



SOCIAL CHOICE AND VOTING SYSTEMS

Sercan Külcü | 30.05.2023

Contents

Contents.....	1
1 Introduction.....	2

1 Introduction

Social choice theory is a branch of economics and political science that studies methods for aggregating individual preferences or opinions into a collective choice. It explores the challenges and possibilities of making decisions on behalf of a group or society based on the preferences of its members. Voting systems are one of the key tools analyzed in social choice theory. Here's how social choice and voting systems are studied and analyzed within the framework of algorithmic game theory:

- **Preference Aggregation:** Algorithmic game theory considers how individual preferences are aggregated to determine a collective choice. Agents in a game have their own preferences over outcomes, and the challenge is to devise mechanisms that aggregate these preferences to reach a decision. This involves designing algorithms and protocols that take individual preferences as input and produce a collective outcome.
- **Strategic Behavior:** Algorithmic game theory studies the strategic behavior of agents in the context of voting systems. Agents may strategically manipulate their preferences or voting strategies to influence the outcome in their favor. The analysis includes examining the strategic possibilities and the resulting equilibria in voting games.
- **Computational Complexity:** Algorithmic game theory also investigates the computational complexity of preference aggregation and voting systems. It analyzes the computational hardness of various voting rules and explores the efficiency of algorithms for determining the outcome based on agents' preferences.
- **Algorithmic Mechanism Design:** Algorithmic game theory considers the design of mechanisms that achieve desirable properties in preference aggregation and voting systems. Mechanism design aims to incentivize agents to truthfully reveal their preferences and discourage strategic manipulation. Algorithmic mechanism design seeks to create incentive-compatible mechanisms that optimize desirable outcomes and address fairness and efficiency considerations.
- **Computational Social Choice:** Computational social choice is an interdisciplinary field that combines elements of computer science, economics, and social choice theory. It focuses on using computational methods and algorithms to address problems related to social choice and preference aggregation. It explores topics such as voting rules, fair division, judgment aggregation, and preference elicitation algorithms.

- Preference Elicitation: Algorithmic game theory examines the problem of preference elicitation, which involves determining agents' preferences in situations where they may have incomplete or uncertain preferences. It studies algorithms and techniques for eliciting preferences through strategic questioning, voting protocols, or other methods to improve the accuracy of preference aggregation.
- Welfare and Fairness Considerations: Algorithmic game theory explores the welfare and fairness implications of different voting systems and preference aggregation mechanisms. It investigates concepts such as Pareto efficiency, envy-freeness, and strategy-proofness to evaluate the desirability and properties of different systems.

By incorporating social choice and voting system analysis into algorithmic game theory, researchers can study the properties of collective decision-making processes, examine strategic behavior, and design algorithms and mechanisms that promote fairness, efficiency, and incentive compatibility in a variety of settings.