Project title: Large Language Model for Robotics

Contact

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Research project

Large Language Models (LLMs) have attracted significant attention recently and can conduct a wide range of tasks, such as content generation, etc. LLMs have been introduced into the field of robotics for navigation, manipulation, reasoning, and planning. One example of this integration is a robot that can interpret and act upon verbal instructions from a user to navigate to a specific location and execute a series of tasks. This capability allows users to interact with robots using natural language, eliminating the need for structured command syntax.

Despite the rapid development of LLM applications in robotics, challenges remain regarding efficient LLM training, effective multimodal model sensing, and environment interaction. To solve these challenges, PhD candidates are expected to study one of the following specialised areas:

(1) Efficient and Privacy-Preserved LLM Training: Many organisations, particularly small-to-medium-sized enterprises (SMEs) and academic institutions, face difficulties in training LLMs from scratch due to resource constraints. Developing an efficient strategy for LLM training is essential. Moreover, it is important to preserve privacy during remote LLM training, such as in cloud-based services.

(2) Robotic Sensing: Robots are typically equipped with multiple sensors, including cameras, motion detectors, Lidar, radar, etc. The ability to accurately interpret sensor data is fundamental for effective robotic perception and subsequent decision-making. This research will concentrate on designing advanced machine learning models capable of processing and analysing data from multiple sensory modalities, which enhances the robot's environmental awareness and responsiveness.

(3) Embodied AI: This area focuses on the interactions between robots, human beings and the surrounding environments. The candidate will propose algorithms that enable robots to understand human beings' intentions from their natural languages and interact with their surroundings. This will facilitate seamless and intuitive human-robot collaboration.

Applicant skills/background

This project requires skills in programming and machine learning. Having experience in hardware development is desirable, but this is not essential.

References

[1] Brohan, A., et.al., 2023, March. Do as i can, not as i say: Grounding language in robotic affordances. In Conference on robot learning PMLR.

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[3] Wei, B., et.al.,, 2021. iMag+: An accurate and rapidly deployable inertial magneto-inductive SLAM system. IEEE Transactions on Mobile Computing, 21(10).