

## Using Multivariate QQ-Plots to Assess Spherical Symmetry

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**Abstract:** Analogous to the univariate plots, multivariate QQ-plots can be used to compare two multivariate distributions (empirical or theoretical) by matching a set of quantiles in one distribution with the corresponding set in the other. We base our plots on Chaudhuri's (1993) multivariate quantiles, which are vectors of the same dimension as the observations. The QQ-plots consist of arrows pointing from one distribution's quantiles to the other's. In two dimensions, the arrows can be plotted directly. In higher dimensions, we can look at projections. Principal component-like projections can be used to find directions in which the two distributions are most different.

These plots can be used to assess spherical symmetry of a sample by comparing the quantiles of the sample to that of a symmetrized version of the data. This technique can help in choosing the number of dimensions in principal components by stopping when the remaining variables appear spherically symmetric.