A Study on Classification Method of Mine Vibration Based on Microseismic Monitoring Cloud Service Platform

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ABSTRACT: With the gradual deepening of mining depth, sudden ground pressure disasters such as rock burst and collapse caused by deep high stress and high rock pressure are major hidden dangers affecting mine safety production. Microseismic monitoring technology has been widely applied in the field of mine ground pressure disaster warning. The existing microseismic monitoring system has some problems, such as inaccurate automatic recognition and classification of waveform signals, low quality and low efficiency of manual processing. In this paper, the automatic classification of vibration signals in the process of mining is studied, and the automatic classification results are uploaded to the cloud service platform in real time, which solves the technical bottleneck of the existing microseismic monitoring system. Meanwhile, the real-time monitoring of mine ground pressure safety is guaranteed based on the cloud service platform of microseismic monitoring.

1. INTRODUCTION

Mineral resources in China are gradually entering the stage of deep well mining. The ground pressure disasters induced by deep high stress and high rock pressure, such as roof collapse, cave-in and rock burst, have seriously affected the safety of mine production. Therefore, mine safety monitoring has great social demand and practical value. Microseismic monitoring technology is widely used in the field of mine ground pressure safety monitoring. The existing microseismic monitoring system has problems such as inaccurate automatic identification and classification of waveform signals, low quality and low efficiency manual processing [1-6]. In this paper, the automatic classification of vibration signals in the process of mining is studied, and the automatic classification results are uploaded to the cloud service platform in real time, which solves the technical bottleneck of the existing microseismic monitoring system. Meanwhile, the real-time monitoring of mine ground pressure safety is guaranteed based on the cloud service platform of microseismic monitoring, which is of great significance for mine production safety [7-8].

2. METHOD

Generally, a time-varying signal can be decomposed into a superposition of multiple eigenfunctions, that is, the signal can be expressed as $x(t)$

$$x(t)=\sum_{k=1}^{K}A_k(t)\cos(\theta_k(t))+e(t)$$

Where: $A_k(t)$ is the instantaneous amplitude of the kth component; $\theta_k(t)$ is the instantaneous phase of the kth component; $e(t)$ is noise or error; k is the number of decomposable components of a signal. Based on the wavelet transform, the synchronous squeeze transform rearranges the wavelet coefficients in the scale direction to make the energy return to the real instantaneous frequency. After the time-frequency transformation of a certain original vibration signal in mine, the time-frequency information is shown in Figure 1.

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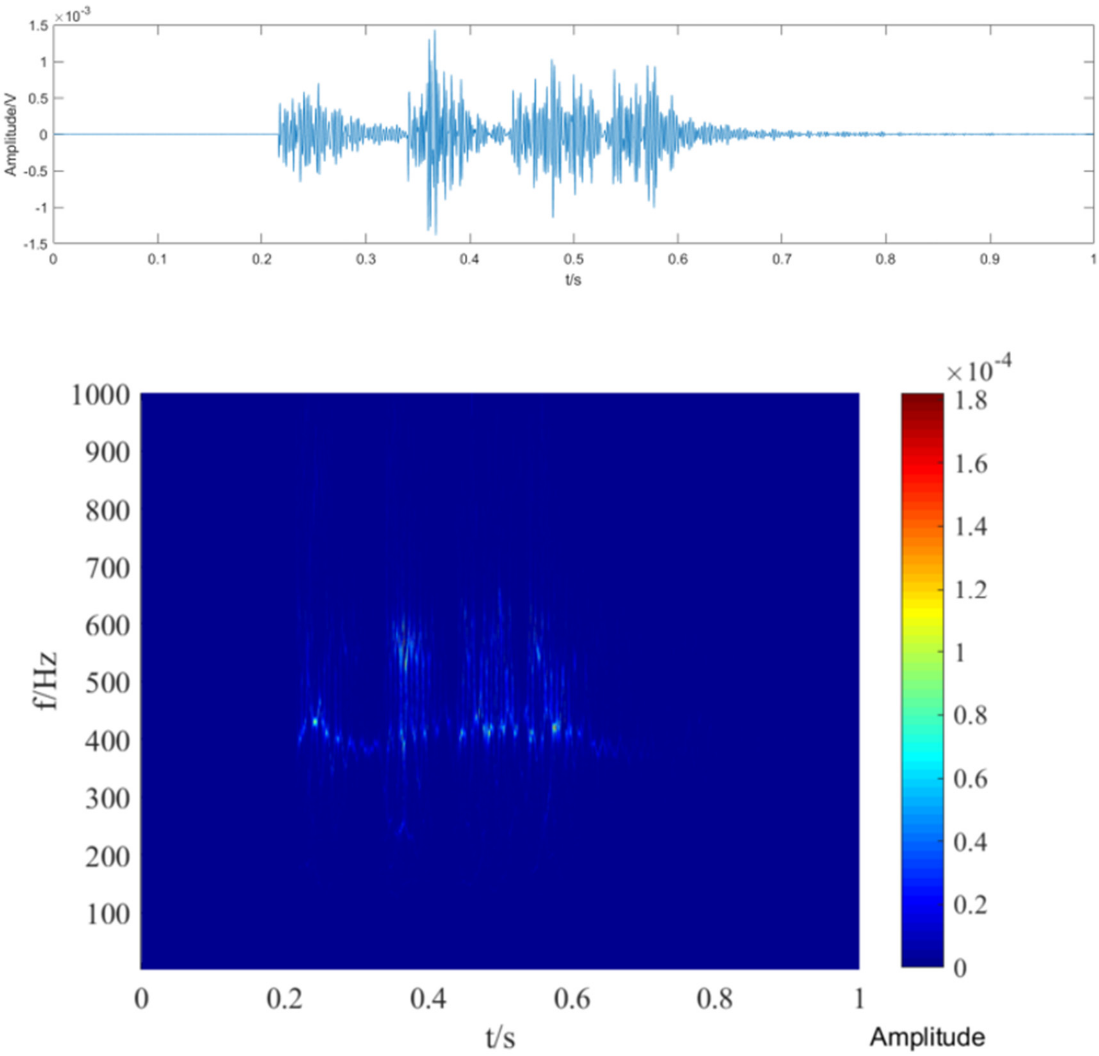

Figure 1. Time and frequency distribution of mine vibration signal

3. EXAMPLES

According to the time-frequency analysis of microseismic signal, blasting signal, drilling signal and electrical noise signal, automatic classification is carried out according to the differences, and the results are shown in the figure. The system automatically identifies microseismic signals as shown in Figure 2, blasting signals as shown in Figure 3, drilling signals as shown in Figure 4, and electrical noise signals as shown in Figure 5. The automatic classification results are uploaded to the cloud service platform in real time, as shown in Figure 6.

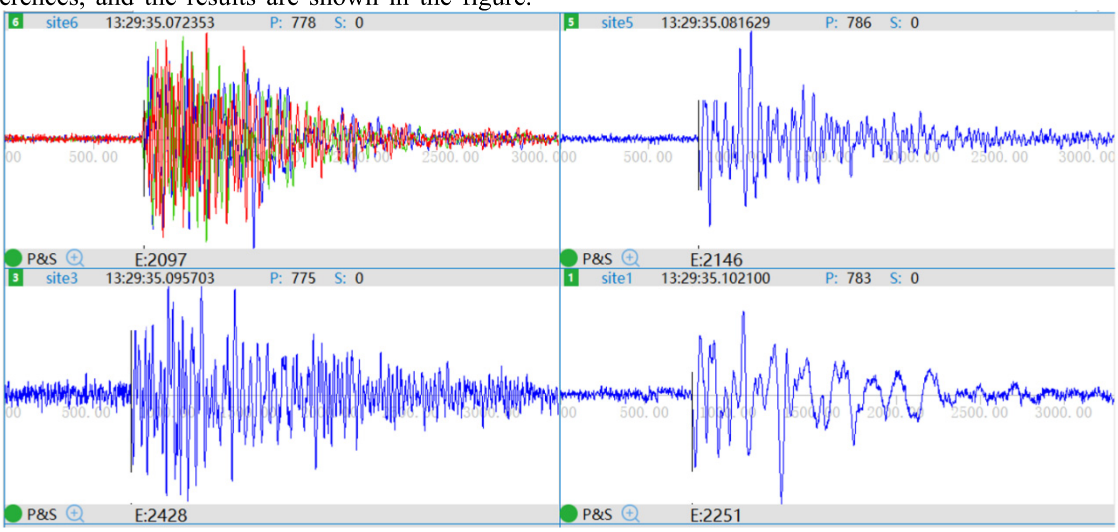

Figure 2. The microseismic signal automatically recognized by the system

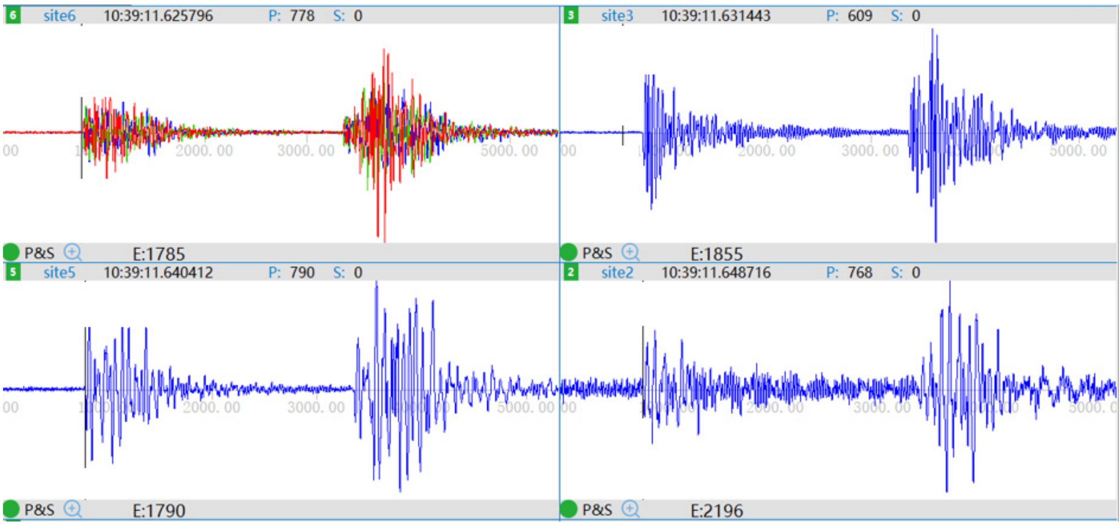

Figure 3:The blasting signal automatically recognized by the system

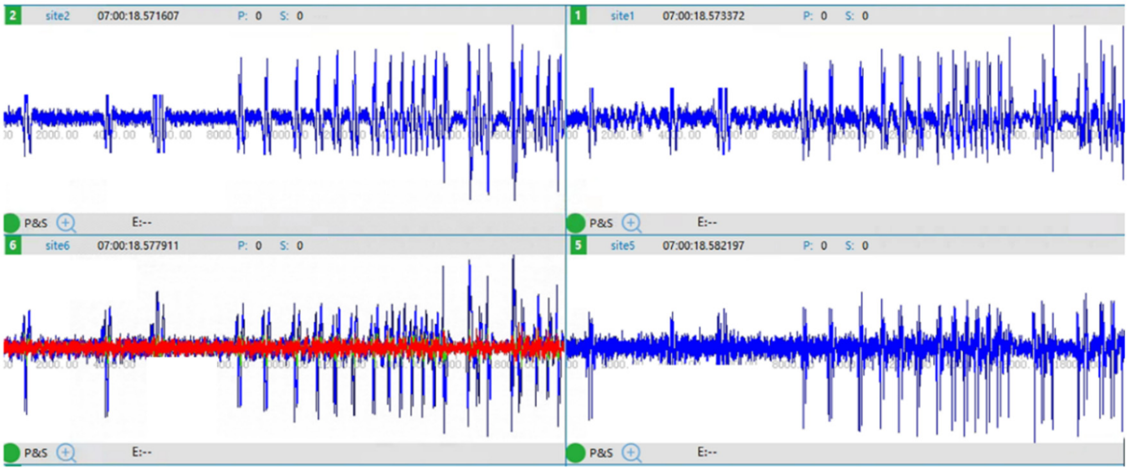

Figure 4:The drilling signal automatically recognized by the system

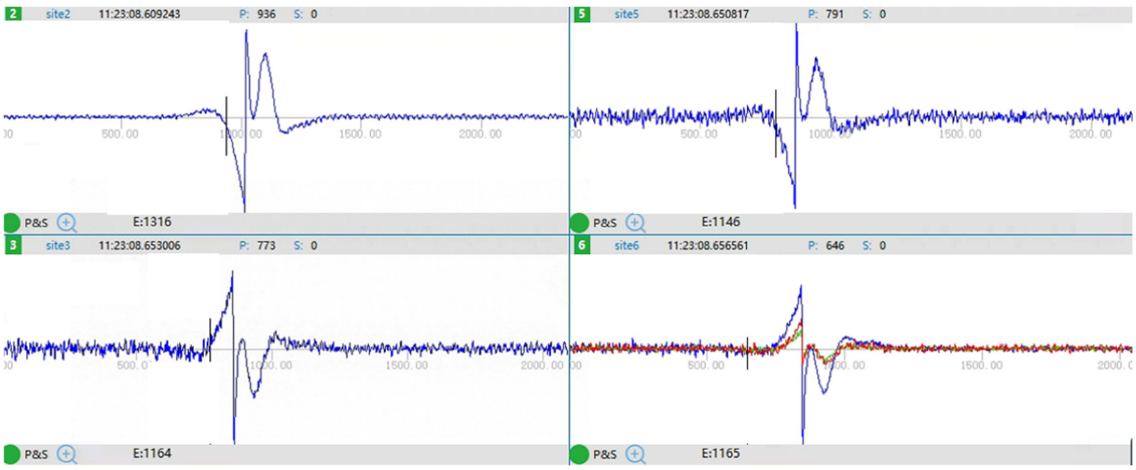

Figure 5:The Electrical noise automatically recognized by the system

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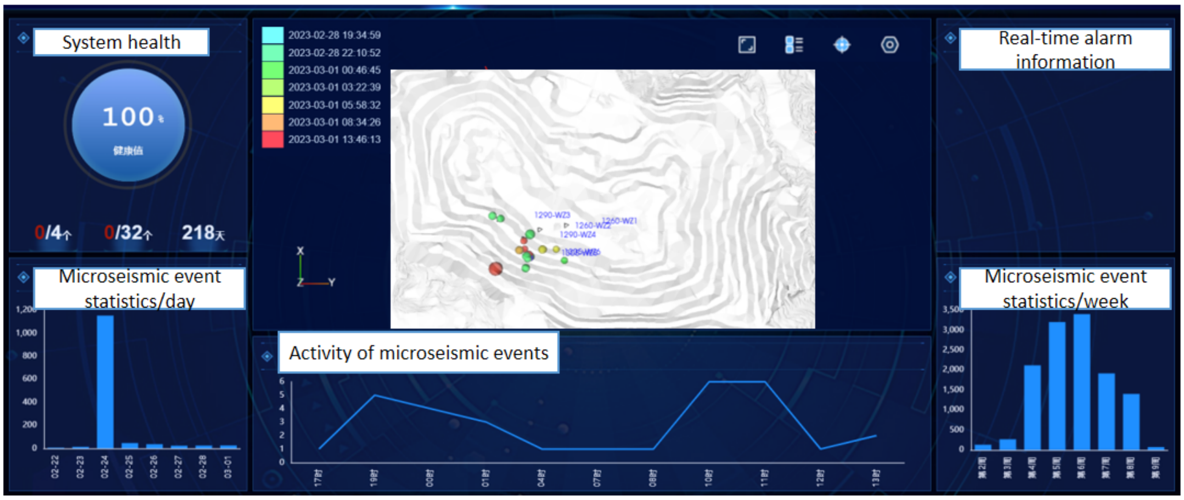

Figure 6: The microseismic signals are automatically uploaded to the cloud service platform

4. CONCLUSION

In this paper, aiming at the problems of inaccurate automatic identification and classification of waveform signals in the existing microseismic monitoring system, low quality and low efficiency of manual processing, the automatic classification of vibration signals in the process of mining is studied, then the automatic classification results are uploaded to the cloud service platform in real time, which solves the technical bottleneck of the existing microseismic monitoring system. The microseismic monitoring cloud service platform ensures the real-time monitoring of mine ground pressure safety.

ACKNOWLEDGEMENT

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