Solving Coordination Problems in UAV Aided Networks Using Game Theory - Review Proposal

Ana Jacinta Pessoa da Pinha - a22200858

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Abstract

This document provides a proposal for a literature review on the topic of solving coordination and mobility problems in UAV-aided Networks with the use of Game Theory models and strategies. First the concept of UAV networks and game theory is explained. A preliminary literature review was conducted in order to identify what studies have already been conducted in this area. Finally, a methodology is proposed for how to conduct this review and provide a state-of-the art on the subject.

1 Introduction

A UAV, or Unmaned Aerial Vehicle, is a remotely piloted drone or aircraft with no passengers. According to Zhang *et. al.* UAVs can be classified as fixed-wing or rotary-wing. Rotary-wing UAVs are commonly used as base stations, as they are capable of hovering in a fixed place, whereas Fixed-wing UAVs are capable of gliding and carrying a heavier load, and thus are more efficient at providing cellular coverage. [5]

Mkiramweni *et. al* and Zhang *et. al.* describe Game Theory as a branch of mathematics and sciences, used to analyse strategies a player can use to achieve a desired outcome in a decision-making scenario, refered to in this context as a game [4, 5].

Given the complex nature of Networks, by deploying UAVs to aid in network communication, we are adding another layer of complexity. In this context, Game Theory can be use to solve a myriad of problems such as power consumption, navigation or performance issues. [4]

In this review I will be focussing on Game Theory applications to solve the particular problem of coordination and mobility between UAVs in UAV-aided Networks.

2 Preliminary Literature Review

I started the preliminary review by searching for potential problems in UAV Network Communication that could be solved by using Game Theory. Zhang *et al.* have conducted a study in 2019 as shown in [4], on the use of Game Theory in UAV-Networks. In this paper, all the studies have been categorized and organized by the specific problem they address. Of all the studies, three addressed the problem of mobility and coordination of UAVs in Networks.

Giagkos *et al.* present two types of algorithms as a solution to coordinate UAVs for better broadband provision in a disaster relief situation: Non-Cooperative and Evolutionary algorithm[3]. Since our focus in the course is cooperative communication, I'll be reviewing the results presented with the evolutionary algorithm, as it provides a cooperative way for the UAVs to coordinate between themselves to better provide coverage in the scenario presented.

Barreiro-Gomez *et al.* uses a multi-agent approach to create a leader-follower system for UAV coordination. In the proposed solution, the UAVs will follow a particular leader agent and coordinate accordingly. The system is based on distributed population games[1].

The last article by Fotouhi *et al.* employs a Non-Cooperative game solution to the problem of coordinating and moving drones to provide hotspots for users on the ground[2]. Since this study doesn't include a cooperative solution, it will not be considered for the context of this review.

3 Methodology

For this review I will be focussing on the two articles analysed in [5] to solve mobility and coordination issues, that implement cooperative solutions. I will then search for articles that have been cited in these works in order to further understand the issues and solutions proposed.

Following this work, I will search the relevant databases for papers and other works that cite these three articles, as well as search for other papers that try to solve this particular problem with similar strategies.

The purpose of this work is to provide a review of possible cooperative solutions that employ game theory to the problem of coordination in UAV-aided Networks, and provide an accurate state-of-the-art on the subject.

References

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