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Prediction and testing of mixtures of features issued from a continuous dictionary

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In this talk, we will consider observations that are random elements of a Hilbert space resulting from the sum of a deterministic signal and a noise. The signals considered will be linear combinations (or mixtures) of a finite number of features issued from continuous parametric dictionaries.

In order to estimate the linear coefficients as well as the non-linear parameters of a mixture in the presence of noise, we propose estimators that are solutions to an optimization problem. We shall quantify the performance of these estimators with respect to the quality of the observations by establishing prediction and estimation bounds that stand with high probability. In practice, it is common to have a set of observations (possibly a continuum) sharing common features. The question arises whether the estimation of signals can be improved by taking advantage of their common structure. We give a framework in which this improvement occurs.

Next, we shall test whether a noisy observation is derived from a given signal and give non-asymptotic upper bounds for the associated testing risk. In particular, our test encompasses the signal detection framework. We will derive an upper bound for the strength that a signal must have in order to be detected in the presence of noise.

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