Independent Components Analysis

Introductory Overview

Independent Component Analysis is a well established and reliable statistical method that performs signal separation. Signal separation is a frequently occurring problem and is central to Statistical Signal Processing, which has a wide range of applications in many areas of technology ranging from Audio and Image Processing to Biomedical Signal Processing, Telecommunications, and Econometrics.

Imagine being in a room with a crowd of people and two speakers giving presentations at the same time. The crowed is making comments and noises in the background. We are interested in what the speakers say and not the comments emanating from the crowd. There are two microphones at different locations, recording the speakers' voices as well as the noise coming from the crowed. Our task is to separate the voice of each speaker while ignoring the background noise (see illustration below).

This is a classic example of the Independent Component Analysis, a well established stochastic technique. ICA can be used as a method of Blind Source Separation, meaning that it can separate independent signals from linear mixtures with virtually no prior knowledge on the signals. An example is decomposition of Electro or Magnetoencephalographic signals. In computational Neuroscience, ICA has been used for Feature Extraction, in which case it seems to adequately model the basic cortical processing of visual and auditory information. New application areas are being discovered at an increasing pace.

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