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Intelligent Assessment of Secondhand Mobile Phone Prices by Machine Learning Techniques

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Abstract: In many areas of price prediction such as house prediction, stock prediction, different classification algorithms can be used. Classification techniques that are based on Machine Learning help to solve the problem that is related to decision making. This research paper aims at the comparing the accuracy of two different classification algorithms which are used in supervised machine learning. Mobile price prediction is the case study of this research work. Dataset is collected from kaggle. Two different classifiers named as SVM and Rigid classifier are used to achieve best possible accuracy. Results are compared on the basis of outcome accuracy score that is achieved from the research experiment. This approach can be used to a variety of industries, like marketing and business, to locate the best goods (with minimal costs and maximum features). Future research is expected to expand on this work, resulting in more sophisticated answers to specific situations and more precise tools for price prediction.

Keywords: Mobile price prediction; Machine learning; Rigid Classifier.

1. Introduction

Mobile phones have become an important need in people's life currently. It increases the demand for mobile phones. The very first question is about the price of the phone with respect to features available in that phone. Price is the most effective attribute of marketing and business. So, the price prediction is the basic purpose of this research work. Artificial intelligence which is vast field of engineering makes machine capable to answers the questions intelligently. Machine learning provides us many techniques for artificial intelligence like regression, classification, supervised and unsupervised learning.

There are many tools which are available for machine learning tasks like MATLAB, python and WEKA etc. but python has the best libraries and tools used in machine learning. Python provides Scikit-learn library which contains simple and efficient tools for executing the supervised learning algorithms. We can use different classifiers like SVM, decision tree, naïve bayes and many more. Different types of feature selection algorithms are available to select the best feature and minimize dataset. So, complexity of computation reduced.

Now a day, mobile phones are selling and purchasing in huge number. Within short timespan new version with new features are launched to market. There are many features which are important to consider mobile price. These features are as following:

- Display resolution
- RAM
- ROM
- Camera
- Processor
- Battery timing

Customers do not acquire things on the basis of pricing in today's market. It is possible in today's marketplace with current pricing procedures for a retailer to set his own prices for things if he feels comfortable doing so. With current advanced technology expanding every minute with modern smartphone firms, the competition inside the smartphone industry is growing altogether next level. As a result, we suggest a smartphone recommendation system to assist consumers in selecting the best cellphone and having the most enjoyable cellphone experience. Given the widespread use of phones, there is large number of potential customers. As a result, a study of the cellphone suggestion system should be performed.

2. Materials and Methods

Machine learning techniques are widely applied for the prediction of prices. There will be some features of mobile phone derived from mobile phone price prediction dataset. We use Python for experiment. The dataset is divided into two groups: test and train dataset. First, we analyze realistic surveyed data related to consumers, cellphone configurations and cellphone usage. Then feature selection methods will apply to reduce the computational costs by reducing the number of inputs to get the meaningful results. After checking all the values of dataset whether there is any missing value scaling applies on dataset in order to obtain more relevant data for machine learning algorithms. The prediction of mobile phone prices is a classification kind of supervised learning, with performance characteristics grouped into classes. SVM and Rigid are most important classifiers that will be used in predicting the mobile phone prices. These algorithms will help the people to predict the prices of mobile phones. These methods have two steps: first preprocess the data and other to train and test the data. We use python for results and analysis.

3. Results

Support vector machine (SVM); 98% accuracy with train set and 85% accuracy with test set.

Rigid classifier; 91% accuracy with both train and test set.

```
import numpy as np # linear algebra
import pandas as pd # data processing, CSV file I/O (e.g. pd.read_csv)
import seaborn as sns
import matplotlib.pyplot as plt
%matplotlib inline
```

Figure 1. Importing Libraries

Python is used here as a basic language for execution purpose. It is seen necessary to import libraries in order to run the code properly. Numpy and matplotlib are important in order to execute it efficiently. These are always helpful in implementation.

```
from sklearn.preprocessing import StandardScaler
from sklearn.model_selection import train_test_split

scaler = StandardScaler()
x = df_train.drop('price_range',axis=1)
y = df_train['price_range']

scaler.fit(x)
x_transformed = scaler.transform(x)

x_train,x_test,y_train,y_test = train_test_split(x_transformed,y,test_size=0.3)
```

Figure 2. Importing Libraries for Preprocessing

Preprocessing is the process of cleaning data. After data collection, a dataset may have many missing values, abnormalities and other issues that render it unfit to be used as input for a machine learning system. As a result, data cleaning, data applying, representation, modification and data balancing are used as pre-processing procedures. Dataset is splitted in train and test dataset.

```
Train Set Accuracy:98.35714285714286
Test Set Accuracy:85.16666666666667

Confusion Matrix:
[[132  14   0   0]
 [ 21 114  20   0]
 [  0  11 133  11]
 [  0   0  12 132]]

ClassificationReport:
              precision    recall  f1-score   support

           0       0.86      0.90      0.88       146
           1       0.82      0.74      0.78       155
           2       0.81      0.86      0.83       155
           3       0.92      0.92      0.92       144

    accuracy                           0.85       600
   macro avg       0.85      0.85      0.85       600
weighted avg       0.85      0.85      0.85       600
```

Figure 3. Accuracy of SVM

The figure 3, shows the accuracy of SVM classifier. The results show that SVM gives 98% accuracy on train dataset and 85% accuracy on test dataset.

Rigid Classifier

```
from sklearn.linear_model import Ridge
from sklearn.linear_model import Lasso
from sklearn.linear_model import ElasticNet
from sklearn.neighbors import KNeighborsRegressor
from sklearn.tree import DecisionTreeRegressor
from sklearn.svm import SVR
from sklearn.ensemble import RandomForestRegressor
from sklearn.metrics import r2_score
from sklearn.model_selection import train_test_split
from sklearn.metrics import mean_squared_error
from math import sqrt
```

Figure 4. Importing Libraries for Rigid Classifier

The figure 4, shows the libraries for rigid classifier. Rigid classifier approach is based on rigid regression. Rigid regression is the model modification approach that may be applied to multicollinearity data analysis. This method is used to produce L2 regularization.

The fig 3.5 shows the table of train dataset. In this table price column is targeted. The dataset is trained for the rigid classifier. Data inconsistency and redundancy is removed from the table to get better results.

```
X = df[predictors].values
y = df[target_column].values

X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.30, random_state=40)
print(X_train.shape); print(X_test.shape)
```

```
(1400, 20)
(600, 20)
```

Figure 5. Splitting of Dataset

In this figure 5, dataset is splitted into train and test dataset for rigid classifier. X and Y variables are used for training and testing of dataset. Then, the results show the information of train and test dataset. The first row describes the train dataset. It shows that it has 1400 rows and 20 columns. The second row describes the test dataset which shows that it has 600 rows and 20 columns.

```
0.31849751797234327
0.9177876299400498
0.3229347607329978
0.9188106175212702
```

Figure 6. Accuracy of Rigid Classifier

The figure 6, shows the accuracy result of rigid classifier. Rigid classifier gives 92% accuracy on both train and test dataset.

4. Discussion

In this research work, it is observed that SVM gives different result on training and testing dataset. It is due to overfitting problem. On other hand rigid classifier gives same results on both datasets.

5. Conclusions

In this work with comparison different algorithms of machine learning in the prediction of mobile prices have shown these algorithms have ability to predict the prices in all aspect because we use all the algorithms prediction accuracy of mobile prices is very high and there is hope that various classifiers of ML can be used to predict the mobile prices instead of traditional methods with human errors. For the system mobile prices dataset is used. The SVM and Rigid classifiers used 21 attributes which are obtained from dataset. There are a lot of studies on prediction of mobile prices. Different variants of ML give different accuracy rates. In this proposed system SVM classifier gives 98% accuracy on train dataset and 85% accuracy on test dataset while Rigid classifier gives 91% accuracy on both train and test dataset. Things that can be done in future is that each of the machine learning classifiers such as rigid classifier can be used for other products in order to predict their prices are improved to intelligent systems since with this action it will reduced costs and human errors.

References

1. Ahrens, J., et al. (2019). "A machine learning method for prediction of multipath channels." arXiv preprint arXiv:1909.04824.
2. Akyildirim, E., et al. (2021). "Prediction of cryptocurrency returns using machine learning." Annals of Operations Research 297(1): 3-36.
3. Arora, P., et al. (2020). "Mobile price prediction using weka 1." vol 5: 330-333.
4. Asim, M. and Z. Khan (2018). "Mobile price class prediction using machine learning techniques." International Journal of Computer Applications 179(29): 6-11.
5. Bakir, H., et al. (2018). "E-Commerce price forecasting using LSTM neural networks." International Journal of Machine Learning and Computing 8(2): 169-174.
6. Chandrashekhara, K., et al. (2019). Smartphone price prediction in retail industry using machine learning techniques. Emerging Research in Electronics, Computer Science and Technology, Springer: 363-373.
7. Chantrapornchai, C. and P. Nusawat (2016). "Two machine learning models for mobile phone battery discharge rate prediction based on usage patterns." Journal of Information Processing Systems 12(3): 436-454.
8. Chen, Z., et al. (2021). "Automated Agriculture Commodity Price Prediction System with Machine Learning Techniques." arXiv preprint arXiv:2106.12747.
9. Dargan, S., et al. (2020). "A survey of deep learning and its applications: a new paradigm to machine learning." Archives of Computational Methods in Engineering 27(4): 1071-1092.
10. de Araújo, G. M., et al. (2012). "An evolutionary approach to improve connectivity prediction in mobile wireless sensor networks." Procedia Computer Science 10: 1100-1105.
11. Dhanapal, R., et al. (2021). Crop price prediction using supervised machine learning algorithms. Journal of Physics: Conference Series, IOP Publishing.
12. Gabralla, L. A., et al. (2013). Oil price prediction using ensemble machine learning. 2013 International Conference on Computing, Electrical and Electronic Engineering (ICCEEE), IEEE.
13. Ganesan, M. and N. Sivakumar (2019). IoT based heart disease prediction and diagnosis model for healthcare using machine learning models. 2019 IEEE International Conference on System, Computation, Automation and Networking (ICSCAN), IEEE.
14. Ghouti, L., et al. (2013). "Mobility prediction in mobile ad hoc networks using extreme learning machines." Procedia Computer Science 19: 305-312.
15. Gupta, R. and C. Pathak (2014). "A machine learning framework for predicting purchase by online customers based on dynamic pricing." Procedia Computer Science 36: 599-605.
16. Henrique, B. M., et al. (2019). "Literature review: Machine learning techniques applied to financial market prediction." Expert Systems with Applications 124: 226-251.
17. Iyer, S. G. and A. D. Pawar (2019). Machine learning model for predicting price of processors using multivariate linear regression. 2019 International Conference on Smart Systems and Inventive Technology (ICSSIT), IEEE.
18. Jeevan, B., et al. (2018). Share price prediction using machine learning technique. 2018 3rd International Conference on Circuits, Control, Communication and Computing (I4C), IEEE.
19. Jordan, M. I. and T. M. Mitchell (2015). "Machine learning: Trends, perspectives, and prospects." Science 349(6245): 255-260.
20. Kalaivani, K., et al. (2021). Predicting the price range of mobile phones using machine learning techniques. AIP Conference Proceedings, AIP Publishing LLC.