Starting Things Off!

Andrew LAM

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Motivation of Updating This Way

- Systematic organization of information, knowledge, paper-reading and writing ideas for the upcoming years
- Keep progress/ moves visible by discretizing at reasonable steps
- Make related communication smoother/ predictable by keeping people around updated

One Slide Introduction: Myself

- **Name**: Andrew LAM (林碩風)
- **Undergrad major**: HKUST QFIN + MATH (2020-24)
- **Motivation of picking IEDA**: "Quantifying the World" with research, after quantifying in finance under a quant trading internship
- **Hobbies**: Cycling, Tetris (original proposed topic), Arcade, Weekly Reflections

What Have I Done: Jun-Aug

I focused on three main arcs, to properly recharge and explore myself before the research seasons kick in:

1. **NLP Applications**
   - Inspired by my Buffett Letters' Parts of Speech project (June 2025)
   - Developing project for analyzing dating markets' posting sentiments
2. **Math Education**
   - Constructed a repository supporting by-topic classifications of various high school level math exams (HKDSE/ HKALE/ Camb STEP...) and automatic document generation under Python infrastructure ($\sim$6K Questions, Jul-Aug 2025)
   - Will spend a minor chunk of time in AY2025-26 on supervising pro-bono math mock events for HKDSE students, after gathering a team of volunteers
3. **Personal: Arcade and Fitness**
   - Developed Bowling hobby and maintained weekly sessions (Jun-Aug)
   - Spent 100+ hours on rhythm game *Maimai* to train musical timing, hand muscles and explore songs of different genres.

Regarding Research - Reading

Prof. Zhang assigned this research project's extension to me in June:

- **Context**: Multi-echelon inventory management (MEIM)
- **Paper Insights**: applies Multi-Agent Deep Reinforcement Learning (MADRL), specifically Heterogeneous-Agent Proximal Policy Optimization (HAPPO), by modelling the system as a Partially Observable Markov Game (POMG)
- **Results**: Agents trained via HAPPO surpass single-agent RL and heuristic baselines, achieving lower total costs and mitigating the bullwhip effect through upfront-only information sharing

Question from Prof:
What if each agent is only interested in maximizing its own benefit without concerning the system's benefit: Would cooperation still arise?

Regarding Research - Rough Plan I

A rough sketch of my follow-ups in the next few weeks:

- Do reading on MEIM's background, common complexities (lead times, demand uncertainty, and inter-echelon coordination), and existing models such as
  1. Traditional inventory Base Stock and (s, S);
  2. Dual-Sourcing;
  3. employing heterogeneous agents to address decentralized decision-making)
- Sensitivity and Initialization of inventory problems (Initial inventories/backlogs, stochastic demand, sensitivity analysis on lead times and costs)

Regarding Research - Rough Plan II

Summarize Problem Variations and Literature insights, on:

1. Bullwhip Effect (Demand variability increases from downstream to upstream due to information distortion)
2. Supply Uncertainty: Price fluctuations, lead-time variability, shipping losses
3. Information-Sharing Scenarios: Fully centralized, decentralized, and hybrid (like CTDE)

Plan to read several other relevant papers (e.g. Lee et al. (1997) on bullwhip effect/ Clark and Scarf (1960) and Shang and Song (2003) for base-stock policy optimality and heuristics)

After going through the above, I will work on the article's HAPPO Implementation via Python:

- Set up actors' observation spaces with inventories, backlogs, and order flows.
- Define neural network models (e.g., using PyTorch with GRU units).
- Custom simulation environments for episodic training.
- Implement PPO via stable-baselines or custom methods.

Upcoming Academic Year: Plans

To balance learning (input) and research (output), I intend to take 12 credits:

- **Required**: ENGG 6780, PDEV 6770B, IEDA 6800C
- **Dept**: IEDA 5270 (Engg Statistic & Data Analytic)
- **Relevant to research**: MATH 5411 (Adv Probability Theory I)
- **Language**: LANG 5005 (Communicating Research in English)
- **For Interest**: COMP 5711 (Introduction to Advanced Algorithmic Techniques)

Any Questions/ Advice?

Not gonna make this sounding too formal :P