Public Abstract

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In typical problems involving pattern recognition, the challenge lies in selecting a good set of features and in devising a reliable algorithm to recognize any particular vector of such features. In general, even when noise is present in the feature vectors, a single pattern naturally emerges from the domain, and the goal becomes to find the class of patterns that most resemble the observed vector. In many other cases, however, various patterns emerge at the same time, and the complexity of the problem increases since the patterns must now be separated before they can be classified. In this research, we propose a new technique, called Guided Under-determined Source Signal Separation (GUSSS), for recognizing patterns in mixtures of signals. Our proposed method is not only capable of dealing with mixtures of signals, but it also requires a single measurement to do so. Traditional techniques for signal separation, such as Independent Component Analysis (ICA), require the number of measurements to equal the number of sources. In our method, however, only one single measurement is required despite the existence of multiple patterns mixed in the measurement. We tested our method using two different frameworks: classification of chemical compounds using Terahertz signatures; and recognition of hand gestures using surface Electromyographic signals (sEMG) in Robotic Assistive Technology. Our experimental results demonstrate that the proposed technique achieves very good results using a small number of features.