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Nonlinear spatial pattern extraction in floristic data bases on national and continental scale

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During the last years, a variety of large floristic and vegetation data bases were built for assessing biodiversity patterns on national and continental levels. The respective high dimensional data bases are very valuable for interpreting large scale patterns of biodiversity and related ecological gradients. In this study, we investigated the floristic data bases "FLORKART", and the "Atlas Flora Europea", which are grid based collections of occurrence data for vascular plants for Germany, and Europe.

The study aims at finding a new way to extract and interpret the main patters from these high dimensional data sets through global nonlinear projections. The data dimensionality was reduced by Isometric Feature Mapping (Isomap) and the resulting independent modes were projected into the geographical space. Isomap is a nonlinear generalization of Classical Multidimensional Scaling (CMDS), well suited for the ordination of very large datasets.

The Isomap ordinations had high explanatory powers on the data sets, explaining up to $\sim$94% of the variance in six dimensions. The first modes of the ordination spaces were well interpretable and clear gradients were extracted, which could be related to climate data. Furthermore, a subsequent cluster analysis of the leading Isomap coordinates recovered unexpected patterns. E.g., for the FLORKART data we were able to extract spatial organizational units of the survey indicating a considerable sampling bias. This global data impairment allows us to identify sub areas of consistent sampling for subsequent analysis. These findings are of special interest for future constructions of the large floristic data bases, and thus for subsequent biodiversity assessments.