CMPLXSYS/POLSCI 391 — Winter 2022 — Discussion
Condorcet Jury Theorem
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# Task 0: Preflight checklist

1. Open the following link with your browser (you'll need to sign into a google account): `https://colab.research.google.com/drive/1QxYv92gJXg5UAufjBA3kPXABpFPm2SEc?usp=sharing`
2. Run the first chunk of code by clicking the play button on the left (Choose "Run anyways" if a dialog box opens up)
3. Verify that a green check mark sign shows up on the left of the play button.
4. Run the second chunk as well and verify again that the green check mark shows up.

Make sure these are working before proceeding further. Contact your GSI if the check marks don't show up or there are any other errors.

# Task 1: One agent

This task prepares you to use the jury simulation tool by simulating a single person/model that decides the verdict/outcome of a case/study.

1. Set `num_agents` to 1. This means the jury consists of only a single person/model.
2. Set `p_correct` to 0.6. This means that the person/model judges correctly 6 out of 10 times.
3. Set `num_votings` to 1. This means the jury (i.e. that one person) votes only once.
4. **Run the chunk 20 times and note down the number of times the Majority decision is correct. What is the fraction of times the decision is** correct?
5. **What do you expect this number to be and why?**

Instead of running the simulation 20 times, you can also increase the number of votings (`num_votings`) to 20 and read the answer from the `SUMMARY` section. Make sure the appropriate option is selected in `output_options`. This is what we will be using henceforth, instead of manually running it multiple times.

**Increase the number of votings to 100 and note down the fraction of times the jury judged correctly (read from summary).**

## Task 2: Multiple agents

This task explores the role of the number of people/models in the accuracy of a jury.

1. Increase the number of agents in the jury to 5 and run the simulation 100 times (i.e. set `num_votings=100`). This means we've increase the number of people that are in a jury and are using majority voting to give a verdict.
2. **What is the fraction of times the jury judged correctly? Is this higher or lower than the jury with just one agent?**
3. **Now increase the number of agents in the jury and note down the fraction of correct decisions for** `num_agents = 10, 20, 50, 100, 500, and 1000`.
4. **What does this tell you about the role of the number of people/models in deciding the accuracy of an outcome?**

## Task 3: Better agents

What if, instead of having more agents, we had better agents?

1. **What variable will you change to increase the accuracy of a single agent?**
2. **With** `num_agents=5` **and** `num_votings=100`**, plot the jury accuracy against individual accuracy for** `p_correct=0.5,0.6,0.7,0.8,0.9`**.**
3. **Make the same plot as above for** `num_agents = 10, 100 and 1000`
4. **According to these graphs, at what individual accuracy do you get the maximum benefit from increasing the number of agents in the jury?**

## Task 4: Too many cooks spoil the broth (?) (Homework)

1. **Plot the individual accuracy against the jury accuracy for values of** `p_correct= 0.1,0.2,0.3,0.4,0.5,0.6,0.7,0.8,0.9` **along with the 1:1 line for** `num_agents=10`**.**
2. **Plot the same graph as above but for** `num_agents=100 and 1000`.
3. **For what values of individual accuracy does increasing the number of agents affect the accuracy of the jury decision negatively?**
4. **Based on the above exercises. How should you use your discretion when deciding whether a set of models is better than a single one for a task?**

Discussion Feedback (anonymous; though you'll need to login to your UM google account to prevent unauthorized access): `https://forms.gle/WyP7o66k6hnozcHA8`