**Social Welfare Functions as Multi-Agent Sorting Algorithms: A Typology of Arrow’s Theorems on Three Different Data Types**

Summary

Viewed from a computer science standpoint, voting systems are nothing more than multi-agent systems which behave as sorting algorithms. From this vantage point, traditional Arrovian social welfare functions are multi-agent sorting algorithms where the information the agents input is of the ordinal data type. Non-Arrovian voting systems (such as approval voting, majority judgment, and range voting), depending on how they are defined, can be interpreted as multi-agent sorting algorithms where the information the agents input is of either the cardinal or real number data type.

In 2014 using social choice terminology without reference to this computer science terminology, I presented a paper at the Public Choice Society (Charleston, South Carolina, USA) and at the Society for Social Choice and Welfare (Boston, USA) meetings, which generalized Arrow’s theorem’s conditions in multiple ways for both cardinal and real data. Under certain generalizations, non-Arrovian voting systems could satisfy Arrow’s conditions, while for other generalizations, non-Arrovian voting systems could not satisfy Arrow’s conditions. It was all dependent on how the conditions were generalized. The purpose of the paper was to make clear what was meant when people said non-Arrovian voting systems satisfied or did not satisfy Arrow’s theorem conditions. This would presumably give election designers who are considering non-Arrovian voting systems better guidance on whether to use them or not and how.

Since 2016, I have been trying to sit down and re-write the results up in terms of multi-agent sorting algorithms whenever I get the chance. My hope is that by making the connections between the social choice, multi-agent systems, and sorting algorithms literatures more clear, this will greatly facilitate research and communication across those three different subfields. Unfortunately, this paper is currently on the backburner as I have several papers ahead of it in my queue. That said, if you are interested in copies of the work I have so far on this paper, please don’t hesitate to contact me.