Design of an Intelligent Fraud Prevention System of Campus

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Abstract. Campus fraud is increasingly rampant, which seriously affects the property safety of students. How to effectively prevent campus fraud has become a major focus of society. This paper proposes a campus fraud prevention system based on neural network. The system deploys monitoring terminals in student dormitories, and collects students' call sounds using monitoring terminals, and uploads call data to the monitoring platform. The monitoring platform converts the voice data into text data, uses the TextMind Chinese psychological analysis system to extract the psychological feature word vectors of the call text, and finally inputs they into the neural network for recognition. When the student is being defrauded, the counselor will be notified by the system immediately to persuade the student to avoid campus fraud. The experimental results show that the identification accuracy rate of campus fraud prevention system based on neural network can reach 93.5%, which is superior to existing fraud prevention systems that rely on identifying fraudulent phone numbers or identifying call text content to prevent fraud.

Keywords: Campus fraud; neural network; psychological feature; prevention system; monitoring terminal; monitoring platform; vocational college; psychological feature

1 INTRODUCTION

With the rapid development of China 's Internet industry, traditional crimes such as theft and robbery across the country have decreased year by year, but the proportion of new cyber crimes, especially telecommunications fraud, in the types of fraud crimes has increased year by year, with an annual rate of 20 % -30 %. At the end of November 2022, a total of 391,000 cases of telecommunications network fraud were uncovered nationwide, an increase of 5.7 % year-on-year.

Due to the lack of social experience, the cases of vocational students suffering from campus fraud are increasing year by year. Although the prevention measures and strat

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egies of campus fraud in vocational colleges have made great progress, the current campus fraud is still a very difficult social problem as in [1] to [3]. Only relying on the education and guidance of the school to the students can not curb such events in the campus effectively. Therefore, in order to improve the prevention rate of campus fraud, it is necessary to improve the intelligence of campus security management system in preventing and controlling fraud.

Campus fraud causes property losses to students, and causes serious trauma to their thoughts and psychology as in [4] to [6]. Because the fraud incidents encountered by vocational students are telecommunication fraud based on mobile phones mainly, the communication management is the focus of campus fraud prevention system construction. At present, the campus fraud prevention system mainly relies on telecom operators to receive complaints about designated fraud calls, confirm by calling back, and then initiate the interception of fraud calls after confirmation. However, this method is inefficient and not timely as in [7], and cannot effectively solve the problem of telecom fraud. And to fraud telephone communication content semantic analysis, thus identifying whether it belongs to telecom fraud as in [8]. However, with the continuous updating of fraud, the accuracy and effectiveness of identifying telecom fraud based on the classification of telephone text content is still low. Therefore, this paper designs an intelligent campus fraud prevention system. The system uploads the students' telephone voice to the monitoring platform in real time through the monitoring terminal. The monitoring platform converts the voice data into text data and analyzes the user's psychological characteristics according to the psychological characteristics database of common campus fraud incidents established, and then uses the neural network to identify whether the student has encountered telecom fraud, when a student is found to be suffering from fraud, the counselor will be notified by the system immediately to persuade the student to avoid the occurrence of campus fraud.

2 INTELLIGENT CAMPUS FRAUD PREVENTION SYSTEM

2.1 Structure of Intelligent Campus Fraud Prevention System

The system consists of a monitoring platform and a monitoring terminal. The monitoring platform is connected to the monitoring terminal through Ethernet.

2.2 Monitoring Platform

The monitoring platform is located in the campus monitoring center as in [9] to [10], and its main functions are:to establish the psychological characteristics database of common campus fraud incident, and using neural network analysis to judge telecom fraud incidents, and manage monitoring terminals deployed on campus.

2.3 Establishment of Psychological Characteristics Database

In this paper, TextMind Chinese psychological analysis system is used to analyze the received call text, and the eigenvalues of 102 kinds of psychological feature words in the call text are extracted as in [11] to [12].Previous studies have shown that 11 psychological characteristic words, such as money words, prepositions, conjunctions, cognitive process words, insight words, causal words, tentative words, exact words, exclusion words, filler affixes, and words with more than 6 words, are closely related to the psychological characteristics of victims of telecom fraud cases.

Among related lexical features, vulnerable people used fewer intermediate copulants, cognitive process words, causal words, insight words, conjunctions, and excluded words and words longer than 6. In addition, among the lexical features associated with cognitive flexibility, vulnerable people used fewer tentative and filler words, and instead used more exact words.

By comparing the characteristics of money words between easy and easy to be deceived, it is found that the proportion of money words in easy to be deceived is significantly higher than that in easy to be deceived.

Therefore, the psychological feature database of fraud event recognition designed in this paper is composed of the feature vector of the above 11 psychological feature words.

Intelligent Fraud Identification Mechanism. Firstly, the intelligent fraud identification mechanism performs linguistic psychological analysis on the call data uploaded by the monitoring terminal, and obtains the eigenvalues of each psychological feature word in the psychological feature data.Then these eigenvalues are input into the trained neural network model for analysis and judgment.If the analysis results determine that the content of the call is suspected to be fraudulent, a fraud warning signal is generated.

Neural Network Structure. BP (back propagation) neural network is a multilayer feedforward neural network trained by error back propagation algorithm as in [13] to [15].In order to realize the nonlinear relationship between the eigenvalues of each psychological feature word and telecom fraud events, this mechanism uses three-layer BP neural network to identify telecom fraud events, and the training data comes from the psychological feature database. The BP neural network consists of input layer, hidden layer and output layer.

The input elements of the input layer are the eigenvalues of each psychological feature word. S={S1, S2, … … , Sn}, so there are n neurons in the input layer. The hidden layer is composed of m neurons and is used for comprehensively evaluating the input data, and the number of nodes in the hidden layer will directly affect the training effect of the BP neural network model. This paper determines the number of nodes in the hidden layer G according to the empirical formula, as shown in Formula (1).

$$G = \sqrt{g + m} + \beta \tag{1}$$

Where, g is the number of neurons in the input layer, m is the number of neurons in the output layer, β is an arbitrary integer, the value is [0,10]. The output layer consists of one neuron, and the output are two results of suspected fraud and non-fraud.

Management of Monitoring Terminal. In the campus, the student living area is concentrated in the student dormitory mainly, so the monitoring terminal is arranged in each student dormitory, and the monitoring platform needs to configure the location parameters of each monitoring terminal.The monitoring platform is combined with the student information management system to become a subsystem of the student information management system.

When the intelligent fraud identification mechanism identifies the suspected fraud phone, the monitoring platform can inquire the detailed information of the relevant students, so that the instructor or the class teacher can contact the students in time.

In order to prevent the disclosure of students' private call information, the monitoring platform only saves the call information of suspected fraudulent calls and does not save students' normal call information.

3 MONITORING TERMINAL

3.1 Design of Monitoring Terminal

The monitoring terminal is composed of hi-Fi pickup module, MCU controller, transmission module and power module. The hi-fi digital pickup module adopts array technology and DSP digital processing unit to carry out multilevel dynamic noise reduction processing. Through automatic noise recognition and processing technology and various noise reduction algorithms and AGC, DTS noise reduction signal microprocessing circuit.It can suppress external noise effectively,and capture complete and clear voice comprehensively, and transmits the captured voice to MCU controller.The transmission module integrates 10/100M adaptive Ethernet interface, connects the monitoring terminal and monitoring platform through network cables, and realizes data exchange between the monitoring terminal and monitoring platform.MCU controller mainly digitizes the audio data of the call and transmits it to the monitoring platform through the transmission module; The system also receives and stores the configuration information delivered by the monitoring platform.The power module mainly converts 220V AC to 12V DC through the AC/DC transformer to supply power to the hi-Fi pickup module. Then convert the 12V power supply into 3.3V power supply using the switching power circuit to supply power to other modules.

3.2 Function of Monitoring Terminal

The monitoring terminal is arranged in each student dormitory mainly. The main function is to monitor the students' mobile phone calls, digitize the students' call audio data at the monitoring terminal, and upload the digitized call information to the monitoring platform.

4 EXPERIMENTS AND ANALYSIS

4.1 Training of BP Neural Network

Because the telephone text data involves personal call privacy issues, there is no public data set at home and abroad, the test data set of this experiment is collected from the Internet mainly. In this paper, 200 campus telecom fraud events and 100 non-telecom fraud events are selected as training sets to train the BP neural network model. After the analysis of the psychological analysis system, the eigenvalues of 11 psychological feature words in each event text are extracted and input into the BP neural network model, and then the fraud phone recognition results are output.

4.2 Test Result and Analysis

A monitoring platform and a monitoring terminal are used to build a campus fraud prevention system, and telephone calls with others are simulated at the monitoring terminal. The number of fraud calls and non-fraud calls test samples accounts for 50 % respectively.

In the test samples of scam calls, the number of correctly predicted test samples is recorded as True Positive (TP),and the number of incorrectly predicted test samples is recorded as False Positive (FP),and in the non-fraud telephone test sample, the correctly predicted test sample is recorded as True Negative (TN), and the wrongly predicted test sample is recorded as False Negative (FN).

According to the calculation formula of evaluation index :

$$\text{Accuracy}=(TP+TN)/(TP+FN+TN+FP) \tag{2}$$

$$\text{Precision}=TP/(TP+FP) \tag{3}$$

$$\text{Recall}=TP/(TP+FN) \tag{4}$$

$$F1=2*\text{Precision}*\text{Recall}/(\text{Precision}+\text{Recall}) \tag{5}$$

Accuracy refers to the probability of correct prediction, Precision represents the number of actual positive samples in the predicted positive samples, and Recall represents the proportion of positive samples judged as positive samples, and F1 is a comprehensive evaluation index. Table 1 shows the comparative test results of the campus fraud prevention system.

Table 1. Test result

Prevention system	**Accuracy(%)**	**Precision(%)**	**Recall(%)**	**F1(%)**
based on user information	79	73.5	51.8	60.8
Based on call content	90.25	90.75	90.26	90.22
Based on psychological characteristics	93.5	95	90.4	92.6

From Table 1, it can be seen that the fraud prevention system based on psychological characteristics is superior to the fraud prevention system based on user information and call content in terms of accuracy, accuracy, recall rate and F1 value index. The main reason is that due to the continuous upgrading of fraud types and fraud methods, the fraud prevention system based on user information and call content is not accurate in identifying new fraud events. However, even for new fraud events, their psychological characteristics are implemented by confusing the people. The fraud prevention system based on psychological characteristics has better recognition effect.

5 CONCLUSIONS

This paper proposes an intelligent campus fraud prevention system. The system consists of a monitoring terminal and a monitoring platform. Through the analysis of the psychological characteristics of the call text data, the neural network technology is used to train the telephone fraud identification model, and the trained telephone fraud identification model analyzes the student call data collected by the monitoring terminal, and finally realizes the effective identification of campus fraud events.

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