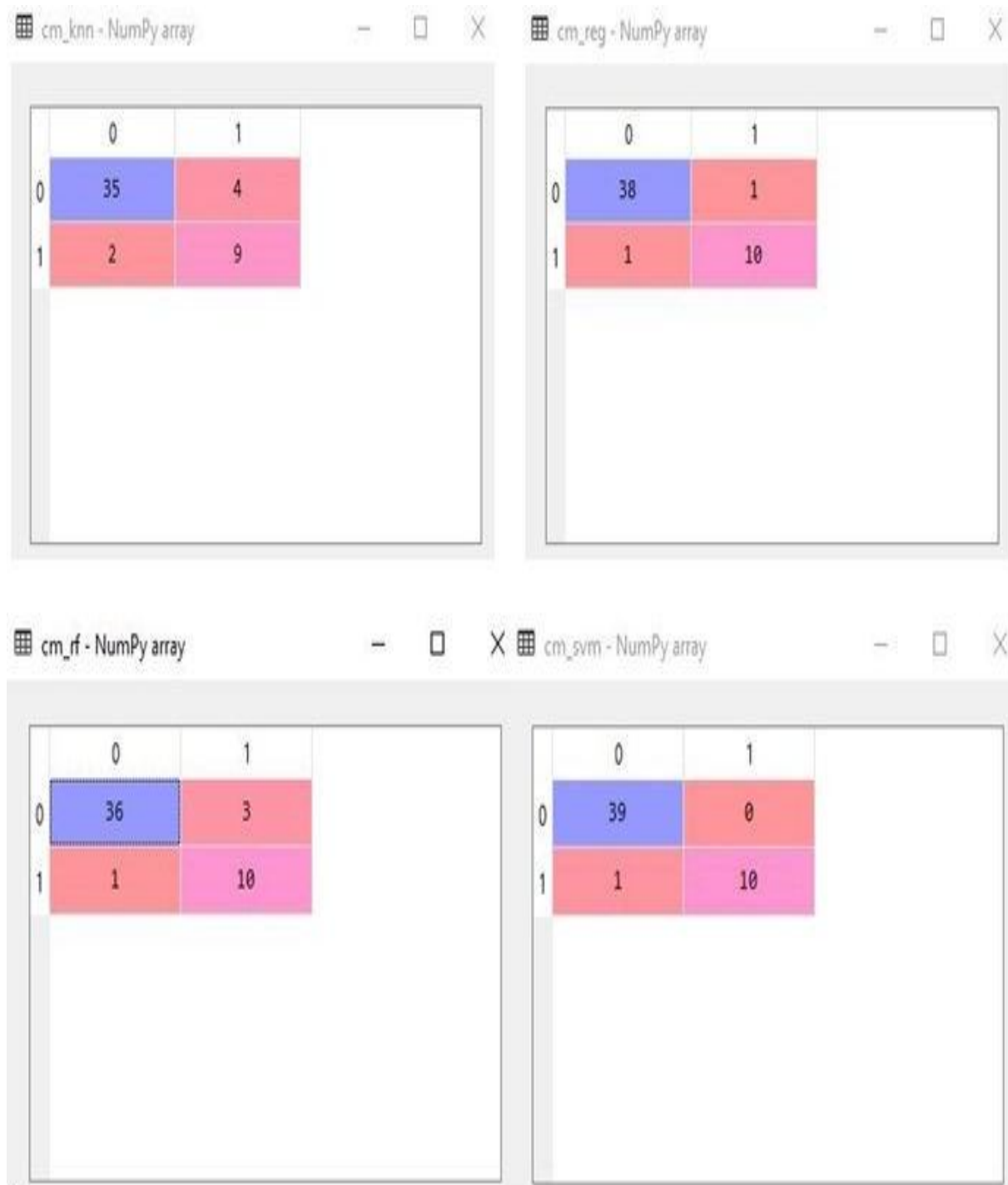


Fig: Confusion Matrix for classifiers.

IV RESULTS

Table: Comparative results of the dassifiers

S. no	Algorithm	Accuracy (%)
1	K – Nearest Neighbors	88%
2	Random Forest	92%
3	Logistic Regression	96%
4	Support Vector Machine	98%

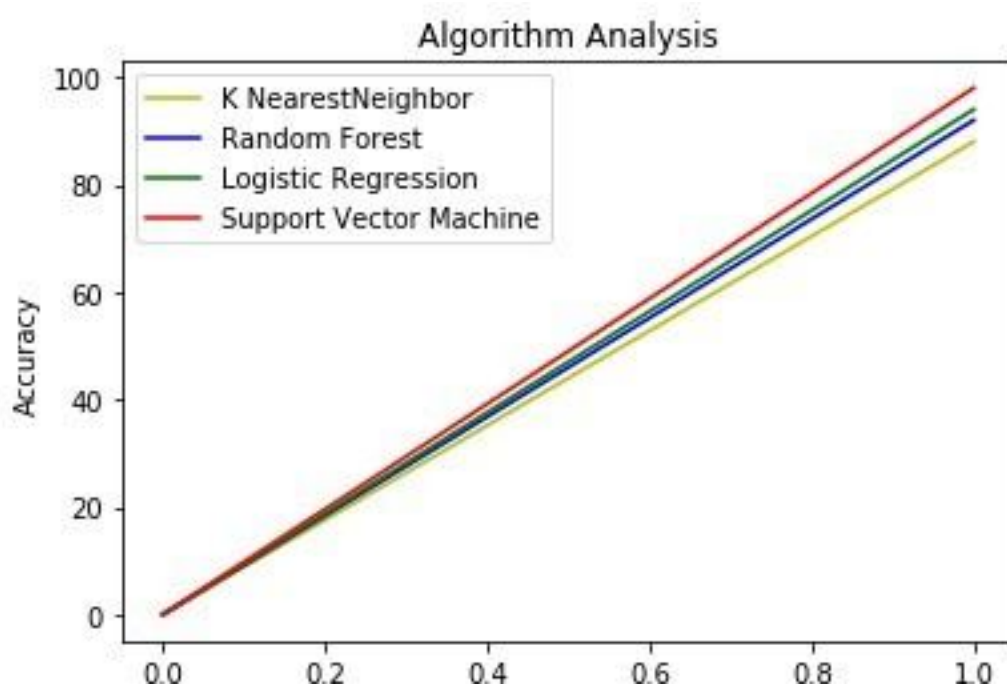


Fig: classifiers Accuracy

Experimental results show that compared with the other forecast models the forecast model developed here has high forecast accuracy, which can forecast the trend of the automobile sales in a fast and error-free manner. One of the most important points to remember about sales forecasts is that they don't need to be perfect to be valuable. Your sales forecast will sometimes, if not always, be slightly different from your results. Of course, wildly inaccurate results are problematic but if you are using clean data and have chosen the right method (which we'll get to), your sales forecast will help you both plan and drive growth. Accurate sales forecasts will make the sales sky rocket. Insights, decisions, information obtained using this model are more reliable.

VCONCLUSION

In order to better grasp the new trend of the automobile sales, a kind of forecast model for predicting sales is established. In this model, the forecasting the sales using conventional intelligent algorithms and judgemental methods are used. The reasonable solutions or measures in view of the potential problems of the forecast are put forward to avoid the occurrence of problems and ensure the normal development of the sales. This model makes predictions efficiently using intelligent algorithm namely support Vector Machines, K-Nearest Neighbour's, Logistic regression and Random Forest. which works well with unstructured and semi structured data like text, Images. It is the best fit when we have no idea on the data and scales relatively well to high dimensional data. Increase in sales helps to survive in the competitive market. Accurate forecasts offer useful insights on future. Best predictions enable sound financial planning. Improves Customer relationship management

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