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DECISION MAKING PATTERN OF FARM WOMEN IN ANIMAL HUSBANDRY PRACTICES USING MACHINE LEARNING

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ABSTRACT

Machine learning techniques have provided opportunities for researchers to design new analytical methods in different areas of agricultural extension. The objective of this study is to estimate the decision-making pattern of farm women in animal husbandry practices. Different machine learning algorithms namely linear regression, support vector machines, k-nearest neighbors, KStar, decision table, M5Rules, random forest and random tree were used for prediction of decision making pattern of farm women in animal husbandry practices in Junagadh district of Gujarat. The feature selection algorithm suggested that the input variable namely age, education, occupation, milk production, type of family, social participation, mass media exposure, extension participation, cosmopoliteness, scientific orientation, risk orientation, economic motivation and innovative proneness have significant influence on decision making pattern of farm women in animal husbandry practices. Based on all the benchmarks used to measure the predictability of fitted algorithms employed in this study, it was discovered that a support vector machines (SMOReg) performed better by achieving the highest prediction accuracy of 87%, lowest MAE of 2.78 and RMSE of 3.97 as compared with other fitted machine learning algorithms. Thus, the SMOReg algorithm explained 87 per cent of total variation in decision making pattern of farm women in animal husbandry practices. It was further observed that, the actual decision making pattern and the predicted decision making pattern of farm women were close to each other and the residual ranged from -4.36. to 12.47.

Keywords: *farm women, animal husbandry practices, decision making, machine learning algorithms*

INTRODUCTION

Livestock project provides employment and fiscal support to rural families who are landless and those have some land. Many of the significant tasks in animal husbandry activities are performed by farm women besides fulfilling their responsibilities as home makers (Randhawa & Chandra, 1993 and Bansal *et al.,* 2021). Farm women now play a very important role in decision making regarding householder resources which are specifically used by them (Giriappa, 1988; Nikhade, 1988 and Thakur *et al.,* 2020). Livestock and dairy have been one of the sectors in India where farm women participation has been significant. Farm women perform a major role of the work relating to the maintenance of milk production, processing and dairy cattle. (Sheela and Sundara, 1993). Promila, (2003) exposed that women spent more time in farming activities. Machine Learning is a subset of artificial intelligence that is mostly concerned with the expansion of pattern algorithms which allow a computer to learn from the historical data. The term machine learning was defined by Samuel, (1959). He revealed that machine learning enables a machine to automatically learn from historical data, improve performance from experiences, and calculate effects without being explicitly programmed. Manish, (2009) demonstrated that machine learning is a rising expertise with the augmentation of artificial intelligence and database procedures which is used in diverse business organization to improve the efficiency and significance of a business practices. Machine learning is comprised of artificial intelligence, data mining, computer science, statistics and mathematics algorithms (Liao, 2003). A pattern machine learning algorithms in agriculture was estimated by Fathima and Geetha, (2014). Machine learning technique uses pattern algorithms to discover valuable information from enormous data set, for business operation (Witten and Eibe, 2011). Kumari and Chitra, (2013) studied support vector machine learning algorithm for predicting diabetes. Their experimental results showed that support vector machine can be successfully used for forecasting diabetes diseases. In this study, eight Machine learning algorithms namely linear regression, support vector machines, k-nearest neighbors, KStar, decision table, M5Rules, random forest and random tree were assessed for decision making pattern of farm women in animal husbandry practices. Furthermore, pattern machine learning algorithms take a data-driven approach to study constructive patterns from experimental data set (Willcock, 2018) and provide a most excellent approach for improving predictions. In addition, pattern machine learning algorithms

have some character benefits like; they can pattern non-linear relationships between multiple data sources (Chlingaryan, 2018). The present research will be helpful for extension workers to know the decision-making pattern of farm women in animal husbandry practices.

OBJECTIVE

The objective of this study is to study on decision making pattern of farm women in animal husbandry practices using machine learning

METHODOLOGY

The present study was conducted in Junagadh district of Gujarat state. The ex-post facto research design and a multistage random sampling technique were used for the study. List of members of dairy cooperative society of 12 selected villages were prepared from record of dairy co-operative societies. From each village, 20 farm women were selected by random sampling method making sample of 240 respondents. The Dataset have 19 input variables namely Age, Education, Experience in animal husbandry practices, Occupation, Size of land holding, Annual income, Herd size, Milk production, Area under fodder crop, Type of family, Size of family, Social participation, Mass media exposure, Extension participation, Cosmopoliteness, Scientific orientation, Risk orientation, Economic motivation, and Innovative proneness while Decision making process score is target variable. The experimental dataset was created in excel sheet with .CSV extension for loading in open-source machine learning software (weka). Normalized algorithm was used to normalize the dataset. Total 13 input variables were Selected by variable evaluator namely **"cfsSubsetEval"** and search technique namely "**BestFirst**" are age, education, occupation, milk production, type of family, social participation, mass media exposure, extension participation, cosmopoliteness, scientific orientation, risk orientation, economic motivation and innovative proneness. The eight machine learning algorithms namely linear regression, support vector machines, k-nearest neighbors, KStar, decision table, M5Rules, random forest and random tree were used over the experimental data set. Parametric values of MAE, RMSE, RAE, RRSE and R^2 were taken into consideration for comparing each fitted machine learning algorithms.

RESULTS AND DISCUSSION

A Waikato Environment for Knowledge Analysis (Weka) is a collection of machine learning algorithms for pattern analysis. Pattern machine learning algorithms are usually driven by the number of input features, the character of pattern line and the type of class variables. From Weka, eight algorithms are evaluated namely Linear Regression (LR), Support Vector Machines (SMOReg), k-Nearest Neighbors (IBK), KStar (K*), Decision Table (DT), M5Rules, Random Forest (RF) and Random Tree (RT). The result of each algorithm is analyzed in terms of coefficient of determination, mean absolute error, root mean squared error, relative absolute error and root relative squared error. The Fig. 1 shows that the selected features have differed distribution range.

The results presented in Table 1 indicate that the function based, and rules-based algorithms have better performance than the lazy based and trees based algorithms. In case of function based, two algorithms are examined namely linear regression (LR) and support vector machines (SMOReg). SMOReg has better performance than LR. For rules based, two algorithms are studied namely decision table (DT) and M5Rules. M5Rules has better performance than DT. In general, it could be observed that, SMOReg algorithm is better than M5Rules algorithm further underlining that the fitted SMOReg algorithm provides higher prediction accuracy than other fitted algorithms.

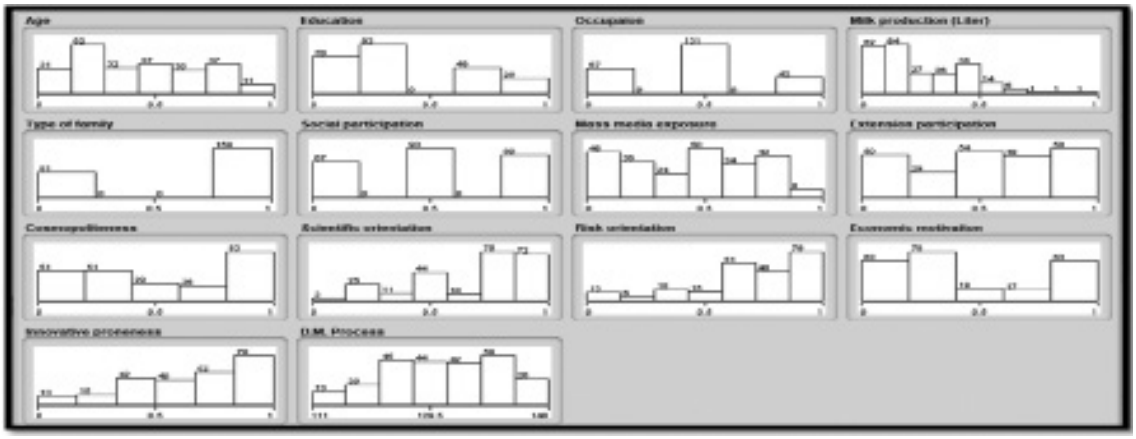

Fig. 1: Selected features distribution

Table 1: Decision making pattern analysis of farm women in animal husbandry practices

Parameters	Algorithms							
	Functions Based		Lazy Based		Rules Based		Tress Based	
	LR	SMO Reg	IBK	KStar	DT	M5Rules	RF	RT
MAE	3.25	2.78	4.71	4.36	5.04	3.25	3.77	4.29
RMSE	4.37	3.97	5.32	6.54	6.65	4.37	5.07	5.82
RAE (%)	34.69	29.65	50.24	46.53	53.73	34.69	40.23	45.79
RRSE (%)	40.72	36.99	49.59	60.95	61.99	40.72	47.22	54.25
R^2 (%)	83.00	87 .00	78.00	64.00	64.00	84 .00	83 .00	74 .00

The Fig.2 shows the prediction accuracy of different fitted machine learning algorithms. Out of eight algorithms used in this study, SMOReg algorithm has better prediction accuracy than other fitted algorithms with 87 %, followed by M5Rules with 84 %. KStar and decision table has lowest prediction accuracy with 64%.

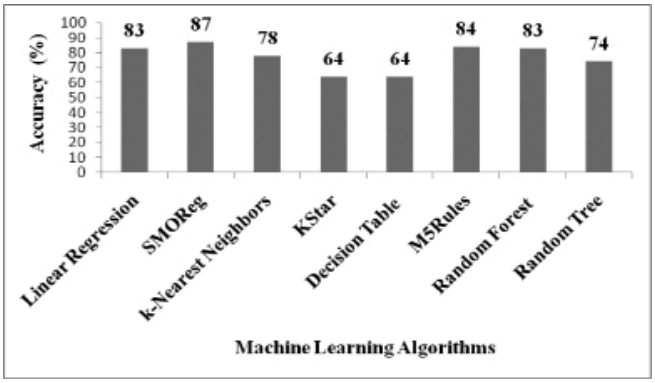

Fig. 2: Prediction accuracy of the different fitted machine learning algorithms

The Fig. 3 demonstrates the error results of the different fitted machine learning algorithms. SMOReg algorithm has lowest MAE of 2.78 and RMSE of 3.97. This exposes minimal error reported during the prediction processes. Decision table has the highest error with 5.04 and 6.65 of MAE and RMSE respectively.

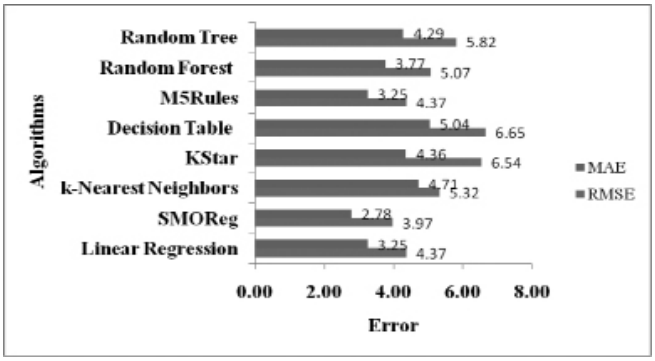

Fig. 3: Error results of the different fitted machine learning algorithms

Table 2: Actual and predicted decision making pattern of farm women in animal husbandry practices using best fitted SMOReg algorithm

Sr. No.	Decision Making Process Score of Farm Women		
	Actual	Predicted	Residual
1	123.00	119.47	-3.53
2	136.00	138.69	2.69
3	124.00	123.95	-0.05
4	121.00	124.10	3.10
5	111.00	123.47	12.47
6	139.00	138.01	-0.99
7	113.00	119.91	6.91
8	117.00	118.99	1.99
9	138.00	144.25	6.25
10	132.00	133.39	1.39
11	121.00	116.64	-4.36
12	146.00	146.44	0.44
13	141.00	141.15	0.15
14	140.00	139.53	-0.48
15	147.00	143.29	-3.71
16	145.00	144.66	-0.34
17	132.00	132.40	0.40
18	146.00	148.97	2.97
19	139.00	137.06	-1.94
20	134.00	133.48	-0.52
21	141.00	139.73	-1.28
22	139.00	137.86	-1.14
23	142.00	145.40	3.40
24	134.00	140.23	6.23

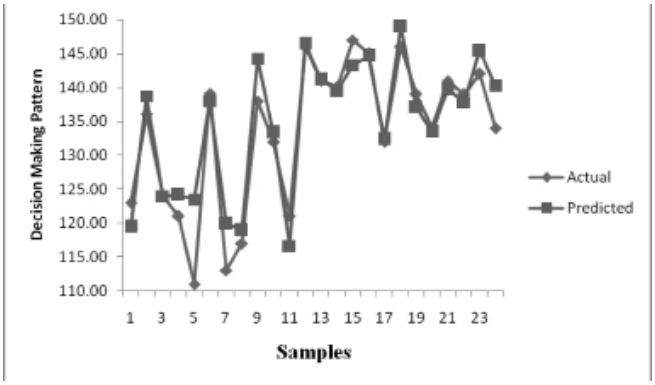

Fig .4 actual and predicted decisions making pattern of farm women in animal husbandry practices using best fitted SMOReg algorithm

The actual and predicted decision making pattern of farm women in animal husbandry practices based on the testing data set is presented in Table 2. The same is demonstrated in Fig.4. It is observed that, the actual decision-making pattern of farm women in animal husbandry practices and the predicted decision making pattern of farm women in animal husbandry practices are closed to each other and the residual ranged from -4.36. to 12.47.

CONCLUSION

A study on the decision-making pattern of farm women in animal husbandry practices using machine learning algorithm is an important dimension of its decision-making pattern prediction. Eight algorithms namely linear regression, support vector machines, k-nearest neighbors, KStar, decision table, M5Rules, random forest and random tree were used in the study as these have been gaining popularity in agricultural extension applications for predictability. The feature selection algorithm suggested that the thirteen input variable namely age, education, occupation, milk production, type of family, social participation, mass media exposure, extension participation, cosmopoliteness, scientific orientation, risk orientation, economic motivation and innovative proneness have significant impact on decision making process. Among these, SMOReg algorithm was found superior with decision making predictability of 87 % (R^2), lowest MAE of 2.78 and RMSE of 3.97 as compared with other fitted machine learning algorithms.

CONFLICT OF INTEREST

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

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