Applying Artificial Intelligence to the Development of a Cognitive Radio Engine

Joseph Gaeddert, Kyouwoong Kim, Rekha Menon, Lizdabel Morales, Youping Zhao, Dr. Kyung K. Bae, Dr. Jeffrey H. Reed

Research Project Objectives

- Study and apply AI techniques to the development of Cognitive Radio Engines
- Identify the suitability of the AI techniques for the various cognitive radio tasks
- Evaluate the techniques in terms of functionality and complexity

What is Cognition?
The mental process of knowing, including aspects such as awareness, perception, reasoning, and judgment.

What is Learning?
The act, process, or experience of gaining knowledge or skill.

What is a Cognitive Radio?

Illustration of Cooperative Learning in a Cognitive Radio Environment

Results and Future Work

- Various AI Techniques have been studied and their possible uses for developing Cognitive Radio Engines have been investigated.
- In the near future, our team will be leveraging the knowledge gathered in this research for the design and implementation of a Cognitive Radio Engine using a combination of the AI techniques investigated

Taxonomy of AI Techniques for Cognitive Radio Engine Development

- **Case-based Learning** – useful technique in environments that are dynamically changing, and knowledge is limited but experience is rich.
- **Knowledge-based Learning** – useful technique for tackling new and unforeseen problems not thought of at the time of training.
- **Search Engine-based Learning** – suitable to find the best-fit rule for a given training example.
- **Hidden Markov Models** – can be used to model complicated statistical processes; it is often used for pattern matching; it is easily scalable and can be used to predict based on past experiences.
- **Artificial Neural Networks** – has the ability to describe a multitude of functions; it is easily scalable; it is excellent for classification problems and easily identifies new patterns.
- **Fuzzy Logic** – good for device control with unclear quality boundaries.
- **Cooperative Learning** – enables distributed learning and more reliable, comprehensive situation awareness, relaxes requirement of individual nodes, and reduces network cost.