Title	***Bayesian Elicitation for Group Decisions with Monte Carlo Filtering Methods***

Mission

Group recommender systems [2,4,5] are automated tools that help groups of people to make a joint decision. A key task in any recommender system is the elicitation [1] of the users' preferences. In an interactive elicitation approach [1,5,6,7] questions are posed to the users in order to incrementally improve the knowledge about the users' preferences until a decision can be made with a certain degree of certainty.

In this project we assume a Bayesian approach (similarly as in previous works on single-user elicitation [6,7]) where a distribution over possible preferences is maintained and answers to questions are used to update this distribution over the preferences of the users. The agents' preferences can be modelled using probabilistic ranking models [8]; Bayesian updates will be done using Monte Carlo Markov Chain (MCMC) [3] approaches.

At each step, the system needs to decide the user to whom ask the question and which question to ask. We focus on a principled criteria for choosing the next query to ask, Expected Value of Information (EVoI), that can be computed in the following two ways:
- myopic EVoI [6,7]: considering the information value by considering expected improvement a posteriori (with horizon of one step), and
- sequential EVoI: considering the best *sequence* of questions in an horizon of k elicitation steps

The student will develop a Bayesian framework for preference elicitation for group decisions and design elicitation strategies based on EVOI, considering as well approximated strategies and heuristics.
The candidate will compare the effectiveness of the elicitation strategies in simulations using real datasets considering the tradeoff between cognitive cost (i.e. number of questions) and computational cost aggregating individual preferences in different ways [4].

References

[1] Darius Braziunas, Craig Boutilier. Elicitation of Factored Utilities. AI Magazine 29(4): 79-92 (2008)
[2] Dara, S., Chowdary, C.R. & Kumar, C.. A survey on group recommender systems. Journal of Intelligent Information Systems, 2019, p 1-25.
[3] MacKay. Information Theory, Inference, and Learning Algorithms. Cambridge University Press, 2003
[4] Judith Masthoff. Group Recommender Systems: Aggregation, Satisfaction and Group Attributes. In Recommender Systems Handbook, pp 743-776 (2015)
[5] Naamani-Dery, L., Golan, I., Kalech, M. et al. Preference Elicitation for Group Decisions Using the Borda Voting Rule. Group Decision and Negotiation (2015) 24: 1015.
[6] Paolo Viappiani, Craig Boutilier. Optimal Bayesian Recommendation Sets and Myopically Optimal Choice Query Sets. NIPS 2010: 2352-2360
[7] Paolo Viappiani and Craig Boutilier. On the Equivalence of Optimal Recommendation Sets and Myopically Optimal Query Sets. To appear in the Artificial Intelligence Journal (2020).
[8] Lirong Xia. Learning and Decision-Making from Rank Data. Synthesis Lectures on Artificial Intelligence and Machine Learning, Morgan & Claypool Publishers 2019

Prerequisites

Be enrolled in master2 in computer science or applied mathematics. Some background in probability / statistics is helpful.

Place

UMR MIA-AgroParisTech. 16, rue Claude Bernard Paris 5th arrondissement.

Duration

5 à 6 mois de stage à partir de février / mars 2020, temps plein.

Remuneration

Gratification according to the INRA scale in force (approx. 570 Euros / month in 2019)

Contact

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