Title: **Blind Signal Identification for Emerging Intelligent Radio Systems**

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Abstract

Blind signal identification (BSiGI) has been intensively studied for many years for military applications, such as electronic warfare and spectrum monitoring and surveillance. Recently, intensive interest on BSiGI has been shown from the large research community, owing to the emergence of software defined and cognitive radios in the wireless world. The transition from military to commercial applications is extremely exciting, as incorporating intelligence into radios is expected to have significant economic, social, and environmental impacts. It simply represents *an idea whose time has come*. This tutorial will provide an introduction to BSiGC intelligent techniques, presenting main approaches, challenges, as well as new trends. Proofs of concepts will be additionally shown, which are based on off-the-air measurements.

The tutorial will begin with introducing the BSiGI problem, along with its motivation and role in an intelligent radio system. The requirements imposed on algorithms for BSiGI will be discussed, which will show the challenges in intelligently identifying the communication signals, especially in non-cooperative environments. Under such conditions, in addition to channel and transmission impairments, no prior information on the incoming signals is available at the receive-side.

Main classical approaches to the BSiGI problem will be presented, with emphasis on their advantages and drawbacks. Identification of a variety of signals—from analog to digital, from single- to multi-carrier, and from single- to multiple-input—will be provided as illustrative examples. While BSiGI has been intensively studied for single-input signals, research efforts are at a very early stage in the context of multiple-antenna systems. New and challenging BSiGI problems have arisen due to the advent and rapid adoption of multiple-input multiple-output techniques, e.g., estimation of the number of transmit antennas and space-time code identification. Such new trends in BSiGI and potential solutions will be presented.

The key performance metrics will be discussed, along with a performance comparison of various methods for diverse signals. Experimental efforts to incorporate BSiGI intelligence in radios will be additionally presented.

The tutorial will conclude with a summary of BSiGI methods, lessons learned, and directions for future research.

This tutorial is of prime interest to graduate students and researchers who would like to learn more about intelligent radio systems in general and intelligent BSiGI in particular. It is designed for an audience coming from either a communications or a measurement and instrumentation background.