Uni ct ECONOMIA E IMPRESA

Avviso di Seminario
Lunedì 21 ottobre 2024, ore 12.00
AULA 15 – Palazzo delle Scienze

Ultrametric models for dimensionality reduction in single and heterogeneous populations

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Abstract: Multidimensional phenomena such as well-being, climate change, sustainable development, and poverty are often defined by nested latent concepts, which can be represented through a tree-shaped structure, assuming hierarchical relationships among variables. The class of ultrametric models introduced here offers methodologies suitable for studying these relationships using a simultaneous and exploratory approach. The pivotal feature of these models is parsimony, as they identify a partition of the variable space into disjoint groups and explore their hierarchical relationships. Starting with the definition of an *ultrametric matrix*, we present the Ultrametric Correlation Model, which reconstructs an observed data correlation matrix using an ultrametric one. This model is then extended to Ultrametric Factor Analysis, which identifies a hierarchy of latent concepts and quantifies them through factors.
While the nonnegativity assumption of ultrametric matrices is realistic in many applications, such as psychometric studies, it can be too restrictive in others. To address this issue, we introduce an extended ultrametric matrix, which accommodates both positive and negative relationships among variable groups by aggregating them from the most concordant to the most discordant. This structure has been used to model covariance matrices in Gaussian mixture models, both with complete and missing data, providing different characterizations of a multidimensional phenomenon in heterogeneous populations. A further extension constrains structures within and across components, giving rise to thirteen parsimonious models that additionally reduce the number of parameters needed to study relationships among variables.

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