Graduate Research in Engineering and Technology (GRET)

Volume 1
Issue 6 *Application of Intelligent Computing and Big data Analytics in Healthcare*

Article 5

May 2022

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Recommended Citation

Sahoo, Sonali; Hotta, Subhalaxmi; and Swarnkar, Tripti (2022) "Fortune of smart-phones by A model recommendation," *Graduate Research in Engineering and Technology (GRET)*: Vol. 1: Iss. 6, Article 5.
DOI: 10.47893/GRET.2022.1112
Available at: https://www.interscience.in/gret/vol1/iss6/5

Fortune of smart-phones by A model recommendation

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ABSTRACT:

In recent market, there are several cell phones available, Smart phones differ based on their Operating system. Here we are going to do a comparison between two Operating systems i.e., "IOS and ANDROID". The comparison starts including the basic features of smart phones. The features are varying from each other. Some of them are categorical and some are numerical. According to these data, classify the smart phones using machine learning classification model. After the classification we are going to analyse which operating system-based Smartphone will be taken for further classification. A "Recommendation system", will be designed which recommend a better smart phone to the customer. In market a lot of smart phones are available, which are of different companies but with same cost. From classification model we will find which set is more affordable with good combination of features. Further Recommendation model will help us to find which model will be the best model according to the customer requirement and budget. On the basis of customer requirement that is what are the features and price of the phone our model is going to predict which model will be more suitable and gives the solution in a form of recommendation. It will give us the exact phone, which is having all the features and also pocket friendly.

Keywords: Statistical Study, Operating System, Data Analysis, iOS, Android.

INTRODUCTION:

In recent market ,several models of cell phones available. Smartphones have become an indispensable element of people's life in the current day. When it comes to purchasing a Smartphone, there are numerous variables to consider, such as display, processor, memory, and so on. thickness, battery, and connectivity are all factors to consider when purchasing a camera. and others are taken into consideration[1]. In India all the locals made and foreign made handsets are being sold. Here we are going to do a comparison between two Operating systems i.e., IOS and ANDROID. Our first objective of this project using Machine Learning on the topic "Fortune of smart phones: By a Model

Recommendation" represents the rapid increase of selling of Android as compare to iOS based on its affordability for citizens offering comparatively more features in a low cost. It is seen that iOS is a leading company across the globe, but it is too expensive for country like India. Android is providing phones in a lower price with the same features as iOS, which is the major reason of "Android leading market" in India. Our second objective of the study is a recommendation system. Our model will recommend a better android phone to a customer requirement

within the budget.

1. BACKGROUND STUDY

People all over the place collectively using smart phones, therefore it is now considered an essential gadget in our daily lives. As specified by the ITU (International Telecommunication Union), almost 96.8% of the world's population is covered by cellular network coverage, with coverage reaching 100% in many countries, particularly industrialised countries like the United States, Australia, Canada, and the United Kingdom [1]. Sarker et al. found that users' activity in "Mobile Phones" is growing faster than that of programmes such as "Desktop Computer" or "Tablet Computer" over time .People use mobile phones for a variety of purposes, including voice communication, web browsing, app usage, email, social networking, and instant messaging [3]. The activity of individual mobile phone users and accompanying contextual information from many sources such as phone logs [4], electronic calendars, sensors, etc. can be logged on the Smartphone.

In the digital era, i fwe plot a graph between selling of smart phones with time then it shows how rapidly we are tending towards smart phone [3].Android launched many versions of smart phones with updated features and pocket friendly more often. iOS is a global demanding product but very expensive. As we all know India is a middle economical market so iOS won't attract more customer as compare to Android. So, market survey results to "Android leading market" in India. The different versions of both Android and iOS are available in market, any manually come to decision is a tedious work. So, if we are going to predict between two different operating system based smart phones, we need to take help of Machine Learning. Android supports all the application being developed by worldwide developers, whereas iOS only supports some specific applications which are specially developed for iOS. So Android is easily accessible [4].

2. PROPOSED WORK:

Recommendation systems are sub class of Machine learning which generally deals with ranking or rating products. The results which are generated are often recommendations for the user for things that they need but are unaware that they want it until they've been recommended it to them [2].

The proposed work is implemented with sklearn libraries, pandas, numpy, matplotlib and other compulsory libraries. We have collected data of smart phones from different websites and created Android and iOS dataset. The machine learning algorithms are implemented along with the classification and recommendation system such as Decision tree and Support Vector Machine (SVM).

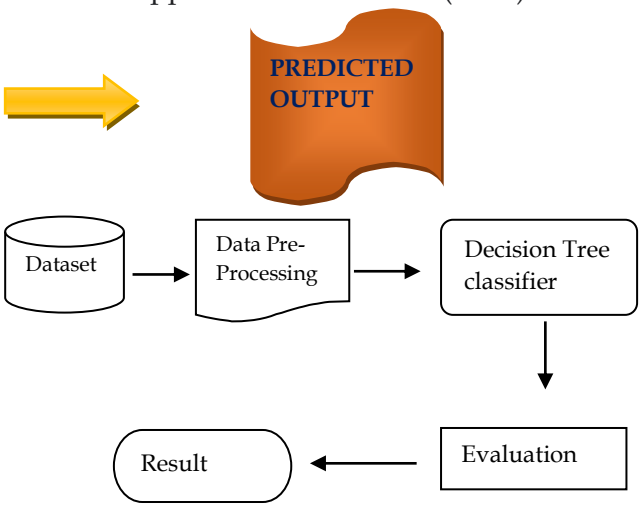

Fig.1: Block diagram of phone prediction based on OS using Smartphone decision dataset

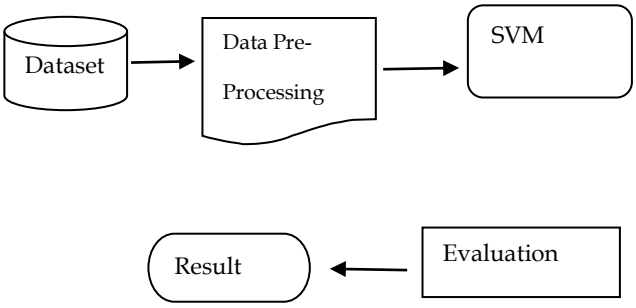

Fig.2: Block diagram of android smartphone recommendation system using Android phone dataset.

Fig.1 represents the proposed pipeline for classification of the given phone on the basis of its OS in two categories Android and iOS. Similarly, Fig.2 represents the work flow for the recommendation system for purchasing Android phone based on customer requirements.

2.1 Dataset

To run the model, we have focused on two different datasets like Smartphone Decision Dataset and Android Phone Dataset. We have collected all the information regarding the smart phones from different sources of internet and created the dataset.

Table-1: Dataset Description

Ds = Dataset

Ins= Instances

Dt= Data types

nf = Number of features

tv= Target variable

Ds	Ins	dt	nf	tv
Smart phone Decision	200	Nume /Cate	13	Affordability
Android phone	310	Nume /Cate	15	Purchase

Two datasets are used for classification and recommendation named as Smartphone Decision and Android phone respectively. The datasets are 9 basic features, 4 and 6 distinct features present respectively. Datasets are imported and pre-processing is done. In smart phone decision dataset decision tree implemented and Identify which line of action has the best chance of succeeding. On an Android phone, SVM is used to construct the maximum marginal hyper plane, which divides the dataset into classes the best.

2.2 METHODS AND MATERIALS:

Our data is combination of multiple data types and features. If we are not taking this into a standardized form then we can't retrieve the information. Pre-processing is the process of converting raw data into a usable format to improve performance.

Data Pre-processing:

In Pre-processing we transformed the categorical data into integer using function String_ to_int.fit_transform. Then we splinted the data into training and test set, train and test ratio as 7:3.

2.2.1 Decision Tree:

The instance classifies the instance into the decision tree by sorting the tree from the leaf node's root route to determine the class level of the instance. This instance is classified by launching the tree, testing the attributes of this node and follows the tree branch corresponding to the attribute value. This step is then run on a new node sub tree.

Decision tree algorithm follows:

- Import Smartphone Decision Dataset and do the pre-processing.

- Divide the dataset into two parts: training and testing.
- Learn the Decision tree using the training data and predicted the test result using the learned model.

Decision trees have a predictive framework that offers a variety of options and allows you to determine which course of action is most likely to succeed.

2.2.3 SVM:

Support vector machine (SVM) are administered machine learning strategies that can be utilized for both classification and relapse issues. Even with a small amount of data, SVM performs admirably [3].

SVM kernel

The SVM kernel is a function that transforms low-dimensional input space into higher-dimensional space from a low-dimensional input space. thus, resulting into transformed data which is linearly separable. Kernel is mainly useful in non-linear separation problems

- Import Android phone dataset.
- Data should be divided into attributes and labels, and the dataset should be divided into training and test groups.
- Train the algorithm on training data and predict the result based on four evaluation metrics i.e., Confusion Matrix, Recall, Precision, F1-measure.

To distinguish different classes, SVM makes a hyper-plane in multidimensional space. SVM iteratively produces the leading hyper-plane, which is at that point used to limit an error. The objective of SVM is to discover a greatest minimal hyper plane that parts the into classes as equitably as conceivable.

Result and Discussion:

In this work, decision tree and SVM helped to fulfil our objective. The significant results obtained are represented in the form of table and graph.

3.1 Decision Tree Classifier: Smartphone Decision Dataset

Decision Tree classifier imported from sklearn .tree package and fitted to the training dataset. In this code we have made a classifier object in which we have passed two fundamental boundary model as "Entropy"; standard used to gauge the nature of parted which is determined by data gain given by entropy and arbitrary state as 100. for producing the irregular state. The most often used metrics for classification tasks are the confusion matrix, precision, recall, and F1-measures. True and False positives, True and False negatives are used to generate the primary classification metrics Precision, Recall, and F1-Score on a per-class basis.

Fig.3 represents the confusion matrix for Smartphone dataset using decision tree classifier.

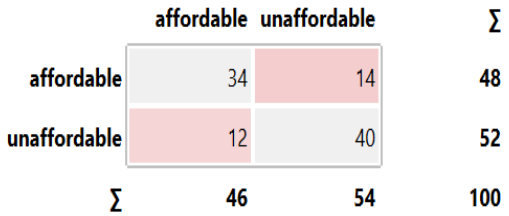

Fig.3 Confusion Matrix for smartphone dataset.

Table.2: Decision Tree Result

Classifier	Precision	Recall	F1	Accuracy
Decision Tree	0.70	0.47	0.56	0.63

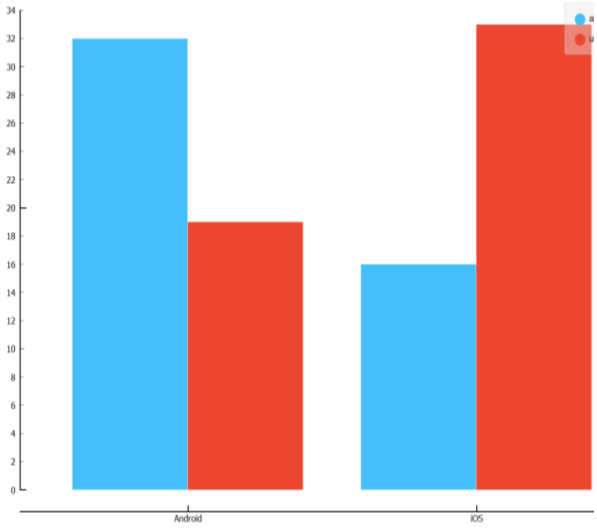

Fig.4 Graphical representation of affordable Smartphone.

As seen from table.2 the, Decision tree classifier shows an accuracy of 63%. From Fig.4 we can conclude that Android is more

reliable, flexible, durable, and affordable according to the financial state of citizens and lead the market in nearer future.

3.2 Support Vector Machine: Android Phone Dataset

SVM classifier imported from sklearn package. The SVC class's fit method is used to train the algorithm using the training data supplied as a parameter to the fit method. The forecast method of the SVC class is used to create predictions.

Table.3 – comparison of SVM model using different kernel functions in terms different prediction measures:

Classifier	Kernel	Precision	Recall	F1	Accuracy
SVM	Linear	0.84	0.86	0.85	0.80
	Sigmoid	0.69	0.80	0.74	0.63
	Rbf	0.80	0.80	0.80	0.74
	Poly (degree=5)	0.88	0.89	0.88	0.82
	Poly (degree=2)	0.81	0.83	0.82	0.76

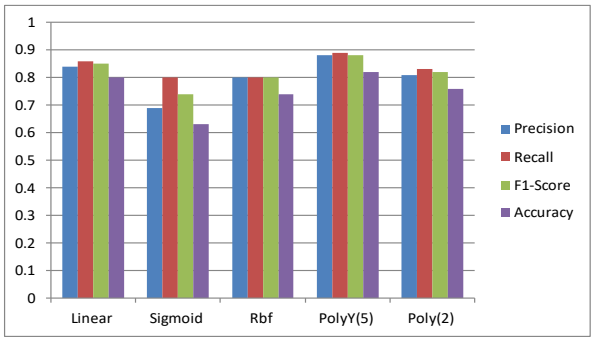

Fig.5 Comparisons of performance of SVM kernel using different kernel function.

SVM operates on different Kernels and different Kernels show different accuracy. In our model SVM Kernel as Polynomial with degree as 5 shows highest accuracy of 0.82. So, for the recommendation system we prefer SVM Polynomial Kernel which will recommend a particular phone to the customer which is having all the required features within the budget.

3. CONCLUSION:

From our work, we have observed that Android is having more selling than iOS. The affordability of Android is 63%, whereas affordability of iOS is 37%. Thus, our model supports our hypothesis of "Android leading market in India". SVM Polynomial kernel is showing highest accuracy of 82%.This proposed recommendation system can be used by customer having all the required features within the budget to choose the Android based phone.

4. FUTURE WORK:

In future we may try to implement the proposed pipeline to study the market of different products. This will help the suppliers and other marketing strategic people to take decision upon the production of the products.

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