ON THE CONNECTIONS AND EQUIVALENCES BETWEEN GAUSSIAN PROCESSES AND KERNEL METHODS IN NONPARAMETRIC REGRESSION

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Abstract: In this talk, I will discuss connections and equivalences between kernel methods and Gaussian processes in machine learning. Kernel methods are approaches that use reproducing kernel Hilbert spaces (RKHS) for constructing hypothesis spaces and have a wide variety of applications including support vector machines and kernel mean embedding of distributions. Gaussian processes are used in Bayesian machine learning in defining prior distributions and have been applied to problems such as nonlinear regression and classification as well as black-box optimization. There are various known connections and equivalences between these two approaches, both being nonparametric approaches using positive definite kernels. On the other hand, there exist some apparent differences between the two approaches, as can be seen in the well-known fact that a sample path of a Gaussian process does not belong to the corresponding RKHS with probability 1. In this talk, I will discuss what kind of equivalence and connection exist between the two approaches in the context of statistical learning theory, focusing on the problem of nonparametric regression. In doing so I will show that there exists a deep, genuine connection between the two approaches, which can explain the aforementioned difference in their hypothesis spaces.