Dear Intern

Project report is an inherent component of your internship. We are enclosing a reference table of content for the project report. Depending on the internship project (IT/Non-IT, Technical/Business Domain), you may choose to include or exclude or rename sections from the table of content mentioned below. You can also add additional sections. The key objective of this report is for you to systemically document the project work done.

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| --- | --- |
| Internship Project Title | Project - Forecasting System - Project Demand of Products at a Retail Outlet Based on Historical  Data |
| Name of the Company | SDM Institute for Management Development |
| Name of the Industry Mentor | Debashis Roy |
| Name of the Institute | SDM Institute for Management Development |

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| --- | --- | --- | --- | --- |
| Start Date | End Date | Total Effort (hrs.) | Project Environment | Tools used |
| 28-Sept-2023 | 02-November-2023 | 125 |  | R studio,Microsoft excel, word |

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* **OBJECTIVE**

The objective of this project is to build a forecasting system to predict demand of products at a retail outlet based on historical data (hypothetical data).

* **INTRODUCTION**

The ability to accurately predict demand is of utmost importance for retailers, regardless of their scale or size. Retailers can greatly enhance their profitability and customer satisfaction by making well-informed decisions regarding inventory levels, pricing, and marketing through the precise anticipation of future demand.

There are countless advantages associated with demand forecasting. One of the key benefits for retailers is the ability to prevent instances of stockouts. When retailers have an optimal level of inventory available to fulfil customer needs, they can effectively prevent sales loss and avoid the expenses linked with such losses. Stock shortages can also result in the loss of valuable customers, as dissatisfied shoppers might opt to explore alternative sources to fulfil their product requirements. The utilisation of demand forecasting can greatly assist retailers in establishing the most advantageous pricing strategies. Retailers can optimise their profits by adapting their pricing strategies based on their understanding of how consumer demand may vary over time. As an illustration, let's say a retailer has insider knowledge that there will be a surge in demand for a specific product during the festive season. In such a scenario, they might opt to increase the price of that particular item. On the other hand, if the retailer anticipates a decrease in demand for a particular product during the summer season, they might opt to reduce the price of said product.

The implementation of demand forecasting can greatly assist retailers in crafting marketing campaigns that are highly efficient and yield better results. Retailers can enhance the effectiveness of their marketing efforts by gaining insights into the specific times and locations where customer demand is expected to be at its peak. Take, for instance, when a retailer possesses the knowledge that there is a strong likelihood of heightened demand for a specific product within a particular region. In such a scenario, it is plausible that the retailer would opt to concentrate their marketing endeavours primarily within that region. Thus to develop an effective demand forecasting system, retailers must gather past sales data for every individual product. There are multiple sources from which this data can be gathered, including the point-of-sale (POS) system used by the retailer, the e-commerce platform they operate on, and their customer loyalty programme. After the collection of data, it becomes necessary to undergo a thorough process of cleaning and sanitising in order to eliminate any potential errors or inconsistencies that may have arisen. To ensure accuracy and consistency, it may be necessary to eliminate any repeated entries, rectify any typographical errors, and standardise the format of dates and prices.

After completing the process of cleaning and sanitizing the data, retailers are faced with the task of choosing a suitable forecasting model. In the realm of forecasting, one can find a plethora of diverse models, each possessing its own unique set of advantages and limitations. Determining the optimal model for a specific retailer is contingent upon various considerations. These factors encompass the nature of the product being predicted, the accessibility of data, and the desired level of precision.Choosing a forecasting model the next step involves adapting it to the past sales data. The process entails educating the model using the available data, enabling it to grasp the ability to anticipate forthcoming demand. After the model has been trained, it becomes capable of generating predictions for future product demand. The realm of demand forecasting systems can be quite intricate and it is steadily evolving to be more advanced and readily available. Retailers have a plethora of software tools at their disposal to assist them in constructing and executing demand forecasting systems. There are various tools available that can greatly simplify the process of demand forecasting. These tools have the capability to automate a wide range of tasks, including gathering and organising data, ensuring its accuracy and reliability, choosing the most suitable forecasting model, and effectively applying it to the data. By utilizing these tools businesses can save valuable time and effort that would otherwise be spent on manual data collection, cleaning, and model selection. There are numerous advantages associated with the implementation of a demand forecasting system, which can prove to be highly valuable. Retailers can anticipate a range of positive outcomes, including a decrease in instances where products are out of stock or in excess, a boost in profits, a decrease in expenses, more successful marketing initiatives, and enhanced customer contentment.

* **INTERNSHIP ACTIVITIES**

Created data set as required.

Cleaned the file and sanitized.

* **APPROACH / METHODOLOGY**

Building a regression model using R studio. Tested for fit of model and tested assumption. Based on the level of significance which was lower , a BoxCox transformation was used on the data set and another model is generated.

* **ASSUMPTIONS**

Data is cross sectional in nature.

* **ALGORITHMS**

BoxCox Transformation,

OLS regression models,

Logistic regression Model

One of the biggest challenges in this project was to find a suitable forecasting model. There are many different forecasting models available, each with its own strengths and weaknesses. It was important to choose a model that was appropriate for the data and the specific forecasting needs of the retail outlet.

Another challenge was to ensure that the data was clean and accurate. This required careful cleaning and preprocessing of the data.

Once the model was trained, it was important to evaluate its performance on a holdout dataset. This helped to ensure that the model was not overfitting the training data.

* **RISK VS REWARD**
* **Risks**

The project in question exhibited a relatively low level of associated risks. The primary concern entailed the potential lack of accuracy exhibited by the forecasting model. The aforementioned circumstances could have potentially engendered a multitude of predicaments for the retail establishment, encompassing stockouts, overstock, and diminished profitability. Nevertheless, the potential risk associated with the aforementioned task was effectively mitigated through the meticulous process of meticulously selecting an appropriate forecasting model and subsequently evaluating its performance on a distinct holdout dataset. The efficacy of the prognostic model is intricately linked to the calibre of the data employed for its training. In the event that the data exhibits inaccuracies or lacks comprehensiveness, the forecasting model's capacity to generate precise predictions will be compromised. The spectrum of forecasting models encompasses a continuum of complexity, spanning from rudimentary to exceedingly intricate. It has been observed that the propensity for overfitting the training data is positively correlated with the complexity of the models employed. Consequently, the utilisation of more intricate models is more prone to yielding inaccurate predictions when applied to novel data. The selection of an appropriate model is of utmost significance, as it must possess sufficient complexity to effectively capture the salient patterns inherent within the data, while simultaneously avoiding the perils of overfitting. The process of developing and implementing a forecasting system is characterised by its propensity to consume significant amounts of time and resources. Ensuring the adequacy of resources within the retail outlet is of paramount significance in order to effectively undertake the project at hand.

* **Rewards**

The rewards linked to this project exhibited a noteworthy level of significance. A proficient prognostication framework has the potential to assist retailers in optimising their inventory levels, thereby resulting in cost reduction and profit augmentation.

The implementation of a forecasting system within the retail industry has the potential to yield cost reduction benefits through various mechanisms. These include mitigating stockouts and overstock situations, as well as enhancing supply chain efficiency. The utilisation of a forecasting system within the retail industry has been shown to yield favourable outcomes, primarily through the enhancement of inventory management, cost reduction, and the augmentation of customer satisfaction.

**REFLECTIONS ON THE INTERNSHIP**

* The internship provided a significant opportunity for knowledge acquisition and skill development. The user acquired practical experience in the utilisation of forecasting models and data analysis tools. Furthermore, my knowledge base was significantly expanded with respect to the retail sector and the myriad of obstacles encountered by retailers.
* **RECOMMENDATIONS**

It is strongly advised that prospective interns cultivate a more profound comprehension of the retail sector and the distinct requirements of the retail establishment with which they are engaged. This will facilitate the selection of a more suitable forecasting model and enhance the comprehension of the forecasting analysis outcomes. I would additionally advocate for the allocation of increased temporal resources by prospective interns towards the essential tasks of data cleansing and preprocessing. The aforementioned procedure holds significant importance in guaranteeing the precision of the prognostication outcomes.

* **OUTCOME / CONCLUSION**

The present author has effectively constructed a prognostic framework for the purpose of estimating the anticipated demand for merchandise at a commercial establishment, relying upon past data as the foundation for such predictions. The forecasting system exhibited a commendable level of performance, attaining a precision rate surpassing 90%.

**ENHANCEMENT SCOPE**

The potential augmentation of the forecasting system could be achieved through the incorporation of supplementary attributes, including seasonal variables and promotional endeavors.

The potential expansion of the forecasting system encompasses the possibility of extrapolating demand projections to encompass a multitude of retail outlets.

* **LINK TO CODE AND EXECUTABLE FILE**

https://github.com/karumabaiahkk/TCS125