Genetic Algorithm Project Short Report

Challenges Encountered

One of the main challenges in developing this genetic algorithm (GA) was ensuring that each generated schedule was valid—specifically, assigning exactly one instance of each activity. Initially, random assignments allowed for duplicates and omitted some activities, causing incorrect results. By restructuring the schedule generation method to explicitly include each activity exactly once, the issue was resolved, resulting in valid and representative schedules.

Another challenge was tuning the mutation rate adaptively. Implementing an adaptive mutation strategy required careful monitoring of improvements between generations. Halving the mutation rate iteratively helped to fine-tune and stabilize the convergence effectively, ensuring that the GA was neither overly explorative nor excessively conservative.

Evaluation of the Generated Schedule

The final schedule produced by the genetic algorithm appears efficient and generally well-balanced regarding room capacities, facilitator preferences, and minimal conflicts. However, occasional placements still seem slightly suboptimal, such as some activities scheduled in rooms marginally larger than necessary or facilitators assigned slightly outside their primary preferences. Nonetheless, these minor inefficiencies are significantly reduced compared to random initial schedules, demonstrating the effectiveness of the GA.

Suggestions for Improvement

Future enhancements might include refining the fitness function further. For example, adding constraints or penalties for back-to-back assignments for facilitators or incorporating proximity considerations between rooms for consecutive classes might increase schedule practicality.

Additionally, employing a multi-objective genetic algorithm could offer trade-offs between multiple desirable attributes, allowing users to select from several optimal solutions according to different priorities (e.g., room utilization, facilitator workload).

Additional Observations

The genetic algorithm successfully improved schedules significantly from initial random populations, validating the effectiveness of the implemented fitness evaluation and genetic operators. The adaptive mutation strategy proved particularly effective in quickly reaching high-quality solutions while preventing premature convergence. Overall, the process demonstrated clearly how minor algorithmic adjustments could substantially enhance practical outcomes.