Fast and robust spectrum sensing method for cognitive radio

Technology #m11-047

Cognitive radio is a wireless communication technology that seeks to increase communication efficiency by dynamically changing transmission parameters in response to actively monitored environmental factors. This communication device relies on spectrum sensing, the task of assessing spectrum usage and the presence of primary users in the geographical area. Current technologies fail to adequately assess spectrum usage despite uncertain knowledge of channel noise characteristics. This technology is a spectrum sensing scheme based on the K-S test, a non-parametric statistical method for comparing continuous, one-dimensional probability distributions for goodness of fit. This technology could be used to design cognitive radio wireless networks that can handle multiple users with improved performance and robustness to noise.

Spectrum sensing based on the K-S test enables faster and more robust filtration of signal from channel uncertainty and noise.

This technology is significantly faster and more robust than available algorithms designed for spectrum detection. Provided with only a short sequence of noise samples, the technology was demonstrated to have a robust signal detection and performance even in the presence of noise. Furthermore, the simulations also demonstrated the technology had improved ability to channel uncertainty and non-Gaussian noise over existing spectrum sensing methods such as energy detectors, feature-based spectrum sensing, and eigenvalue-based methods.

The increased speed and robustness of this technology has been successfully tested in software simulations of multipath fading multiple-input multiple-output (MIMO) channels.

Lead Inventor:

Xiaodong Wang, Ph.D.
Applications:

• Improved performance for design of cognitive radio wireless networks made of multiple users in harsh, demanding, or unpredictable conditions
• Soldiers in combat zones, explorers in exotic locations, large businesses or government agencies with global connections that rely on large amounts of data transfer, and potentially even commercial users who desire better wireless communication.
• Robust algorithm enhances spectrum sensing under conditions where existing technologies perform poorly.

Advantages:

• Robust against impulsive noise and maintains high sensing performance.
• Does not require prior knowledge of the probability of noise and the signal-to-noise ratio of the primary user, as is the case with feature-based sensing methods.
• Significantly outperforms the energy detector in the presence of non-Gaussian noise.
• Requires a comparatively small number of noise samples, as compared to eigenvalue-based blind sensing.

Patent information:

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Related Publications:


Inventors

Xiaodong Wang