Progress Presentation

June 27th - July 19th

Agenda

- small updates to the algorithm
- experiments
- revisiting some diagnostic plots
- paper, schedule, examiner, etc.

Updates to Algorithm

- Beliefs are now allowed to diverge -> random actions
  - If the belief in the root node of the top level forest diverges, the run ends
  - If the target node is initialised with a diverged belief at the start of a single simulation, the simulation fails and we move on to the next one
- Softargmax for determining actions for a lower forest:
  - before: $\mathbb{P}(a_j \mid b) \propto \exp\left(\frac{N_+(b,a_j)}{\sqrt{N_+(b)}}\right) = \exp\left(\frac{W(b,a_j)}{W(b)}\sqrt{N_+(b)}\right)$
  - now: $\mathbb{P}(a_j \mid b) \propto \exp\left(\frac{\hat{U}(b,a_j)}{c_{\text{sft}} \cdot (1/\sqrt{N_+(b)})}\right)$
    - (Boltzmann distribution with "state energies" $-\hat{U}(b,a_j)$ and temperature $1/\sqrt{N_+(b)}$)
- Improved memory usage (with 3 agents it was using 20+GB, now around 10-15GB at most)

Experiments

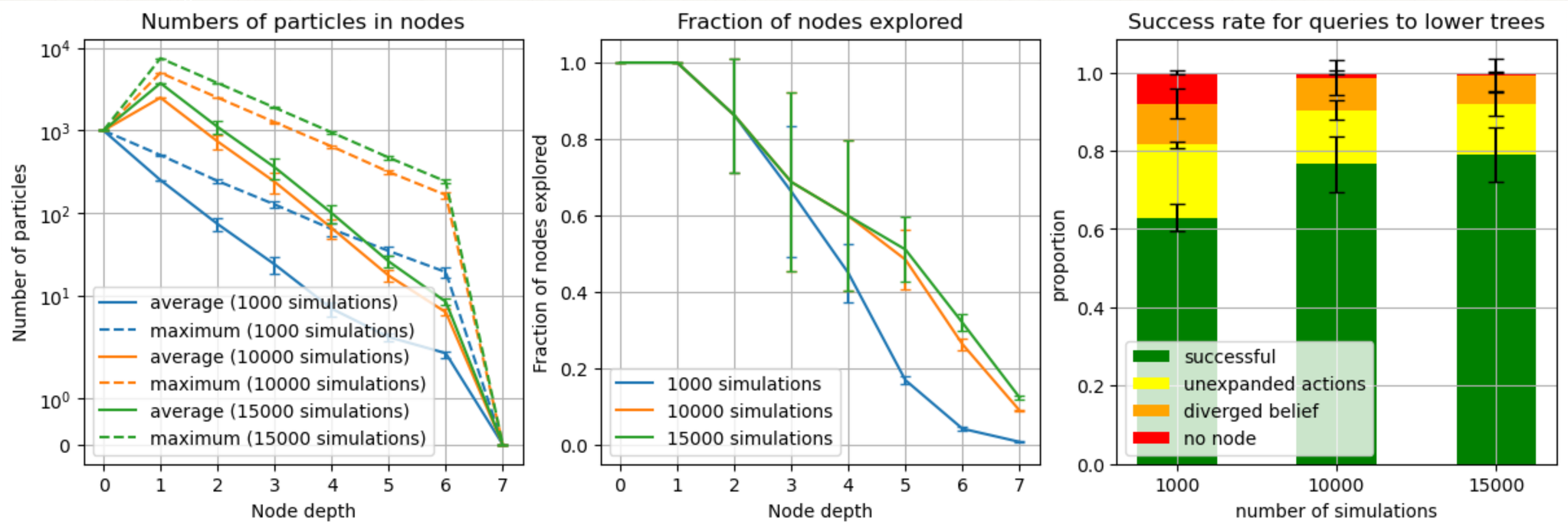
- Experiment 1
  - goal: investigating the effect of different costs of attacking in a two-agent system
  - independent variable: the cost of attacking (0.01, 0, -0.01, -0.1, -0.9, -1)
  - dependent variables:
    - proportions of different actions over the duration of the simulation
    - distribution of attack streak lengths

- how to quantify “bounded rationality” / prediction error?
  - number of times a lower forest belief diverges is not a good metric, because the upper forest is exploring different actions
  - instead: at the end of a turn, compare the actions each agent would perform and the actions we think they will perform

Revised diagnostic plots

Number of simulations

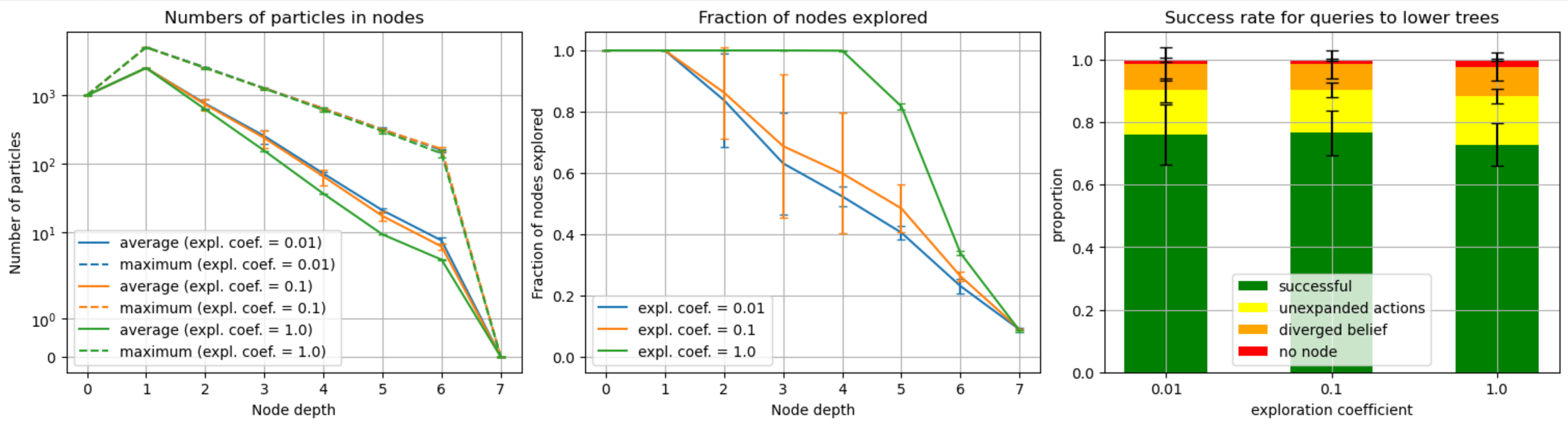
- averages over 5 runs
- two agents
- exploration coefficient 0.1
- reasoning level 1
- only first time step
- results from one agent's forests



Revised diagnostic plots

Exploration Coefficient

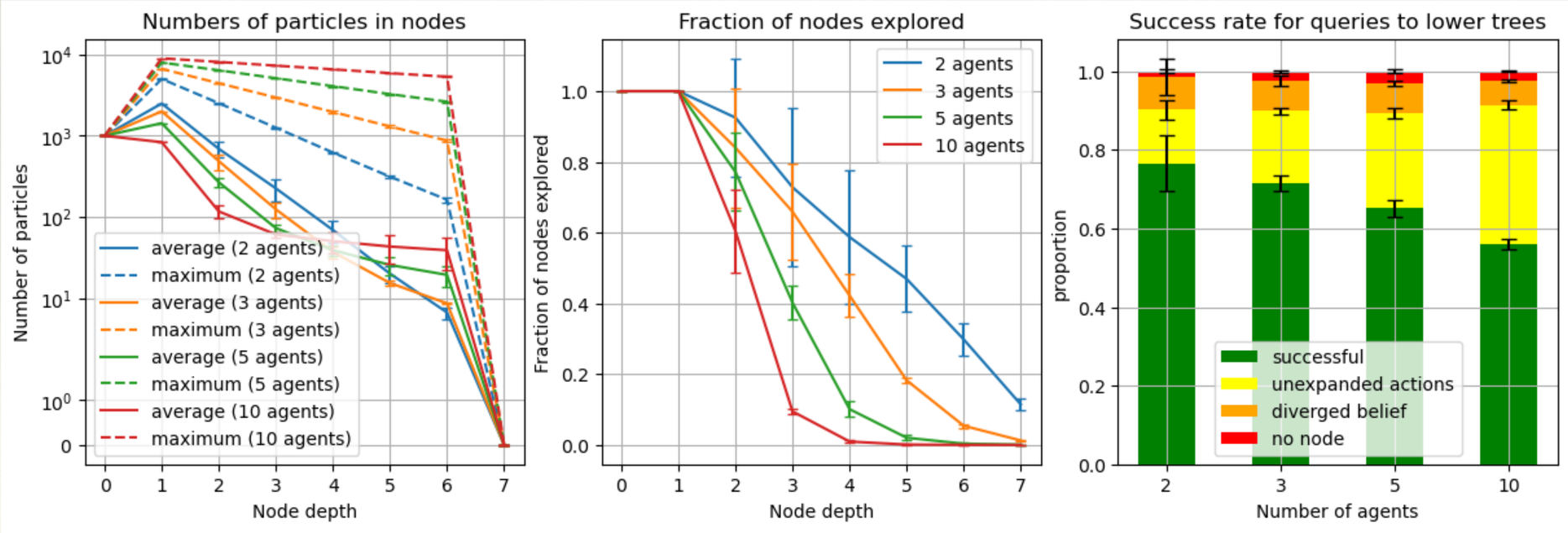
- averages over 5 runs
- two agents
- 10k simulations
- reasoning level 1
- only first time step
- results from one agent's forests



Revised diagnostic plots

- averages over 5 runs
- 10k simulations
- exploration coefficient 0.1
- reasoning level 1
- only first time step
- results from one agent's forests
  - Note: particle counts (left and middle plots) are from the level 1 forest

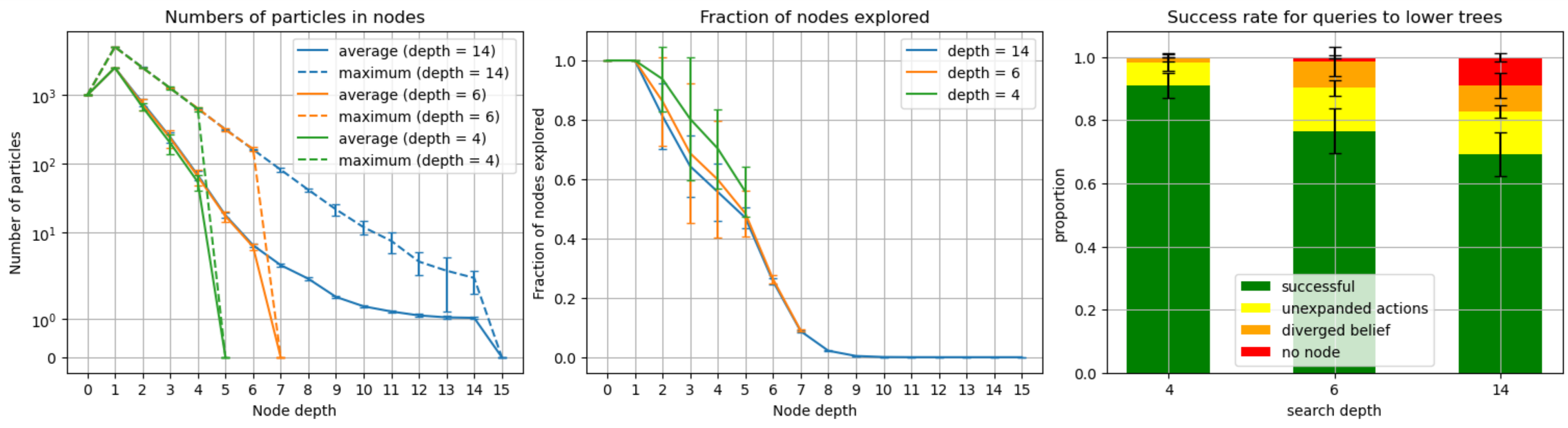
Number of Agents



Revised diagnostic plots

Search depth

- averages over 5 runs
- 10k simulations
- exploration coefficient 0.1
- two agents
- reasoning level 1
- only first time step
- results from one agent's forests



Practicalities

- paper
  - first draft of methods is done
  - next: literature review?
- what is the examiner situation?
- schedule is looking tight

Notes from Meeting

- Paper:
  - finish section 3.1: be as comprehensive as possible
  - make a figure illustrating the structure of interactive states (similar in style to the "matrix" format used in slides)
  - literature review: write more in the style of a thesis. Around 5 pages
- Memory usage:
  - check global variables, Python is not very good at handling them memory-wise
- New softargmax approach:
  - think of an appropriate range for c_{sft}
  - similar to quantal response equilibrium
- Quantifying bounded rationality:
  - agent-level
  - system-level: how does payoff received differ from optimal behaviour (which is for everyone to never do anything)