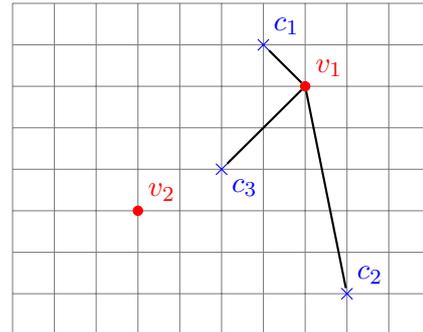




## An Electoral Photograph with Neural Networks

Voting has become an integral part of the modern society. Usually, it means electing a leader or a governing body. However, the trained eye will also see it in taking day-to-day decisions: maybe a team needs to pick a good meeting time, or a group of referees have to pick a winner for a contest. Some computational problems can also be seen as voting: selecting a diverse set of movies to offer to passengers on a plane, or selecting where to build a fire station to allow for rapid response. While the normative role of voting in decision-making can not be understated, Jean-François Laslier argues that:



Even though an election's goal is to designate a winner, an election not only reveals the name of the elected candidate, it also provides a kind of *official photograph* of voters' preferences as expressed by the votes. Large national elections are not only mechanisms for choice, they are also very specific democratic moments at which a nation learns about itself by facing a picture of itself, a picture somehow taken by the voting rule. For the democratic system to function well, it is important that this picture not be distorted.

What is this photograph? People often talk about the left-right political spectrum, with the theory that candidates' political programs can be identified by points on this axis. This theory does not hold in practice, since even the two extremes have different nuances to it. How about adding a second axis, such as libertarian-authoritarian? This is known as the "Political Compass", but what if we used different axes and why restrict ourselves to two dimensions only? More dimensions will likely better explain the data, but at the cost of explainability, and have you ever tried hanging a five-dimensional painting on the wall?

**Goal.** We know that finding an exact embedding is NP-hard even for two dimensions, so people resorted to various empirical techniques. However, no previous work looks at using modern deep learning techniques for finding the embedding, and in this project we aim to remedy this. We will assess our approach on PrefLib and the Swiss smartvote datasets.

**Requirements.** Competence in Python and a good understanding of machine learning. Interest in voting theory is a plus. We will have weekly meetings to discuss open questions and determine the next steps.

**Interested? Please contact us for more details!**

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