Interval-Related Talks at the 20th International Conference on Information Processing and Management of Uncertainty in Knowledge-Based Systems IPMU 2024 (Lisbon, Portugal, July 22–26, 2024)

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We practically never know the exact values of the physical quantities. Usually, we know these values with some uncertainty. Often, the only information that we have about a quantity x is a lower bound $\underline{x}$ and an upper bound $\overline{x}$. In such cases, all we know about the actual value x is that it is contained in an interval $[\underline{x}, \overline{x}]$. Several papers presented at this conference dealt with such interval uncertainty.

Several talks analyze how interval uncertainty affects the result of data processing: the paper [8] analyzes the interval uncertainty's effect on logistic regression, [5] analyzes its effect on interpolation, [4] analyzes its effect on classification, and [6] analyzes its effect on statistical resampling techniques.

One of the relevant challenges is related to the fact that one of the main objectives of data processing is to make decisions. A usual way to make a decision is to come up with an appropriate objective function, and then to select the action with the largest value of this objective function. However, since the inputs to the objective function are known with interval uncertainty, the value of this function is also known with interval uncertainty. When for each possible action, we only know an interval contains the corresponding value of the objective function, it is often not clear which of these values is the largest. From the commonsense viewpoint, if the vast majority of numbers from one interval are larger than all the numbers from the second interval, we can say that with high degree of confidence, the first value is larger. The paper [7] analyzes possible ways to describe such degrees. Paper [2] considers an important particular case of the decision making problem, when we need to select the shortest path.

A specific issue related to interval uncertainty is that we sometimes have two (or more) intervals describing the same quantity, and it is desirable to decide which interval is more informative. If one interval is fully contained in the second

interval, then of course the first interval is more informative. If the vast majority of points from the first interval belong to the second interval, we can conclude, with a high degree of confidence, that the first interval is more informative. The papers [1] and [3] describe reasonable ways to provide numerical description of this degree.

References

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