UG 4th year research projects/2023

1. Simulation of hyper processor architectures on rented cloud resources
    a. Revisit any one of the early era topological architectures (eg., torus, systolic arrays, ncube, non-blocking multistage networks etc) with each vertex replaced by a domain specific architectural node (eg GPU) for optimizing algorithmic performance of linear algebra (matrix computation) and NN workloads
    b. Can systolic arrays be optimized for NN workload types (eg RNN, CNN) by altering the MAC unit functionality?

2. Distributed algorithms
    a. Revisit multiple writer-multiple reader (MWMR) register implementation in the presence of BFT: aim for low overhead probabilistic consensus and to be pluggable into a lightweight distributed ledger

3. Multi parameter producer- consumer matching using graph stable matching
    a. Performance comparison of three approaches (G-S, TTC and RV) for stability, robustness in adversarial conditions, and pareto optimality (e.g., consider the donor-organ matching problem or similar)

4. Heuristics for multi objective combinatorial optimisation
    a. Dynamic case: Use a community of self-adapting evolutionary ‘deep’(or otherwise) RL agents to home in towards the optimal solution
    b. Static case: Can an optimisation objective be emulated over a generic pattern classification model? Consider the effectiveness or otherwise in speed, solution novelty, accuracy, explainabilty objectives of such an emulation

5. Distributed population protocols
    a. How successfully can a swarm algorithm like PSO be emulated by a population protocol in solving an optimisation task like vehicle routing problem? Also, with or without node failures?
    b. Replacing particles with RL agents – what are the emergent properties of such large populations, and what is their significance?

6. Programmed SDN rules as smart contracts – can they provide robustness against DDoS attacks?

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