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Churn Prediction Model Using Various Machine Learning Classification Techniques

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ABSTRACT:- Client churn is a major problem and one of the most important enterprises for large companies. Due to the direct effect on the earnings of the companies, especially in the telecom field, companies are seeking to develop means to prognosticate implicit client to churn. thus, chancing factors that increase client churn is important to take necessary conduct to reduce this churn. The main donation of our work is to develop a churn vaticination model which assists telecom drivers to prognosticate guests who are most likely subject to churn. The model developed in this work uses machine literacy ways on big data platform and builds a new way of features' engineering and selection. In order to measure the performance of the model, this work also linked churn factors that are essential in determining the root causes of churn. By knowing the significant churn factors from guests' data, CRM can ameliorate productivity, recommend applicable elevations to the group of likely churn guests grounded on analogous geste patterns, and exorbitantly ameliorate marketing juggernauts of the company. The proposed churn vaticination model is estimated using criteria, similar as delicacy, perfection, recall, f- measure, and entering operating characteristics(ROC) area. Likewise, it also provides factors behind the churning of churn guests through the rules generated by using the trait-named classifier algorithm.

KEYWORDS: Crucial terms entering Operating Characteristics, Deep literacy, complication Neural Network, churn prediction, Feature selection.

I. INTRODUCTION

Consumers moment go through a complex decision making process before subscribing to any one of the multitudinous Telecom service options. The services handed by the Telecom merchandisers aren't largely discerned and number portability is commonplace. The mobile telephone assiduity churn is the analogous problem. client fidelity becomes an issue. Hence, it's getting decreasingly important for telecommunications companies to proactively identify factors that have a tendency to unsubscribe and take preventative measures to retain guests. To calculate your probable monthly churn, start with the number of druggies who churn that month. Also divide by the total number of stoner days that month to get the number of churns per stoner day. Also multiply by the number of days in the month to get your performing monthly churn rate. It's set up that data mining ways are more effective in prognosticating consumer churn from the exploration conducted over the once many times. Creating an effective churn vaticination model is an essential exertion taking a lot of work right from determining applicable predictor variables (features) from the large volume of available client data to choosing an effective prophetic data mining fashion suitable for the point set. The A multi-layer perception approach for client churn vaticination has used in for client- related data similar as client profiling, calling pattern, and popular data in addition to the network data they induce. Grounded on the client's history of calling geste and geste, there's a possibility to classify their station of either going down or not. Data booby-trapping ways are set up to be more effective in prognosticating churn from the exploration done over the once decade. The prophetic modeling ways in churn vaticination are also considered to be more accurate. Churn vaticination systems and sentiment analysis using bracket as well as clustering ways to classify churn guests and the reasons behind the churning of telecom guests. In telecom assiduity should we induce large quantum of data on diurnal base, it's veritably tedious task to mine such a kind of last data using specific data mining ways, while hard to interpret the vaticination on classical ways. Eventually similar telecommunication data may be containing some churn and, it's important necessary to identify hunt problems. Big companies apply churn vaticination models to be suitable to descry possible churners before they effectively leave the company.

It's set up that data mining ways are more effective in prognosticating consumer churn from the exploration conducted over the once many times. Creating an effective churn vaticination model is an essential exertion taking a



lot of work right from determining applicable predictor variables (features) from the large volume of available client data to choosing an effective prophetic data mining fashion suitable for the point set. Telecom diligence collects a large quantum of client- related data similar as client profiling, calling pattern, and popular data in addition to the network data they induce. Grounded on the client's history of calling geste , there's a possibility to classify their station of either going down or not. Data booby-trapping ways are set up to be more effective in prognosticating churn from the exploration done over the once decade. The prophetic modeling ways in churn vaticination are also considered to be more accurate. Churn vaticination systems and sentiment analysis using bracket as well as clustering ways to classify churn guests and the reasons behind the churning of telecom guests. In telecom assiduity should we induce large quantum of data on diurnal base, it's veritably tedious task to mine such a kind of last data using specific data mining ways, while hard to interpret the vaticination on classical ways. Colorful experimenters formerly described hunt a work to exclude churn from large data sets emulsion static as well as dynamic approaches, but still similar systems are facing numerous problems factual identification of churn. Eventually similar telecommunication data may be containing some churn and, it's important necessary to identify hunt problems. To successful identification of churn from large data is furnishing effectiveness to client relationship operation(CRM) using colorful soft computing ways in e.g. Inheritable algorithms, announcement boosting etc. In this exploration we proposed churn identification as well as vaticination from large scale telecommunication data set using Natural Language Processing (NLP) and machine literacy ways to dealing with big data. First system deals with strategic NLP process which contains datapre-processing, data normalization, point birth and point selection independently. Point birth ways have been proposed like TF- IDF, Stanford NLP and circumstance correlation ways. Where machine literacy bracket algorithms are has used to train and test the entiremodule. Neuro fuzzy algorithms are used to divide the subscribers into separate classes grounded on their input attributes. Using these classes, the Adaptive Neuro Fuzzy Conclusion System (ANFIS) is used to develop a sensitive vaticination model for churn operation.

II. LITERATURE SURVEY

Numerous styles similar as machine literacy and data mining are used for churn vaticination. The decision- tree algorithm is a dependable system for churn vaticination. In addition, a neural network system, data certainty, and flyspeck mass optimization are used for churn vaticination. According to system a current collection of software to increase the standard of detecting possible churners. The places are uprooted from request information and customer accounts and are classified as deal, request pattern and call pattern adaptations overview functionality. The characteristics are estimated using two probabilistic data mining algorithms from Naïve Bayes and Bayesian Network, and their findings compared to those attained by the use of C4.5 decision tree, an algorithm extensively used in numerous bracket and vaticination tasks. According to formalization of time- window of the collection process, coupled with literature review. Second, by expanding the duration of consumer events from one to seventeen times using logistic retrogression, bracket trees and bagging together with bracket trees, this analysis analyzes the rise in churn model delicacy. The practical result is that experimenters may mainly reduce the data- related pressures, similar as data collection, medication, and analysis. The price guests are anticipated to pay depends on the length and the pro-motional nature of the subscription. The review business is transferring a letter telling them that the service is ending. According to the most effective consumer engagement strategies can be used to high the customer satisfaction position efficiently. The study indicates a Multilayer Perceptron(MLP) neural network system to estimate customer development in one of Malaysia's leading telecommunications enterprises. The results were varied with the most traditional churn vaticination strategies similar as Multiple Retrogression Analysis and assaying Logistic Retrogression. The minimal neural network armature includes 14 input bumps, 1 concealed knot and 1 affair knot with the literacy algorithm Levenberg Marquardt(LM). Multilayer Perceptron(MLP) neural network approach to prognosticate customer churn in one of theleading telecommunications companies in Malaysia compared to the most common churn vaticination ways, similar as Multiple Retrogression Analysis and Logistic Retrogression Analysis. In system on creating an effective and descriptive statistical churn model exercising a Partial Least Forecourt (PLS) approach concentrated on explosively associated intervals in data sets. A primary analysis reveals that travails. That the proposed model provides further dependable results than conventional cast models and recognizes core variables in order to more explain churning actions. Also, network administration, overage administration and issue handling approaches are introduced in certain simple marketing juggernauts and bandied. Burez and Van den Poel Unbalance data sets studies in churn vaticination models, and contrasts arbitrary slice performance, Advanced Under- slice, grade Boosting system, and Weighted Random



Forest. The conception was estimated using Metrics (AUC, Lift). The study shows that the methodology under slice is preferable to the other ways estimated. Brandusoiu describes an innovative data mining system to explain the broad dataset type of consumer churn discovery. About 3500 consumer details is anatomized grounded on incoming number as well as gregarious input call and textbooks. Specific machine learning algorithms were used for training bracket and exploration, independently. The system's estimated average delicacy is about 90 percent for the entire dataset. He etal. with roughly 5.23 million subscribers, a major Chinese telecommunications pot developed a prophetic model concentrated on the Neural Network system to address the issue of consumer churn. The average degree of perfection was the extent of pungency of 91.1. Idris suggested a inheritable engineering result to modeling AdaBoost- churning telecommunications problems. Two Standard Data Sets vindicated the series. With a perfection of 89, one from Orange Telecom and the other from cell2cell and 63 for the other bone . Huang etal. the client churn studied on the big data platform. The experimenters' end was to show that big data significantly improves the cycle of churn vaticination, grounded on the volume, variety and pace of the data. A broad data depository for fracture engineering was anticipated to accommodate data from the Project Support and Business Support Department at China's biggest telecommunications establishment. AUC used the timber algorithm at arbitrary and assessed. According to with k-means and fuzzy c- means clustering algorithms are clustered input features to place subscribers in separate separate groups. The Adaptive Neuro Fuzzy Conclusion System(ANFIS) is introduced using these classes to construct a prophetic model for active churn operation. The first vaticination step begins with Neuro fuzzy resemblant bracket. FIS also takes Neuro fuzzy classifiers labors as input to decide on churners conditioning. measures of success can be used to fete inefficiency problems. Churn operation criteria are associated with client service network services, operations, and effectiveness. GSM number versatility is a vital criterion for churner 's determination. In System a New set of apps to ameliorate the identification position of implicit churners. The features are deduced from call details and client biographies and are distributed as description features related to contract, call pattern, and call pattern changes. The features are tested using two Naïve Bayes and Bayesian Network probabilistic data mining algorithms and their results compared to those attained from the use of C4.5 decision tree, an algorithm generally used in numerous bracket and vaticination tasks. These have contributed, among other factors, to the threat that guests can fluently switch to challengers. One of the ways that can be used to do this is to ameliorate churn vaticination from large quantum of data with birth in the near future. According to Formalization of the selection system in time window, along with analysis of literature. Second, this study analyzes the increase in churn model thickness by extending the history of client events from one to seventeen times using logistic retrogression, bracket trees and bagging along with bracket trees. The functional consequence is that experimenters, similar as data storehouse, planning and exploration, can significantly reduce data- related burdens. The quantum that consumers have to pay depends on the subscription's duration and promotional sense. A letter is transferred by the review company to remind them that the subscription is coming to an end. also ask them if they want to renew their subscription, along with guidance on how to do that. guests are unfit to cancel their subscription and have a grace period of four weeks once they've subscribed lapsed. According to the most effective client retention ways should be used to effectively reduce client development rates. The exploration suggests a neural network approach for Multilayer Perceptron (MLP) to prognosticate client churn in one of Malaysia's leading telecommunications enterprises. The findings were compared with the most common ways of churn vaticination similar as Multiple Retrogression Analysis and Logistic Retrogression Analysis. The optimal configuration of the neural network contains 14 input bumps, 1 hidden knot and 1 affair knot with Levenberg Marquardt(LM) literacy algorithm. Multilayer Perceptron(MLP) neural network approach to prognosticate customer churn in one of the leading telecommunications companies in Malaysia most common Analysis and Logistic Regression Analysis. In system on erecting a prophetic churn model that's accurate and terse using a Partial Least Forecourt(PLS) methodology grounded on largely identified data sets between variables. A primary trial shows that the model presented provides more accurate performance than traditional models of vaticination and identifies crucial variables to more understand churning actions. also, there's a range of introductory churn marketing strategies system operation, overage operation, and complaint operation strategies is presented and bandied. Burez and Van den Poel studied the problem of unbalance datasets in churn vaticination models and compared performance of Random Sampling, Advanced Under- slice, grade Boosting Model, and Weighted Random timbers. They used(AUC, Lift) criteria to estimate the model. The result



showed that under slice fashion outperformed the other tested ways. Schouten et al. presented an advanced methodology of data mining to prognosticate churn for repaid guests using dataset for call details of 3333 guests with 21 features, and a dependent churn parameter with two values yea/ No. Some features include information about the number of incoming and gregarious dispatches and voicemail for each client. The author applied top element analysis algorithm — PCA to reduce data confines. Three machine literacy algorithms were used Neural Networks, Support Vector Machine, and Bayes Networks to prognosticate churn factor. The author used AUC to measure the performance of the algorithms. The AUC values were 99.10, 99.55 and 99.70 for Bayes Networks, Neural networks and support vector machine, independently. The dataset used in this study is small and no missing values were. Karahoca proposed a model for vaticination grounded on the Neural Network algorithm in order to break the problem of client churn in a large Chinese telecom company which contains about 5.23 million guests. The vaticination delicacy standard was the overall delicacy rate, and reached 91.1. Kamalraj proposed an approach grounded on inheritable programming with Adaboosting to model the churn problem in telecommunications. The model was tested on two standard data sets. One by Orange Telecom and the other by cell 2 cell, with 89 delicacy for the cell2cell dataset and 63 for the other bone.

Summary of the Literature

We identify some research gap based on entire literature review that are mention in below

1. Various researchers have already done the churn prediction model but most of the system having accuracy issues due to imbalanced data.
2. Sometimes data contain mini miss-classified instances it is hard classifies by supervised learning algorithm.
3. Most of the systems have used structured data so there is no scope for NLP feature extraction.
4. Hard to detect according to user wise based on sentiment analysis.
5. Low churn prediction accuracy
6. Time complexity very high due to RF generates and extracts redundant features.
7. High error rate of system.

III. PROPOSED SYSTEM DESIGN

In the proposed exploration work to design and develop an approach for churn vaticination using NLP and machine literacy approaches to enhance the system delicacy. also we identify the client changing geste pattern during vaticination. We also estimate the factor which substantially influences to reduce delicacy of churn vaticination and eventually estimate and calculate churn rate for month wise as well as day wise, which useful for enhance the service quality of system. In this exploration we proposed churn vaticination from large scale data, system originally deals with telecommunication synthetic data set which contains some imbalance Meta data. To apply data preprocessing, data normalization, point birth as well as point selection independently. During this prosecution some Optimization strategies have been used to exclude spare features which occasionally induce high error rate during the prosecution. The proposed system prosecution for training and testing. After completion both phases system describes bracket delicacy for entire data set.

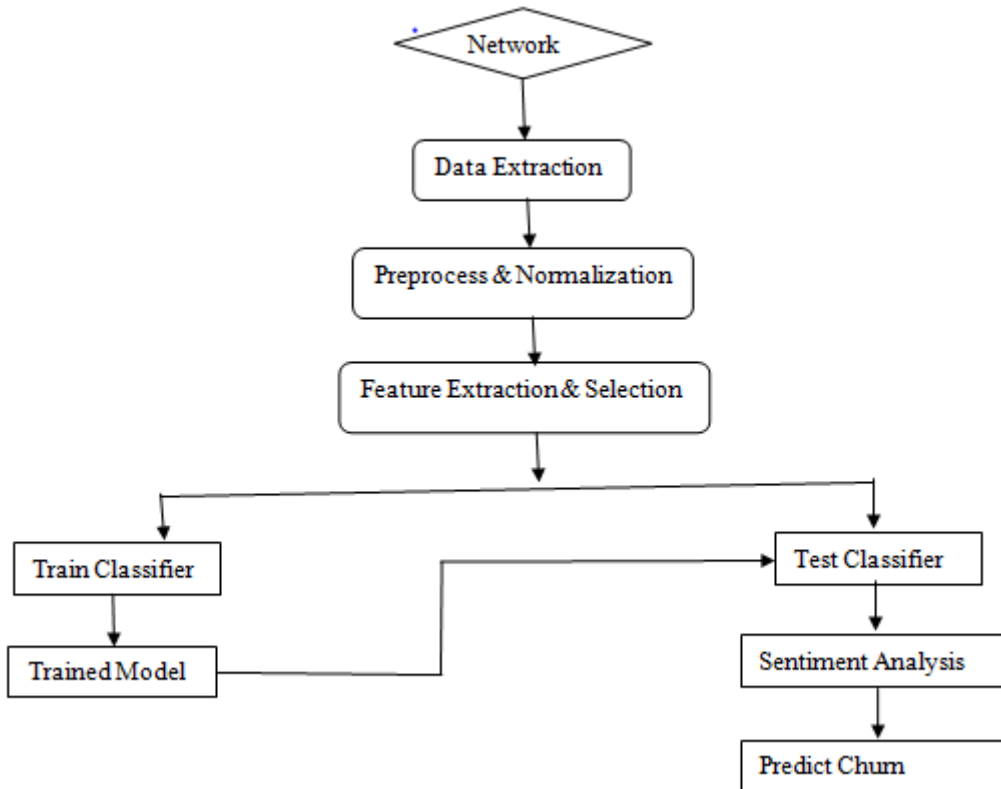


Figure 1 : Proposed system design

The end of this kind of exploration in the telecommunications assiduity is to help businesses make further profit. Telecom companies have come given to read development as one of the most important sources of income. thus, this exploration was aimed at erecting a system in the Telecom Company that predicts client churn. similar vaticination models will achieve high AUC values. The sample data was divided into 70 for training and 30 for testing to estimate and develop the model. We chose 10-fold cross-validation for assessing and optimizing hyperactive parameters. We used engineering tools, effective function metamorphosis and selection approach. Making the interface fit for machine literacy algorithms. Another concern was also set up the data wasn't balanced. Only about 5 of the entries are guests' churn. A problem has been answered by under- slice or using trees algorithms that aren't affected by this issue. In detecting the churn in large data and furnishing accurate vaticination, our different classifiers can be more accurate.

This work contributes to suggesting a supervised approach to the birth of dimensional orders, opting suitable characteristics and avoiding duplication by measuring correlation between characteristics. The results attained show that there's a comparatively advanced f- score in the weighted frequency of the term with the correlation process. In this regard, opting features using weighted word frequency is more important. The imbrication between features in a order of aspect is avoided by measuring the association

- Data Acquisition- First of all the information for different Telecom Sector client grounded on certain parameters is uprooted data.
- Preprocessing- also we will apply colorful preprocessing way similar as verbal analysis, stop word junking, stemming(janitors algorithm), indicator term selection and data drawing in order to make our dataset proper.
- Verbal analysis- verbal analysis separates the input ABC into,



- 1) Word characters(e.g. the lettersa-z) and
- 2) Word partitions(e.g. space, newline, and tab).

- Stop word junking- Stop word junking refers to the junking of words that do most constantly in documents.
- Stemming- Stemming replaces all the variants of a word with a single stem word. Variants include plurals, gerund forms, third person suffixes, once tense suffixes,etc.).
- Data Training- We collect artificial as well as real time using online news data and give training with any machine learning classifier.
- Testing with machine literacy- We prognosticate online news using any machine learning classifier, weight calculator for real time or synthetic input data consequently.
- Analysis- We demonstrate the delicacy of proposed system and estimate with other being systems.

Limitations of previous algorithm

- System reflects good delicacy on structured dataset only.
- One disadvantage of some soft computing styles are that the complexity of the algorithm is high when there are further than a number of inputs fed into the system.

he algorithm's main thing is to produce a system that produces largely repairable results with exceptional perfection. The machine learning algorithm in use seeks to negotiate the same thing. The input of the system can be of size or resolution. It doesn't depend on the operating system. The dataset then are trained and tested. In the proposed exploration work to design and develop an approach for churn vaticination using NLP and machine literacy approaches to enhance the system delicacy. It's veritably important for making the data useful because noisy data can lead to poor results. In telecom dataset, there are a lot of missing values, incorrect values like Null" and imbalance attributes in the dataset. In our dataset, the number of features is 29. We anatomized the dataset for filtering and reduced the number of features so that it contains only useful features.

Proposed System

In the proposed exploration work to design and develop an approach for churn vaticination using NLP and machine literacy approaches to enhance the system delicacy. also we identify the client changing geste pattern during vaticination. We also estimate the factor which substantially influences to reduce delicacy of churn vaticination and eventually estimate and calculate churn rate for month wise as well as day wise, which useful for enhance the service quality of system. In this exploration we proposed churn vaticination from large scale data, system originally deals with telecommunication synthetic data set which contains some imbalance meta data. To apply data preprocessing, data normalization, point birth as well as point selection independently. During this prosecution some Optimization strategies have been used to exclude spare features which occasionally induce high error rate during the prosecution. The proposed system prosecution for training and testing. After completion both phases system describes bracket delicacy for entire data set.

1. Bagging Classifier

IV. ALGORITHM DESIGN

Input: inp 1.....n all input parameters, Desired Threshold

Th.Output: Executed for output as lable.

Step 1 : Read all records from database (R into

DB)Step 2:Parts [] ← Split(R)

Step 3:

$$CVal = \sum_{k=0}^n Parts[k]$$



Step 4: check (Cval with Respective threshold)Step 5:T← get current state with timestamp Step 6 : if(T.time > Defined Time)

Read all measure of for TP and

FNElse continue. Tot++

Step 7: calculate score = (TP *100 /

Tot)Step 8 : if (score >= Th)

Generate event

end for

2. Decision Tree Classifier

Input : Selected feature of all test instances D i...n , Training database policies {T 1..... T n }

Output: No. of probable classified trees with weight and

label.Step 1: Read (D into D[i])

V←Extract features

(D) Step 2:

N←Count_Features(D) Step

3: for each(c into TrainDB)

Step 4: Nc[i]

==Ext_Features(c)

Step 5: select relevant features of w=

{Nc[i], N}Step 6: Statement (w>t)

Step 9: Return Tree Insatnce { Nc[i], N, w, label}

3. Knearest neighbour Classifier

Input: Train_DatasetF TrF[], Test_DatesetF TsF[],

Threshold T.Output: Classified label

Step 1: Read R {All attributes} from current parameters.

Step 2: Map with train features with each sample.

Step 3 : Calculate distance of train DB with same evidences



$$distance = \sum_{k=0}^n (TrF, TsF)$$

Step 4 : evaluate distance > threshold

Step 5: Return the predicted label

4. Random Forest Classifier

Input: Training Rules Tr [], Test Instances Ts [], Threshold T.

Output: Weight w{0-1}

Step 1: Read each test instance from (TsInstnace from Ts)

Step 2: $TsIns = \sum_{k=0}^n \{Ak \dots An\}$

Step 3: Read each train instance from (TrInstnace from Tr)

Step 4: $TrIns = \sum_{j=0}^n \{Aj \dots Am\}$

Step 5: $w = WeightCalc(TsIns, TrIns)$

Step 6: if (w >= T)

Step 7: Forward feed layer to input layer for output OutLayer [] {Tsf, w}

Step 8: optimized feed layer weight, C weigth OutLayer [0]

Step 9: Return Cweight

V. RESULT AND DISCUSSIONS

The below analysis is the system classification graph. The graphs display how system classify the overall inputs into classification various instances. The proposed system is implemented with RNN combination, which gives all results with satisfactory level. For performance evaluation 2500 instances given for training and 267 reviews given for testing with different cross validation. Here system compares or match the proposed results with two different existing systems.

Table 1 :Comparative analysis of various classification algorithms

No.	Method	Accuracy	Precision	Recall	F-1 score
1	Random Forest	0.95	0.95	1	0.97
2	DT	0.89	0.92	0.96	0.94
3	BaggingClassifier	0.94	0.96	0.94	0.97
4	Knearest neighbours	0.81	0.86	0.92	0.89

The above Table 1 depicts the comparative analysis of various classification algorithms evaluation for proposed churn prediction module. The KNeighbors provides lowest accuracy thus Random forest classification gives highest accuracy with 95% on various cross validation. The similar results have been demonstrated in below Figure 2.

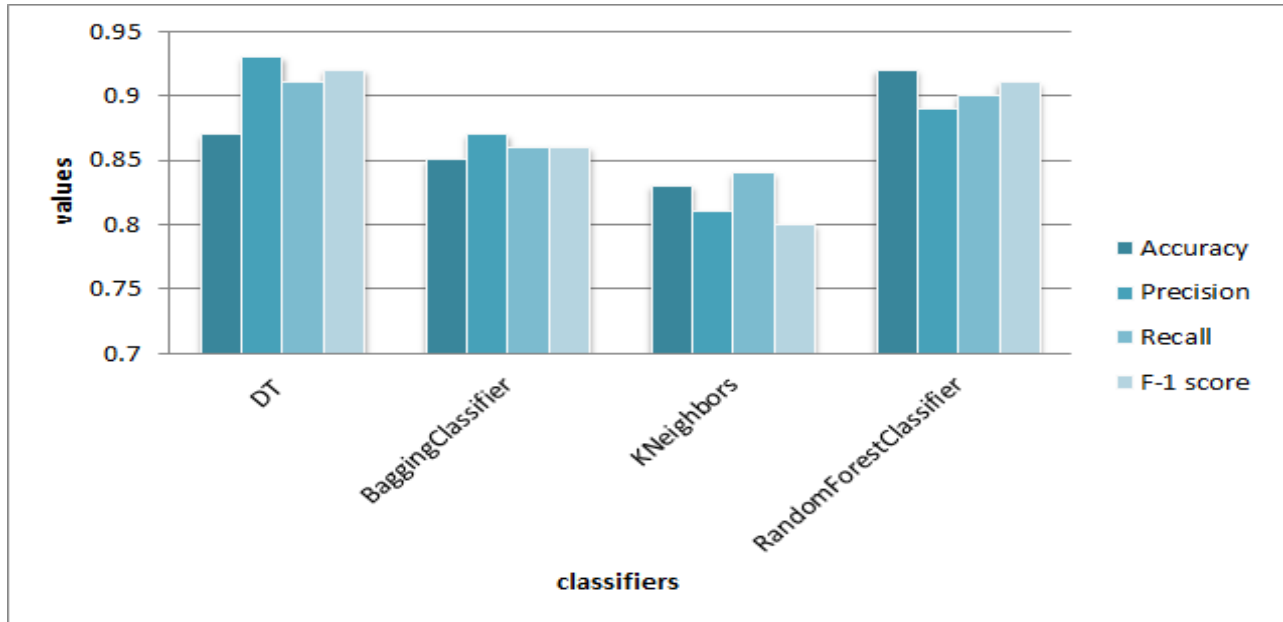


Figure 2 : Comparative analysis of various classification algorithm

VI. CONCLUSION FUTURE WORK

This work substantially focuses on relating and detecting churn consumers from massive data set of telecommunications and discusses churn vaticination systems produced by different algorithms. Some systems still face problems of conversion of verbal data, which can do at high error rate during prosecution. numerous experimenters have been putting forward Natural Language Processing(NLP) ways as well as colorful machine learning algorithms such a combination is likely to induce good performance when structuring data. client churn is a major problem and one of the most important enterprises for large companies. Due to the direct effect on the earnings of the companies, especially in the telecom field, companies are seeking to develop machine literacy algorithms to prognosticate implicit client churn. In this work Random Forest, Decision tree, Bagging Classifier and K- nearest neighbor classifiers are employed to find out churn vaticination rate. Among all these algorithm arbitrary timber classifier gives loftiest delicacy of 95% as compared to decision tree, Bagging classifier and K- nearest neighbor classifier whereas KNN classifier has smallest delicacy of 81%

REFERENCES

- [1] Karahoca, Adem, and Dilek Karahoca." GSM churn operation by using fuzzy c- means clustering and adaptive neuro fuzzy conclusion system." Expert Systems with Applications38.3 (2011) 1814- 1822.
- [2] Kirui, Clement, etal." Predicting client churn in mobile telephony assiduity using probabilistic classifiers in the data mining." International Journal of Computer Science Issues(IJCSI)10.2 Part 1(2013) 165.
- [3] Ballings, Michel, and Dirk Van den Poel." client event history for churn vaticination How long is long enough?" Expert Systems with Applications39.18(2012) 13517- 13522.
- [4] Ismail, Mohammad Ridwan, etal." A multi-layer perceptron approach for client churn vaticination." International Journal of Multimedia and Ubiquitous Engineering10.7(2015) 213- 222.
- [5] Lee, Hyeseon, etal." Mining churning actions and developing retention strategies grounded on a partial least places(PLS) model." Decision Support Systems52.1(2011) 207- 216.
- [6] Burez D, den PoelV. Handling class imbalance in client churn vaticination. Expert Syst Appl. 2009; 36(3) 4626 – 36.
- [7] Brandusoiu I, Todorean Gavril, HaB. styles for churn vaticination in the repaid mobile telecommunications assiduity. In International conference on dispatches. 2016.p. 97 – 100.
- [8] He Y, He Z, Zhang D. A study on vaticination of client churns in fixed communication network grounded on



- data mining. In Sixth transnational conference on fuzzy systems and knowledge discovery, vol. 1. 2009, p. 92 – 4.
- [9] Idris A, Khan A, Lee YS. inheritable programming and adaboosting grounded churn vaticination for telecom. In IEEE transnational conference on systems, man, and cybernetics(SMC). 2012.p. 1328 – 32.
- [10] Huang F, Zhu Ml, Yuan K, Deng EO. Telco churn vaticination with big data. In ACM SIGMOD transnational conference on operation of data. 2015. p.607 – 18
- [11] Karahoca, Adem, and Dilek Karahoca." GSM churn operation by using fuzzy c- means clustering and adaptive neuro fuzzy conclusion system." Expert Systems with Applications38.3(2011) 1814- 1822.
- [12] Kirui, Clement, etal." Predicting client churn in mobile telephony assiduity using probabilistic classifiers in the data mining." International Journal of Computer Science Issues(IJCSI)10.2 Part 1(2013) 165.
- [13] Ballings, Michel, and Dirk Van den Poel." client event history for churn vaticination How long is long enough?" Expert Systems with Applications 39.18 (2012) 13517- 13522.
- [14] Ismail, Mohammad Ridwan, etal." Amulti-layer perceptron approach for client vaticination." International Journal of Multimedia and Ubiquitous Engineering 10.7 (2015) 213- 222.
- [15] Lee, Hyeseon, etal." Mining churning actions and developing retention strategies grounded on a partial least places (PLS) model." Decision Support Systems 52.1 (2011) 207- 216.
- [16] Burez, Jonathan, and Dirk Van den Poel." Handling class imbalance in client/customer churn vaticination." Expert Systems with Applications 36.3(2009) 4626- 4636.
- [17] Schouten, Kim, etal." Supervised and unsupervised aspect order discovery for sentiment analysis withco-occurrence data." IEEE deals on cybernetics 48.4 (2017) 1263- 1275.
- [18] Karahoca, Adem, and Dilek Karahoca." GSM churn operation by using fuzzy c- means clustering and adaptive neuro fuzzy conclusion system." Expert Systems with Applications 38.3 (2011) 1814- 1822.
- [19] Kamalraj,N., andA. Malathi." A check on churn vaticination ways in communication sector." International Journal of Computer Applications 64.5 (2013) 39- 42.
- [20] Li L, Jiang P, Xu H, Lin G, Guo D, Wu H. Water quality prediction based on recurrent neural network and improved evidence theory: a case study of Qiantang River, China. Environmental Science and Pollution Research. 2019 Jul;26(19):19879-96.
- [21] Idris A, Khan A, Lee YS. Genetic programming and adaboosting based churn prediction for telecom. In2012 IEEE international conference on Systems, Man, and Cybernetics (SMC) 2012 Oct 14 (pp. 1328-1332). IEEE.
- [22] Huang F, Zhu M, Yuan K, Deng EO. Telco churn prediction with big data. In: ACM SIGMOD international conference on management of data. 2015. p .607–18



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