

TWO PROPOSALS FOR CIRCULAR ORDERING AGGREGATION

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Abstract

In this talk we deal with the problem of obtaining a Circular Order on a set of n items using angular values from p heterogeneous data sets. The problem resembles the classical problem of determining the *true* order or ranks among n objects using the ranks assigned by p independent *judges*. Although there exist a huge literature in ranking aggregation for Euclidean data, the problem is unexplored in the circular setting, where the Euclidean methods cannot be directly applied due to the underlying geometry of the circle. We consider two original proposals.

The first one is based on solving a Traveling Salesman Problem (TSP). The TSP approach for Circular Ordering Aggregation is formulated as a problem of searching the shortest tour in a graph where the vertex are the items to order and the length of the edges measure the aggregated pairwise relationships.

The second, is based on the *Hodge* theory which has been developed within the fields of graph theory, linear algebra and topology and that has been proposed recently in the literature to derive algorithms for rank aggregation using pairwise information. The originality behind this proposal is that of using triplewise input information. In the same line that skew-symmetric matrices are used to define *pairwise flows*, skew-symmetric hypermatrices can be used to define *triplewise flows*. In fact, the triplewise data seems to be the natural way of input the information in the circular setting because 3 is the minimum number of items to be uniquely ordered in the circle.

Besides some theoretical results developed under the Hodge theory, we present, several interesting examples that illustrate the weaknesses

and strengths of the methods and a very extensive simulation study to compare the different techniques.