Artificial Intelligence & Robotics

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Abstract— The Artificial Intelligence and Robotics although addressing in similar problems. The two fields interact profitably in the area of building intelligent agents; this inter action has resulted in important developments in the area of vision and phased action. Recent advancements of technologies, including computation, robotics, machine learning communication, and miniaturization technologies, brings us closer to futuristic visions of compassionate intelligent devices. The missing element is a basic understanding of how to relate human functions (physiological, physical, and cognitive) to the design of intelligent devices and systems that aid and interact with people. Robotics is the branch of technology that deals with the design, construction, operation and application of robots and computer systems for their control sensory feedback, and information processing.

Key words: Manipulators, Degree of Freedom, Monte Carlo Localization, Skeletonization

I. INTRODUCTION

Robots are physical agents to perform tasks by manipulating the physical world. They are equipped with effectors such as legs, wheels, joints, and grippers. Effectors have a single purpose: to assert physical forces on the environment. Robots are also equipped with sensors, which allow them to perceive their environment. Most of today's robots fall into one of three primary categories.

Manipulators or Robot Arms are physically anchored to their workplace, for example in a factory assembly line or on the International Space Station. Manipulator motion usually involves a chain of controllable joints, enabling such robots to place their effectors in any position within the workplace.

Fig. 1: An Industrial Robotic Manipulator for on a Pallet.

The second category is the Mobile Robot. Mobile robots move about their environment using wheels, legs, or similar mechanisms. They have been put to use delivering food in hospitals, moving containers at loading docks, and similar tasks. The third type of robot is a Mobile Manipulator. Humanoid robots mimic the human torso. Mobile manipulator scan applies their effectors further afield than anchored manipulators can, but their task is made because they don't have the rigidity that the anchor provides. Roboticists are nowhere near achieving this level of artificial Intelligence but they have made a lot of progress with more limited AI.

Fig. 2: Honda's P3 Asimo

II. ROBOT HARDWARE

A. *Sensors*

Sensors are sophisticated devices that are frequently used to detect and respond to electrical or optical signals. A Sensor converts the physical parameter (for example: temperature, blood pressure, humidity, speed, etc.) into a signal which can be measured electrically.Let's explain the example of temperature. The mercury in the glass thermometer expands and contracts the liquid to convert the measured temperature which can be read by a viewer on the calibrated glass tube.

B. *Effectors*

Effectors are the means by which robots move and change the shape of their bodies. To understand the design of effectors, it will help to talk about motion and shape in the abstract, using the concept of a degree of freedom (DOF) we count one degree of freedom for each independent direction in which a robot, or one of its effectors, can move.

III. ROBOTIC PERCEPTION

Perception is the process by which robots map sensor measurements into internal representations of the environment. Perception is difficult because sensors are noisy, and the environment is partially observable, unpredictable, and often dynamic.

A. *Simultaneous Localization & Mapping (SLAM)*

Simultaneous Localization is the problem of finding out where things are— including the robot itself Knowledge about where things are is at the core of any successful physical interaction with the environment. Robot manipulators must know the location of objects they seek to manipulate; navigating robots must know where they are to find their way around. Localization using particle filtering is called Monte Carlo localization, or MCL. The process of SLAM uses a complex array of computations, algorithms and sensory inputs to navigate around a previously unknown environment or to revise a map of a previously known environment

B. *Machine Learning in Robot Perception*

Machine learning plays an important role in robot perception. It is particularly a case when a best inside representation is unknown. The common approach is to map the high dimensional sensor streams into the lower-dimensional spaces using unsupervised machine learning methods. Such an approach is called low-dimensional embedding. Machine learning makes it easy to learn sensor and motion models from data, while allowing discovering a suitable internal representation. Another machine learning technique makes it possible robots to continuously adapt to broad changes in sensor measurements. Humans walking from a sun-lit space into a dark neon-lit room. Clearly things are darker inside. But the change of light source also affects all the colors: Neon light has a stronger component of green light than sunlight. Yet human seem not to notice the change. If human walk together with people into a neon-lit room, human don't think that suddenly their faces turned green. human perception quickly adapts to the new lighting conditions, and brain ignores the differences.

IV. Plan to Move

All of a robot's deliberations ultimately come down to deciding how to move effectors. The point-to-point motion problem is to deliver the robot or its end effector to a designated target location. A greater challenge is the compliant motion problem, in which a robot moves while being in physical contact with an obstacle. An example of compliant motion is a robot manipulator that screws in a light bulb, or a robot that pushes a box across a table top.

A. *Configuration Space*

The space of robot states defined by location, orientation, and joint angle, is a better place to work than the original 3D space.

B. *Path Planning*

The path planning problem is to find a path from one configuration to another in configuration space. the complication added by robotics is that path planning involves *continuous* spaces. There are two main approaches: cell decomposition and skeletonization. Each reduces the continuous path-planning problem to a discrete graph-search problem. Path-planning is an important primitive for autonomous mobile robots that lets robots find the shortest – or otherwise optimal – path between two points. Otherwise optimal paths could be paths that minimize the amount of turning, the amount of braking or whatever a specific application requires. Algorithms to find a shortest path are important not only in robotics, but also in network routing, video games and gene sequencing.

V. Moving

The plans particularly produced by deterministic path planners—assumes the robot can simply follow path the algorithm produces. In real world, of course, this is not case. Robots have inertia & weight and are unable to execute arbitrary paths except at slow speeds. In most cases, the robot gets to exert forces rather than specify positions. This section discusses methods for calculating these forces.

– Dynamics and control
– Potential-field control
– Reactive control
– Reinforcement learning control

VI. Robotic Software

A methodology for structuring algorithms is software called a software architecture. An architecture includes languages and tools for writing programs, as well as an overall philosophy for how programs can be brought together. Modern-day software architectures for robotics must decide how to combine reactive control and model-based deliberative planning. In many ways, reactive and deliberate techniques have orthogonal strengths and weaknesses. Reactive control is sensor-driven and appropriate for making low-level decisions in real time. However, it rarely yields a plausible solution at the global level, because global control decisions depend on information that cannot be sensed at the time of decision making. For such problems, deliberate planning is a more appropriate choice. Consequently, most robot architectures use reactive techniques at the lower levels of control and deliberative techniques at the higher levels. We encountered such a combination in the discussion of PD controllers, where we combined a (reactive) PD controller with a (deliberate) path planner. Architectures that combine reactive and deliberate techniques are called hybrid architectures.

VII. Application Domains

– Industry and Agriculture. Transportation.
– Robotic cars. Health care.

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