Research on Railroad Turnout Fault Diagnosis Based on Support Vector Machine

¹ KORUKONDA VENKATA RATHNAM, ² GUTLAPALLI ASHOK KUMAR, ³ YELISETTY ASHOKA CHAKRAVARTHI, ⁴ GUNTURI NAGENDRA BABU REDDY, ⁵ GUNTUPALLI GOPIKRISHNA,

[1]Assistant Professor, Dept. Of CSE, ABR College of Engineering and Technology, Kanigiri,

[2, 3, 4, 5,] BTech Student, Dept. Of CSE, ABR College of Engineering and Technology, Kanigiri,

Abstract: The turnout gadget is a crucial signalling tool to ensure the protection of train operation, and its reliability is crucial for the protection and operation of the railway. Switch monitoring is normally based totally on revel in and expertise of tracking time. This technique has many issues, in conjunction with wrong location, gradual scanning, and poor typical performance. Therefore, it's going to have an effect on the use of performance. Using S700K type speed transfer due to the fact the research item, the principle of virtual manage switch and switching mechanism come to be analyzed, and with microcomputer monitoring, the set of rules primarily based on aid vector system (SVM) is used for prognosis due to the difficulty of prognosis, and compared with algorithms of neural community (BP) and Bayesian network (NB). The effects display that the diagnosis is higher the use of the SVM-primarily based definitely set of rules.

Keywords- turnout railroad equipment; intelligent diagnosis; support vector machine

I. INTRODUCTION

With the non-forestall development of generation, the railway system is likewise continuously being evolved, and its paintings have turned out to be extra mature. As the fundamental equipment to make sure the safety of the trains, the reliability of the changes will have a right away effect on the protection and operation of the transportation. At present, the microcomputer monitoring device is used to display screen the working conditions of the electronic railway signalling gadget. Doctors can apprehend the going for walks situations of the tool from the statistics amassed by means of

the use of the microcomputer tracking device, pick out the cause of the fault, and document the violation. The safety of tracking gadget is typically primarily based on experience and understanding of well timed protection. This method has many troubles, together with wrong fault location, sluggish assessment and terrible average overall performance, and many others. Therefore, it'll have an effect on riding. In order to keep away from the dearth of changes that are not checked through experienced workforce, we create a smart face to check the accuracy by means of way of the usage of the presently amassed statistics by using microcomputer tracking, combining contemporary assets and pc device to test the diagnostic adjustments, which can be significantly decreased. Efforts of the railway personnel and quick determine on the fault. In this paper, the precept of switching manipulate circuit and an errors of switches is analyzed through way of taking S700K type brief-step transfer because the studies estimate, and collectively with microcomputer evaluation, the Support Vector Machine (SVM) primarily based algorithm is used. Given the difficulty of prognosis.

II REVIEW OF LITERATURE

1) Scientific studies

Author: Zhang Kai.

Fault evaluation is important to ensure the protection and reliability of excessive-velocity railway. Traditional diagnostic strategies for high-speed trains depend upon manually extracting functions using uncooked facts, however the way is hard work-widespread and disruptive to the final result. Convolution neural network (CNN), as a deep studying version, can examine uncooked records representations. This paper studies fault detection for excessive-speed trains primarily based totally on CNN. The modern-day modifications in the time domain are transformed into 2D greyscale photographs, after which the greyscale picks are fed into the CNN for crime classification. The plan is an automated diagnostic system that gets rid of the complicated manual technique. The experimental outcomes display that there can be a enormous improvement within the real trade records mind-set for the cutting-edge curve and show the effectiveness of the proposed approach without a manual.

2. Text Mining-Based Fault Detection for High-Speed Railway Signalling System Equipment.

Author: Zhao Yang

Natural language in excessive-speed rail gadget statistics management poses a chief challenge for analysis due to its negative trends and uncertain semantics. In this paper, textual content mining based totally mostly on fault prognosis for automobile on-board machine (VOBE) of immoderate-pace railways changed into proposed, wherein the content cloth version is used to extract the fault function in tracking statistics of an arbitrary nature. In addition, Bayesian community (BN) is also used to regulate the uncertainty and complexity of VOBE diagnosis. Furthermore, a way that uses all synthetic intelligence and information is supplied to gather an appropriate BN model for VOBE. Finally, the accuracy and precision of the plan had been examined the usage of actual facts from the Wuhan-Guangzhou high-velocity rail signalling structures.

3. Fault diagnosis approach of wavelet packet strength of hastily growing turnouts
AUTHORS: An Chunlan, Gan Fangcheng, Luo Wei et al.

Aiming on the herbal obstacles of cloud mastering system in workout, a modern fault analysis technique primarily based totally on wavelet packet power entropy and advanced fuzzy kernel reading machine is proposed. On the simplest hand, the furnished technique can higher cast off

the results using the wavelet packet energy entropy technique, and then again, the hairy shape membership diploma matrix U, the matrix of weight W that's used to provide an explanation for the random pattern, and the kernel characteristic is delivered to create a cloud analyzing tool model of the fuzzy kernel with immoderate and immoderate self belief. The experimental effects of the bearing and take a look at valve have been acquired and analyzed in MATLAB 2010b. The effects display that the proposed fuzzy kernel cloud studying machine method can gain honest or barely better type than cloud analyzing system, kernel cloud gaining knowledge of gadget, once more-propagation, manual vector system and the bushy help vector system.

4. Application of multi-elegance assist vector device for airport anti-gun diagnosis
AUTHORS: Deng S, Lin S Y, Chang WL
This paper offers a multi-modal help vector device (SVM) and again-propagation neural community (BPNN) for anti-aircraft gun prognosis. These competencies prevent diagnostic errors and allow new faults to be recognized fast. Our experimental effects show that each SVM and BPNN provide right trying out accuracy whilst checking out a enough range of training samples, and the multivariate SVM version has better

accuracy than the BPNN model when checking out a enough extensive style of schooling samples. Consists of a number of small workshops. Our multi-class SVM method additionally has the gain of trouble-fixing and requires much less manage; it's far less difficult to use it for fault prognosis trouble than BPNN.

5. Research on smart railway crime diagnosis based on neural community
AUTHOR: Zhang K.
Fault prognosis is vital to make certain the safety and reliability of excessive-tempo railway. Traditional diagnostic tactics for excessive-velocity trains depend on manual extraction.

III IMPLEMENTATION

Modules:

• Users

• The chief

• Prior statistics

• Benefits of machine studying

DESCRIPTION OF MODULES:

User:

User can check in first. When registering, it requires a valid e mail and contact wide variety for similarly communiqué. Once the person is registered, the administrator can prompt the user. Once the administrator is activated, the consumer can log into our gadget. The person can download the data consistent with our dataset matching gadget. For the execution of the algorithm, the statistics must be in flow mode. Here we take a railway dataset. The consumer also can add new documents to present documents based on our Django application. The consumer can click on the classification within the net web page to get the information to calculate accuracy, precision, recall and F1 score based on algorithms.

Administrator:

The administrator can log in with their login credentials. Admin can assist customers sign up. Once enabled, handiest the user can log into our device. Admin can view all documents in browser. The supervisor can click on the outcomes in the web page to peer the accuracy, precision, take into account and F1 rating calculated consistent with the algorithms. The execution of all the algorithms is done, and then the admin can see the entire fact of the net page.

Prerequisites:

Python code becomes used to dispose of useless attributes. After that, the quantity of identifications and proportions were found with the aid of digging. All the sentences inside the guide line are counted to locate the quantity of instructions

consistent with manual and this variety is placed within the guide line. Then we get five attributes which can be the variety of critiques, % of repeats, variety of ingredients, range of meals items and commands. The % repeat refers back to the number of people who will make the meals once more after following the recipe. After trying out the consequences with each attribute and seeing their correlation, we discard 2 of the attributes and get the final records with three attributes (service, components, and instructions).

Benefits of Machine Learning:

According to the class system, the wiped clean statistics is divided into 60% education and 40% checking out, then the facts is derived from six gaining knowledge of machines which include Naive Bayes (NB), guide vector gadget (SVM), neural network (NN). The accuracy of the category is calculated and proven in my results. The classifier that gives the most accuracy can be taken into consideration as the pleasant classifier.

IV SYSTEM ANALYSIS

IMPORTANT:

The aid vector machine set of rules cannot be used for huge data. It does no longer paintings thoroughly while the dataset has extra noise, such as when the target classes overlap when the wide variety of factors for each statistics point exceeds the number of education records. , the support vector system will underperform. As the assist vector classifier works by setting the data factors, above and under the distribution hyper plane, there is no clear indication for the distribution.

SYSTEM REPAIR PROCEDURE:

SVM algorithm isn't appropriate for large information

SVM does not carry out well when the dataset incorporates extra noise, i.e. Overlapping lessons.

σ� If the variety of functions for each data supply exceeds the training dataset, SVM will underperform.

σ� As the help vector classifier works via imparting records factors, above and under the distribution hyper plane, there's no manner to describe the distribution.

PROPOSED SYSTEM:

Support vector system is a supervised studying device and is used for distribution and retrieval issues. Support vector system is much less popular as it plays unique calculations with less computing energy. It is regularly used in classification troubles. The goal of the guide vector system is to locate the terrible distribution of the aircraft by using showing the distance. Given the training information, the set of

rules generates the exceptional hyper plane that separates the brand new examples. In both locations, this hyper plane is a line dividing the aircraft into two components in which each unit is on either side. The purpose of the help vector device algorithm is to find the aircraft in N-dimensional area that separates the records factors.

ADVANTAGES OF THE PROPOSED SYSTEM:

SVM works nicely whilst there's a clean separation between instructions.

σ� SVM works first-rate in excessive strain environment.

σ� SVM is useful in cases where the variety of dimensions is greater than the range of samples.

σ� SVM also has proper reminiscence

V TURNOUT FAULT DIAGNOSIS

A. Diagnostic system

Changing diagnostic equipment generally includes 3 techniques, including statistics acquisition, product elimination and fault prognosis. Defect characteristic extraction specifically goals to clear up the trouble of disorder facts representation and feature extraction in this text, and to get better features through analysis and calculation,

which may be utilized in into the following step of diagnosis. As shown in Figure 2.
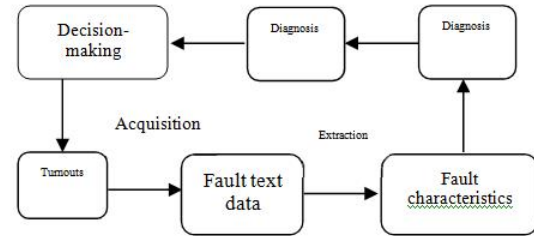

Figure 1. Diagnostic Process

B. Feature extraction

According to the trade of the switching method and the switching modern-day curve, the switching modern curve may be divided into three phases, particularly the whole segment, the running section and the latching phase. Based on the conversation between the mistake possibility and the modern-day effect curve, the significance of interrupting the fault sign is decided. In this paper, six function values proven in Table 2 are determined on as the simple facts for fault detection.

The transfer curve segmentation technique is the critical thing to obtaining all the feature values, specifically in the case of the fault us of a, the switch order curve is strange and it's far extra difficult to properly obtain the electric trends of each segment. Potential cases are anticipated via assessment of the failure charge curve.

TABLE I.PARAMETER TABLE

No.	Properties
1	AC voltage of breakout panel X1, X2
2	DC voltage of breakout reels X1, X2
3	AC Voltage of Relay 1-4 Coils
4	DC voltage of relay coils 1-4
5	AC voltage across resistor R1
6	DC voltage across resistor R1

C. Inspection

With the sign online X1, relays 1 to four, and AC and DC voltages at both ends of resistor R1. There are 8 styles of faults, including: out of doors 2-pipe skip open circuit (Class I), outside 2-pipe skip fault (Class II), indoor relay disconnection (Class III), indoor diode disconnection (Class IV), X1 inside. Pass disconnect (Class V), 1DQJ indoor disconnect (Class VI), 1QJF indoor disconnect (Class VII), and outside relay bypass open circuit (Class VIII). The education samples may be located in Table Ⅲ and the check samples are shown in Table Ⅳ.

TABLE II. TRAINING DATA

Type	Voltage at breakout reels X1-X2 Voltage at relay coils 1-4 Voltage across resistor R1		Voltage at breakout reels X1-X2 Voltage at relay coils 1-4 Voltage across resistor R1		Voltage at breakout reels X1-X2 Voltage at relay coils 1-4 Voltage across resistor R1	
	AC	DC	AC	DC	AC	DC
I	105	0	105	0	25	0
	102.4	1.524	110.2	1.552	30.52	0.991
	105.2	0.954	99.25	0.594	26.54	0.525
II	26	0	25	0	78	0
	25.54	0.221	24.25	0.261	75.65	0.658
	24.98	0.651	26.21	0.156	77.65	0.325
III	69	35	0	0	40	20
	70.65	34.22	0.214	0.254	40.22	21.03
	72.54	34.94	0.265	0.365	40.65	21.36
IV	0	0	106	0	25	0
	0.622	1.264	100.3	0.954	0.952	0.006
	0.669	1.036	102.5	0.336	0.362	0.014
V	0	0	0	0	0	0
	0.002	0.003	0.995	1.254	0.225	1.260
	0.652	0.021	0.652	1.005	0.365	0.658
VI	0	0	0	0	0	0
	0.021	0.958	1.007	0.004	0.225	1.260
	0.035	0.729	0.548	0.841	0.365	0.658
VII	0	0	100	0	15	0
	0.204	0.256	100.2	0.584	16.23	0.265
	0.264	0.145	100.9	0.169	15.45	0.646
VIII	69	35	0	0	40	20
	66.25	30.26	0.684	0.298	46.20	20.32
	62.14	33.25	0.214	1.921	40.32	20.36

To exhibit the diagnostic capacity of the type set of rules for one of kind training samples and to affirm the correctness of the usage of the guide vector distribution (SVM) set of rules, we take two different type algorithms for functions contrast, the BP neural network (BP) algorithm with the simple Bayesian community set of rules. (NB), and we calculate the diagnostic accuracy based totally on one-of-a-kind education fashions, proven in Table V.

TABLE III. ACCURACY RATES OF TEST RESULT

Type	SVM	NB	BP
I	80.67%	77.25%	76.92%
II	82.54%	80.45%	79.93%
III	73.46%	72.99%	72.05%
IV	75.81%	74.63%	74.39%
V	81.40%	81.12%	80.89%
VI	82.33%	80.28%	80.05%
VII	79.55%	78.46%	77.90%
VIII	83.56%	81.12%	80.78%

Table Ⅴ shows that for the detection of the speed-up fault, the SVM-primarily based fault detection has finished the highest detection accuracy and reliability in comparison with other fault detection technique.

VI CONCLUSION

The renovation of electrical system inside the teach is the principle feature of all electric powered trains, and alternate manage could be very vital in sign renovation, which has a superb effect on educate safety, improving efficiency and reduction within the variety of employees. Attempt. The conventional management of electrical device in railways has been advanced maturely and gradually inside the route of information, but there are nonetheless many problems that have to be stepped forward during improvement. In this paper, we only cognizance on the hassle of illness information recorded throughout the control alternate system, recommend a disorder detection method based on SVM, and make full use of the extraction procedure to complete the

verification procedure. It must be provided by the next meeting, which will provide an appropriate foundation for fault detection inside the electric powered teach.

REFERENCES

1. Zhang Kai. Research on intelligent diagnosis of railroad turnout fault based on neural network [D]. Chang'an University, 2016.

2. Zhai Y. Q. Research on the application of Bayesian network in turnout control circuit fault diagnosis [D]. Lanzhou Jiao tong University. 2012.

3. Zou Yunhuai. Research on turnout fault classification based on text mining [D]. Beijing Jiao tong University. 2016.

4. Tian Jian. Research on High-speed Railway Turnout Fault Diagnosis Method Based on Fuzzy Neural Network [D]. Beijing Jiao tong University.2015.

5. Zhu Mengwen. Research on ZYJ7 type speed switch fault diagnosis system. [D]. Southwest Jiao tong University. 2016.

6. Zhao Yang. Text mining-based fault diagnosis for on-board equipment of high-speed railway signalling system. [D]. Southwest Jiao tong University.2015.

7. An Chunlan, Gan Fangcheng, Luo Wei et al. Fault diagnosis method of wavelet packet energy of speed raising turnouts [J]. Journal of Railway Science and Engineering, 2015, 34(2): 269-274.

8. Zhang Talent. Research on current curve analysis of S700K rutting machine based on Fret and improved BP neural network [D]. Lanzhou Jiao tong University, 2015.

9. Tang Xiaotao Trouble. Shooting of speed raising turnout (S700K rutting machine) [J]. Science and Technology Innovation Herald, 2009, 43(29): 40-40.

10. Deng S, Lin S Y, Chang W L. Application of multiclass support vector machines for fault diagnosis of field air defence gun [J]. Expert Systems with Applications, 2011, 38(5):6007-6013.

11. Prasadu Peddi (2015) "A review of the academic achievement of students utilising large-scale data analysis", ISSN: 2057-5688, Vol 7, Issue 1, pp: 28-35.