[O06] Source Separation for Electronic Surveillance

Source separation is a critical early processing stage in electronic surveillance systems where the multiple simultaneously intercepted transmissions need to be detected, separated and identified for possible threats (e.g. pulsed and continuous wave radar, navigation systems, etc.). When the signals to be detected and separated overlap in time and frequency this can prove a challenging signal processing task that cannot be solved through simple filtering or beamforming. Recently sparse representations have emerged as a very powerful technique for solving source separation problems, particularly in underdetermined scenarios (i.e when there are fewer target sources than sensors), including the difficult case of single channel source separation. Sparse representations usually exploit prior knowledge of the nature of the signals to be intercepted to create 'nonlinear' separation algorithms that substantially surpass the performance of traditional filtering techniques. Furthermore, in certain circumstances, they can also be adapted to learn the structure of the signals being observed to achieve the separation in a totally blind manner.

The aim of this project is to develop new algorithms based around sparse representations capable of detection, separation and classification of individual EM signals that overlap in time and frequency. In addition computational efficiency will be pursued by borrowing recent ideas from compressed sensing theory.