INTEL® UNNATI INDUSTRIAL TRAINING

Smart Mobile Phone Price Prediction using Machine Learning

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1. INTRODUCTION

Smartphones have become an essential part of our life in the current digital age. Customers frequently struggle to find a smartphone that fits their needs and their budget because there are so many different smartphone models on the market. Many customers' purchasing decisions are influenced by price, which is an important consideration.

To maximize revenues and maintain market dominance, smartphone retailers and manufacturers must choose the right price strategy for their goods. They can make wise judgments about product pricing, marketing, and inventory management with the aid of accurate price forecasts.

To create models that can forecast smartphone costs based on numerous factors such as brand, CPU, RAM, storage capacity, camera quality, battery power, and more, machine learning and data analysis techniques can be used for previous smartphone data. The models can learn to generate predictions on unobserved data by analyzing the links and patterns within the dataset, supporting customers and businesses in making wise decisions.

In the smartphone business, the "Smart Mobile Phone Price Prediction" problem is of enormous practical importance since precise price estimation can help both consumers and sellers. The forecasts can help shoppers compare pricing, spot good offers, and choose products that fit their needs and budget. Price forecasts can be used by producers and sellers to improve pricing tactics, acquire a competitive advantage, and boost client happiness.

2. RELATED WORKS

People are becoming more and more interested in smartphones because of their various features. In addition to the price, there are several aspects to consider while purchasing a phone. There isn't a straightforward formula for figuring out a phone's pricing based on its features. Recent advances in machine learning techniques make it possible to handle such issues with few mistakes. But the question of which algorithm is best suited to address that particular issue still stands. We have looked into various machine learning algorithms for estimating telephone prices to relieve this strain. For this one, we used a dataset from Kaggle that includes information about phone costs and features. Twenty separate factors that have an impact on phone prices were used in our investigation, which involved 25 algorithms. The results demonstrate that the SVC algorithm produced the greatest value with an accuracy rating of 0.9470. [1]

Any company wants to see its product flourish and be able to compete with other products on the market, and a big part of that is how much they charge for it. The most crucial factor in marketing any product is choosing the right pricing. In this study, the market price of smartphones is predicted based on their attributes using support vector regression analysis, a machine learning technique. The SVR model uses a variety of feature variants for data preparation or input methods. Compared to other models, support vector regression offers more encouraging predictions for better decision-making about the price prediction of smartphones. [2]

This project's objectives are to anticipate a mobile's pricing based on its specs and to determine the most efficient Automatic way of doing so. To find the classification technique that can most accurately predict the pricing class for mobile devices, the model was trained using a range of classification techniques. To choose the best approach out of those that were used, the created model was evaluated utilizing matrices such as the overall accuracy confusion matrice, etc. [3]

With the advancement of technology, cell phones have become an essential component of daily life. Brand, internal memory, wifi, battery life, camera quality, and the availability of 4G are now influencing how people choose which mobile phones to purchase. But people don't always connect those factors to the cost of mobile phones; in this case, this paper aims to solve the issue by training the mobile phone dataset using machine learning algorithms like Support Vector Machine, Decision Tree, K Nearest Neighbours, and Nave Bayes before predicting the price level. To forecast smartphone pricing based on accuracy, precision, recall, and F1 score, we applied the proper algorithms. This not only gives users more options for mobile phones but also offers guidance to companies who sell mobile phones on how to set fair prices for the many functions they provide. Customers will be assisted in making informed mobile phone choices in the future by this concept of price level prediction. The outcome shows that, out of the 4 classifiers, SVM performs the best, with accuracy and F1 score of 94.8% and 97.3, respectively, without feature selection and 95.5% and 97.7%, respectively, with feature selection. [4]

3. CONTRIBUTIONS

The objective of this project was to create a machine-learning model for forecasting smartphone pricing. To do this, we first preprocessed the dataset, managing missing values and transforming data types as required to guarantee data quality and consistency. In addition, we performed exploratory data analysis to learn more about the connections between various variables and the goal variable, which in this case was the cost of the smartphone. We investigated the data using histograms, scatter plots, and correlation matrices to identify any trends or associations that would guide our prediction model.

We used the chosen features to train two regression models, the Random Forest Regressor and the Support Vector Regressor. While the Support Vector Regressor used support vector machines for regression problems, the Random Forest Regressor used an ensemble of decision trees to create predictions. By comparing the training and testing accuracy scores, we were able to gauge how well the models fit the data and how accurate they were at forecasting future outcomes.

The flow of implementation can be analyzed from the figure given below in Fig.1.

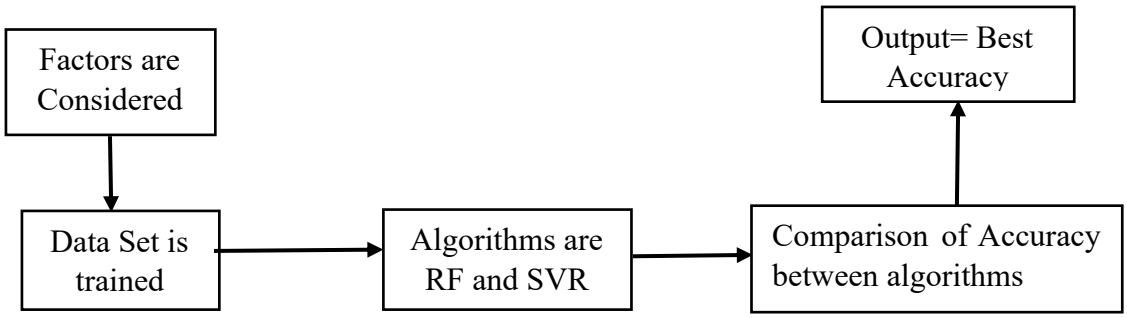

Figure 1: Design Flow of Model

We visualized the disparities between real prices and anticipated values using scatter plots in addition to accuracy scores. We were able to see how data points were distributed around the line of ideal predictions using this visual representation, which gave us information about the precision and potential biases of our model's predictions.

This methodology was used in our study to create a trustworthy and efficient machine-learning model for predicting smartphone prices. We aimed to develop a model that accurately forecasts smartphone pricing, supporting decision-making and market analysis in the smartphone business through preprocessing, feature selection, model training, and evaluation.

4. EVALUATION

The Random Forest Regressor proved capable of forecasting smartphone pricing using the chosen features, with training and testing accuracy of 96% and 95%, respectively. A tight alignment was seen in the scatter plot showing the differences between actual prices and anticipated values, indicating that the model was reasonably accurate in making predictions. Similar results were obtained by the Support Vector Regressor in terms of training and testing accuracy, demonstrating its potency in accurately forecasting smartphone costs. Both models demonstrated promising results, highlighting their potential for smartphone price prediction.

	Unnamed: 0	Brand me	Ratings	RAM	ROM	Mobile_Size	Primary_Cam	Selfi_Cam	Battery_Power	Price
0	0	LG V30+ (Black, 128)	4.3	4.0	128.0	6.00	48	13.0	4000	24999
1	1	I Kall K11	3.4	6.0	64.0	4.50	48	12.0	4000	15999
2	2	Nokia 105 ss	4.3	4.0	4.0	4.50	64	16.0	4000	15000
3	3	Samsung Galaxy A50 (White, 64)	4.4	6.0	64.0	6.40	48	15.0	3800	18999
4	4	POCO F1 (Steel Blue, 128)	4.5	6.0	128.0	6.18	35	15.0	3800	18999

Figure 2:Dataset Sample

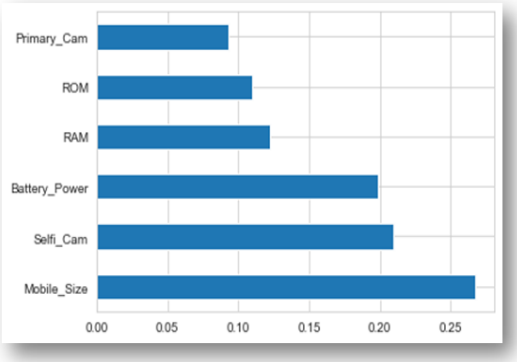

Figure 3: Specifications Analysis

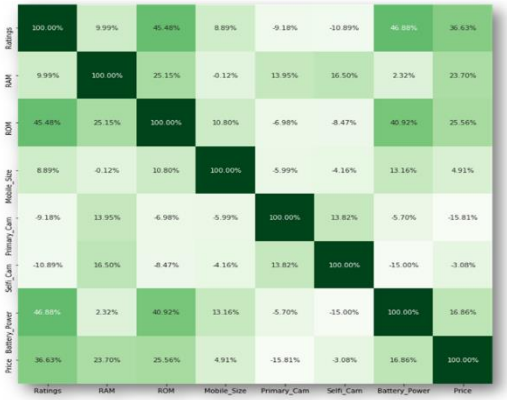

Figure 4: Accuracy Analysis

5. FUTURE WORKS

Despite positive results from our models, more research and development are required. Additional study is needed in the areas of incorporating more accurate specifications and contextual information, such as market trends, consumer input, and competition in the smartphone industry. Investigating complex deep learning structures, such as transformers or recurrent neural networks, can show complex relationships and patterns in smartphone data. For the model to perform better and provide more accurate predictions, the hyperparameters must be tuned carefully. Additionally, including outside data sources such as consumer demographics or economic indicators can give a thorough knowledge of the variables influencing smartphone pricing variations. These research directions have the potential to advance the discipline and resolve present constraints.

6. CONCLUSION

The construction of machine learning models for predicting smartphone prices using a variety of variables was the main goal of this work. The Support Vector Regressor and Random Forest Regressor both predicted smartphone pricing with excellent accuracy, which offered very encouraging results. These results demonstrate the potential of machine learning algorithms in the field of smartphone price prediction and make a substantial contribution to it. The study highlights the significance of additional investigation and developments in fields including feature engineering, model choice, and data integration. Continued research in these areas may result in even more precise forecasts as well as insightful data for the smartphone market, allowing for well-informed market analysis and decision-making.

7. CITATIONS

[1] A. Kalmaz and O. Akin, “Estimation of Mobile Phone Prices with Machine Learning,” in *8th International Conference on Engineering and Emerging Technologies (ICEET)*, 2022.

[2] K. Chandrashekhara, M. Thungamani, N. G. Babu and T. N. Manjunath, “Smartphone Price Prediction in retail Industry Using Machine Learning Techniques,” in *Springer*, Singapore, 2019.

[3] M. P. Rao, P. V. Mantina and L. Pallavi, “Price to Performance Ratio of Smartphone using Machine Learning,” in *International Conference on Computational Intelligence , Communication Technology and Networking (CICTN)*, 2023.

[4] N. Hu., “Classification of Mobile Phone Price Dataset using Machine Learning Algorithms,” in *3rd International Conference on Pattern Recognition and Machine Learning* , 2023.