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ATTITUDE OF PG SCHOLARS OF AGRICULTURAL EXTENSION TOWARDS APPLICATION OF MOBILE TECHNOLOGY USING ARTIFICIAL INTELLIGENCE TECHNIQUE

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ABSTRACT

Application of mobile technology is playing a vital role for the enhancement of understanding of agricultural market conditions and farmers business towards agricultural. In present days, data are growing rapidly in massive amount in every domain. One such domain of interest for researchers is application of mobile technology in agricultural extension field. To find interesting hidden patterns from the experimental datasets, artificial intelligence technique is used to build accurate algorithms for classification and prediction. In this paper classification and predictive models for attitude towards application of mobile technology in agricultural extension of the postgraduate scholars are built using machine learning classification algorithms viz; functions based multilayer perceptron and support vector machines; lazy based k-nearest neighbors and KStar; tree based J48 and random forest with respect to their accuracy of correctly classified instances, incorrectly classified instances and receiver operating characteristic (ROC) area. Experimental results explain that random forest algorithm is better than other fitted algorithms with 81 % predictability, followed by k-nearest neighbors with 78% predictability and Support vector machines algorithm has the lowest predictability with 69 %. The study also suggested that predictor variables namely extracurricular activities, information collection interpersonal communication and professional zeal have significant influence on attitude towards application of mobile technology in agricultural extension of the postgraduate scholars. Based on all the benchmarks used to measure the machine learning algorithms fitted in this study, it was discovered that Random Forest algorithm performance is the most appropriate in terms of predictability based on experimental dataset. Therefore focus was to design a predictive system on the most suitable algorithm which is random forest in this domain.

Keywords*: agricultural extension, mobile technology, artificial intelligence, machine learning*

INTRODUCTION

The attitude of the scholars pursuing post graduation in agricultural extension towards application of mobile technology for transfer of agricultural innovation is one of the key factors to decide and understand e-extension employability (Vegad *et al.*, 2021). The e-extension employee is expected with excellence leaning with Smartphone (Darji et al., 2017, & Yeragorla *et al.*, 2021). In the current study, attitude has been conceptualized as positive or negative feelings of postgraduate scholars towards used of mobile application in transfer of technology. It is assumed that optimistic feelings in the direction of any equipment, system, instrument means person is psychologically more concerned with them. To know psychological attachment of scholars towards mobile technology in extension job data were collected. Artificial Intelligence (AI) can be used cross disciplinary and it can also bring a model shift in how we see farming today. AI solutions will not only enable farmers to do more with less, it will also improve quality and make sure faster go-to-market for crops. AI is becoming the key drivers for providing the digital solution almost in all the fields and business sectors. Machine learning (ML) is a subfield of artificial intelligence, which is mostly concerned with the development of classification algorithms which allow a computer to study from the secondary data. Samuel, (١٩٥٩) said that ML enables a machine to automatically study from past data, improve performance from experiences, and forecast things without being clearly programmed. Manish, (2009) said that ML is a growing technology with the augmentation of AI and experimental database procedures which is used in different business organization to improve the effectiveness and significance of a business process. ML is a multidisciplinary domain that joins AI, data mining, mathematics algorithms, computer science and statistics (Liao, 2003). ML algorithm in agricultural was projected by Fathima and Geetha, (2014). ML technique uses classification algorithms to get valuable knowledge from large experimental data set, for agricultural operation (Witten and Eibe, 2011). Kumari and Chitra, (2013) used support vector machine learning algorithm for forecasting diabetes. Their experimental results demonstrated that SVM can be successfully used for forecasting diabetes diseases. Willcock, (2018) demonstrated that ML algorithms take a data-driven technique to study useful relationships from experimental data set and provide a best way for improving predictions. Chlingaryan, (2018) explained that ML algorithms have some individual benefits like; they can model non-linear relationships between multiple data sources. The present study will be useful for researchers to know the attitude of postgraduate scholars of agricultural extension towards application of mobile technology.

OBJECTIVE

To study the attitude of the scholars pursuing post graduation in agricultural extension towards application of mobile technology for transfer of agricultural innovation using artificial intelligence technique

METHODOLOGY

The present study was conducted in state agricultural universities of gujarat. The ex-post facto research design was used for the exploration. Experimental data were selected from a random sample of 120 scholars pursuing post graduation in agricultural extension in SAUs of Gujarat state. The experimental dataset having 18 independent variables viz; academic performance, native place, annual family income, father's education, mother's education, family occupation, involvement in extracurricular activity, medium of education, information collection behavior, job preference, attitude towards extension work, library exposure, self confidence, achievement motivation, interpersonal communication, innovativeness , willingness to work in rural area and professional zeal. An attitude towards application of mobile technology in agricultural extension of the postgraduate scholars is dependent variable. The dataset was created in excel sheet with .CSV extension for research work using weka software. Normalized algorithm was used to normalize the dataset. Chosen independent variables by variable evaluator namely "cfsSubsetEval" and search method namely "BestFirst" are additional activities, information collection behaviour, job preference, attitude towards extension work, achievement motivation, interpersonal communication and professional zeal. The Fig.1 shows the conceptual view of system. The raw data are used, which are then cleaned and sorted. The six machine learning classification algorithms viz; multilayer perceptron, support vector machines, k-nearest neighbors, KStar, J48 and random forest are then used over the trained data. The result of each algorithm is compared with each other. Correctly Classified Instances, Incorrectly Classified Instances, Receiver Operating Characteristic (ROC) Area, Precision Recall Curve (PRC) Area, Kappa Statistic, MAE, RMSE, RAE and RRSE. True Positive Rate, False Positive Rate, Precision, Recall, F-Measure and MCC values are taken into consideration for each algorithm. Thereafter performance is measured using three factors viz; precision, recall, and accuracy (Baby, 2021).

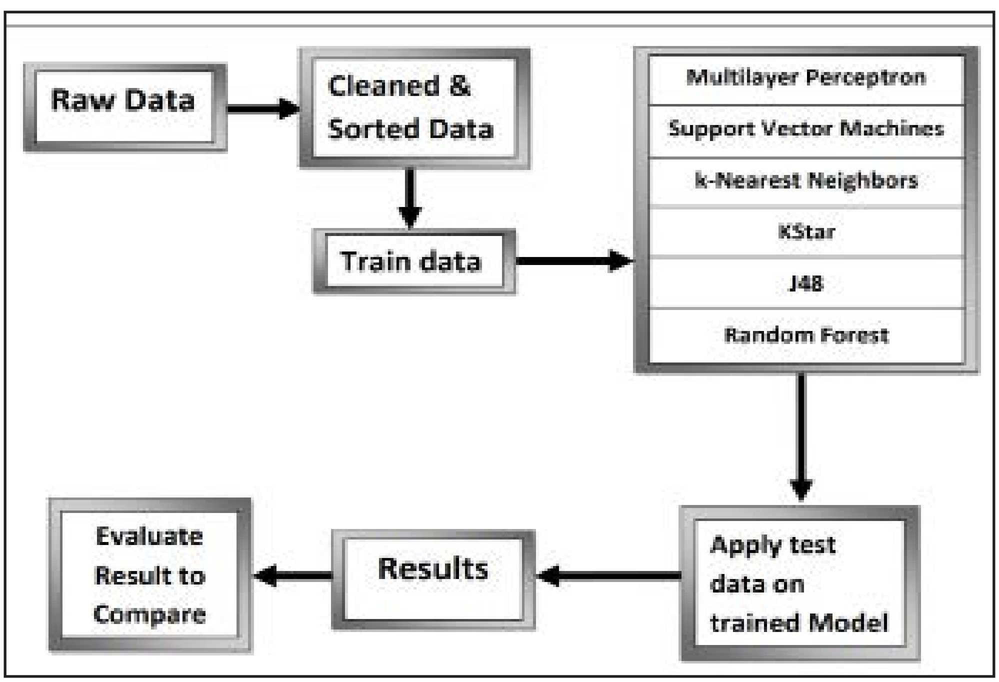

Fig. 1: Conceptual view of system

RESULTS AND DISCUSSION

The open source weka-3.8.5 software was used for data analysis. Weka has a number of classification algorithms. The results are discovered with 10 fold cross validation to avoid overlapping. Form 19 independent variables, important 7 variables namely extracurricular activities, information collection behaviour, job preference, attitude towards extension work, achievement motivation, interpersonal communication and professional zeal for classification were sorted out using "cfsSubsetEval" variable selection algorithm. For this research, the algorithms namely MLP, SMO, IBK, KStar, J48 and RF are studied. The performance of each algorithm is examined in terms of correctly classified instances, incorrectly classified instances, ROC area, PRC area, kappa statistic, MAE, RMSE, RAE and RRSE, TP rate, FP rate, precision, recall, F-measure and MCC.

Table 1: Comparison of the results for each Classification Algorithms (n=120)

Parameters	Classifier Algorithms					
	Function Based		Lazy Based		Tree Based	
	Multilayer Perceptron (MLP)	Support Vector Machines (SMO)	k-Nearest Neighbors (IBK)	KStar	J48	Random Forest (RF)
Correctly Classified Instances (%)	71	69	78	77	77	81
Incorrectly Classified Instances (%)	29	31	22	23	23	19
Kappa Statistics	0.50	0.42	0.63	0.60	0.60	0.67
Mean Absolute Error (MAE)	0.24	0.31	0.15	0.15	0.18	0.14
Root Mean Squared Error (RMSE)	0.40	0.41	0.38	0.36	0.38	0.31
Relative Absolute Error (%)	60.15	75.56	37.70	37.84	45.59	36.17
Root Relative Squared Error (%)	90.13	83.31	83.67	79.37	83.69	68.24

The Table 1 depicts the performance of six fitted classification algorithms based on correctly classified instances, incorrectly classified instances, kappa statistics, MAE, RMSE, RAE and RRSE to build the algorithms respectively. The RF algorithm classified instances correctly with a prediction accurate rate of 81 %. Thus, the results indicated that fitted RF algorithm can be relied on for predictions.

The Fig. 2 demonstrates the prediction accuracy for different fitted classification algorithms. Out of six algorithms used in this research work, RF has better predictability than other fitted classification algorithms with 81 %, followed by IBK with 78 % predictability. SMO classification algorithm has lowest predictability with 69 %.

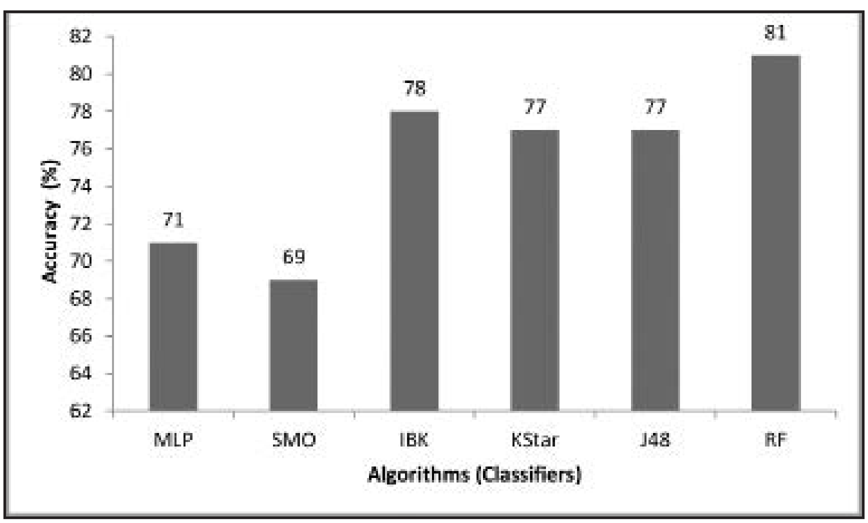

Fig. 2: Prediction Accuracy of Classification Algorithms

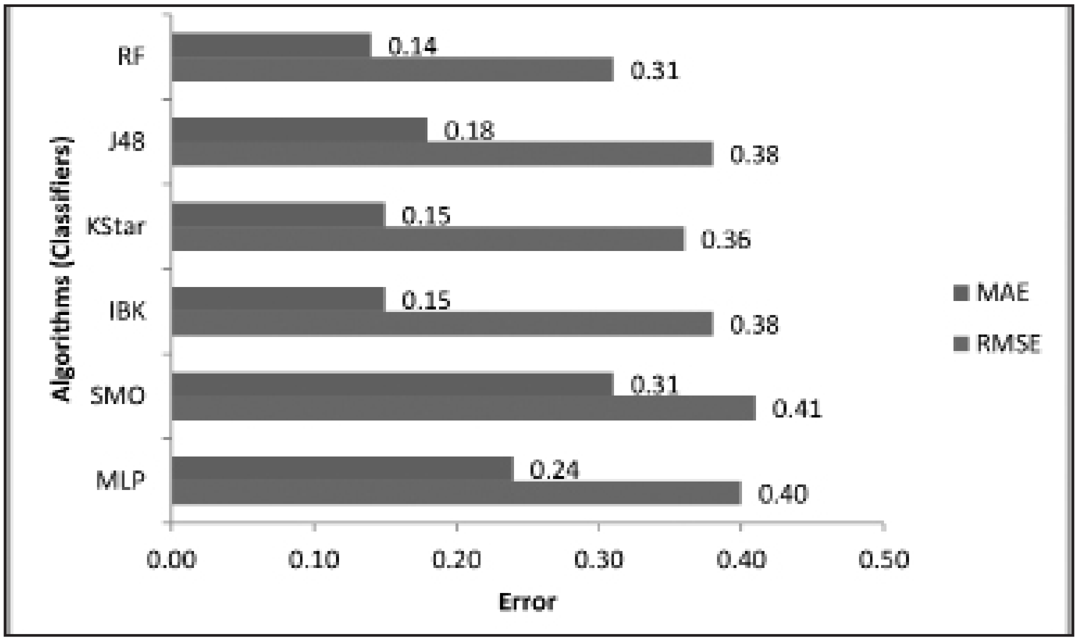

Fig. 3: Error results of classification algorithms

The Fig. 3 shows the error results of the different fitted classification algorithms. RF algorithm has MAE of 0.14 and RMSE of 0.31. This point out least error observed during the prediction processes. SMO classification algorithm has the highest error rate with 0.31 and 0.41 of MAE and RMSE respectively.

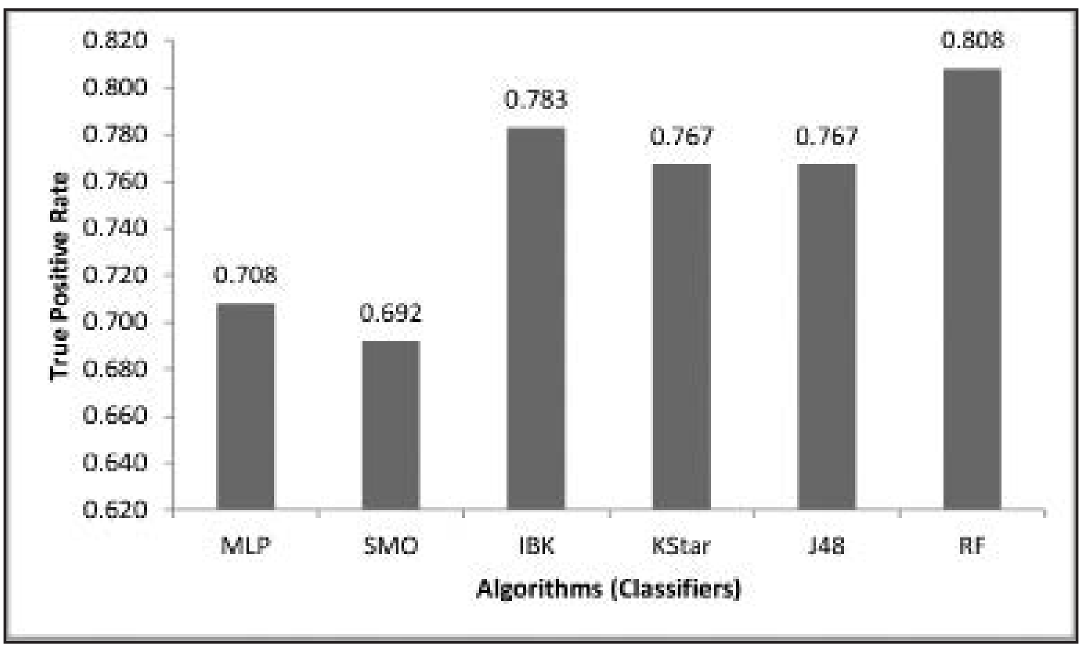

Fig. 4: True positive rate of classification algorithms

The Fig. 4 demonstrates the true positive rate for different fitted classification algorithms. Out of six algorithms used in this research work, RF has better true positive rate than other fitted classification algorithms with 0.808 followed by IBK with 0.783. SMO classification algorithm has the lowest true positive rate with 0.692.

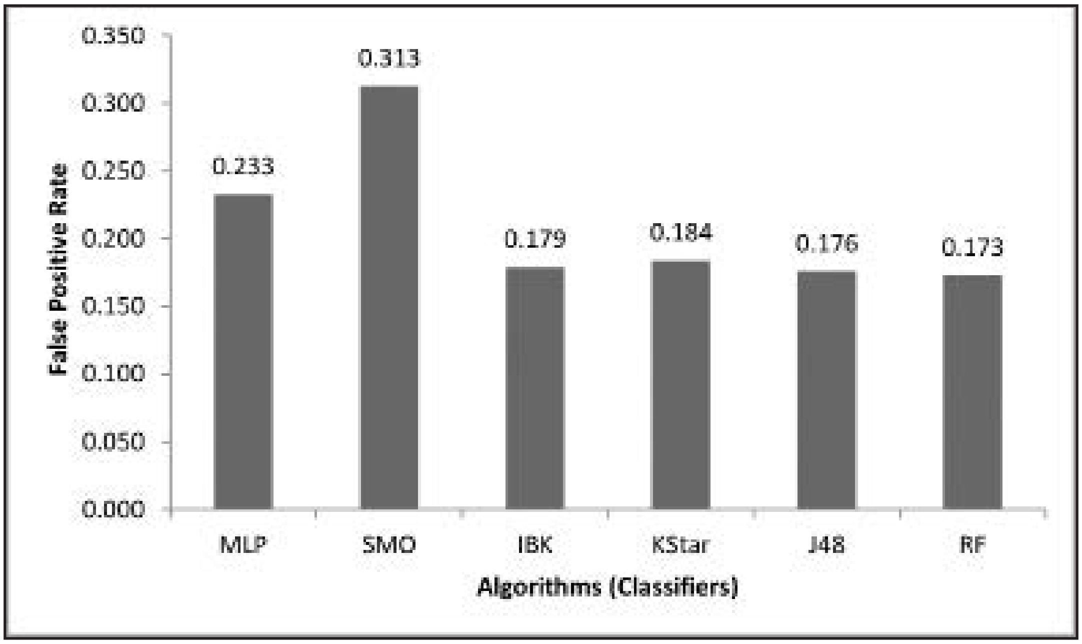

Fig. 5: False positive rate of classification algorithms

The Fig. 5 explains the false positive rate for different fitted classification algorithms. Out of six algorithms used in this research work, RF has lowest false positive rate with 0.173 followed by J48 with 0.176. SMO classification algorithm has the highest false positive rate with 0.313.

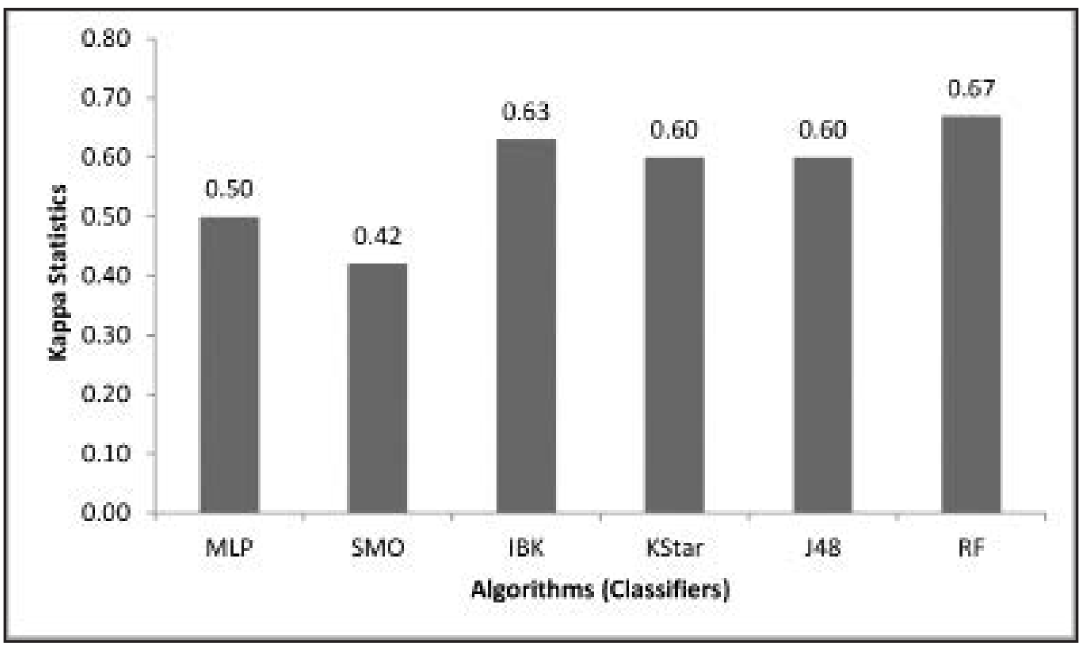

Fig. 6: Kappa Statistics of Classification Algorithms

The Fig. 6 shows the kappa statistics for different fitted classification algorithms. Out of six algorithms used in this research work, RF has better kappa statistics than other fitted classification algorithms with 0.67, followed by IBK with 0.63. SMO classification algorithm has the lowest kappa statistics with 0.42.

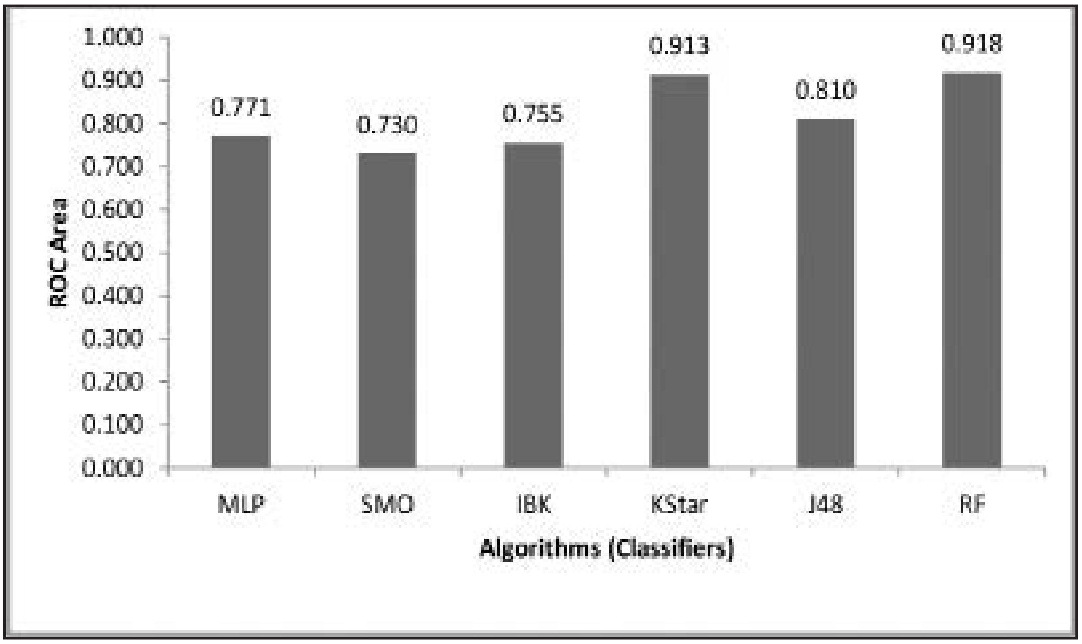

Fig. 7: ROC Area of classification algorithms

The Fig. 7 depicts the ROC area curve for different fitted classification algorithms. RF has the highest ROC area with 0.918 followed by KStar with 0.913. SMO has the lowest ROC area with 0.730.

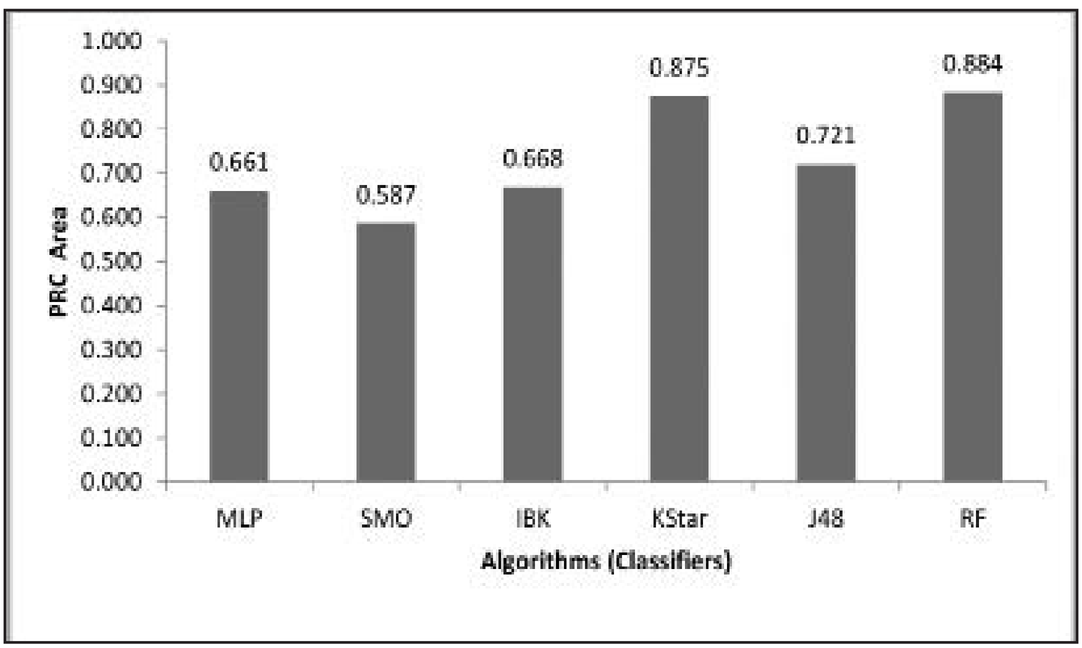

Fig. 8: PRC area of classification algorithms

The Fig. 8 explains the PRC area for different fitted classification algorithms. RF recorded a high PRC area with 0.884 followed by KStar with 0.875. SMO has the lowest PRC area with 0.587.

The Table 2 shows the result obtained after fitting the six classification algorithms on experimental dataset. The fitted RF algorithm has obtained the highest prediction accuracy of 0.81, precision of 0.82 and recall of 0.81. The SMO has obtained the lowest prediction accuracy of 0.69, precision of 0.66 and recall of 0.69. The F1 score and Mathews Correlation Coefficient (MCC) were figure out to measure the test accuracy and quality of fitted classification algorithm respectively. The RF has obtained the highest F1 score of 0.80 and MCC of 0.68. The SMO has obtained the lowest F1 score of 0.65 and MCC of 0.46.

Table 2: Comparison of the results for each classification algorithms

Parameters	Classifier Algorithms					
	Function Based		Lazy Based		Tree Based	
	Multilayer Perceptron (MLP)	Support Vector Machines (SMO)	k-Nearest Neighbors (IBK)	KStar	J48	**Random Forest (RF)**
Accuracy	0.71	0.69	0.78	0.77	0.77	0.81
Precision	0.69	0.66	0.78	0.76	0.76	0.82
Recall	0.71	0.69	0.78	0.77	0.77	0.81
F1 score	0.70	0.65	0.77	0.76	0.76	0.80
MCC	0.49	0.46	0.63	0.60	0.61	0.68

CONCLUSION

The attitude of the scholars pursuing post graduation in agricultural extension towards application of mobile technology for transfer of agricultural innovation is one of the important factors to decide and understand e-extension employability. The aim of this research is to fit and compare six different machine learning classification algorithms namely multilayer perceptron (MLP), support vector machines (SMO), k-nearest neighbors (IBK), KStar J48 and random forest (RF) for prediction of attitude towards application of mobile technology in agricultural extension of the postgraduate scholars. The fitted algorithms, using artificial intelligence technique suggested that that predictor variables namely extracurricular activity, information collection behaviour, job preference, attitude towards extension work, achievement motivation, interpersonal communication and professional zeal have influence on *attitude* towards application of mobile technology in agricultural extension of the postgraduate scholars. The experimental results revealed that the fitted RF classifier algorithm performed better by obtaining the highest prediction accuracy (0.81), precision (0.82) and recall (0.81) than other fitted algorithms. In terms of test's accuracy (F1 score) and quality (MCC) also RF classifier algorithm demonstrated the highest prediction accuracy and best quality of classification. The RF classifier algorithm explained 81% of total variation in attitude towards application of mobile technology in agricultural extension of the postgraduate scholars. In general, it can be concluded that fitted RF classifier algorithm used on the experimental dataset should be recommended for development of an attitude towards application of mobile technology in agricultural extension of the postgraduate scholars prediction model.

CONFLICT OF INTEREST

"We, The Authors declare that there is no conflict of interest."

REFERENCES

Baby, A., Parmar, R. S., Raj, M. P. and Reddy, K. I. (2021). Prediction for rice yield using data mining approach in Ranga Reddy district of Telangana, India. *J. Agrometeorology.*, **23** (2); 242-248.

Chlingaryan, A., Sukkarieh, S. and Whelan, B. (2018). Machine learning approaches for crop yield prediction and nitrogen status estimation in precision agriculture: a review. *Comput. Electron. Agric*. 151; 61–69.

Darji, A. R.. Panchasara B. R. and Vinaya Kumar H.M. (2017). Determinates of attitude of postgraduate research scholars towards the use of computer for their empowerment. *Guj. J. Ext. Edu.*, 28 (2): 277-281.

Fathima, N G and Geetha, R. (2014). Agriculture crop pattern using data mining techniques. *Intl.J. Adv. Res. Comp Sci. Soft. Eng.*, 4**;** 781-785.

Kumari, AV. and Chitra, R. (2013). Classification of Diabetes Disease Using Support Vector Machine. *International Journal of Engineering Research and Applications(IJERA).*, 7(1); 67:70.

Liao, SH. (2003). Knowledge Management Technologies and applications Literature review from 1995 to 2002. Expert System with Application., 25;155-164

Manish, Jain. (2009). Data Mining: Typical Data Mining Process for Predictive Modeling. BPB Publications; 235-241

Samuel, Arthur L. (1959). Some Studies in Machine Learning Using the Game of Checkers". IBM Journal of Research and Development. 44; 206–226.

Vegad, N.M. and Chauhan, N. B. and Vinaya Kumar H. M. (2021) Factors responsible to form attitude of the postgraduate scholars of agricultural extension and communion towards extension. *Guj. J. Ext. Edu.* 32(1):72-75.

Willcock, S., Hooftman, D.A., Bagstad, K.J., Balbi, S., Marzo, A., Prato, C., Sciandrello, S., Signorello, G. and Voigt, B. (2018). Machine learning for ecosystem services. *Ecosystem services* 33; 165–174.

Witten, IH.; Eibe, Frank. (2011). Data Mining: Practical Machine Learning Tools and Techniques. Second Edition (Morgan Kaufmann Series in Data Management Systems); 189-303.

Yeragorla, Venkata Harikrishna, Patel, J. B. and Vinaya Kumar, H. M. (2021) Development of a scale to measure the attitude of extension personnel towards e-extension. *Guj. J. Ext. Edu.* 32(1):34-37.

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