Research outputs in 2016

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Abstract

This note reports my research results in 2016. Three main research topics are addressed: Extreme-value analysis, High dimensional statistical learning, and Copulas

1 Extreme-value analysis

The decay of the survival function is driven by a real parameter called the extreme-value index. When this parameter is positive, the survival function is said to be heavy-tailed. In [1], I proposed a new estimator of the extreme-value estimator dedicated to this context. If this parameter is zero, then the survival function decreases to zero at an exponential rate. An important part of my work is dedicated to the study of such distributions [2, 3]. For instance, in reliability, the distributions of interest are included in a semi-parametric family whose tails are decreasing exponentially fast. These so-called Weibull-tail distributions include Gaussian, gamma, exponential and Weibull distributions, among others.

The estimation of extreme risk measures (L_p quantiles, expectiles, marginal expected shortfall, conditional tail moment) is addressed in in [4, 5, 6, 7, 8, 9, 10, 11]. See [12, 13] for applications to hydrology.

2 High dimensional statistical learning

Besides, I developped dimension reduction methods for high dimensional classification [14] and regression [15] problems with some applications in astrophysics.

Finally, I worked on the classification of grassland management practices using satellite image time series with high spatial resolution. To work at the parcel scale while accounting for the spectral variability inside the grasslands, the pixels signal distribution is modeled by a Gaussian distribution. To deal with the small ground sample size compared to the large number of variables, a parsimonious Gaussian model is used. A high dimensional symmetrized Kullback-Leibler divergence (KLD) is introduced to compute the similarity between each pair of grasslands. The proposed model provides better results than the conventional KLD in terms of classification accuracy using SVM [16, 17, 18, 19].

3 Copulas

Copula provides a relevant tool to build multivariate probability laws, from fixed marginal distributions and required degree of dependence. From Sklar's Theorem, the dependence properties of a continuous multivariate distribution can be entirely summarized, independently of its margins, by a copula. I proposed a new families of multivariate copulas adapted to high-dimensional problems [20, 21].

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