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Applications of wavelet texture analysis and image segmentation to problems of artificial intelligence

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Wavelet transforms have been used for the last two decades for processing and analyzing data. Wavelet transforms, like Fourier transforms, approximate complex data as a weighted sum of simple functions obtained from an orthogonal basis function. Wavelet transform techniques are particularly powerful for analysis of non-stationary and scale-dependent datasets. Image segmentation is a method of identifying potential thresholds of interest. Otsu's method finds the threshold which maximizes between-class variance in the image grayscale histogram.

One wavelet transform technique, wavelet texture analysis (WTA) has generated particular interest in the medical field for its potential use in artificial intelligence and computer-aided diagnoses. WTA can be used in conjunction with neural networks to build databases that can be used for machine vision.

Here we demonstrate one application of WTA by identifying artificial and geologic textures using functions we have built in the Matlab environment. By applying wavelet transforms on an image which has been simplified using image segmentation, textures can be identified via statistical pattern recognition quickly and efficiently. The program can correctly identify texture type of artificial texture images 100% of the time. Similarly, it can be used to identify the type of real biogenic sedimentary structure with an accuracy ranging between 85-100% depending on the texture type. The simplicity and speed of the program suggests a wide range of potential applications in

machine vision systems.