Commentary

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Based on better game theory, a computation offloading strategy for cloud robots

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Abstract

The Internet of Things (IoT) and cloud computing have ushered in a paradigm change that has resulted in the creation of integrated robotic applications and services. The computation-intensive jobs are moved to the cloud to fulfil the rising need for robots' energy-intensive applications. As a result, job offloading is crucial in cloud networked robotics (CNR) for exploiting cloud infrastructure compute support. However, given the time limitation, the additional expenses of data transmission, and remote processing, making optimal offloading decisions is not simple. Despite the fact that many attempts have been made to investigate various elements of offloading, the most of them are focused on mobile cloud computing. In fact, the CNR's offloading process is more complicated due to the robot's on-demand mobility, which has a substantial impact on the link between offloading, movement, and communication. To overcome these restrictions, more extensive offloading strategies that can handle higher levels of complication must be established during system modelling. Unlike earlier research that focused on each of the aforementioned problems independently, our method intends to consider path planning, link selection, and offloading as part of the decision-making process for various types of CNR systems.

Keywords: CNR; Offloading; Cloud technology

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Introduction

The fast growth of cloud technology and the Internet of Things (IoT) in recent years has increased the possibilities for combining autonomous robotic sensing and actuation in dynamic and complicated applications. Over the last few years, substantial research has concentrated on designing collaborative robots for service-based applications in modern society to compensate for the increasingly difficult and specific application demands. This has given rise to the concept of "networked robotics," which is described as a collection of robotic devices linked together by a wired or wireless communication network to achieve a shared goal. Tele-operated robots and multi-robot systems are other terms for them. The term "networked robots" refers to any gadget that requires the assistance of a network. The purpose for this is to encompass all future and existing systems such as unmanned aerial vehicles (UAVs) or warehouse robots, as well as production lines, home automation systems, and some specific systems where people conduct computation [1].

Such systems have a wide range of applications, including industrial assistance, planetary rover control, medical surgery, service-based operations, and so on. The task of sensing, actuating, communicating, and processing is distributed among a collection of robots in networked robotics. As a result of their tremendous endurance, speed, and precision, they may now be used in time-consuming and possibly risky jobs. From analytical jobs like scene analysis, 3D path planning for search and rescue, and navigation duties to more interactive tasks like scene recognition, 3D printing, and medical operations [2], the fully equipped modern robot can provide a wide range of services. Even if the work so far has been outstanding, there are still certain restrictions. Despite recent progress, preparing individual robots with boundless capacities is still impossible [3].

Constraints exist in every robotic system, whether they are hardware or software. System resource restrictions, communication constraints, and learning constraints are just a few examples. Moore's law limits the hardware advances of robots to some extent. Because raising the clock speed and battery capacity of robots can result in an increase (octuplet) in power consumption [4], this is the case. As a result, a hardware-based strategy isn't the best option because there aren't many enhancements we can successfully implement without hefty compensation. Despite this issue, there is still a lot of room for improvement in terms of software advancements.

To save energy, reduce response time, and extend the robot's battery life, one way is to "offload" the computation/task entirely to a remote resource. Task offloading, which began as a notion in mobile cloud computing, has now expanded to robotic networks, resulting in "cloud networked robotics" [5]. It's the ideal combination of a robotics network and cloud infrastructure, with the ability to increase the performance of a variety of service-based applications. The design of mobility-driven and communication-aware offloading in CNR applications generates a number of ideas that will be the subject of future research projects.

Conclusion

CNR's job offloading decisions are heavily influenced by communication and mobility. While communication determines the amount of bandwidth available for cloud communication, mobility determines the location of offloading as well as the robot's movement. Unlike mobile cloud computing, "on-demand mobility" for a robotic network means that the robot actively plots its path and chooses the best communication channels (AP selection) to allow job offloading.

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