Simulating Policy Priority Inference

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GitHub Repository: Group 1 (click here)
Checkpoint 2 – Project Progress Update

1. Overview / Summary of Progress

Our project simulates dynamic budget allocation across interdependent policy targets (UN SDGs) connected by network spillover effects. Since Checkpoint 1, we have modularized the base model in C and established an initial complete workflow from data preprocessing to simulation output. This marks a transition from concept to execution, as the program now runs successfully on a sample test network using a gap-based allocation rule, generating performance metrics in CSV format for analysis. The results confirm that our simplified PPI model can be operationalized as a computational system, as outlined in our original proposal.

2. Working Code and Initial Results

In our initial results, the implemented systems include core C modules, namely graph.c, alloc_rule.c, dynamics.c, metrics.c, config.c, io.c, sim.c, main.c, which define the simulation framework that we are trying to implement. We then pre-processed the data, which is handled by the Python files, map_gen.py and map.py that convert string IDs to numeric IDs and produce clean network inputs, including num_network.csv, num_init.csv, and num_targets.csv. The simulation parameters are defined further in default.ini, while the system output results are in allocations.csv, metrics.csv, efficiency.csv, trajectory.csv, and final_vs_target.csv.

As described in our conceptual model, we mainly tested the gap-based allocation rules. This model iteratively updates node values using budget allocations and neighbor spillovers. We then set our parameters gamma as 0.1, steps at 1500, and budget with 10 units. The simulation iteratively updates node values using budget allocations and neighbor spillovers. Throughout our iteration, we saw that the Root Mean Square Error (RMSE) and mean gap monotonically decrease towards convergence. In our initial results, we saw that all nodes converge to the targets within 1500 iterations. This shows that the model performs reliably and that the update process is working as designed.

As a complement to the results above, Figure 1 shows nodes whose values change the most over time. These top-variance nodes represent the most dynamically responsive parts of the network. They rise rapidly in early iterations and then stabilize near their targets, showing the behavior of convergence. Figure 2 shows the 20 nodes that receive the most total budget across all iterations. Each colored layer represents one node's allocation over time. Allocations quickly reach steady levels. This indicates that resources distribution stabilizes early before the simulation termination.

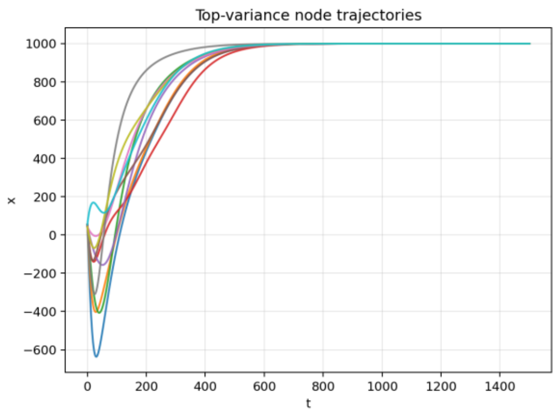

Figure 1

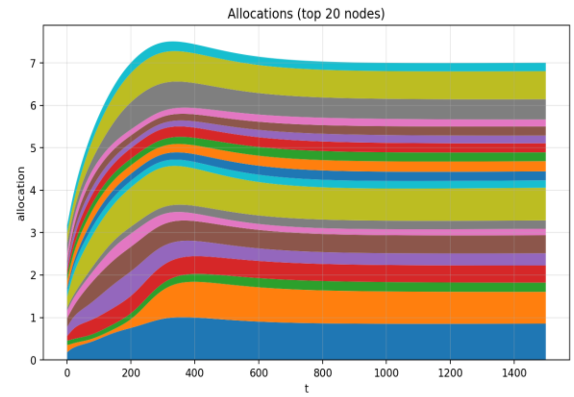

Figure 2

3. Next Steps / Division of Labor

Based on our initial results, we know that the policy simulation does work. However, to provide more novelty, we are currently exploring some ideas. For example, we may compare graph implementations and report runtime, memory, and edge-iterations throughout the identical workloads. Second, we are planning to generate visualizations to see the comparison across networks, trajectories, RMSE/mean-gap curves, and so on. Lastly, based on the last lecture on parallel computing, we intend to use OpenMP for per-mode state updates and optionally MPI for inter-process communication with speedup and efficiency reported across threads and ranks.

To date, our team is working well together. We are using SharePoint and GitHub to maintain version control and have engaged virtually several times using Teams. We plan to meet regularly in the coming weeks for progress check-ins. For the rest of the semester, the division of labor is divided among the three of us. See below for the detailed responsibilities:

Member	**Responsibilities**
Wen Feng	Lead coding, Report writing and drafting
Moe Kyaw Thu	Coding, Conceptualization, Report writing and drafting
Andy Redman	Coding, Conceptualization, PowerPoint and video preparation, Report writing