Similarity Measures in Kernel Space with Applications to Robust Signal Processing and Machine Learning

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Abstract

Similarity measures play significant roles in machine learning and signal processing . In recent years, some new similarity measures were proposed, which are defined as certain distances in kernel space. Typical examples include the Information Potential (IP), Cross Information Potential (CIP), Cauchy-Schwartz Divergence, Correntropy, and so on. In particular, the Correntropy as a nonlinear and local similarity measure is directly related to the probability of how similar two random variables are in a neighborhood of the joint space, controlled by the kernel bandwidth, which also has its root in Renyi's entropy (hence the name "Correntropy"). Since Correntropy (especially with a small kernel bandwidth) is insensitive to outliers, it is naturally a robust cost for signal processing and machine learning. The Correntropy Induced Metric (CIM) as a nice approximation of the l_0 norm can also be used as a sparsity penalty in sparse learning. This talk will give an overview of several similarity measures in kernel space, with a particular emphasis on Correntropy. The applications to robust regression, adaptive filtering, system identification, and deep learning will be discussed.

Keywords

Information Theoretic Learning, Entropy, Correntropy, Kernel Methods.

Biography

Badong Chen received the B.S. and M.S. degrees in control theory and engineering from Chongqing University, in 1997 and 2003, respectively, and the Ph.D. degree in computer science and technology from Tsinghua University in 2008. He was a Post-Doctoral Researcher with Tsinghua University from 2008 to 2010, and a Post-Doctoral Associate at the University of Florida Computational NeuroEngineering Laboratory (CNEL) during the period October, 2010 to September, 2012. He is currently a professor at the Institute of Artificial Intelligence and Robotics (IAIR), Xi'an Jiaotong University. His research interests are in signal processing, information theory, machine learning, and their applications in cognitive science and engineering. He has published 2 books, 3 chapters, and over 100 papers in various journals and conference proceedings. Dr. Chen is an IEEE senior member and an associate editor of IEEE Transactions on Neural Networks and Learning Systems and has been on the editorial boards of Applied Mathematics and Entropy.