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PREDICTING MOVIE SUCCESS BY RANDOM FOREST ALGORITHM USING IMDB DATASET

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ABSTRACT: The Critics, storyline, heroes, music, etc. affect movie success. To forecast movie success, data mining and various machine learning approaches have been established, however in this work, we utilize random forest algorithm with reduced cost and schedule. The random forest classifier takes the dataset randomly from the available dataset, generates the decision tree, and then votes on the prediction results. The highest score and accuracy represent the movie's success. For the IMDB dataset sample, we use KAGGLE's online resource, and the experimental results are generated in Python, which helps analyze the proposed methodology. Score, accuracy, precision, recall value, F1 score, mean absolute error, and mean square error are used to measure the suggested method's performance. The suggested method is compared against Gaussian NB, Multinomial NB, Bernoulli NB, K-Neighbors Classifier, Decision Tree, and Logistic regression. Our proposed method scores 70% and is more accurate than others. Comparatively, the Bernoulli NB, Multinomial NB, and logistic regression have lower F1 scores, precision, and recall values. Comparing proposed and existing approaches using mean absolute error and mean square error yields 32% and 36%, respectively. This strategy improves movie success predictions.

Keywords: Movie reviews, Success Prediction, Machine Learning, IMDB, Kaggle.

1. INTRODUCTION

The movie industry is a sizable investment sector, but larger company sectors are more complex and difficult to decide how to invest in. Large investments carry greater dangers. No one can forecast a movie's performance in the market, according to J. Valenti, CEO of the Motion Picture Association of America (MPAA). Not until the movie starts in a dark theatre and the audience and the screen start to ignite [1]. Due to the movie industry's excessive daily growth, there are currently vast quantities of data available online, which makes it an intriguing area for data analysis. Trying to predict a movie's success is an extremely difficult undertaking. The definition of a successful movie varies depending on several factors. Some films are considered successful based on their global box office haul, while others may not perform as well commercially but still receive favorable reviews and are well-liked. The amount of money made from movies depends on a number of factors, including the actors who play the roles, the budget allocated for film production, the reviews of film critics, the movie's rating, the year it was released, etc. There is no technique that enables us to conduct analysis for forecasting the amount of money a specific movie will be producing because of these several factors. However, a model that can be used to estimate the anticipated revenue for a specific movie can be created by looking at the profits made by earlier films. The movie studios that will be producing the film may find such a prediction to be quite helpful in helping them make decisions on various costs, such as artist salary, movie advertising, marketing in various cities, etc. Additionally, it enables investors to forecast an anticipated return on investment (ROI). It will also be helpful for many movie theatres to project the revenue they would make from showing a specific film.

There are many factors that affect how well a movie does, including the number of screens it will play on, how much publicity it will receive, the actors and directors involved, the budget, the genre, and the number of similar movies that have already been released in the past years, months, and days. As a source of fervor, empathy, enthusiasm, and amusement, movies have become an essential part of our life [2]. Films are a priceless resource for the world because they have also been a significant medium for cultural exchange between many cultures and regions. Because of this, the movie industry has developed into a business with huge market potential. As a result, the knowledge and research around the film industry are becoming distinctly deeper. The film line will be able to decide the publicity cost and time of demonstrating the motion picture to expand the benefit and

returns to investment made therein if they have the ability to precisely foresee the movies potential returns over investment based on the total cost of ownership for a motion picture. The problem of predicting a film's box office revenue has previously been extensively addressed from a quantifiable standpoint.

There are many factors that affect how well a movie does, including the number of screens it will play on, how much publicity it will receive, the actors and directors involved, the budget, the genre, and the number of similar movies that have already been released in the past years, months, and days. As part of this plan, we are concentrating on developing a strategy based on affiliation and machine learning to improve the movie's success prediction. The success of movies is predicted in this article using a random forest classifier, and this classifier is compared to other machine learning methods. Machine learning is one of the approaches needed for effective data analysis given the enormous amount of data that is being generated. This methodology is now widely utilized for data analysis purposes. Utilizing a variety of performance measurement factors, including Precision, Recall, F1 Score, Mean Square Error, Mean Absolute Error, Root Mean Square Error, etc., it is determined that our proposed approach performs better than the current approach. This indicates that our strategy is substantially more accurate in predicting movie success rates.

2. RELATED WORK

Kumar, and Kumar (2018) proposed framework predicts the achievement of a motion picture in light of its gainfulness by utilizing chronicled information from different sources. Utilizing informal community examination and content mining methods, the framework naturally separates a few gatherings of highlights, including "who" are on the best composition (actor and director) what a film is about, "when" a motion picture will be released, and in addition "semi variety" highlights that match "who" with "what", and "when" with "what". Examination comes about with motion pictures amid years‟ time frame demonstrated that the framework beats benchmark techniques by a substantial edge in anticipating motion picture productivity. Novel highlights we proposed likewise made extraordinary commitments to the expectation. Moreover, to planning a choice emotionally supportive network with reasonable utilities, our investigation of key factors for motion picture productivity may likewise have suggestions for hypothetical research on group execution and the achievement of imaginative work [2].

Latif and Afzal (2016) used IMDB for our experimentation. They created dataset and then transformed it and applied machine learning approaches to build efficient models that can predict the movies popularity. Performing data mining on IMDB is a hard task because of so many attributes related to a movie and all in different dimensions with lots of noisy data and missing fields. After performing classification, they have found out that their best results are achieved through simple logistic and logistic regression at around 84 %. The attributes that contributed the most to information are met score and number of votes for each movie, Oscar awards won by the movies and the number of screens the movie is going to be screened [3].

Chaudhari et al. (2016) developed a tool, which can predict the success of movie being a hit or flop. As this factor is important for everyone involved in the movie, for example: If a movie is flop, it exacerbates the image of actor or director. The tool will use searching algorithms and then use of bespoke system to predict the percentage of success of movie which is yet to be released. Their analysis of the data collected from various resources like IMDB, Kaggle. They gather a series of interesting facts and relationships using a variety of data mining techniques such as Bayes Classification Algorithm, Decision Tree etc. Subsequently, a classifier is learned and used to classify new movies with respect to their predicted box-office collection. Experimental results

showed that the proposed approach improved the classification accuracy as compared to a fully independent setting. In particular, they discovered the rate of success with respect to various parameters such as language, country, budget, Facebook likes of the actors and actresses etc and focus on relevant details such as the relationship between the budget of the movie and rating of the movie, language and rating, facebook likes and rating etc. The data mining techniques used will enable us to uncover information which will both confirm or disproved common assumptions about movies, and also allow us to predict the success of a future film given select information about the filmbefore its release [4].

Meenakshi et al., (2018) developed a system based upon data mining techniques that may help in predicting the success of a movie in advance thereby reducing certain level of uncertainty. An attempt is made to predict the past as well as the future of movie for the purpose of business certainty or simply a theoretical condition in which decision making the success of the movie is without risk, because the decision maker has all the information about the exact outcome of the decision, before he or she makes the decision. With over two million spectators a day and films exported to over 100 countries, the impact of Bollywood film industry is formidable. They gathered a series of interesting facts and relationships using a variety of data mining techniques [7]. In particular, they concentrated on attributes relevant to the success prediction of movies, such as whether any particular actors or actresses are likely to help a movie to succeed. They additionally reported on the techniques used, giving their implementation and utility. Additionally, they found some attention-grabbing facts, such as the budget of a movie isn't any indication of how well-rated it'll be, there's a downward trend within the quality of films over time, and also the director and actors/actresses involved in the movie [5].

Quader et al. (2017) proposed a decision support system for movie investment sector using machine learning techniques. This research helps investors associated with this business for avoiding investment risks. The system predicted an approximate success rate of a movie based on its profitability by analyzing historical data from different sources like IMDB, Rotten Tomatoes, Box Office Mojo and Metacritic. Using Support Vector Machine (SVM), Neural Network and Natural Language Processing the system predicts a movie box office profit based on some pre-released features and post-released features. They showed Neural Network gives an accuracy of 84.1% for pre-released features and 89.27% for all features while SVM has 83.44% and 88.87% accuracy for pre- released features and all features respectively when one away prediction is considered. Moreover, they figured out that budget, IMDB votes and no. of screens are the most important features which play a vital role while predicting a movie's box-office success [6].

3. MACHINE LEARNING CLASSIFICATION

Machine Learning is a perception which consents the machine to acquire from examples and experience, andthat moreover deprived of being overtly programmed. Thus, instead of you scripting the code, what you do is you feed data to the generic technique, and the technique/ machine builds the logic based on the given data. [13, 8] It permits the computers system or the machines to construct data-driven decisions rather than being explicitly programmed for carrying out a certain task. These programs or techniques are designed in a way that they learn and improve over time when are exposed to new data.

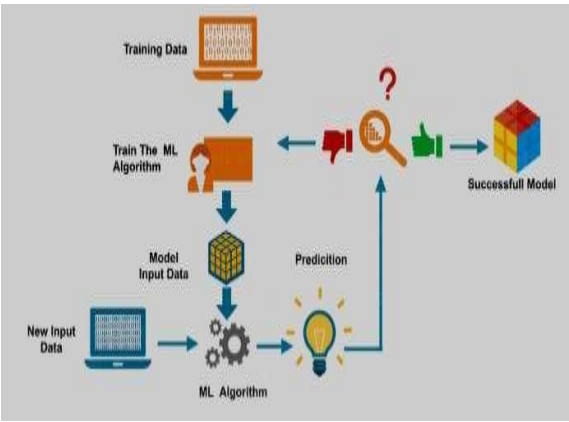


Fig.1: Working steps of Machine learning technique

Machine Learning Technique is trained using atraining data set to create a model. When new input data is introduced to the ML technique, it makes a prediction based on the model. The prediction is evaluated for accuracy and if the accuracy is acceptable, the Machine Learning technique is deployed. If the accuracy is not acceptable, the Machine Learning technique is trained again and again with an augmented training data set. [8] This is just a very high-level example as there are many factors and other steps involved.

3.1 *Types of Machine Leaning Techniques*

There are three important types of Machine LearningTechniques such as supervised learning, unsupervised learning and reinforcement learning, which we arediscussing in detail:

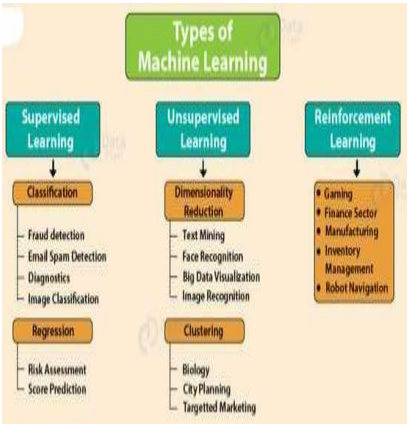


Fig.2: Classification of Machine Learning Techniques

3.1.1 Supervised Learning

Supervised Learning is the most popular paradigm for performing machine learning operations. It is widely used for data where there is a precise mapping between input-output data. The dataset, in this case, is labeled, meaning that the algorithm identifies the features explicitly and carries out predictions or classification accordingly. [9] As the training period progresses, the algorithm is able to identify the relationships between the two variables such that we can predict a new outcome. Resulting Supervised learning algorithms are task-oriented. As we provide it with more and more

examples, it is able to learn more properly so that it can undertake the task and yield us the output more accurately. Some of the algorithms that come under supervised learning are as follows: Linear regression, random forest, support vector machine, artificial intelligence [10], etc. There are two main types of supervised learning problems: they are classification that involves predicting a class label and regression that involves predicting a numerical value [10].

- Classification: Supervised learning problemthat involves predicting a class label.
- Regression: Supervised learning problem thatinvolves predicting a numerical label.

Both classification and regression problems may have one or more input variables and input variables may beany data type, such as numerical or categorical [45].

3.1.2 UNSUPERVISED LEARNING

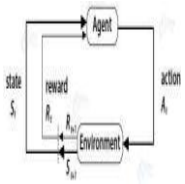
Unsupervised machine learning holds the advantage ofbeing able to work with unlabeled data. This means that human labor is not required to make the dataset machine-readable, allowing much larger datasets to be worked on by the program. The model learns through observation and finds structures in the data. Once the model is given a dataset, it automatically finds patterns and relationships in the dataset by creating clusters in it [11]. In supervised learning, the labels allow the algorithm to find the exact nature of the relationship between any two data points. However, unsupervised learning does not have labels to work off of, resulting in the creation of hidden structures. Relationships between data points are perceived by the algorithm in an abstract manner, with no input required from human beings. The creation of these hidden structures is what makes unsupervised learning algorithms versatile. Instead of a defined and set problem statement, unsupervised learning algorithms can adapt to the data by dynamically changing hidden structures. [11] This offers more post-deployment development than supervised learning algorithms. What it cannot do is add labels to the cluster, like it cannot say this a group of apples or mangoes, but it will separate all the apples from mangoes. Suppose wepresented images of apples, bananas and mangoes to the model, so what it does, based on some patterns andrelationships it creates clusters and divides the dataset into those clusters. Now if a new data is fed to the model, it adds it to one of the created clusters. The example of unsupervised learning is k-mean clustering, principle component analysis, SVD, FP-growth etc [16]. There are many types of unsupervised learning, although there are two main problems that are often encountered by a practitioner: they are clustering that involves finding groups in the data and density estimation that involves summarizing the distribution of data [11].

- Clustering: Unsupervised learning problemthat involves finding groups in data.
- Density Estimation: Unsupervised learning problem that involves summarizing the distribution of data.

3.1.3 REINFORCEMENT LEARNING

Reinforcement learning directly takes inspiration from how human beings learn from data in their lives. It features an algorithm that improves upon itself and learns from new situations using a trial-and-error method. Favorable outputs are encouraged or „reinforced", and non-favorable outputs are discouraged or „punished". Based on the psychological concept of conditioning, reinforcement learning works by putting the algorithm in a work environment with an interpreter and a reward system. In all iteration of the algorithm, the output result is given to the interpreter, which decides whether the outcome is favorable or not [12]. In case of the program finding the correct solution, the interpreter reinforces the solution by providing a reward to the algorithm. If the outcome is not favorable, the algorithm is forced to reiterate until it finds a better result. In most cases, the reward system is directly tied to the effectiveness of the result [12]. In typical reinforcement learning use-

cases, such as finding the shortest route between two points on a map, the solution is not an absolute value. Instead, it takes on a score of effectiveness, expressed in a percentage value. The higher this percentage value is the more reward is given to the algorithm. Thus, the program is trained to give the best possible solution for the best possible reward [17]. This simple feedback



reward is known as a reinforcement signal.

Fig. 3: Example of reinforcement learning

4. PROPOSED WORK

Most of the earlier works are predicting the IMDB Score. Means they are using different attribute to predict the IMDB Score hence they taken this as a Regression Problem. But our main focus is to predict the success rate. So, we divide the whole Range of IMDB in five different categories so that we can take it as Classification Problem and hence we can also increase the past scores. (To get a good Score in Regressor requires proper dataset but in classification a good score can easily raise). So, we had classified the movies in a category followed as: Table 1: Range of IMDB rating.

IMDB Rating	Score (My system of scoring)
0-2	0
2-4	1
4-6	2
6-8	3
8 and so on	4

This is all about the workflow as it's all divided in the following steps which made this easy.

Fig.4: Work flow of Movie prediction

To predict the movies success rate, our methodology follows the subsequent steps which are discussing below:

Step1: Collecting database

In the first step we need dataset to work upon. As we are familiar with a website named as Kaggle, which is the best place for all kinds of datasets. So, talking about our aim we need a dataset which comprises of every single detail about the movie. Hence, we have the official; dataset of IMDB movies which iscollection of every detail of around 4000 +n movies. Discussing about the attributes or the details of dataset of each movie as we have in following.

Table 2: Attributes of Movie dataset

color	director_name	num_critic_for_reviews	duration
director_facebook_likes	actor_3_facebook_likes	actor_2_name	actor_1_facebook_likes
gross	genres	actor_1_name	movie_title
num_voted_users	cast_total_facebook_likes	actor_3_name	facenumber_in_poster
plot_keywords	movie_imdb_link	num_user_for_reviews	language
country	content_rating	budget	title_year
actor_2_facebook_likes	imdb_score	aspect_ratio	movie_facebook_likes

So, with the help of this dataset we will try to implement a Classification model which can easily predict the Movie success rate as 0 with least and so on**.**

Step2: Cleaning Database

In this step we already had collected the database so this is the time where we need to filter or clean the dataset. So in this we take Care of few things as following. As cleaning the data is first task in ML & DS workflow. Without this we will face many issues in exploring the required terms. As cleaning just not actually means to clean the data. It exactly meansfiltering and modifying your data such that it is easy toexplore, understand and model.

1. First task is to remove all the Nan or Emptyvalues.
2. Then we need to handle the missing value.
3. Handling the Outliers

So, in this process we clean the data and make it readyfor the Training purpose.

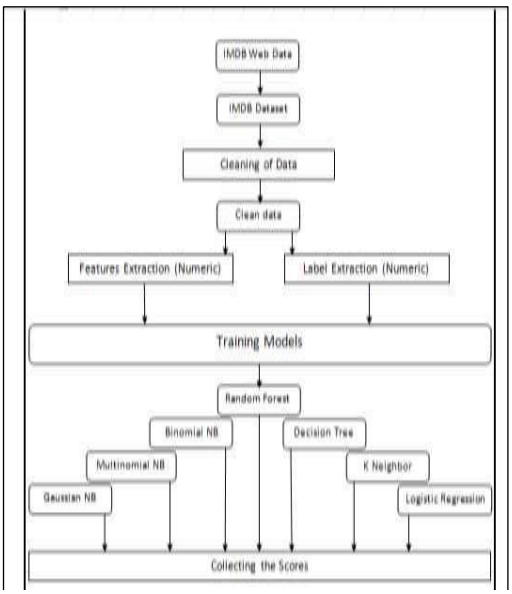


Fig.5 Data flow diagram of proposed work

Step3: Picking Features (Necessary)

In this step, we need to the features or we can say that we need to select the columns which we need to feed in the following model.

As in given dataset we have three types of data

1. Numerical data
2. Categorical Data
3. Composite data

As all the classifiers are best suited for the Numerical Values so we will be going to select all the numerical columns for the training purpose.

Step4: Training Different Models

From the last step we have training dataset and resulting IMDB scores now we need train different model or we can say that we need to train different classifiers so that prediction can be taken out. In this we are using following Models.

1. Logistic regression
2. Decision tree
3. K Neighbors Classifier
4. Gaussian Naïve Bayes
5. Multinomial Naïve Bayes
6. Binomial Naïve Bayes
7. Random Forest

Here we have used a few of best classifiers.

Step5: Printing all the Scores

In this step we printed all the scores of all used classifiers hence get to know that Random Forest is the best regressor.

Step6: Result

As a result, we final implemented a classifier which can predict the Success rate of any IMDB movie.

5. RESULT ANALYSIS

In this section of the dissertation we perform the result analysis on different measuring parameters like score, accuracy, precision, recall, f1-measure, mean absolute error and mean square error and comparison is done between the proposed methodology (random forest classifier), logistic regression and K neighbors‟classifiers.

5.1 *COMPARISON OF SCORE*

The score parameter is used prove the rating score to the movie and the comparative analysis of this parameter is done among different machine learning such as GuassianNB, MultinomialNB, BernoulliNB, KNeighnorsClassifier, Decision Tree, Logistic regression and our proposed method (random forest). The simulation results of our proposed method and existing method is shown in table 3 and it is 70%which is much more about the other exiting approach. The analysis is done using the comparison graph shown in figure 6 and it is found that our proposed method has higher value than the others. It means that the proposed method is more success in the prediction of movie success or hit.

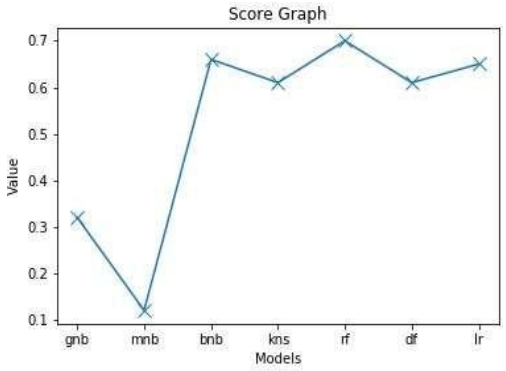


Fig. 6: Comparison of Score parameters

Table 3: Comparative analysis of score parameter between Random forest and existing method

Comparison of Score			
S. No.	**Name of Classifier**	**Short Name**	**Score in %**
1	GaussianNB	GNB	32
2	MultinomialNB	MNB	12
3	BernoulliNB	BNB	66
4	KNeighborsClassifier	KNS Model	61
5	**Random Forest (Proposed Method)**	**RF**	**70**
6	Decision Tree	DT	61
7	Logistic regression	LR	65

5.2 COMPARISON OF ACCURACY

This section presents the comparison of accuracy parameter to show the prediction accuracy of movie and the comparative analysis of this parameter is done among different machine learning such as Gaussian NB, Multinomial NB, Bernoulli NB, KNeighnors Classifier, Decision Tree, Logistic regression and our proposed method (random forest). The simulation results of our proposed method and existing method is shown in table 4 and it is 70% which is much more about the other exiting approach. The analysis is done using the comparison graph shown in figure 7 and it is found that our proposed method has higher value than the others. In this the value of accuracy is equivalent to score parameter. If score of the movie will high accuracy of the movie prediction will high. And it is analyzed that the proposed method is more success in the prediction of movie success or hit.

Table 4: Comparative analysis of accuracy parameter between Random forest and existing method

Comparison of Accuracy			
S. No.	**Name of Classifier**	**Short Name**	**Accuracy in %**
1	Gaussian NB	GNB	32
2	Multinomial NB	MNB	12
3	Bernoulli NB	BNB	66
4	KNeighbors Classifier	KNS Model	61
5	**Random Forest (Proposed Method)**	**RF**	**70**
6	Decision Tree	DT	61
7	Logistic regression	LR	65

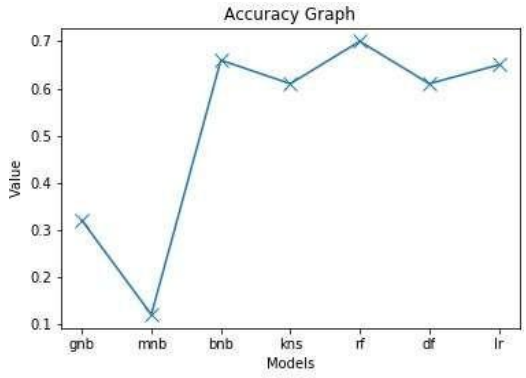


Fig. 7: Comparison of accuracy parameters

5.3.3 COMPARISON OF PRECISION SCORE

This section presents the comparison of precision score parameter to show the prediction accuracy of movie and the comparative analysis of this parameter is done among different machine learning such as Gaussian NB, Multinomial NB, Bernoulli NB, K-Neighbors Classifier, Decision Tree, Logistic regression and our proposed method (random forest). The simulation results of our proposed method and existing method is shown in table 5 and it is 66% which is much more about the other exiting approach. The analysis of precision parameter is done using the comparison graph shown in figure 8 and it is found that our proposed method has higher value than the others. Due to the higher precision value it is analyzed that the proposed method is more success in the prediction of movie success or hit.

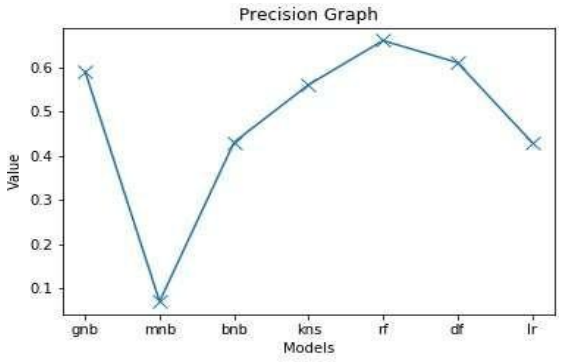


Fig. 8: Comparison of Precision Score

Table 5: Comparative analysis of Precision parameter between Random forest and existing method

Comparison of Precision Score			
S. No.	**Name of Classifier**	**Short Name**	**Precision Score in %**
1	Gaussian NB	GNB	59
2	Multinomial NB	MNB	07
3	Bernoulli NB	BNB	43
4	K Neighbors Classifier	KNS Model	56
5	**Random Forest (Proposed Method)**	**RF**	**66**
6	Decision Tree	DT	61
7	Logistic regression	LR	43

5.3.4 COMPARISON OF F1 SCORE

This section presents the comparison of F1 score parameter to show the prediction accuracy of movie and the comparative analysis of this parameter is done among different machine learning such as Gaussian NB, Multinomial NB, Bernoulli NB, KNeighnors Classifier, Decision Tree, Logistic regression and our proposed method (random forest). The simulation results of our proposed method and existing method is shown in table 6 and it is 66% which is much more about the other exiting approach. The analysis of F1 score parameter is done using the comparison graph shown in figure 9 and it is found that our proposed method has higher value than the others. Due to the higher F1 score value it is analyzed that the proposed method is more success in the prediction of movie success or hit.

Table 6: Comparative analysis of F1 score parameter between Random forest and existing method

Comparison of F1 Score			
S. No.	**Name of Classifier**	**Short Name**	**F1 Score in %**
1	Gaussian NB	GNB	23
2	Multinomial NB	MNB	09
3	Bernoulli NB	BNB	52
4	K Neighbors Classifier	KNS Model	57
5	Random Forest **(Proposed Method)**	**RF**	**66**
6	Decision Tree	DT	61
7	Logistic regression	LR	52

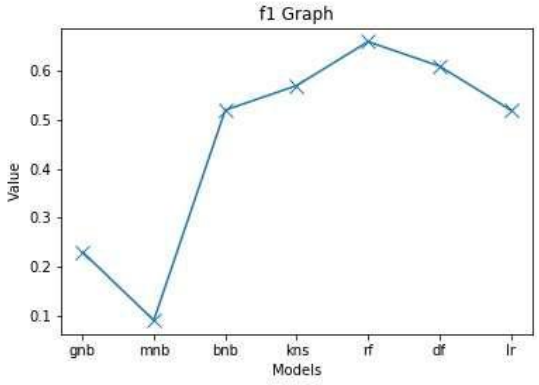


Fig. 9: Comparison of F1 score parameters

5.5 COMPARISON OF RECALL SCORE

This section presents the comparison of Recall score parameter to show the prediction accuracy of movie and the comparative analysis of this parameter is done among different machine learning such as GuassianNB, MultinomialNB, BernoulliNB, KNeighnors Classifier, Decision Tree, Logistic regression and our proposed method (random forest). The simulation results of our proposed method and existing method is shown in table 7 and it is 69% which is much more about the other exiting approach. The analysis of recall score parameter is done using the comparison graph shown in figure 10 and it is found that our proposed method has higher value than the others. Due to the higher recall value it is analyzed that the proposed method is more success in the prediction of movie success or hit.

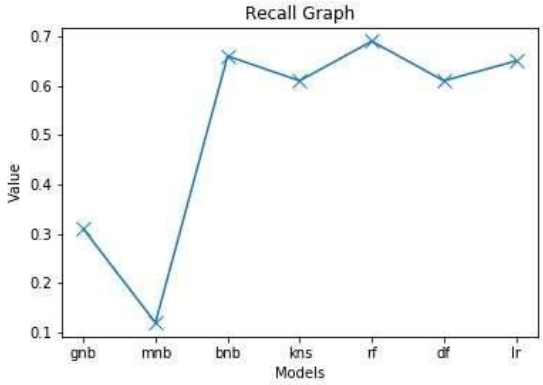


Fig. 10: Comparison of Recall score parameters

Table 7: Comparative analysis of Recall score parameter between Random forest and existing method

Comparison of Recall Score			
S. No.	**Name of Classifier**	**Short Name**	**Recall Score**
1	Gaussian NB	GNB	0.31
2	Multinomial NB	MNB	0.12
3	Bernoulli NB	BNB	0.66
4	KNeighbors Classifier	KNS Model	0.61
5	**Random Forest (Proposed Method)**	**RF**	**0.69**
6	Decision Tree	DT	0.61

7	Logistic regression	LR	0.65

6. CONCLUSION

In this research study, we explore with a powerful categorization machine learning algorithm. Utilizing performance measurement measures including precision, recall, F1 score, accuracy, etc., the suggested method and the present method are experimentally compared. Python is a language that is used to simulate the suggested and current methods since it is simple to use and consumes less computing time than other languages. After simulation, the proposed technique produced a result for the accuracy and score parameter of 70%, which is significantly better than the current method. The precision and recall parameters are also used in the analysis of the proposed and current methods, and the suggested methods' value, which is 66%, is higher than that of the existing approach. Later, the suggested and existing methods are compared using the F1 score, and the results are 69% and 58%, respectively, which is roughly 11% better than the existing approach. We also conduct the study using the MAE, MSE, and root mean squared error, which are 32%, 36%, and 61% of the suggested technique, respectively, and are much lower than the current method. We can anticipate the success rate of movies based on these characteristics with ease. Although the movie can be predicted using the IMDB dataset, prediction cannot be done in the absence of data such as the name of the lead actor, the genre of the film, and the location where the film would be produced. Therefore, it is vital to include these additional criteria in future study in order to increase the accuracy of success prediction for movies. Use a hybrid approach to machine learning that combines the key elements of random forest with another approach, such as logistic regression, to increase the success of movie prediction.

REFERENCE

[1.] B. R. Litman & H. Ahn. (1998). Predicting financial success of motion pictures. In B. R. Litman (Ed.), the motion picture mega-industry. Boston, MA: Allyn & Bacon Publishing, Inc.
[2.] Kumar and Kumar, “Predicting Movie Success or Failure using Linear Regression & SVM over Map-Reduce in Hadoop”, International Journal of Innovative Research in Computer and Communication Engineering, Vol. 6, Issue 6, June 2018.
[3.] “Prediction of Movies popularity Using Machine Learning Techniques”, International Journal of Computer Science and Network Security, VOL.16 No.8, August 2016, pp 127-131.
[4.] Chaudhari et al., “A Data Mining Approach to Language Success Prediction of A Feature Film”, International Journal of Engineering Sciences & Management Research, 2016, pp. 1-9.
[5.] Meenakshi et al., “A Data mining Technique for Analyzing and Predicting the success of Movie”, Journal of Physics: Conf. Series 1000 (2018) 012100 doi :10.1088/1742-6596/1000/1/012100. Pp 1-9.
[6.] Quader et al., “A Machine Learning Approach to Predict Movie Box-Office Success”, 20th International Conference of Computer and Information Technology (ICCIT), 22-24 December, 2017.
[7.] G. Diamantopoulos and M. Spann 2005 Performance analysis of CART and C5.0 using sampling techniques Advances in Computer Applications. 11 3, pp. 233–243.
[8.] https://www.edureka.co/blog/what-is-machine- learning/
[9.] Christopher M. Bishop, “Pattern Recognition and Machine Learning (Information Science and Statistics)”, 2006. Page-3
[10.] Russel, “Artificial Intelligence: A Modern Approach”, January 1, 2015
[11.] Hastie et al. “The Elements of Statistical Learning: Data Mining, Inference, and Prediction”, Second Edition (Springer Series in Statistics) , 2016, pp. 28. [online]. Available: https://www.amazon.com/Elements-Statistical-Learning-Prediction-Statistics.
[12.] Richard S. Sutton et al., “Reinforcement Learning: An Introduction (Adaptive Computation and Machine Learning”,2018, second edition, pp.-2. [Online]. Available: https://www.amazon.com/Reinforcement-Learning-Introduction-Adaptive-Computation.
[13.] A. Smola and S. Vishwanathan, Introduction to Machine Learning. United Kingdom at the University Press, Cambridge, October 1, 2010.
[14.] Online]. Available: www.analyticsvidhya.com.

[15.] Sunpreet Kaur, Sonika Jindal "A Survey on Machine Learning Algorithms", International Journal of Innovative Research in Advanced Engineering (IJIRAE)2016,Issue 11, Volume 3.
[16.] W. Gerstner, "Supervised learning for neural networks: a tutorial with JAAv exercises".
[17.] O. R. s. P. breiman L, friedman J.H., "Classification and regression trees." Belmont CA Wadsworth International group, 1984. B. C. . U. P.E.tgoff, "Multivariate decision trees: machine learning," no. 19, 1995, pp. 45–4.