

Artificial Bee Colony (ABC) Optimization and Artificial Neural Networks (ANN) based Classification on Agriculture dataset

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Abstract

The developing field of Farming is the foreseeing or determining the surrender and sorts of trim to be developed in a specific season. The issues Artificial Neural Networks confronted in foreseeing this range are like distinguishing the accessibility of water (dry spell administration), climatic changes, need of mindfulness of fertilizers to be utilized for the specific maladies, changes in climate occasions, seed quality, sort of water system to be practiced, investigations of pesticides and fertilizers, and limited due to startling characteristic calamity etc. The recently plan demonstrate can classify accurately the sort of edit that can be developed in a specific season in a specific zone. This expectation comes about may offer assistance the agriculturists to sow that trim in that season and in this manner they increment their abdicate rate. Huge information analytics is the doable stage to test and degree the edit. In this paper, a novel crossover Artificial Bee Colony (ABC) and Artificial Neural Networks (ANN) is proposed for fathoming persistent optimization issues. Looking capacity and arbitrariness in selecting the populace is increments when utilizing this ABC calculation. To appear the execution of our proposed crossover ABC with ANN, a number of tests are carried out on rural dataset .The test comes about demonstrate that our proposed strategy is sensible and productive for tackling profoundly complex optimization issues.

Keywords: Classification, Crop yield, Data analytics, Prediction, ABC-ANN

1. INTRODUCTION

Agriculture is one of the greatest areas to progress the financial rate of the nation. Trim abdicate forecast may be a new rising thought in horticulture [1-5]. The most point of this inquire about is to plan the successful trim abdicate generation and wellbeing chance investigation by utilizing enormous information analytics show. Expectation of climate and water accessibility prior makes a difference the agriculturists to supply required fertilizers for expanding the surrender rate [10]. These days Shrewd cultivating strategies are being created to bargain with issues related to conventional cultivating strategies. Prior in computerized cultivating procedure numerous endeavors should be made to handle the information from the cushioning field. These days the presentation of Web of Things (IoT) and Remote Sensor Organize (WSN) has made all complex work straightforward and effective.[7] Over the past few decades, machine learning calculations have been proposed to abdicate trim expectation, counting hereditary calculation (GA), back vector machine (SVM), direct relapse, Artificial Neural Networks (ANN), Naïve Bayes (NB) and so on [11]. Machine learning calculations consider energetic alter of inputs. For illustration, energetic changes in temperature esteem (in the event that it is tall), water accessibility (dry season condition), and fertilizer utilization for the current time period [8]. Compared with the aforementioned machine learning calculations, profound learning approaches have exceptionally capable highlights to appear the huge execution in accuracy horticulture [6].

To examine the rural designs to be utilized can be gotten by utilizing classification strategy accessible in information mining. This approach will offer assistance the ranchers to foresee rural designs prior and increment the abdicate rate. Numerous inquire about has been performed in this point and has made a difference to extend the exactness of classification prepare. The dataset has been surrounded by us utilizing the basic fields necessary for classification. The most objective of this inquire about is to propose a modern classifier which can classify the dataset precisely and increment the abdicate rate. A unused classifier which can classify the dataset precisely and increment the abdicate rate. The Artificial Neural Networks (ANN) is prevalent classifier which can be utilized together with ABC demonstrate to optimize the comes about.

2. LITERATURE REVIEW

The optimization calculation utilized in this paper is ABC which is generally straightforward and simple to execute since of its direct nature. ABC has been utilized in numerous inquire about since of its moo computational taken a toll and simple usage strategy. Consequently this calculations has been broadly utilized by numerous creators for optimizing their yield The inquire about work carried utilizing this calculation by a few creators has been organized below:

S.No.	Authours Nname and Year of Publication	Description
1	Karaboga and Basturk (2012)[19]	ABC is used for optimizing a large set of numerical test functions and its results were compared with GA, PSO, DE and ES.
2	Mala et al. (2009)[24]	ABC for test suite optimization and compared it with ACO, and concluded that ABC based approach has several advantages over ACO
3	Karaboga and Akay (2009a)[18]	Compared the performances of ABC with harmony search and bees algorithms on numerical optimization
4	Akay and Karaboga (2010)[13]	Introduced modified versions of ABC algorithm and applied them for efficiently solving real-parameter optimization problems
5	Ruiz-VanoyeandDaz-Parra(2011)[32]	Studied the functional similarities between meta heuristic algorithms including ABC and the science of life.
6	Dongli et al. (2011)[23]	A modified ABC algorithm for numerical optimization problems and tested its performance on a set of benchmark problems
7	Rajasekhar et al. (2011b)[25]	A new version of mutation ABC has been proposed to levy the mutation problem
8	Stanarevic et al. (2010)[21]	A modified ABC algorithm for constrained problems which employs a “smart bee” having memory to keep the location and quality of food sources
9	Diwold et al. (2011) [22]	Proposed two new variants of ABC which use new methods for the position update of the artificial bees.
10	Rajasekhar et al. (2011b)[27]	Proposed an improved version of ABC algorithm with mutation based on Levy probability distributions.
11	.Wuetal.(2011a) [30]	Introduced an approach based on ABC algorithm for estimating the parameter for solving non-linear rational models.

The table above depicts the modifications that has been made on ABC and its related distributions and applications regions. From this table, it can be clearly watched that, the development of this field has topped the possibilities, in show disdain toward of the point that ABC is fair 10years ancient. By dissecting the over papers it can be expressed that the center of the work on ABC primarily focuses on algorithmic and application angles. ABC can too be connected for optimization in energetic focussing dubious situations. In arrange to move forward the execution of ABC in terms of meeting with ANN components can be proposed.

3. PROPOSED METHOD

In this stage Artificial Bee Colony (ABC) Optimization calculations which comes beneath the branches of Manufactured Insights have been utilized as an device to illuminate the optimization prepare. Considering that optimizing the finest highlight extricated will result in great classification we have utilized ABC for optimization and ANN for classification. In this ABC calculation the bees are partitioned into three bunches within the populace counting utilized bees, spectators, and scouts. Utilized bees get nourishment from the found nourishment sources and send data to the spectator bees. The spectator bees get data from the utilized bees and make choices for superior nourishment sources. When the source of the nourishment is depleted by the employed bees, the passerby bees will get to be scouting bees trying to find arbitrary nourishment sources.

For classification prepare Artificial Neural Networks(ANN) is proposed because it is one of the benchmark show for any classifier. Learning calculation plays an vital part for creating way better comes about in any ANN show [12]. Ordinarily ANN is combined with back-propagation (BP) calculation to decrease mean-squared mistake between the specified yields and the genuine yields for the specific inputs to the systems [13]. But still, there are a few restrictions in BP algorithm also. The brief coming of BP are just like the comes about are merge to nearby

minima or now and then it isn't guaranteed[9], another is it comes beneath moderate learning prepare so the comes about are not significant.[12,13] consequently to progress the exactness and the merging rate of BP calculation, a modern half breed show called as ANN-ABC is proposed. The objective of the hybridization of artificial bee colony (ABC) and back-propagation calculation is to optimize the ANN preparing by dodging the neighborhood minima arrangement. To approve the execution of the proposed cross breed show, ANN-ABC will be tried on dry season range classification issue with dataset gotten from distinctive sources. In ABC, the position of a food source represents a possible solution to the problem and the nectar amount of a food source corresponds to the quality (fitness) of the associated solution. In the basic form, the number of employed bees is equal to the number of food sources (solutions) since each employed bee is associated with one and only one food source.

The general algorithmic structure of the ABC optimization approach is given as follows:

Initialization Phase: In the initialization phase, the population of food sources (solutions) is initialized by artificial scout bees and control parameters are set.

*REPEAT Employed Bees Phase Onlooker Bees Phase Scout Bees Phase
Memorize the best solution achieved so far
UNTIL (Cycle=Maximum Cycle Number or a Maximum CPU time)*

Representative bee's stage:

Within the utilized bees phase, artificial utilized bees seek for unused nourishment sources having more nectar inside the neighborhood of the food source in their memory. They find a neighbor nourishment source and after that assess its fitness. After creating the unused nourishment source, its fitness is calculated and a covetous choice is connected between it and its parent. After that, utilized bees share their nourishment source data with spectator bees holding up within the hive by moving on the moving range.

Onlooker bee's stage:

Within the passerby bee's stage, artificial passerby bees probabilistically select their nourishment sources depending on the data given by the utilized bees. For this reason, a fitness based choice method can be utilized, such as the roulette wheel determination strategy. After a nourishment source for an passerby bee is probabilistically chosen, a neighborhood source is decided, and its fitness value is computed. As within the utilized bees stage, a eager choice is connected between two sources.

Scout bees stage:

Within the scout bee's stage, utilized bees whose arrangements cannot be progressed through a foreordained number of trials, called "limit", gotten to be scouts and their arrangements are surrendered. At that point, the scouts begin to look for unused arrangements, haphazardly. Consequently, those sources which are at first destitute or have been made destitute by abuse are surrendered and negative input conduct emerges to adjust the positive input. These three steps are reshaped until an end criterion is satisfied, for case a most extreme cycle number or a most extreme CPU time.

The execution steps of the ABC-ANN are as follows:

1. Initialize food sources (ANN proposed weights) to 0.5.
2. Employed bees find food sources and store them.
3. Fitness is calculated in ANN for each weight solution proposed based on (accuracy or AUC or f-measure).
4. Onlooker bee calculates the probability of each weight solution.
5. Scout bee checks if each proposed solution has reached a point where if it is not promising.
6. Store the best food source based on a greedy selection of the best fitness value.
7. Repeat steps 2-6 until maximum number of iterations is reached.

Algorithm 1: ABC-ANN algorithm

- 1 Produce the initial positions of bees in the population $x_i; i = 1 \dots SN$
- 2 Evaluate the nectar quality of the initial position point.
- 3 cycle = 1
- 4 repeat
- 5 Generate new positions representing of new solutions v_i by the employed bees using (Equation.4) and evaluate the nectar quality of new positions.
- 6 Apply greedy selection process to solutions found by employed bees.
- 7 Compute the probability values p_i of the solutions x_i by using (Eq. 5)
- 8 Generate the new solutions v_i for the onlookers from the solutions x_i selected depending on p_i values and evaluate the nectar quality of new positions.
- 9 ANN is applied to select the best fitness values from the solutions found by onlooker bees.
- 10 Determine the abandoned solution for the scout, if exists, and replace it with a new randomly produce solution x_i by (Equation.6)
- 11 Memorize the best solution achieved so far
- 12 cycle = cycle+1
- 13 Until cycle = MCN; repeat this process until maximum iteration is reached.

4. EXPERIMENTAL SETUP**4.1 Dataset**

In to assess the execution of all our half breed demonstrates we have taken an rural dataset. This dataset is taken from different sources like precipitation information, soil and trim databases. The fundamental areas are collected together and shaped as a unused rural dataset. This dataset is organized to examine the dry season condition relating in a specific year. This dry spell condition is recognized by considering the highlights like month, precipitation, temperature, weight, mugginess, and put. By dissecting this the trim reasonable to that time period can be developed. Our agrarian dataset comprises of 25 traits and 8965 occurrences recorded from Dec. 2016 to Nov. 2017 for the places interior and exterior Tamil Nadu.

4.2 Data Pre-processing

Pre-processing the most important step in machine learning, as in this phase only datacleaning, data reduction and data replacement is performed.

4.3 Implementation**Parameter setting for ABC**

The parameters to be initialised before implementing this ABC algorithm includes
 Number of iteration=100
 Swarm size=20
 Maximum epoch=50
 Seed=0.5
 Number of food source=10
 Upper bound=1
 Lower bound=0

Parameter settings for ANN

The parameter needed to implement ANN are
 Learning rate =0.3
 Momentum=0.2
 Maximum epoch=100
 Seed=0
 Hidden layers=(number of attributes+number of classes)/2
 Reset=true

4.4 Performance evaluation measures

The confusion matrix results are normally used for neural network classification process is applied here.

True Positive (TP): It is measure of number of which there is a prevailing drought condition is correctly detected. Usually higher value is considered to be the best.

False negative (FN): It is the measure of which there is a drought condition identified as no droughtcondition. Usually lower values are considered to be the best.

False positive(FP):It is the measure of number of which there is no drought but it is classified as drought .this condition is also known as false alarm.

True negative (TN): It is the measure of number of which there is no drought condition classified correctly as no drought. Usually lower values are considered to be the best.

The confusion matrix values TP, FN, FP, and TN can be used to calculate accuracy, precision, recall, F-measure.

$$ACCURACY = \frac{TN+TP}{TN+TP+FN+FP}$$

$$RECALL(Sensitivity)=TP/(TP+FN)$$

$$PRECISION = \frac{TP}{TP + FP}$$

$$F\ measure = \frac{2(precision \times recall)}{precision + recall}$$

5. RESULTS AND DISCUSSION

The dataset utilized has been assessed different wellness work so that ideal comes about can be gotten more precisely. The comes about gotten were recorded in terms of different measures like exactness, exactness , review and f-measure. The screen shot of our execution of ABC with ANN is recorded underneath in figure.1.

The performance measures evaluated has been listed clearly in table.1.

Table 1: The values obtained for confusion matrix

Algorithms	TP	FP	TN	FN
ABC-ANN	62	34	343	25

The results obtained listed in table 2 shows that ABC-ANN hybrid model got the best TN,FN, Accuracy and Precison values. The proposed hybrid algorithm were executed on our agricultural dataset

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Epoch 90/100
120/1536 [=>.....] - ETA: 0s - loss: 0.4690 - acc: 0.8083
6/1536 [=====] - 0s 38us/step - loss: 0.4766 - acc: 0.8021
Epoch 91/100
120/1536 [=>.....] - ETA: 0s - loss: 0.4555 - acc: 0.8167
6/1536 [=====] - 0s 36us/step - loss: 0.4763 - acc: 0.8021
Epoch 92/100
120/1536 [=>.....] - ETA: 0s - loss: 0.4778 - acc: 0.8083
6/1536 [=====] - 0s 36us/step - loss: 0.4767 - acc: 0.8021
Epoch 93/100
120/1536 [=>.....] - ETA: 0s - loss: 0.4571 - acc: 0.8417
6/1536 [=====] - 0s 37us/step - loss: 0.4763 - acc: 0.8021
Epoch 94/100
120/1536 [=>.....] - ETA: 0s - loss: 0.5669 - acc: 0.7333
0/1536 [=====] - ETA: 0s - loss: 0.4746 - acc: 0.8021
36 [=====] - 0s 49us/step - loss: 0.4767 - acc: 0.8021
Epoch 95/100
120/1536 [=>.....] - ETA: 0s - loss: 0.5015 - acc: 0.8000
6/1536 [=====] - 0s 37us/step - loss: 0.4764 - acc: 0.8021
Epoch 96/100
120/1536 [=>.....] - ETA: 0s - loss: 0.5007 - acc: 0.8000
0/1536 [=====] - ETA: 0s - loss: 0.4701 - acc: 0.8063
36 [=====] - 0s 49us/step - loss: 0.4759 - acc: 0.8021
Epoch 97/100
120/1536 [=>.....] - ETA: 0s - loss: 0.4821 - acc: 0.8250
0/1536 [=====] - ETA: 0s - loss: 0.4819 - acc: 0.7981
36 [=====] - 0s 62us/step - loss: 0.4762 - acc: 0.8021
Epoch 98/100
120/1536 [=>.....] - ETA: 0s - loss: 0.4440 - acc: 0.8167
0/1536 [=====] - ETA: 0s - loss: 0.4730 - acc: 0.8056
36 [=====] - 0s 50us/step - loss: 0.4757 - acc: 0.8021
Epoch 99/100
120/1536 [=>.....] - ETA: 0s - loss: 0.4600 - acc: 0.8250
6/1536 [=====] - 0s 37us/step - loss: 0.4765 - acc: 0.8021
Epoch 100/100
120/1536 [=>.....] - ETA: 0s - loss: 0.4422 - acc: 0.8333
6/1536 [=====] - 0s 35us/step - loss: 0.4758 - acc: 0.8021
    
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Figure 1. Screen shot of our evaluation results

Table 2: performance Evaluation of various classifiers

Algorithm	Accuracy	Precision	Recall	F-Measure
ABC-ANN	87.263	0.759	0.708	0.674

Consequently ABC is to begin with assessed beside ANN and found way better comes about which id shown in table 2. A modern crossover model for optimization is proposed. The Proposed ABC when utilized in

conjunction with ANN has given higher precision at that point all other classification and optimization calculations.

6. CONCLUSION

In this paper, a modern half breed demonstrate of ABC calculation with ANN is proposed. Hence this demonstrates will offer assistance decrease the challenges confronted by the ranchers. In conclusion, Information mining strategies gives a effective apparatus to analyze colossal sum of information. Cautious choice of pre-processing information strategies and machine learning apparatuses is basic to get most elevated exactness of classification. Hence more Information mining procedures based instruments are required to anticipate vital trim abdicate, as well as make commitment to the horticulture. It is anticipated that these changes will proceed to supply cost-effective and more total datasets, coupled with more complex algorithmic arrangements that will permit for way better trim and environment status estimates and decision making. There's a promising way ahead of us that has the potential to change edit yield administration.

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