Automatic Tunnel Geological Condition Analysis System Using Multi-Spectral Images

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System Summary

This system photographs a multi-spectral image of a tunnel's face, then analyze it with AI to determine how much bedrock weathering has occurred.
A distribution map (Fig. 2) of the cutting face's degree of weathering is automatically created from the multi-spectral image only by an AI. The AI learns the relationship of "spectral reflection intensity curves obtained from each areas of the multi-spectral image (Fig. 1)" and the "area of weathering determined by the engineer's observation of the tunnel face" using both as teacher data.
"Spectral reflection intensity curves" and "weathering" relationships of around 5,000 areas in groups of granite, andesite, tuff, and other rocks were given to the AI to build the algorithm to determine the degree of weathering. As a result, the AI learned to determine the degree of the weathering of a bedrock with equal accuracy as geological engineers.

Actual Usage of the System

A measuring vehicle that has a light source and can automatically obtains multi-spectral images (Photo 1) was brought to the construction site. A program that automatically processes measurement to data output was developed. With the vehicle and the program combined, geological information of the tunnel face can be obtained automatically in a short time.
The vehicle also has systems installed to measure the intensity and conditions of cracks of the bedrock, which are both important indicators to evaluate bedrock.

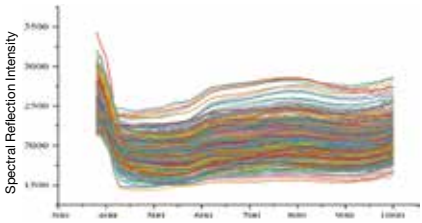

Fig. 1 Sample of a Spectral Reflection Intensity Curve

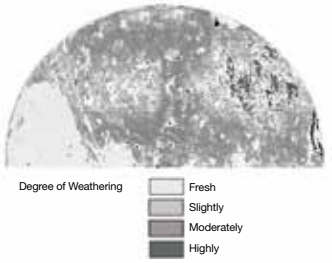

Fig. 2 Sample of an Auto-analysis Using the System

Photo 1 Measurement Vehicle