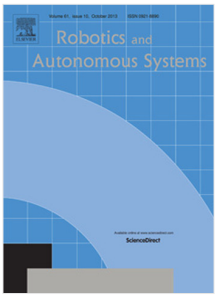
Accepted Manuscript



Lazy max-sum for allocation of tasks with growing costs

James Parker, Alessandro Farinelli, Maria Gini

PII: S0921-8890(17)30729-7
DOI: https://doi.org/10.1016/j.robot.2018.08.015
Reference: ROBOT 3077

To appear in: *Robotics and Autonomous Systems*

Please cite this article as: J. Parker, et al., Lazy max-sum for allocation of tasks with growing costs, *Robotics and Autonomous Systems* (2018), https://doi.org/10.1016/j.robot.2018.08.015

Lazy Max-Sum for Allocation of Tasks with Growing Costs

James Parker[a], Alessandro Farinelli[b], Maria Gini[a]

[a] *Computer Science and Engineering, University of Minnesota*
[b] *Department of Computer Science, University of Verona*

Abstract

We propose a model for the allocation of agents to tasks when the tasks have a cost which grows over time. Our model accounts for both the natural growth of tasks and the effort of the agents at containing such growth. The objective is to produce solutions that minimize the growth of tasks (potentially stopping such growth) by efficiently coordinating the operations of the agents. This problem has strong spatial and temporal components, as the agents require time not only to work on the tasks but also to move between tasks and during that time the costs of completing the tasks continue to grow. We propose a novel distributed coordination algorithm, called Lazy max-sum, which works well even when the model of the environment has errors. The algorithm handles homogeneous as well as heterogeneous agents, which can do different amounts of work per time unit and have different travel speeds. We show experimentally that the algorithm outperforms other methods in both a simple simulation and the RoboCup Rescue agent simulation.

Keywords: multi-agent, task allocation, decentralized methods

1. Introduction

In many real world problems, a number of agents (or resources) has to be allocated to tasks that need to be done. This is framed as an assignment problem and solved using optimization methods. Since each agent incurs a cost for doing a task, the objective is typically to minimize the sum of the costs. Costs can be expressed as distance to travel, or time, or energy consumed, which has to be minimized.

In this paper we are interested in task allocation when the agents are robots (or other physical agents) and the tasks are geographically distributed, hence to do the tasks the agents have to travel to the task locations. More specifically, we are interested in tasks that have a cost that changes over time and where multiple

Email addresses: jparker@cs.umn.edu (James Parker), alessandro.farinelli@univr.it (Alessandro Farinelli), gini@umn.edu (Maria Gini)