Data Analysis by Scale Dependent Anisotropic Random Walks

Dr. Dimitri Volchenkov
Texas Tech University
Department of Math & Stats

Abstract:

Catching a structural pattern in the data (graphs, texts, musical scores, etc.) involves lifting of an empirical metric defined on elements to a metric defined on their distributions and might be understood as a version of the famous Monge-Kantorovich (MK) transportation problem, searching for minimizing the transportation costs over all available transportation plans. We discuss MK-transportation metrics calculated as propagators over a class of scale dependent random walks (non-local diffusions). We show that many empirical metrics known in measure theory, Markov chains, electrical circuits, music (tonality scale), land use (land prices), etc. are the special cases of the MK-transportation metric. The information flows between a single data element and the database can be described by conditional mutual informations. In case of a time series or a dynamical system, such a decomposition fully describes information relations between the past, future, and present states, allowing for the robust estimation of our ability to predict the future at every time scale of the system evolution

Bio

Dr. Dimitri Volchenkov is an applied mathematician working in the field of data analysis, stochastic non-linear dynamics, complexity and uncertainty in the real-world systems. He is the Assoc. Professor @ Math & Stats TTU and CSO @ http://datasmartproject.com/ , the start-up company for developing mobile applications.