A Machine Learning Approach to deal with Ambiguity in the Humanitarian Decision Making

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One of the major challenges for humanitarian organizations when planning relief efforts is dealing with the inherent ambiguity and uncertainty in disaster situations. The available information that comes from different sources in post-disaster settings may involve missing elements and inconsistencies, which can severely hamper effective humanitarian decision making. In this paper, we propose a new methodological framework based on graph clustering and stochastic optimization to support humanitarian decision makers in analyzing the implications of divergent estimates from multiple data sources on final decisions and efficiently integrating these estimates into decision making. We illustrate the proposed approach on a case study that focuses on locating shelters to serve internally displaced people in a conflict setting, specifically, the Syrian civil war. We use the needs assessment information published by two different reliable sources to estimate the shelter needs in Idleb, a district of Syria. The analysis of data provided by two assessment sources has revealed a high degree of ambiguity due to inconsistent estimates. We apply the proposed methodology to integrate the ambiguous and divergent estimates into the decision making for determining shelter locations in the district. The results highlight that our methodology leads to higher satisfaction of demand for shelters than other approaches such as a classical stochastic programming model. Moreover, we show that our solution integrates information coming from both sources more efficiently thereby hedging against the ambiguity more effectively.

Key words: humanitarian decision making, ambiguity, data aggregation, clustering, stochastic optimization