Performance of a Distributed Task Allocation Algorithm in a Realistic Network Environment

Matthew Rantanen¹, Dr. Nicholas Mastronarde¹, Dr. Karthik Dantu²
Departments: ¹Electrical Engineering, ²Computer Science and Engineering

Objective
- Allocate a set of tasks to a set of agents where no two agents are assigned the same task
- Attempt to optimize the overall reward obtained from agents being assigned a specific assignment of tasks
- Evaluate the performance of the Asynchronous Consensus Based Bundle Algorithm (ACBBA) [1] in a lossy network environment

Testing
- Evaluated the performance of the ACBBA in a perfect communication scenario to determine optimal performance
- Evaluated the ACBBA performance using the 802.11b broadcast mechanism for communication in the UB Airborne Networking Communications Testbed [2]
- Static routing used for each node in the network

Algorithm Description
- Agents continuously loop through three main phases:
  - Bundle Construction Phase: Agents bid on tasks in order to place tasks in their set of assigned tasks (bundle)
  - State Exchange Phase: Agents exchange messages regarding task bids and bid winners
  - Conflict Resolution Phase: Agents determine which agent had the highest bid and adjust their bundles based on received information and their current internal state
  - The highest bidder for a task is assigned that specific task
  - Each message only contains info about a single task
  - Silence on the network is interpreted as convergence

Results
- An increase in agents resulted in an increased occurrence of the same task being assigned to multiple agents
- An increase in repeated tasks is interpreted as a decrease in performance
- An increase in agents lead to more packet loss in the network
- Packet loss was mostly independent of the total number of tasks available for assignment
- Increased packet loss resulted in decreased performance
- Packet loss resulted in lost messages needed for consensus and accurate conflict resolution

Conclusion
- An increased amount of transmitting nodes in the network resulted in wireless interference that prevented the algorithm from properly communicating and resulted in degraded performance
- A lack of methods for ensuring message delivery resulted in a loss of critical information necessary for proper performance that lead to a decrease in performance

Future Work
- Characterize the ACBBA when reliable communication methods are used for packet delivery
- Test the algorithm’s performance when deployed on physical drones in a mobile ad-hoc network
- Test the performance of the algorithm when different dynamic routing protocols are used, such as the OLSR and AODV protocols

References

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