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Analysis of Surface Morphology and Block Size of Blasting in Open Pit Mines based on Digital Mining Technology

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Abstract

The ore particle size distribution reflected by the blasting heap after blasting is one of the indicators used to judge the blasting effect. The reasonable ore particle size distribution after blasting can reduce the subsequent blasting workload to reduce the mining cost of blasting and lay a foundation for mineral processing, which is an important step of mineral processing automation. Now in our country usually explosion the heap of grain size analysis method of screening method, water sedimentation method or electron microscopy and determination method, and the paper adopted the above is accurate and effective image granularity analysis method, to overcome the artificial error through the use of modern information technology and digital mining technology for open-pit mine production blasting explosive area based on subsequent decisions.

Keywords

Digital Mining; Particle Size Analysis and Research; Image Particle Size Detection Methods.

1. Research Background and Significance

Ore blast quality plays a very important role in optimizing blasting parameters, reducing mining costs and improving production efficiency [1]. Usually, the blasting effect of open pit ore can be measured by the accumulation position of the blast pile, the blasting vibration, the particle size distribution of the blasting pile ore, the cost of blasting and other indicators, among which the particle size distribution of the blasting ore is an important basis for quantitatively measuring the blasting effect, and it is also an important reference basis for the optimization of blasting quality management and blasting parameters[2-3]. Efficient and accurate ore particle size identification can guide the optimization and design of blasting parameters, thereby further reducing the workload of secondary crushing, improving the efficiency of the subsequent processing process of the blast reactor, and improving the utilization rate of resources. Accurate determination of the particle size and particle size composition of the blasting rock can not only improve the blasting process, but also be an important technical basis for carrying out blasting optimization research[4], which is an important research topic in the field of mining applications today.

2. Particle Image Method

The size of the particle is called particle size, and under normal conditions, the size of the particle is expressed in diameter, so it is also called particle size. Particle size is an important structural feature of minerals and is the basis for their classification and nomenclature. Particle size analysis has a wide range of applications in the petroleum and geological industries, and the results are important basic data for sedimentary environment research, material movement mode determination, hydrodynamic condition research and particle size trend analysis, and can also be used as an auxiliary means for formation comparison. Particle size detection methods have a variety of forms, commonly used

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methods are: sedimentation method, light scattering particle size test method, laser coherence spectroscopy particle size analysis method, and the image method used this time. From the current domestic situation, there is no better automation system for blasting ore, but the Maanshan Mine Research Institute proposes to use static photography to shoot the blast rock blocks, obtain random negatives, and then enlarge the pictures, and then thicken the edges of the rock blocks by manual methods, and then the processed pictures are processed by gray level detection, take intermediate results, and then use computer processing to obtain the distribution law of the pile rock blocks [5].The method is simple, reasonable, can be used in practice, and the usual detection method although there is a large number of ore often need to consume a lot of time and affected by many factors, the same sample after the study of different inspectors will also have a certain error, through the computer hardware and software on the basis of the ore sample sampling, processing analysis of images, reference selection and ore and background separation and other steps of objective analysis of rock particles can get more accurate results. The application of computer image processing technology in the analysis of ore blasting effect will become the trend of blasting technology development, which will bring immeasurable economic benefits to mine production.

3. Background of Digital Mines

At present, with the sharp increase in the demand for mineral resources and the reduction of mineral resource reserves, and the conditions for mining mineral resources are getting worse and worse, the requirements for the mining safety environment are becoming more and more stringent, so digital mines are an inevitable trend in the development of mining. The ultimate goal of digital mining is to achieve truly safe, efficient and economical mining of mines, which can not only meet the needs of human beings for mineral resources, but also adapt to the carrying capacity of ecology and environment, and achieve the goal of scientific sustainable development. Although the development of digital mines has achieved impressive results for more than a decade, the construction of digital mines is still in its infancy. The development prospects of digital mines are very broad, but at the same time full of challenges, on this basis, the blasting surface form and block degree analysis and development of various functions of mine application software, mine information analysis and application, mine production quality assessment and monitoring, mine engineering simulation and decision-making, etc., are based on various application software and related models as tools. For different applications and mine engineering needs, research and development of mining application software suitable for different users, with different functions, such as mining CAD, virtual mine, mining simulation, engineering calculations, artificial intelligence and scientific visualization and other software tools, this analysis using Desktop64 software for granular analysis.

4. Desktop Analysis and Processing

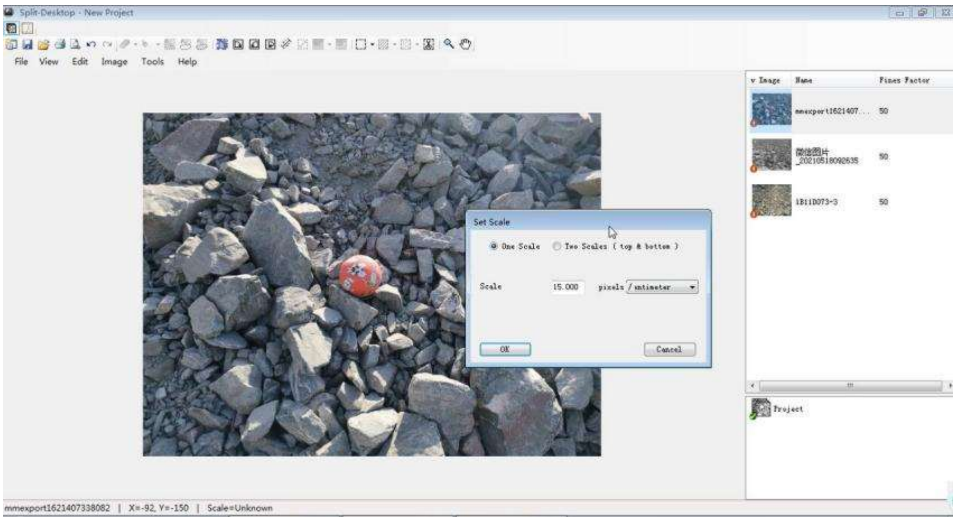

Figure 1. Setting the data for the reference object

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Based on the photos of the ore site after the blasting of a mining area, the data is analyzed according to the size between the reference object and the stone block.

(1) Import the pictures of the explosion area that need to be processed, and import the images collected at the explosion site into the software for processing. Create a project for each exploded image and build a separate database for that project, and each project can import one or more images at a time.

(2) The number and size of the reference objects are determined before setting, and the analysis is set to a single-ball reference object analysis and a small ball as the reference object is set at 15.00cm.

(3) Pick up boundaries

The upper strip is used to adjust the number of blue borders, some parts can not be automatically picked up need to be manually adjusted, appropriate adjustment to find the most appropriate value for the next step of operation, the lower strip is used to adjust fine particles, and the upper and lower strips are adjusted to the most appropriate value for the next step of processing.

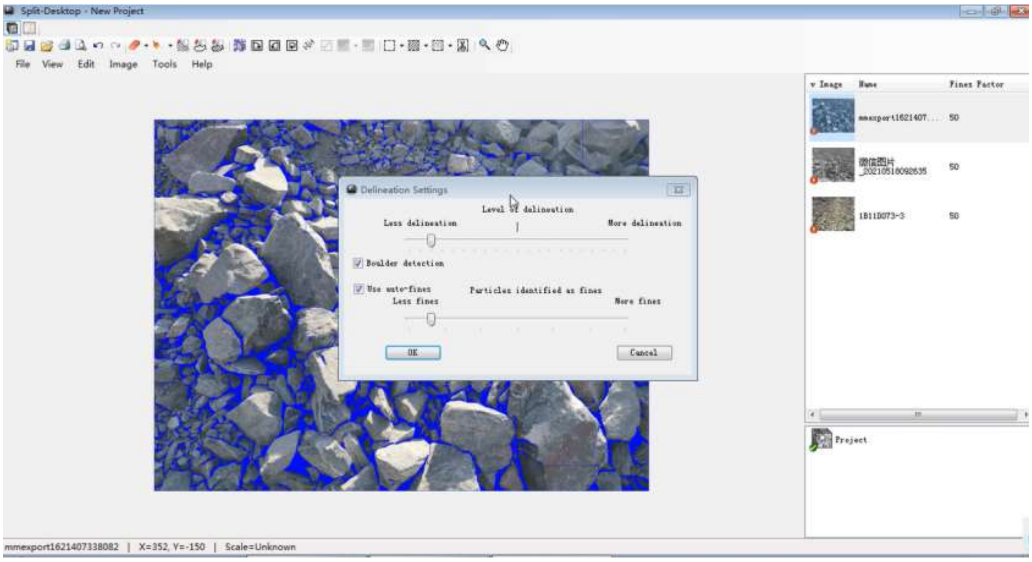

Figure 2. Adjusts the blue boundary and the fine particle values

(4) Reference treatment

The reference is closed to separate from the rock and filled, marking the diameter of the reference object by 15 cm.

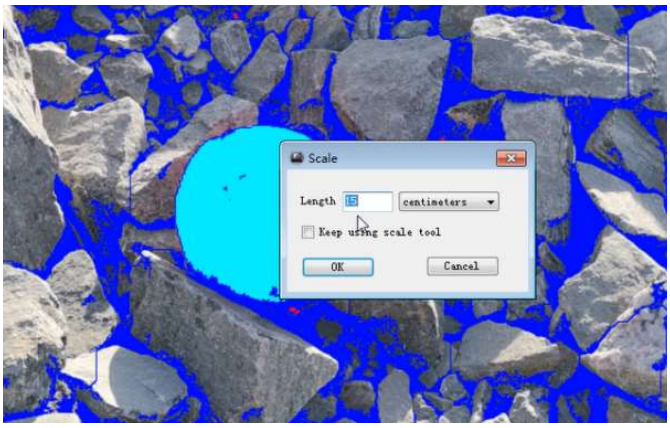

Figure 3. Processing reference objects

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(5) Manually adjust the fine particles, draw the contour of the large rock, switch the site shape of the rock with the left and right keys to describe the contour in detail, and the results of the fine particle delineation treatment are shown in Figure 4. The comparison results before and after the overall graphical analysis processing are shown in Figure 5-6.

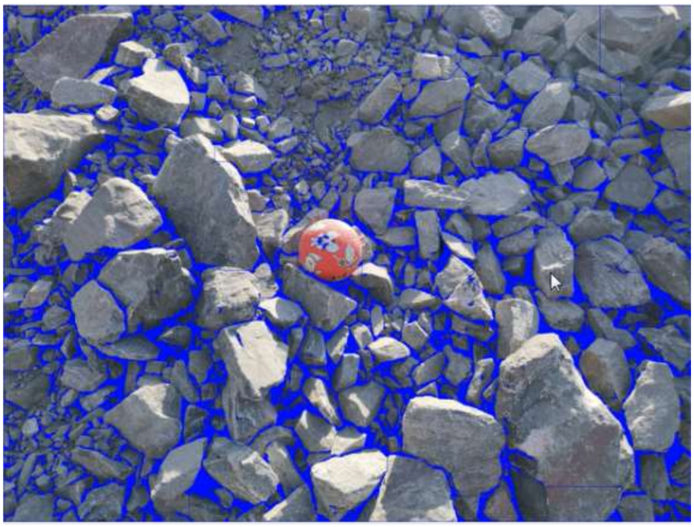

Figure 4. Fine particle delineation treatment

Figure 5. Before analysis processing

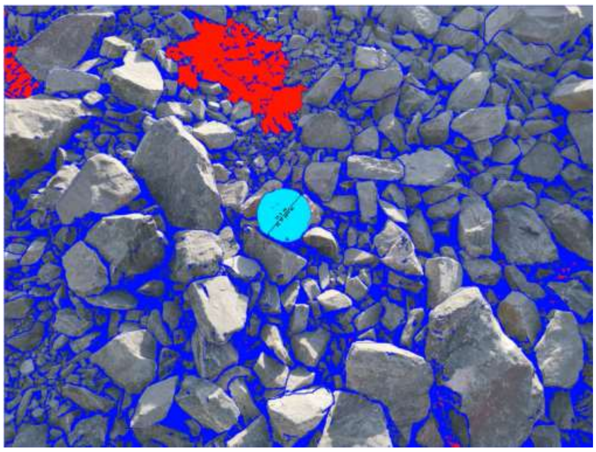

Figure 6. After analysis processing

(6) Analysis results

The images of magnetite in different blasting areas of a mining area were used for particle size analysis and processing. The processing results are shown in Table 1. From the data in Table 1, it can be seen that the particle size of ore shows a decreasing trend from large to small. The curve of particle size analysis results is shown in Figure 7.The study shows that after blasting in the blasting area of the mine, the large-grained ore accounts for a relatively heavy proportion, while the fine-grained ore accounts for a relatively small proportion. Before the ore beneficiability test, the ore material composition of the deposit should be studied first, and the ore types should be divided. Identify the occurrence state of elements, identify mineral species, ore structure and structure, particle size characteristics, analysis will be in line with the size of the ore beneficiation treatment can also be the larger size of the rock for one or two stages of grinding to ensure the beneficiation work.

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Table 1. Results of grain size analysis

Ore types	Critical area	% Passing	Size[cm]
Magnetite	01	X10	0.02
		X20	0.39
		X30	2.67
		X40	11.93
		X50	22.70
		X60	32.33
		X70	43.48
		X80	58.60
		X90	88.01
		Topsize (99.95%)	490.25
Magnetite	02	X10	0.27
		X20	1.62
		X30	4.26
		X40	8.27
		X50	14.26
		X60	20.76
		X70	27.53
		X80	35.80
		X90	48.47
		Topsize (99.95%)	134.82
Magnetite	03	X10	0.51
		X20	3.74
		X30	10.35
		X40	19.69
		X50	31.39
		X60	49.51
		X70	83.85
		X80	172.13
		X90	286.05
		Topsize (99.95%)	498.28

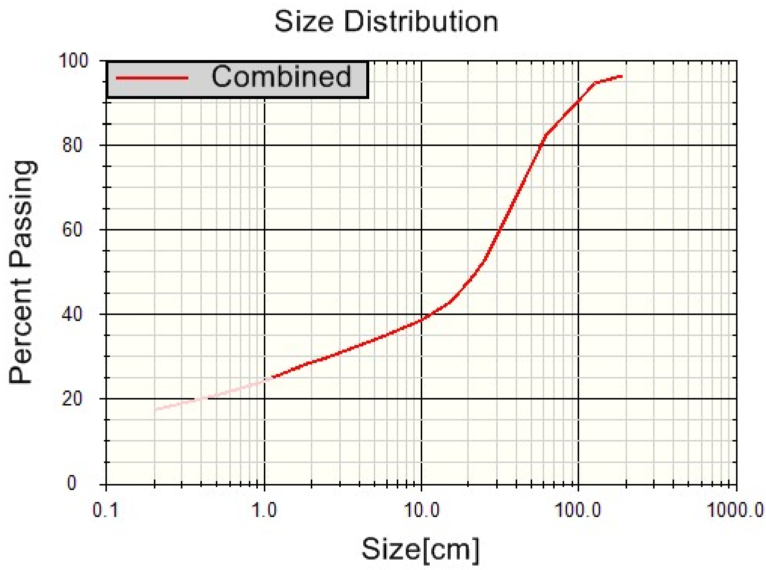

Figure 7. Curve of particle size analysis results

5. Deficiencies and Prospects

(1) Although the particle size analysis in this paper obtained more ideal analysis results, due to the uncertainty of the open-pit ore image itself, it is inevitable that some rock blocks will be over-analyzed and lack of analysis, for example, when the quality of the rock mass image is better, the analysis results are more reliable, and the analysis results are not very ideal, and some manual processing is required.

(2) Given the limited research conditions and standards, the granularity analysis has artificial or non-human factors leading to errors, and the research can still have room for improvement.

6. Conclusion

Digital mine, also known as smart mine, is a digital intelligent body that can complete the accurate and timely collection, networked transmission, standardized integration, visual display, automatic operation and intelligent service of all information of mining enterprises on the basis of mine digitalization. On this basis, this paper applies the accuracy, simple operation, fast calculation and easy maintenance of the image analysis method to achieve high-efficiency ore particle size analysis in the explosive area of the mining area. In the production process, the process parameters of the grinding mine can be adjusted in time according to the data obtained after processing, which helps the actual production. Image particle size analysis based on digital mines has good practicality for improving grinding efficiency and improving beneficiation automation production, which has a very broad prospect.

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