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Lecture Transcript: Introduction to Foundational Models in Robotics

Topic: Introduction to Foundational Models in Robotics

Today, we'll delve into the exciting world of foundational models for decision-making in robotics. This area has become increasingly important, fueled by the rise of large language models like ChatGPT. Most of you are familiar with ChatGPT, which gives us a solid starting point for today's discussion. By the end of this lecture, we'll explore beyond ChatGPT, examining the broader implications of these models in robotics.

Topic: Overview of Foundational Models

We'll cover three key topics today:

1. **Large Language Models in Embodied AI**: These models are crucial for tasks like game playing and robotics, providing a bridge between unstructured human instructions and structured robotic tasks.
2. **Challenges and Opportunities**: We'll explore the difficulties and potential advancements in applying foundational models to decision-making in robotics.
3. **Vision Foundation Models**: Less known but equally important, these models help robots understand and interact with their visual environment.

Topic: Task Planning with Large Language Models

Consider a general-purpose robot in the 22nd century. You might ask it to help with simple tasks based on verbal instructions, like cleaning up a spill or fetching a snack. However, in our current 21st-century technology, robots require explicit programming for tasks. For instance, robots need structured inputs like segmented point clouds for grasping objects. This segment of the lecture will explain how large language models can translate unstructured instructions into executable robotic actions, effectively simplifying task planning.

Topic: Utilizing Human Knowledge through Language Models

Humans use language to abstract complex tasks into simpler instructions, a principle that large language models exploit by accessing vast amounts of text data on the internet. For example,

online tutorials on making fried rice break down the task into manageable steps, such as scrambling eggs or sautéing vegetables. By harnessing this textual knowledge, robots can plan and execute tasks more autonomously, bridging the gap between human linguistic instructions and robotic actions.

Topic: Practical Applications and Case Studies

We'll review several case studies, including the application of large language models to robotic task planning. These models can generate detailed task instructions, transforming vague human commands into precise action plans for robots. For example, telling a robot to clean up spilled coke might result in a step-by-step plan involving uprighting cans and picking up napkins, mimicking human problem-solving strategies.

Conclusion and Extended Reading

The lecture will conclude with an overview of the potential for integrating large language models with robotics to create more adaptive, efficient, and intuitive robotic systems. Additionally, a list of recommended readings will be provided for those interested in further exploring the topic.

Feel free to ask questions throughout the session or approach me after the lecture for more detailed discussions or clarifications on specific points covered today.