香港科技大学（广州）
THE HONG KONG
UNIVERSITY OF SCIENCE AND
TECHNOLOGY (GUANGZHOU)

数据科学与分析学域
DATA SCIENCE AND ANALYTICS THRUST
信息枢纽
INFORMATION HUB

DSA Research Experiences for Undergraduates

Research Project

Section1: Faculty Information

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Thrust/Hub	System Hub / Thrust of Intelligent Transportation Info Hub / Thrust of Data Science and Analytics	Office	W2 L5 511
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Section2: Research Project Proposal

Project Title	Enhancing Spatial Awareness in Multi-agent Networks for Urban Applications
Project Description (max 800 words)	In recent years, large language models (LLMs) have rapidly advanced, enabling them to be used as agents to transform traditional tasks. By organizing multiple agents to work together, we've seen success in handling complex challenges, such as interdisciplinary research, industrial management, and cross-file coding. These multi-agent systems rely on effective communication and information sharing, often structured hierarchically or in a flow-based design. However, the real spatial relationships between agents—how they interact in physical or virtual space—have received little attention. This is critical for applications like urban traffic control and land management, where spatial awareness is key. In this project, we aim to explore two main questions: 1. How can a single LLM agent understand spatial information? 2. How do we design a multi-agent network that functions effectively within spatial awareness? This project aims to: 1. Develop methods for LLM agents to perceive and interpret spatial information. This includes exploring how agents can process data from sensors, maps, or other spatial data sources to understand their environment. 2. Design a multi-agent network that incorporates spatial relationships. We'll investigate how agents can communicate and collaborate effectively within a spatial framework, ensuring that their interactions are context-aware and location-sensitive. 3. Test and refine these systems in real-world urban scenarios. By applying our models to tasks like traffic optimization or urban

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	planning, we'll evaluate their performance and make improvements based on practical feedback. You will get: **Insight into spatial-aware AI :** Understand how LLM agents can "see" and "interpret" the world around them, from street layouts to building locations. This opens up new possibilities for AI in urban planning, robotics, and more. **Advanced research for spatial multi-agent systems :** Learn how to design networks of agents that can work together in a spatial context. Think of it as choreographing a dance where each agent knows its place and role on the stage. **Real-world case studies :** See our models in action in real urban scenarios. We'll help to deploy your solution on real-world scenarios, showing how our agents can make cities smarter. A high-quality paper is also expected.
Proposed Research Duration	Start Date: _1__ / _June___ / 2025___ End Date: __1__ / _December_ / ___2025_
Student/Researcher Duties	Work collaboratively with team members, share insights and findings, and engage in discussions to enhance the project's outcomes. Stay updated with the latest advancements in LLMs and spatial-aware AI, and apply new knowledge to the project. Specifically, you must strictly adhere to **academic integrity** and **confidentiality agreements**. If the project progresses to the industrial deployment phase, you must ensure that all real data are kept secure and not disclosed.
Technical Skills Required	☑Python ☑Machine Learning ☑Big Data ☐ R ☑ Deep Learning ☐ SQL ☐ C/C++ ☐ Other: _____
Preferred Student/Researcher Background	**Experience:** - Coursework or projects in machine learning, especially in NLP. - Hands-on experience with PyTorch. **Bonus:** - Experience with agent design or traffic controlling. - Familiarity with Linux for LLM training.
Maximum Number of Students/Researchers	☐ 1 ☑ 2

Section3: Pre-Application Research Exposure Meeting

Faculty members are encouraged to schedule a Research Exposure Meeting to introduce students to their projects.

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Preferred Date	Each Friday	
Preferred Time	15:00-16:00	
Meeting Mode	☑In-Person	☐ Online
Venue (if in-person)	W2-511	
Meeting Link (if online)		

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