
Measures of (In)dependence Using Positive Definite Kernels*

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Abstract

Given two random variables X and Y , it is a well-known fact that their independence can be characterized by the covariance between $f(X)$ and $g(Y)$ being zero for all bounded and continuous functions f and g . By choosing the functions f and g to belong to reproducing kernel Hilbert spaces (RKHS), the independence between X and Y can be characterized by the Hilbert-Schmidt norms of the cross-covariance operator induced by the reproducing kernels of these RKHSs. This is called the Hilbert-Schmidt Independence Criterion (HSIC) which measures the degree of dependence/independence between X and Y . In this work, we provide characterizations of kernels that guarantee: X and Y are independent if and only HSIC is zero. We also establish the connection of HSIC to distance covariance and investigate the applications of HSIC in independence testing.

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