Multi-Drone Scheduling for High-Reliable and High-Performance UAV-based Surveillance Networking

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Introduction and Lyapunov Optimization

Introduction

- Suppose a number of drones scout an area and send that information to a central mobile edge computing center.

- If all drones send all their data, the accuracy of the reconnaissance will be the greatest, but overflow can occur because multiple pieces of information are gathered in one center. In the opposite case, if fewer drones provide reconnaissance information, overflow can be prevented, but reconnaissance accuracy is poor.

- we propose an algorithm that guarantees stability while maximizing performance on time average by controlling the number of drones that deliver information to the center every hour.

Drift-Plus-Penalty (DPP) Approach

$$f(t) = \text{Accuracy}(k[t]) - V \bullet B[t]\{a(k[t]) - b(k[t])\}$$

uncontrollable

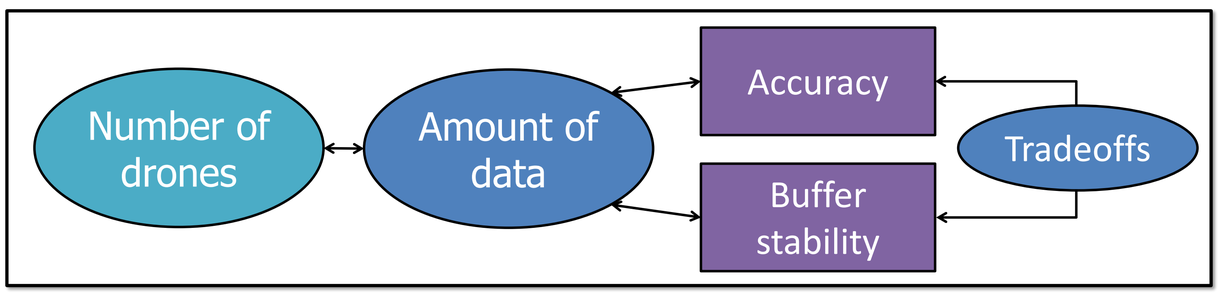
$$\text{Maximize} \quad f(t) = Accuracy(k[t]) - V*B[t]a(k[t])$$

$B[t] = 0$ (no data buffer) $\longrightarrow$ maximize $Accuracy(k[t])$
maximize number of drones

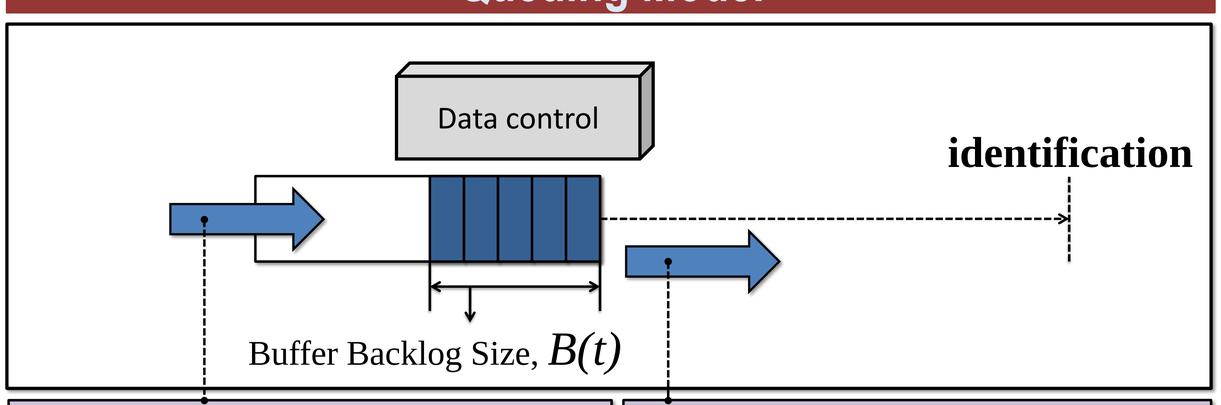
$B[t] = \infty$ (possibility of overflow) $\longrightarrow$ maximize $-V*B[t]a(k[t])$
minimize $a(k[t])$

Performance model and Number of drone selection

Tradeoffs



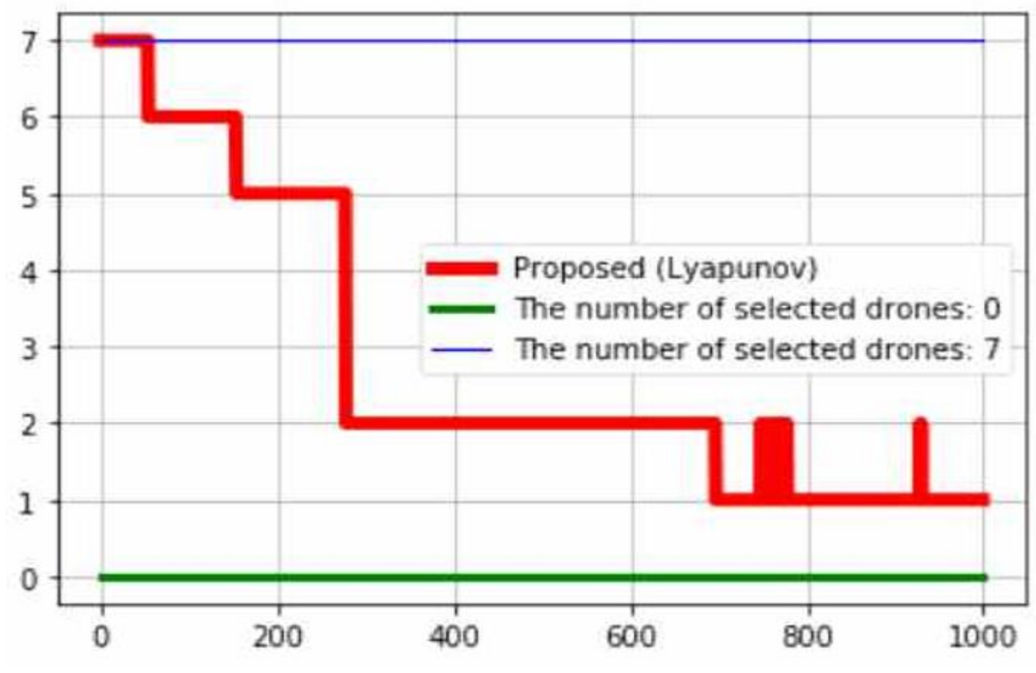
Queuing Model



Arrival Process (Control Action):
Proportional to the number of drones

Departure Process (Random Action):
Different for each image

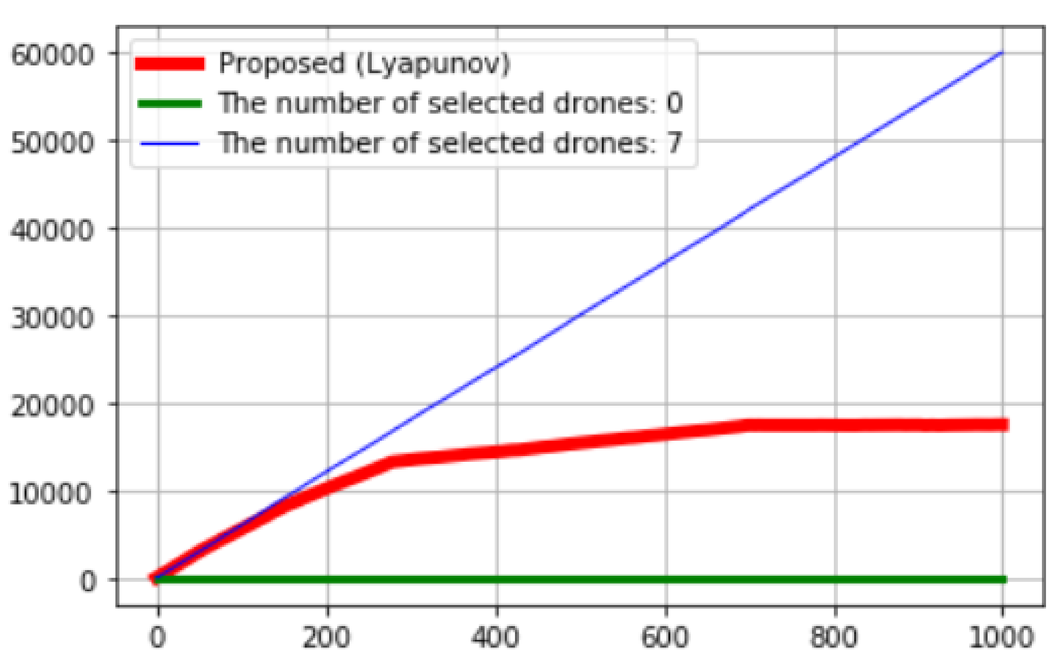
Number of drone selection



Static Drone Selection and Dynamic Drone Selection Trends

Performance Evaluation and Concluding Remarks

Performance Evaluation



Changes in the amount of data in the buffer due to static and dynamic drone selection

Concluding Remarks

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More data can result in higher reconnaissance performance, but less reliable mobile edge computing centers. Therefore, in this paper, we propose an algorithm that maximizes reconnaissance performance within the limit of system stability and evaluate its performance.

Future Research Directions

→ consider regional dependence in drone scheduling.
→ criteria for selecting specific drones for reconnaissance
(DSNR, Communication channel performance)

• **References** M. Shin, J. Kim, and M. Levorato, "Auction-Based Charging Scheduling With Deep Learning Framework for Multi-Drone Networks," *IEEE Transactions on Vehicular Technology*, 68(5):4235-4248, May 2019.

Korean Institute of Communication Sciences Winter Conference (KICS winter 2020)
February 5th – 7th, 2020
Yong pyong, South Korea