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To cite this version:

Martin Jedwabny, Pierre Bisquert, Madalina Croitoru. PAPOW: Papow Aggregates Preferences and Orderings to select Winners. AAMAS 2019 - 18th International Conference on Autonomous Agents and MultiAgent Systems, May 2019, Montréal, Canada. pp.2363-2365, 10.5555/3306127.3332113 . lirmm-02180361

HAL Id: lirmm-02180361

https://hal-lirmm.ccsd.cnrs.fr/lirmm-02180361v1

Submitted on 11 Jul 2019

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PAPOW: Papow Aggregates Preferences and Orderings to select Winners

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July 11, 2019

Abstract

In this demonstration paper, we introduce PAPOW: Papow Aggregates Preferences and Orderings to select Winners. The tool allows for demographic filtering of voters depending on their characteristics. We show its application on a use-case from the NoAW H2020 project.

Keywords: Voting Theory; Demographic Filtering; Preference Aggregation.

1 Introduction

In this demonstration paper we place ourselves in the setting of multi-agent collective decision making via voting techniques. This problem has ubiquitous applications stemming from political elections, to industrial decision support systems and, more recently, to management techniques popularized by the arrival of Internet such as Doodle. In this setting, the introduction of massive scale vote manipulation techniques (see for instance the Cambridge Analytica scandal) called for the need of demographic vote analysis and user profiling. The application was also developed as a decision support system in the context of the NoAW H2020 project that aims for approaches to turn agricultural waste into ecological and economic assets.

There are several software packages that provide solutions [1, 2, 5] for multi-agent preference aggregation. Let us mention here the most well known: Whale4 (WHich ALternative is Elected) [1] and Pnyx [2]. These tools provide numerous aggregation methods, the possibility for the agents to input partial rankings, visualize and/or hide agent preferences amongst each other and visualization

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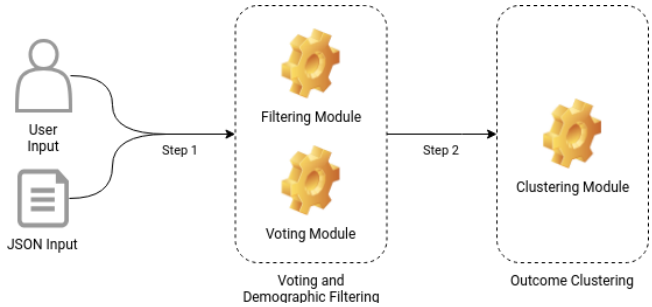

Figure 1: A schematic presentation of the tool's architecture.

tools such as weighted majority graph generation. Unfortunately, none of the mentioned preference aggregation software packages provide demographic analysis through vote filtering mechanisms and user profiling, nor multi-axis result clustering through demographic filters and preference aggregation techniques.

To address this gap in the literature, in this demonstration paper we introduce PAPOW: Papow Aggregates Preferences and Orderings to select Winners. The research question we address is "How to identify critical voter profiles that might be subject to manipulation in order to change the results? ".

Indeed, the tool we propose allows the user to "play around" with the various filters and clustering methods in order to identify such "danger zones". To this respect we try to counter balance manipulation effects (such as those seen in Cambridge Analytica, for instance). Of course such profiles could also be identified from a theoretical point of view but such endeavor is outside the scope of the current tool demonstration paper.

To this end, in this paper we show how PAPOW implements various preference aggregation mechanisms well known in the literature (see in the following section), allows for agent profiling through parametrizable categorization, has multi-criteria agent selection mechanisms through logical formulas that facilitate demographic-dependent outcome comparison and provide flexible result clustering visualization.

This tool is available in Github[1] and use case examples can be found in Youtube[2].

2 PAPOW Features

2.1 Workflow and architecture

The main three phases of our software are: (1) data input, (2) voting and demographic filtering and (3) outcome visualization.

[1] `https://github.com/martinjedwabny/PAPOW`
[2] `https://youtu.be/c9PCPYunce4`

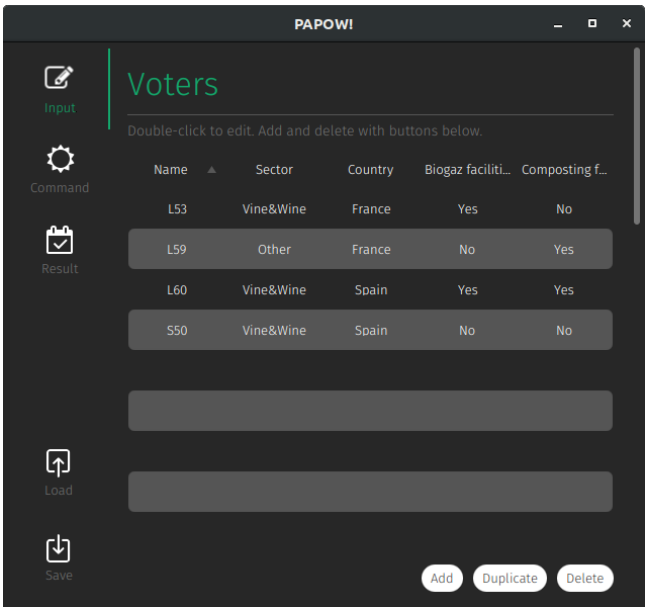

Figure 2: Snapshot of the input phase.

Let us consider a classic workflow (see Figure 1) that necessity the creation of users and voting alternatives from scratch. Please note that our tool admits .JSON file input and export format for saving and later loading of existing projects. In the input phase, the user can create, edit or delete voters along with their characteristics. Once the voting alternatives are created the user can specify the various voting questions over these alternatives.

Voting and demographic filtering. After the input data is specified (see Figure 2), the user must precise the voting mechanisms desired to aggregate the individual preferences. Our software lets voters express their votes in the form of total preorders. The voting rules provided by our software are Plurality, k-Approval, Copeland's method, Instant runoff, Borda count [3, 6]. Then the user can create demographic filtering criteria which generate different results according to the voters selected profile (see Figure 3).

Outcome clustering. Finally, users can analyze the results for each question, voting rule and criterion with various clustering options (see Figure 4). Through the clustering options, they can visualize the results for a particular demographic filtering criterion or compare the filters under a particular question and/or voting rule.

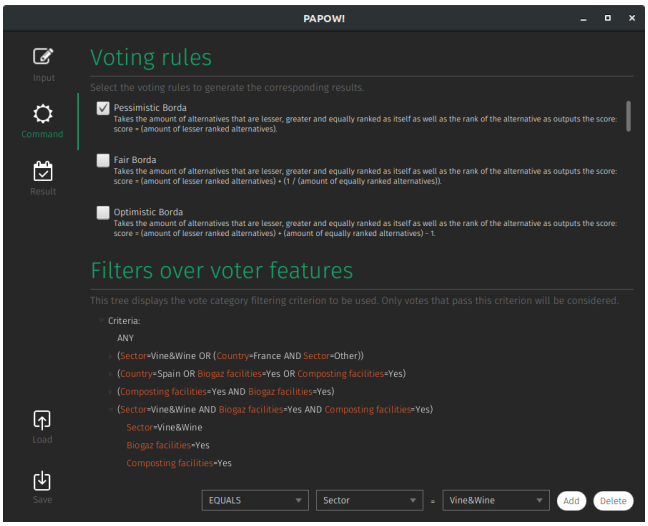

Figure 3: Snapshot of the command phase.

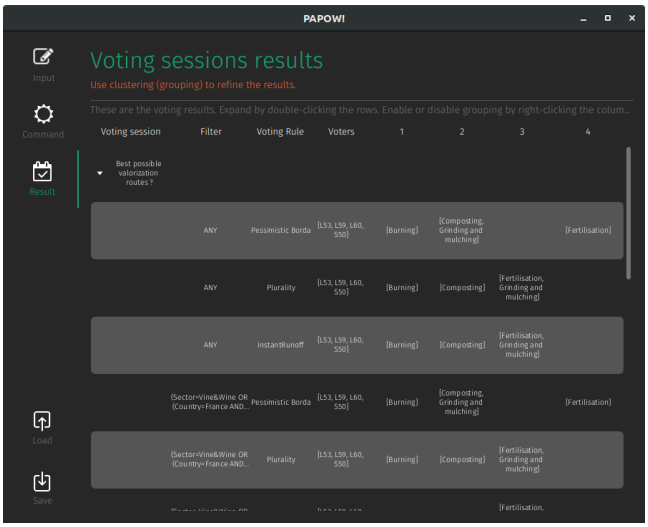

Figure 4: Snapshot of the result phase.

3 Discussion

As far as we know, PAPOW is the first voting tool that allows for user profiling and demographic analysis through filtering criteria as well as outcome clustering. Having implemented the main modules of the voting software, various ideas present themselves for future work. We plan to formalize the clustering capabilities we introduced. Also, we are interested in the development of further research in the topic of demographic analysis and the prevention of vote manipulation through user profile targeting and think of this tool as a solid basis to experiment over such ideas.

This tool was developed with related European H2020 NoAW [5] and GloPACK [7] projects. It will be used both as a standalone solution as well as part of a larger scale project that combines the power of argumentation and defeasible reasoning [4].

4 Acknowledgments

The authors acknowledge the support of the European H2020 NoAW project (project ID 688338) and the European H2020 GLOPACK project (project ID 773375).

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