

Active Elicitation of Imprecise Probability Models

Natan T’Joens
Gert de Cooman
Arthur Van Camp
Jasper De Bock

Ghent University - imec, IDLab, ELIS
Technologiepark – Zwijnaarde 914, 9052 Zwijnaarde, Belgium

NATAN.TJOENS@UGENT.BE
GERT.DECOOMAN@UGENT.BE
ARTHUR.VANCAMP@UGENT.BE
JASPER.DEBOCK@UGENT.BE

Poster Abstract

When considering the problem of eliciting an imprecise probability model from experts, one can distinguish between two different, yet related goals. The first is to construct an imprecise probability model that captures the expert’s beliefs as completely as possible. The second is to gather information that is aimed specifically at answering a given question or solving a given decision problem. We here focus on the latter.

The mathematical framework in which we study this problem, is that of sets of desirable gambles (Quaeghebeur, 2014; de Cooman and Quaeghebeur, 2012). Questions with regard to probabilities can be translated to the desirability of gambles. For instance, a positive answer to the question ‘Do you think A is more likely to occur than B?’, is equivalent to a specific gamble being desirable. We consider the problem where consecutive questions are chosen from a limited set of possible questions in an optimal way, in such a way that the decision problem can be solved as quickly as possible. The decision problem will typically be making a choice between two gambles, or in general, choosing one gamble out of a set of gambles. First, we make an abstraction of the problem by simplifying the kinds of answers an expert can give (Quaeghebeur et al., 2015). These problems are closely related to the study of convex closed cones (Rockafellar, 1970), and serve us with theoretical insight that is useful in tackling more general cases. For these more complex problems, we provide a few preliminary ideas and insights. As these problems are not very effectively approached theoretically, we propose heuristic and semi-heuristic methods to solve them. Finally, we give results of simulations using these methods and draw conclusions. We also discuss possible approaches for similar problems, together with some ideas for future research.

References

- G. de Cooman and E. Quaeghebeur. Exchangeability and sets of desirable gambles. *International Journal of Approximate Reasoning*, 53(3):363–395, 2012.
- E. Quaeghebeur. Desirability. In T. Augustin, F. P. A. Coolen, G. de Cooman, and M. C. M. Troffaes, editors, *Introduction to Imprecise Probabilities*, pages 1–27. John Wiley & Sons, 2014.
- E. Quaeghebeur, G. de Cooman, and F. Hermans. Accept & reject statement-based uncertainty models. *International Journal of Approximate Reasoning*, 57:69–102, 2015.
- R. T. Rockafellar. *Convex Analysis*. Princeton University Press, 1970.