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Seminário

Grupo de Probabilidades e Estatística

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Structural uncertainty modelling: algebraic, information-theoretic, and statistical perspectives, with psychometric applications

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Abstract

Model identifiability is a central issue in statistical modelling when multiple explanatory models coexist. This indeterminacy has profound implications across disciplines, including psychometrics, where it affects the measurement of latent traits, and decision theory, where it leads to deviations from rational behaviour. Unlike statistical uncertainty, which arises from the use of sample data, this type of structural uncertainty stems from intrinsic symmetries in the phenomenon under analysis and can be formalised using algebraic and information-theoretic methods.

This talk explores recent approaches to address different forms of structural uncertainty. First, I will examine model identifiability in factor analysis, considering how Grassmannian relations entail entropy- or graph-theoretic conditions that characterise factor recovery under partial observability. This framework allows studying model uncertainty through partial correlations and relates to conditional independence and conditional mutual information in a probabilistic setting. Finally, I will extend these findings to decision-making, analysing how model symmetries may shape preference orderings and how they capture ambiguity in Ellsberg's paradox, and to Bayesian hierarchical modelling for Graded Response Models, illustrating their implications through simulations and future applications.

Mario Angellelli is also a member of the Italian Statistical Society (SIS), National Institute of Higher Mathematics - Algebraic and Geometric Structures, and their Applications research group (INdAM - GNSAGA), and an affiliate member of the Italian Association of Psychology - Experimental Psychology section.

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