CS280r Final Project Report
Project Name

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Abstract

1. Introduction

As has been shown in many studies of human interaction, communication is not free. In Amir et al. (2015), the importance of efficient communication was stressed, as study participants reported that when provided with complete plans, they could not review the information in a timely manner. Similarly, we see in Hahn et al. (2016) that crowdsourcing tasks consistently struggle with providing an amount of context that allows workers to complete an assignment while not spending the majority of their allotted task time getting up to speed. An added complication is that in many settings, the ideal contextual information to provide is subjective and multiple parties have competing interests in having their contributions addressed. While we could allow for a single contributor or an outside controller to make these subjective decisions, past experiences with content generators like Wikipedia with a strong hierarchical or dictatorial leadership Benkler et al. (2015) (in particular our in-class experience) have shown that the resulting content is often suboptimal from the viewpoint of the whole and heavily skewed to conform to the opinion(s) of the decision-maker(s). Schwartz (2015) stresses that those situations in which group members have different information and the actions of individuals are interdependent are the most critical to be collectively assessed.

Under these conditions, we see a strong case for adopting social budgeting techniques to crowdsource contextual points. As shown in Boutilier et al. (2015), if we assume adopt a utilitarian framework in which we hope to maximize the satisfaction of all group members, properly chosen voting rules can ensure that we minimize the maximum difference between the optimal possible satisfaction to all members and that selected by the voting rule in expectation (the regret), whereas it is clear that for a dictatorial selection this could be trivially equal to the worst case if the size of the alternative set is larger than two times the size of the set of options to be selected.

In particular, we will seek to test the effectiveness of the subset selection algorithm generated by Caragiannis et al. (2017), which approaches the problem as a variation on the maximin rule. In particular, the authors show that it is possible to derive an explicit utility function which maximizes regret while maintaining consistency with the votes, leading to the following expression for maximum regret for a subset selection T:

$$\max_{S\in A_k} \sum_{i=1}^{n} \frac{\mathbb{1}[S \succ_{\sigma_i} T]}{\sigma_i(S)}$$

Where $S \succ_{\sigma_i} T$ indicates that there is no alternative in T preferred to every alternative in S given the utility function σ_i, and $\sigma_i(S)$ is the ordinal ranking of the best alternative in set S in the ranking determined by the utility function σ_i.

Intuitively, any term in this maximization captures the lost satisfaction to the voters of not having the given set S_i chosen rather than T, weighted by how much he or she liked his or her best option in S_i. This will lead to a greater penalization for sets T that do not give many participants at least one of their top choices.

We seek the set T that minimizes this quantity.

$$\mathrm{argmin}_{T\in A_k} \max_{S\in A_k} \sum_{i=1}^{n} \frac{\mathbb{1}[S \succ_{\sigma_i} T]}{\sigma_i(S)}$$

Shah et al. show that this can be solved through an ILP with nm variables and $nm^2 + \binom{n}{m}$ constraints, where n is the number of voters and m is the number of alternatives available.

For comparison, we also use plurality/knapsack voting, which has been used in real-world participatory budgeting programs (likely in part because of its computational simplicity and ease of understanding) Goel et al. (2015) and is shown in Shah et al. to have empirical regret approaching that of the subset selection algorithm above for subset sizes greater than three, which will be the case in our experiment and should be generally true for problems of this nature.

2. Body of the Paper

- **Experimental Design.** A description of the experiment that was run; enough detail should be provided that the reader could reasonably duplicate the experiment. Results should not be reported in this section.

- **Results.** A report of the results of the experiments, and their significance.

2.1. Citations

Here are two examples of how to cite a paper properly:

- **?** shows that ...

- Prior work has shown that ... (**?**).

3. Related Work

Discussion of previous important, similar work in the area with comparison to the particular approach taken and results of the paper. Avoid simply providing a laundry list of other work that is somehow related to the subject of the paper. This section should contain brief, in depth discussions of the work most similar to your project, i.e., to research that takes an approach to the problem or produces results with which your project should be compared. As is always the case with written work, throughout the paper you should have citations to work that you draw on. For example, if you have adapted a system, include a citation to the system when you first mention it; if you are extending a formalization, include a citation to the original on first mention. If you are unclear about whether a simple citation suffices or an extended discussion is needed in the Related Work section, look at the papers read for class this semester for models. If you are still unsure, check with the teaching staff.

4. Conclusion

Describes the insights that can be taken away from the work reported in the paper.

5. Future work

Suggests extensions or challenges raised by the project.

O. Amir, B. J. Grosz, K. Z. Gajos, S. M. Swenson, L. M. Sanders, From care plans to care coordination: Opportunities for computer support of teamwork in complex healthcare, in: Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems, ACM, 1419–1428, 2015.

N. Hahn, J. Chang, J. E. Kim, A. Kittur, The Knowledge Accelerator: Big picture thinking in small pieces, in: Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems, ACM, 2258–2270, 2016.

Y. Benkler, A. Shaw, B. M. Hill, Peer production: A Form of collective Intelligence, Handbook of Collective Intelligence 175.

R. Schwartz, How to Design an Agenda for an Effective Meeting, Harvard Business Review .

C. Boutilier, I. Caragiannis, S. Haber, T. Lu, A. D. Procaccia, O. Sheffet, Optimal social choice functions: A utilitarian view, Artificial Intelligence 227 (2015) 190–213.

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A. Goel, A. K. Krishnaswamy, S. Sakshuwong, T. Aitamurto, Knapsack voting, Collective Intelligence .