Two sample tests for the equality in distribution of random sets

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Random sets serve as a valuable model for various phenomena in many branches of science. In many applications, we encounter sets that are non-convex and have a complex structure which is hard to describe using a particular model. When comparing distributions of such sets, it is more convenient to use a non-parametric approach.

In this talk, we present two approaches for non-parametric testing of equality in the distribution of two samples of random non-convex sets.

The first approach uses a permutation test based on $\mathfrak{N}$-distances, where the negative definite kernel employed, is the square root of the area of the symmetric difference between sets.

For the second approach, we first introduce depths for possibly non-convex random sets and propose an estimation of the depths based on the samples. It allows us to graphically compare the distribution between two samples of sets using DD-plots. Also, we construct a statistical test of equality in distribution based on the proximity of the DD-plot to the (0,0)–(1,1) line using the global envelope test. In the case the null hypothesis is not accepted, this test allows us to detect sets within the samples responsible for the rejection.

The procedures are compared and justified through a simulation study.