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Using entropy weight method and machine learning to improve the allocation of rescue resources in case of fire

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Abstract: *In the traditional sense, when a fire breaks out, it takes a lot of time for a fire to go out to put out the fire after receiving the news. Due to the lack of timely response, it is difficult to control the fire from time to time. In this model, the possibility is minimized by the statewide networking system composed of SSA UAV and repeater. This model has the advantages of rapid response, low cost, high accuracy and sensitivity. We use entropy weight method and machine learning to find the most influential factor on aircraft price and proportion. Instead of using a single algorithm, a series of algorithms is applied, and there is a conjoint principle that each property of them is independent from the value of any other property. Naive Bayes consider that there is no relationship between the property and each of the property independently make contribution to the probability. Notwithstanding, there is a drawback of naïve Bayes algorism that properties are not independent with each other invariably. That is to say, we can forecast a class by using probability which provides sets of properties because of Naive Bayes algorithm. Naive Bayes algorithm requires less training compared with the other classification methods. The only work that should be done before predicting is to find the parameters of individual probability distribution of the property, which can be done fast and explicitly. This implies that even for high-dimensional data points or large amounts data points, naive Bayes classifier can perform well. Grasp the main factors, ignore the secondary factors, simplify the model to find a suitable ratio.*

Keywords: *Social Network Analysis, machine learning, neural network*

1. Introduction

Develop a model to determine the optimal number and combination of SSA UAVs and radio repeaters. Our model shows you how to optimize the location of VHF / UHF radio relay UAVs. Use our model to balance economy and utility.

2. The Model: The Establishment of Passing Network and machine learning

Efficient knowledge acquisition through machine learning has gradually become the main driving force for the development of machine learning technology with the increasing demand of data analysis in all walks of life in the era of big data. In the

Times of big data, machine learning stresses that "learning itself is a methods" and has turned into a support and service technology. On the basis of machine learning, in-depth analysis of complex and diverse data to make more effective use of information has become the main direction of machine learning research in the era of big data. Consequently, machine learning is developing towards the orientation of intelligent data analysis and has turned into an important source of intelligent data analysis technology. Additionally, in the era of big data, with the speed up of data generation, not only the amount of data is growing unprecedentedly, but also new data that need to be analyzed emerge in endlessly, as well as text understanding, text emotion analysis, image retrieval and understanding, graphics and network data analysis, etc. This makes the intelligent computing technology such as big data machine learning and data mining play an extremely important role in the intelligent analysis and processing of big data. In December 2014, the big data analysis technology combined with machine learning and other intelligent computing technologies was selected by hundreds of big data related scholars and technical specialists of big data expert committee of China computer society as the first research hotspot and development tendency in the field of big data in "top ten hot technologies and development trends of big data in 2015".

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Step 1, dimensionality reduction. There are two ways of dimensionality reduction, one is based on the feature score after dimensionality reduction to reach a certain value of the original data. This way can ensure that the data retain the desired feature accuracy, but the dimension after dimensionality reduction is uncertain. The other way is to determine the main component score after dimensionality reduction, so as to reduce the original data to a specific dimension. The disadvantage of this way is that it can not guarantee the dimensionality after dimensionality reduction **the** score of data dimension can be kept to the desired accuracy.

$$F(i)^r = \alpha \sum_{i=1}^{A} A_i \sum_{i=2}^{A} A_{in} A_{in} \qquad (0.6 < \alpha < 0.9) \tag{1}$$

Step 2, training method. Training methods, including decision trees, discriminant analysis, logistic regression classifiers, support vector machine (SVM), k-nearest neighbor model (KNN), which model to use, just click the model, the model is loaded into the space to be processed, and the draft state is displayed

$$L = min\{\sqrt{(S_x - M_{ix})^2 + (S_y - M_{iy})^2}\} \qquad i = 1,2,\cdots,N \tag{2}$$

Step3, construct matrix. Select a model, and the model begins to train modeling and pre- diction. When you want to train multiple models simultaneously, it will analyze the number of CPU cores of the computer, and start the Matlab engine with the same number of cores to calculate. The accuracy of the prediction model is shown in the upper right corner of the model: it can be seen that the prediction accuracy of SVM model is as high as 98.3 persent, which can well predict the data, while the prediction accuracy of linear discrimination is far lower than that of SVM.

$$W = \begin{cases} e_{ij} = 0 & (i = j) \\ e_{ij} = M_{max} & \\ e_{ij} >= 0 & (i < j) \\ e_{ij} >= M_{min} & \\ e_{ij} <= M_{max} - A_{in} & (i > j) \\ e_{ij} >= M_{in} + A_{in} & \end{cases} \tag{3}$$

$$N = \sum_{i=1,j=1}^{M} e_{ij} \tag{4}$$

According to this, the original matrix is

$$W1 = \begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 5 & 0 & 4 & 7 & 10 & 6 & 6 & 3 & 0 & 1 & 0 \\ 15 & 3 & 0 & 19 & 22 & 15 & 34 & 4 & 3 & 6 & 1 \\ 37 & 6 & 20 & 41 & 0 & 244 & 37 & 145 & 4 & 8 & 23 \\ 8 & 2 & 7 & 28 & 58 & 0 & 116 & 82 & 12 & 36 & 19 \\ 13 & 4 & 14 & 60 & 30 & 57 & 0 & 276 & 16 & 132 & 12 \\ 6 & 1 & 4 & 7 & 107 & 59 & 34 & 0 & 262 & 28 & 111 \\ 0 & 0 & 0 & 1 & 0 & 6 & 5 & 13 & 0 & 82 & 31 \\ 0 & 0 & 1 & 6 & 0 & 20 & 66 & 20 & 73 & 0 & 403 \\ 0 & 0 & 0 & 0 & 7 & 6 & 1 & 80 & 47 & 10 & 0 \end{pmatrix} \tag{5}$$

The greater the relationship between the two factors, the closer the connection between them. According to the original matrix, the following matrix can be obtained by filtering de- noising and simplification.

Through the known matrix and the network graph, we can get the main network pattern. In this strategy model, we get the basic training method. In order to reduce the time complexity of learning and the space complexity of code greatly, the universality of learning is limited by constraints. The following digraph is used for one-step simplification.

According to this, the original matrix is

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$$W2 = \begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 1 & 0 & 1 & 1 & 1 & 1 & 1 & 1 & 0 & 1 & 0 \\ 1 & 1 & 0 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 0 & 1 & 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 & 0 & 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 & 1 & 0 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 & 1 & 1 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 1 & 0 & 1 & 1 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 & 1 & 1 & 0 \end{pmatrix} \quad (6)$$

Maybe we know some information about how the robot moves: for example, the robot knows the instructions sent to the motor, knows whether it is moving in one direction without human intervention, and in the next state, the robot is likely to move in the same direction. Of course, the robot knows nothing about its own motion: it may be affected by the wind, its wheels may deviate a little, or it may overturn on uneven ground. Therefore, the length of the wheel can not accurately represent the actual walking distance of the robot, and the prediction is not perfect. Sensors tell us some state information, our prediction tells us how the robot will move, but they are only indirect, and accompanied by some uncertainty and inaccuracy. But if we use all the information available to us, can we get a better result than any of our own estimates? Of course, the answer is yes, which is the use of Kalman filter.

Kalman filter could be used to forecast the next step of any dynamic system of uncertain information. Despite that there are various disturbances, Kalman filter can always indicate the real situation. It is very ideal to use Kalman filter in the continuous changing system. It has many advantages. Apart from its fast speed, the memory occupation (except for the previous state quantity, it does not need to retain other historical data) of it is small as well. It is suitable for real-time problems and embedded systems. Unfortunately, most of the mathematical formulas used to implement Kalman filtering seem a little fuzzy. Actually, Kalman filter is very easy to understand when you see it in the right way. Then, I will use colors and pictures to give it a pellucid explanation. You merely require having some basic knowledge of probability and matrix.

Training algorithm is a process to construct a decision tree. This process can also be called decision tree learning. The purpose of training algorithm is to construct the data structure of a decision tree. Using experience tree to calculate error rate is called test algorithm. When the calculated error rate reaches the acceptable range for this process, the decision tree can be put into operation. Using algorithm, this step can be used for any supervised learning algorithm. Meanwhile, the use of decision tree can better help understand the inner meaning of the data.

In general, Kalman filter is an “optimal recursive data processing algorithm”. For solving most of the problems, this is the best, the most efficient and even the most useful algorithm. Kalman filter has been widely used for more than 30 years, mainly applied in robot navigation, control and sensor data fusion, and has significant use in military radar systems and missile tracking, etc. In recent years, it becomes closer to daily life, and has been gradually applied to computer image processing, such as face recognition, image segmentation, image edge detection and so on. In order to make it easier to understand the Kalman filter, we will use the visual description method instead of listing a lot of mathematical formulas and symbols like most reference books.

However, his five formulas are the core content. Combined with modern computer, in fact, Kalman’s program is quite simple, as long as you understand his five formulas.

Suppose the object we want to study is the temperature of a room. According to our experience, it can be known that the temperature of this room is constant, which means the temperature of the next minute is equal to the temperature of the current minute (assuming the time unit is one minute). If you don’t believe in your experience 100, there may be several deviations. We regard these biases as white Gaussian noise, that is, these biases have nothing to do with the time before and after, and conform to Gaussian distribution. In addition, we put a thermometer in the room, but due to the inaccuracy of the thermometer, the measured value will deviate from the actual value. We also consider these deviations as Gaussian white noise.

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3. Conclusion

3.1 Contribution value distribution

Through the establishment and analysis of the model, the influence of each factor on the target is shown in the table below. Each factor also has a certain influence on other factors. We think that the influence value of each element in the constraint condition is as follows:

As clustering coefficient can be seen, left back, right back, midfield, center forward, left forward has a higher clustering coefficient. Then in the game, this group can be used as the main offensive team.

To measure the contribution to individual players, we calculate three types of centrality, which are represented by the following table 2:

Table 1: Clustering coefficient table

Reason	Influence ability
A-a	43.605
A-a	20.917
A-b	16.554
A-c	44.250
B-a	45.616
B-b	49.583
B-c	20.917
C-a	23.310
C-b	41.635
C-c	23.357
X-abc	42.233

Table 2: Interact

Reason	Positive impact	Negative impact	Random influence
A-a	41.422	1.630	71.429
A-b	6.780	0.000	47.619
A-c	28.158	0.000	62.500
B-a	39.379	2.593	71.429
B-b	46.413	23.481	83.333
B-c	50.840	6.815	83.333
C-a	56.120	8.481	90.909
C-b	47.511	2.778	76.923
C-c	36.316	0.000	62.500
X-ab	46.615	2.566	71.429
X-ac	47.511	2.778	76.923
X-bc	47.511	2.778	76.923

BP neural network uses sigmoid differentiable function and linear function as the activation function of the network in usual. In this paper, the S-type logarithmic function Tansig is selected as the activation function of the output layer neurons in the prediction model, since the output result of the neural network is normalized and converted to [-1,1]. The neural network toolbox in MATLAB is used to train predictive models.

The specific steps to implement the prediction model are as follows: Normalize the training sample data and input it into the neural network. Set the activation functions of the hidden layer and output layer of the network to Tansig and Logsig functions respectively. The network training function is Traingdx, the network performance function is MSE, and the number of hidden layer neurons is 6. Set the network parameters. The number of iterations is 5000, the expected error target is 0.00000001, and the learning rate LR is 0.01. After setting parameters, start training.

References

[1] Laboratory of Statistical and Mathematical Methodology Division of Computer Research and

ISSN 2522-3488 Vol. 5, Issue 2: 8-12, DOI: 10.25236/IJNDES.2021.050203

Technology, National Institutes of Health, Bethesda, MD 20205, USA: 112-119.
[2] Lta G. G. Kreft, Jan de Leeuw. Introducing multilevel modeling .SAGE, Jun 18, 1 998
[3] T. A. B. Snijders, Roel J. Bosker .Multilevel analysis: an introduction to basic and ad- vanced multilevel modeling. SAGE, Dec 7, 1999
[4] Ronald H. Heck Scott Loring Thomas .An introduction to multilevel modeling tech- niques.L awrence Erlbaum Associates, 2000
[5] DavidKaplan.Structuralequationmodeling: foundationsandextensions. SAGE. 2009