

# Principal manifolds and graphs in practice: from molecular biology to dynamical systems

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Methodology of principal object construction (non-linear principal manifolds, principal graphs) that we have developed before (including method of elastic maps, principal trees, metro map data visualization), allows to construct and utilize principal objects in various applications, from molecular biology to dynamical systems analysis. In this presentation we review the general framework of principal object construction and concentrate on the practice of their use. We describe several examples: from the analysis of high-throughput data in cancer research with demonstration of the advantage of the use of non-linear principal manifolds in comparison to the linear ones of the same dimension; from the analysis of genetic texts using branching principal components; from systems biology when principal manifolds allow to classify time series data and estimate the non-linear invariant manifolds of a dynamical model of NF $\kappa$ B pathway.