# DSS Statistics Seminar

## October 30, 2020, 12:00 a.m.

**https://meet.google.com/wwp-jixu-bmj**

# On functional representations to deal with (fuzzy) set-valued data

*A. Colubi*

*Justus Liebig University Giessen, Germany*

Numerous experimental studies involve semi-quantitative expert information, or measured in a non-precise way, which can be modeled with interval (fluctuations, grouped data, etc.) or fuzzy (ratings, opinions, perceptions etc.) data. A general framework to analyze these kinds of inexact data with statistical tools developed for Hilbertian random variables will be presented.

The space of nonempty convex and compact (fuzzy) subsets of $R^p$, has been traditionally used to handle this kind of imprecise data. Mathematically, these elements can be characterized via the support function, which agrees with the usual Minkowski addition, and naturally embeds the considered into a cone of a separable Hilbert space. The support function embedding holds interesting properties, but it lacks of an intuitive interpretation for imprecise data. Moreover, although the Minkowski addition is very natural when $p = 1$, if $p > 1$ the shapes which are obtained when two sets are aggregated are apparently unrelated to the original sets, because it tends to convexify. An alternative and more intuitive functional representation will be introduced in order to circumvent these difficulties. The imprecise data will be modeled by using star-shaped sets on $R^p$. These sets will be characterized through a center and the corresponding polar coordinates, which have a clear interpretation in terms of location and imprecision, and lead to a natural directionally extension of the Minkowski addition. The structures required for a meaningful statistical analysis from the so-called ontic perspective are introduced, and how to determine the representation in practice is discussed.

SAPIENZA
UNIVERSITÀ DI ROMA