A System to Identify the Terrorism Tendency from Objective and Psychological Aspects

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Abstract—**This paper figures out a system to identify whether a person has the tendency to be a terrorist. The system, which is used to inspect the terrorism tendency of the monitored people mainly from two aspects: objective and psychological conditions, is more objective and comprehensive than before to some extent. In terms of objective conditions, BP Neural Network is used to get a preliminary determination of the terrorism tendency by analyzing the six main social factors-religion, nationality, age, marriage, sex and records of crimes. On the other hand, by using Grey Relational Analysis (GRA) and Analytic Hierarchy Process (AHP), the paper chooses the most correlative five factors of Cattell's 16 Personality Factors: Openness to Change, Sensitivity, Reasoning, Social Boldness and Abstractedness to evaluate their psychological situation.**

Keywords-analytic hierarchy process; BP neural network; cattell's 16 personality factors; grey relational analysis; terrorism tendency introduction

I. INTRODUCTION

Since the spread of terrorism around the world has brought great harm to the society, more and more people start to call for more efficient ways to guard against terrorism. For this purpose, in regard to the conditions for the naissance of terrorists and their characteristics, experts in the field of psychology and sociology have never stopped their study and exploration.

Up to this day, thankfully, these studies have made some achievements in the aspect of the emergence and development of terrorism. Horgan [1] proposed a process model of terrorism, thinking that becoming a terrorist is a gradual process. In this process, many factors play the key role. Moghaddam [2] likened the process of becoming a terrorist to that of climbing the stairs. Dollard [3] proposed the Setback - attack theory model. That is, the occurrence of terrorist activities is born of the psychological frustration of terrorist organizations and terrorists.

In general, it has been widely recognized that the cause of terrorists can be divided into two parts, social properties and personal characters. But most of these research achievements still stay in the theoretical stage, focusing on the description and explanation. This paper quantitatively analyses the major indexes of the two parts to improve the ability on the prediction and identification. In addition, considering the concealment of the identification process, a set of appraisal system in no need of cooperation from the object is put forward in this paper.

II. METHODS

A. BP Neural Network Model

Artificial neural network was presented and developed on the basis of modern neuroscience. According to the different types of the neuron connections, the neural networks can be divided into several types [4].

This paper studies feed-forward neural network, as the feed-forward neural network using the error back propagation function in the weight training process, it is also known as back propagation neural network, or BP network for short. BP neural network is a core part of the feed-forward neural network, which can realize a special non-linear transformation, transform the input space to the output space.

In the network, each neuron just accepts the input of the front layer and exports to the next layer, there is no feedback. Usually the feed-forward network can be divided into different layers, and the input with the layer only connects with the output of the $(i-1)th$ layer. The input and output nodes connect to the outside world, and the other intermediary layers are called hidden layers. According to the article <The determination of the BP neural network hidden layer unit number> [5], the number of hidden layers can be showed:

$$n_1 = \log_2 n$$

Where n_1 stands for the number of hidden layers, n stands for the number of input of nerve cell. Therefore, in this model,

$$n = 6, n_1 = \log_2 6 \approx 3$$

The number of output nerve cell $n_2 = 2$. For the Input layer, after sifting repeatedly, the religion, age, sex, nationality, marriage, and records of crimes these six indexes were chosen. The neural network can be shown as Figure 1.
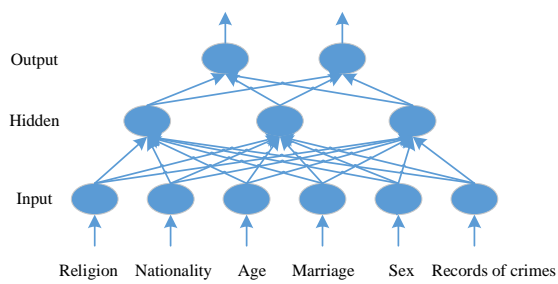
FIGURE I. BP NEURAL NETWORK SKETCH

When it comes to obtain a risk index, several steps are needed. Firstly, a valuation to social attributes of the terrorists is given. Detailed contents are in the Table 1.

After that, the paper figures out the weight of each index by using BP Neural Network to achieve machine learning, with the samples of known ordinary people and terrorists in the Table 2, which to evaluate whether the unknown for terrorist groups. Thus, combining the weight of each index with the new data of the people who whether they are ordinary or terrorists are unknown, the system can make an evaluation for them.

TABLE I. A VALUATION TO SOCIAL ATTRIBUTES

Religion	40(Islam)	30 (Buddhism)	20(Christian)	10 (rest)	
Nationality	50 (Syria)	40 (Afghan)	30 (Iraq)	20 (Immigrant from the Middle East)	10 (rest)
Age	4 (25-35)	3 (35-40)	2 (16-25)	1 (rest)	
Sex	2 (male)	1 (female)			
Marriage	2 (single)	1 (married)			
Records of crimes	50 (frequently)	40 (many)	30 (some)	20 (several)	10 （none）

TABLE II. SAMPLES OF ORDINARY PEOPLE AND TERRORISTS

No.	Religion	Nationality	Age	Sex	Marriage	Records of crimes	Result
1	10	10	4	1	1	10	1; 0
2	10	10	3	2	2	50	1; 0
3	10	20	2	2	2	10	1; 0
4	10	10	1	2	1	50	1; 0
5	20	10	1	1	1	10	1; 0
6	10	30	1	1	2	10	1; 0
7	20	10	1	2	2	10	1; 0
8	10	20	1	1	1	10	1; 0
9	20	10	3	2	1	10	1; 0
10	10	10	4	1	1	10	1; 0
11	10	10	4	2	1	10	0; 1
12	10	30	2	1	1	10	0; 1
13	10	10	2	1	2	10	0; 1
14	20	20	1	1	1	10	0; 1

If the result is [1; 0], it means conforms to the first condition; that is to say, this person almost has no possibility to be a terrorist. And if the result is [0; 1], it means y conforms to the second condition; that is to say, it seems that this person has possibility be a terrorist.

After many times of learning, the weights needed is provided. The result is as following:

Input Weights =

-0.4459 0.2380 -2.2185 16.2424 2.3455 2.6284

-1.7289 1.0662 -0.6406 5.7305 -2.9600 1.2364

-0.5104 -0.3619 0.9238 9.5577 7.0343 -0.1640

Layer Weights =

-5.7166 4.8943 13.0401

1.8056 -0.3257 -13.6508

Through running the MATLAB neural network toolbox and 5 times of learning, it is known that after 18 times of iterations, the training data are optimal, and the mean squared error is best, which is 1.3895e-06. The iterative gradient data is less than the minimum stated gradient. The result is anastomotic to assumption, i.e., the result is believable. So, as long as these 6 factors are in this network, the result can be determined by

$$o^s_i = \varphi(\sum_{j=1}^{3} w_{ij}\varphi(\sum_{k=1}^{6} \overline{w_{jk}} I^s_k))$$

And usually,

$$\varphi(v) = \frac{2}{1+e^{-2v}} - 1$$

Therefore, once given the suspects' objective conditions, the system can use BP Neural Network to initially identify them. What's more, BP Neural Network can be more accurate by self-learning with the help of more real data.

B. Psychological Assessment

A way to evaluate whether a person has possibility to be a terrorist has been given above from the view of the social attributes. This model will evaluate a person from the view of personality characteristics.

According to Psychologist Raymond B. Cattell [6], people's psychological characters can be divided into 16 different kinds of feature, which can determine a person's mental state by using them.

The system uses the grey correlation model to rank the 16 kinds of features by comparing with the relationship between them and terrorist activities, and then find out the top ones. Furthermore, the system builds analytic hierarchy process model (AHP) based on the weights above to determine whether a person has possibility to be a terrorist.

Grey Relational Analysis (GRA) [7] is one of the grey system analysis methods. For the factors between two systems, the measure of the correlation change with time or between different objects is called the correlation. In the process of system development, if the two factors' change trends are consistent, it means that there is a high degree of correlation between them. On the other hand, it is low. Therefore, GRA is a method which measures the degree of correlation among factors according to the similar or dissimilar degree of their development trend.

Analytic hierarchy process (AHP) [8] is used to solve some complex blurry problems. It divides a problem into different hierarchies orderly as general object, sub-object for each stratum, evaluation criteria and specific options.

First of all, the system takes data of ordinary people, terrorists and critical state as sample to analyze. Among them, A- Q_4 correspond with 16 psychological indexes, such as Warmth (A), Reasoning (B), Emotional stability (C).

Secondly, an AHP model was built with each element in the samples to be an ordered sequence. Then the system conducts initialization of the data and make the same dimensions of sample data. According to their features, the method of initial-value transform was chosen.

Thirdly, the system takes risk index as a reference sequence to make the preparation for a GRA model. The relevance to terrorist of the 16 psychological indexes can be seen in Table 3.

TABLE III. RELECANCE TO TERRORIST OF THE 16 PSYCHOLOGICAL INDEXES

Personality Factors	Relevance To Terrorist	Sequence
Warmth (A)	0.729020434	8
Reasoning (B)	0.738669167	3
Emotional Stability (C)	0.724834028	11
Dominance (E)	0.718870305	14
Liveliness (F)	0.72366318	12
Rule-Consciousness (G)	0.721180835	13
Social Boldness (H)	0.733654823	7
Sensitivity (I)	0.739320394	2
Vigilance (L)	0.731039271	6
Abstractedness (M)	0.731249261	5
Privateness (N)	0.729540066	7
Apprehension (O)	0.71470951	16
Openness to Change (Q_1)	0.741900407	1
Self-Reliance (Q_1)	0.725860526	10
Perfectionism (Q_1)	0.726899053	9
Tension (Q_1)	0.716754103	15

From Table 3 above, this article chooses the top 5 psychology characteristic indexes: Openness to Change (Q_1), Sensitivity (I), Reasoning (B), Social Boldness (H) and Abstractedness (M). The AHP model is established to evaluate the possibility of being a terrorist with the five indexes as criterion layer from the perspective of psychology.

Sort the five personal characters concluded from GRA according to the correlation and weight them from high to low as is shown in Table 4.

TABLE IV. WEIGHT OF PERSONALITY FACTORS

Personality Factors	Weight
Openness to Change (Q_1)	9
Sensitivity (I)	7
Reasoning (B)	5
Social Boldness (H)	3
Abstractedness (M)	1

Number footnotes separately in superscripts. Place the actual footnote at the bottom of the column in which it was cited. Do not put footnotes in the reference list. Use letters for table footnotes. Then the matrix of the rule layer was established in Table 5.

TABLE V. RULE LAYER MATRIX

A	Q_1	I	B	H	M
Q_1	1.000	0.778	0.556	0.333	0.111
I	1.286	1.000	0.714	0.429	0.143
B	1.800	1.400	1.000	0.600	0.200
H	3.000	2.333	1.667	1.000	0.333
M	9.000	7.000	5.000	3.000	1.000

Here the paper takes the personality factors of a terrorist as an example to deduce the model. The critical parameters of personality factors were took as the standard. Comparing the indexes of the sample with the standard and whether the sample tend to terrorism can be determined.

The five specific values of the terrorist's personality factors are [6 6 10 5 6], and the five critical parameters of personality factors are [10 11 8 9 13].The total sorts of the hierarchy are shown in the following Table 6.

TABLE VI. THE TOTAL SORTS

Criteria	Q_1	I	B	H	M	Rank of Weight
Weight of Criteria	0.0622	0.0799	0.1119	0.1865	0.5595	
Alternative Weight Distribution	0.6364	0.6552	0.4334	0.6350	0.6891	0.6444
Critical Value	0.3636	0.3448	0.5666	0.3650	0.3109	0.3556

From the above calculation result, the conclusion is that the person has a tendency to terrorism on his character. By parity of reasoning, as long as the five specific values of one's personality factors were obtained and the ratio is smaller than 0.7, the paper can make the judgment that this guy seems to have a tendency to terrorism mentally.

III. RESULT AND DISCUSSION

In this paper, from two aspects-objective and psychology conditions, a relatively complete system is proposed to evaluate the monitored people based on the data.

Firstly, considering from social factors, six main indexes (Age, Sex, Marriage, Nationality, Religion and Crime Record) of both normal people and terrorists are learned by BP Neural Network. In this way, a preliminary evaluation part has been generated and a preliminary determination of the terrorism tendency can be made through these social indexes.

Then, from the point of psychology, Cattell 16 personality factors are used to analyze them. With the help of Gray Correlation Analysis, the most correlative five personality factors are found. They are Openness to Change (Q_1), Sensitivity (I), Reasoning (B), Social Boldness (H) and Abstractedness (M). Next, compared the specific value of these factors with the critical mental state, the further assessment of terrorism tendency can be got by using Analytic Hierarchy Process.

However, there is much work needed to be done in the future. Given the fact that the system can't be quite accurate until much more real data are learn by BP Neural Network. Also, the weights in AHP need further considerations, as "9 8 7 6 5" may be more proper than "9 7 5 3 1".

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