

Optimized stochastic resonance method for signal detection and image processing



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Invention

Stochastic resonance (SR) is a phenomenon where the performance of a nonlinear system can sometime be enhanced by adding a suitable noise to the input signal. The widely employed signal-to-noise ratio (SNR) gain-based stochastic resonance approaches have several severe limitations. The definition of SNR varies from one application to another, and a priori knowledge of the signal is required. Additionally, SNR is not directly related to detection performance when the noise is non-Gaussian and the system is nonlinear. This technology provides a method for determining the optimal noise to add to improve detection performance. This technology can also be employed in other applications such as image and video processing, communication, and biomedical signal processing.

Technology

This method determines the stochastic resonance noise probability density function to be added to an observed data process to optimize detection. The function can also be added to an image to optimize detection of objects. The method determines the conditions required for performance improvement using additive stochastic resonance noise. False alarm rates can be maintained without adjusting the detector threshold level.

Applications

- Signal detection and processing in observed sensor data:
 - Electromagnetic and acoustic
 - Radar
 - Sonar
 - Imagery
 - Visual
 - Hyperspectral
 - Multi-spectral
- Communications
- Geophysical
- Environmental
- Biomedical

Advantages

This technology enables improved signal detection using a novel method for determining the optimal SR noise.

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