PhD program in Statistics

DSS Statistics Seminar

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Webinar **https://uniroma1.zoom.us/j/86881977368?pwd=SWRFcVFjMDZTa0lXZk05TE1zNm5adz09**

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Wrapping onto a torus: handling multivariate circular data in the presence of outliers

Luca Greco

University Giustino Fortunato, Benevento

Multivariate circular data arise commonly in many different fields, including the analysis of wind directions, protein bioinformatics, animal movements, handwriting recognition, people orientation, cognitive and experimental psychology, human motor resonance, neuronal activity, robotics, astronomy, biology, physics, earth science and meteorology.

Observations can be thought of as points on a p-dimensional torus, whose surface is obtained by revolving the unit circle in a $p-$dimensional manifold. The peculiarity of multivariate torus data is periodicity, that reflects in the boundedness of the sample space and often of the parametric space.

The problem of modeling circular data has been tackled through suitable distributions, among which two of the most popular are the von Mises and the Wrapped Normal. Here, we focus on the family of unimodal and elliptically symmetric wrapped distributions with emphasis on the Wrapped Normal.

Despite the boundedness of the support of circular variates, torus data are not immune to the occurrence of outliers, that is unexpected values, such as angles or directions, that do not share the main pattern of the bulk of the data. Then, a robust procedure to fit a wrapped distribution is presented. The proposed algorithm is characterized by the computation of data dependent weights aimed to down-weight anomalous values. We discuss and compare different approaches to obtain weights, with particular attention to the weighted likelihood methodology. A formal outliers detection rule is also suggested, that is based on classical robust distances evaluated over unwrapped data.

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