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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 identify the class of learned patterns that most resembles the observed feature vector. Some times, however, the observed vector is not a single, but a mixture of multiple learned patterns and the challenge becomes to recognize all the present patterns and not just one of them. In order to do so, the patterns in the observed feature vector must first be separated -- an apparent paradox since the actual patterns forming the observed vector are hitherto unknown and should probably be identified first. At the same time, many techniques to separate mixture of signals have emerged from the literature in signal processing, but they require multiple and independent observations of the mixture of patterns, which is not usually possible or desirable in a pattern recognition setting. However, we believe that these two problems -- pattern separation and recognition -- are one the same, and it can benefit from a hybrid technique derived from both contexts. So, in this research, we propose a technique based on Source Separation for recognizing patterns in mixtures of signals. From the signal processing perspective, our method can handle extremely under-determined cases, i.e., cases where one measurement is required despite the existence of multiple patterns mixed in the measurement -- a typical scenario from the pattern recognition perspective. We have run extensive tests to demonstrate the robustness and effectiveness of the method. We have also proposed frameworks for applications in various areas such as classification of chemical compounds using terahertz signatures; root phenotyping using terahertz imaging; recognition of muscle activity patterns using surface electromyographic signals (sEMG) for Robotic Assistive Technology; detection of vocal dysfunctions; and Hyperspectral Image analysis.