Several different types of sensors are used to monitor complex systems and processes. The high volume, variety, and velocity of data acquired by sensors leads to the so-called curse of dimensionality. Accordingly, the key research question of this talk is: *how to fuse information from multidimensional sensor signals for monitoring and prognosis?* This question permeates diverse domains, for instance, in-process monitoring of additive manufacturing processes and identification of epileptic seizures from electroencephalography signals, among others. An approach to answer this question is to map the sensors signals as a network graph. Based on three experimental case studies from two domains, namely, additive manufacturing and neurophysiology, it is demonstrated that this graph theoretic signal processing approach offers an effective means to monitor complex bio-physical systems in a data rich environment.