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Research Progress on Wear Degree of Mine Filling Pipeline Based on Voiceprint Recognition

Yijun Xing[1], Peng Yang[1, *]

[1]Beijing Key Laboratory of Information Service Engineering, Beijing Union University Beijing, China

[*] Corresponding author: Yang Peng (Email: yangpeng@buu.edu.cn)

Abstract: With the increasing demand for mineral resources, the number of mines with favorable mining conditions is gradually decreasing. Human beings are faced with the challenge of having to mine resources in depth, and important engineering problems in deep mining are constantly emerging. On the one hand, it requires a large amount of mineral resources, and on the other hand, sustainable development and green mining are required to protect the environment. Debris flows, etc., seriously threaten the safety of human existence. Therefore, it is critical to know the wear level of the filling line. There are various technologies for non-destructive testing. In order to explore new non-destructive testing technologies that are easy to apply in underground mines, the application of traditional testing technology and new voiceprint recognition technology in mines and the development of future applications are discussed.

Keywords: Filling line, Non-destructive testing, Voiceprint recognition.

1. Introduction

The development and utilization of mineral resources is the basis for the development of human society and the progress of civilization. More than 70% of the production resources on which the global economy depends are derived from mineral resources. With the continuous evolution of the industrial revolution, the demand for mineral resources in countries around the world is also increasing year by year, and even many strategic mineral resources have become a bottleneck resource area in my country. With the increasing demand for mineral resources, the number of mines with superior mining conditions is gradually decreasing. Human beings are faced with the challenge of mining resources deep in the mines, and important engineering problems such as deep mining continue to emerge. On the one hand, it needs a lot of mineral resources, and on the other hand, it needs to achieve sustainable development and green mining to protect the environment. Mining will inevitably have a certain negative impact on the mining environment, resulting in unstable surrounding rock, surface movement, and geological disasters such as collapses, landslides, mudslides, etc., which seriously threaten the safety of human existence[1].

New and environmentally friendly mining methods have been paid attention to and developed. Among them, the tailings-cemented filling mining method is widely used, that is, the mining tailings generated by mining are filled into the underground goaf to avoid mining hazards caused by underground collapse. The integrated solution has become an integrated solution. a major trend in the world mining industry[2].

During the mining process, the filling slurry, such as tailings cement, is continuously transported from the ground filling station through the special filling pipeline to the underground working space. Complete the mining task under the layer.

The engineering problem of long-term transportation of filled slurry pipelines is how to accurately grasp the wear conditions of the pipelines. Once ruptured, major safety accidents are very likely to occur. Therefore, how to understand the wear of the filling pipeline on site through simple non-destructive testing methods has become an important research topic within a safe range.

2. Traditional Mine Fill Pipeline Inspec-tion Technology

2.1. Sonic detection

Acoustic detection[3]is a conventional non-destructive testing technology that can be detected by the frequency of effective acoustic waves. Acoustic detection technology originated from the development of single- and dual-channel acoustic wave instruments in the 1970s. Observe the propagation and characteristics of sound waves in the medium, and analyze the physical and mechanical properties of the medium. When using the non-destructive testing of the filling pipeline, the ultrasonic thickness gauge is used to emit sound waves to the parts to be tested. If the inner wall of the filling pipeline is damaged, the ultrasonic waves will be reflected. Determine whether the filling pipe is worn or not by the reflected sound waves. The commonly used sound signal detection technology is to detect the sound wave signal propagating inside or on the surface of the solid medium to achieve the purpose of target detection, identification and positioning.

2.2. Electromagnetic detection

Electromagnetic testing uses the principle of electromagnetic coupling to excite and receive ultrasonic waves and has become a new technology in the field of non-destructive testing. Guanbao Li[4] uses low-frequency magnetostrictive ultrasonic guided wave technology to screen for long-distance pipe wall defects and 100% internal and external corrosion screening of the pipe wall. Effectively solve the pipeline inspection and improve the detection efficiency; SUN Hai-jiang[5]. used the pipeline current detection system based on the alternating current gradient method to detect buried steel pipelines, and applied the erosion damage prediction method based on multiphase flow analysis to long-distance transmission. The internal corrosion

prediction of pipelines and the electromagnetic detection system are applied to the detection of the outer protective layer, external corrosion and leakage points of the buried pipelines so as to effectively ensure the safe operation of the buried long-distance pipelines.

3. Mine Pipeline Detection and Detecti-on Technology Based on Voiceprint r-ecognition

Voiceprint recognition[6] technology is a biometric technology that distinguishes a piece of sound from other sounds based on its acoustic characteristics. With the development of digital technology and digital signal processing technology, people began to apply this technology to various fields related to sound technology and achieved a lot of breakthroughs. In the application process of voiceprint recognition, it is mainly divided into two parts: feature extraction and pattern recognition. Feature extraction is the process of extracting the characteristic parameters that characterize the sound, and pattern recognition is to match the extracted feature signal segment with the target signal to draw a conclusion.

3.1. Principle of voiceprint recognition technology

Voiceprint recognition is a pattern recognition problem that mainly includes three stages: sound signal preprocessing, sound feature parameter extraction, training model and recognition. The flow chart is shown in Figure 1.

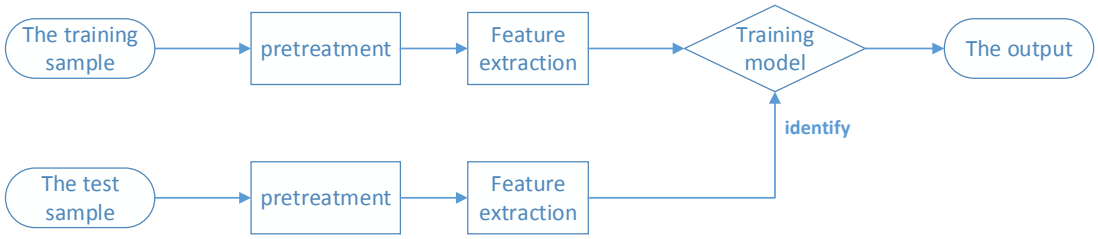

Figure 1. Voiceprint recognition flowchart

Preprocessing: Preprocessing is the leading link of voiceprint recognition and an essential key task. The object it processes is the original sound signal, and the result of preprocessing directly determines the performance of subsequent recognition tasks. In addition to the traditional pre-emphasis, framing and windowing functions, the preprocessing of the sound signal also includes steps such as sound noise reduction and sound endpoint detection.

Feature extraction: The task of feature extraction is to describe the original information with less information, that is, to extract robust parameters that can describe the main features of the original signal. The extracted features are often required to be reliable, stable and easy to extract. The essence of feature extraction is a process of data compression and dimensionality reduction, which transforms the original speech signal with high redundancy, inconspicuous features, and intractability into a sequence of feature vectors with low redundancy, obvious features, and easy processing. Voiceprint features have been developed for many years, and some more reliable parameters have been found, such as linear prediction cepstral coefficients, Mel cepstral coefficients, and speaker identity feature vectors.

3.2. Development of voiceprint recognition technology

In 1960, the voiceprint recognition technology was applied to speaker recognition under research based on knowledge related to the statistical analysis of the variance of the voiceprint recognition method in the field of signal processing in the form of template pairing and made significant progress. The subsequent analysis method and theory are: the Mel Frequency Cepstral Coefficient (MFCC), which maps the linear cepstrum to the Mel nonlinear spectrum based on auditory perception and then converts it to the cepstrum. The two most commonly used feature extraction methods are MFCC and FBank. With the evolution of the voiceprint model, the traditional voiceprint recognition technology has been combined with algorithms such as acoustics, machine learning, and signaling. Thoughts continue to improve. Over time, end-to-end systems were developed from this. By definition of pattern recognition, a Gaussian mixture model is a parametric generative model with representational power for real data; a general background model is a model based on a Gaussian mixture model. It is improved from above and trained from a large amount of mixed data. The sound segment required for detection is too long, does not meet the actual use requirements, and lacks compensation corresponding to channel variability. With the rapid development of machine learning technology, the powerful nonlinear classification ability of the support vector machine kernel function has greatly improved the application performance of voiceprint recognition, and at the same time, to a certain extent, it compensates for the effect of channel deformation on voiceprint modeling. Impact. The last stage is now voiceprint recognition with the help of deep learning, from the fusion of voiceprint recognition algorithms to the replacement of traditional voiceprint recognition modules to the proposal of a new voiceprint recognition scheme based on deep learning algorithms. It is an important research hotspot at present and a future research trend.

4. Conclusion

In the application of detection and identification of the wear of mine filling pipelines, taking Jinchuan Nickel Mine Group in Gansu Province as an example, the traditional method is that experienced workers judge by visual inspection, tapping on the pipeline, etc. This method is inefficient and requires workers to pass inspection. Due to the complex environment of the mine, errors are prone to occurring, so the limitations are strong. Compared with traditional sound wave detection and electromagnetic detection, the voiceprint recognition method has the following advantages: (1) By collecting the sound data generated by the friction between

the filling pipe and the slurry and extracting the parameters containing the sound characteristics, the characteristics of the pipe can be analyzed by the characteristics. state, so as to take corresponding measures to reduce the harm. (2) Compared with other non-destructive testing technologies, voiceprint recognition technology is more suitable for mines, and the sound signal is easy to obtain. Therefore, it is particularly important to study a voiceprint recognition processing process suitable for the sky-high pipeline in the mine, so that it can accurately judge the degree of wear on the pipeline. For the improvement of the mine pipeline detection system and the maintenance of pipeline safety, it is particularly important to promote the information visualization of the mine system.

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