TEB1113
Algorithm and data structure
Performance Report

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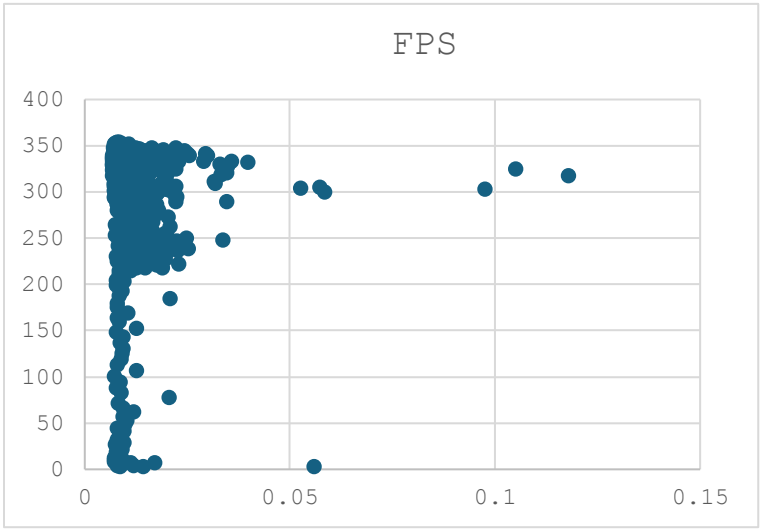
Introduction

This report will be observing the performance of a swarm program ran in unity and how the number of drones directly affects the performance on the machine. For our swarm program we chose a search and rescue as our application domain and the drones are deployed in numbers to search through forest terrain to locate victims or detect hazards in the forest. In our replication of a search and rescue drone, we have implemented a GPS tracking so that we are aware of the location of each drone, sensor to detect a victim in proximity with the drone and battery levels to detect which drones need to be returned. To create a more realistic setting, The battery levels of each drone will also change at a set interval partitioning will occur each time the battery levels change and the drones will change their colour accordingly.

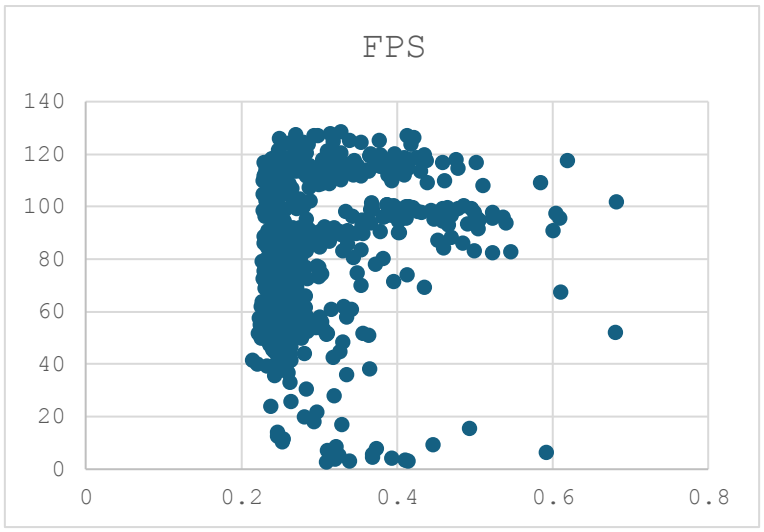
Performance

To calculate how well the swarm program is able to perform on a machine we will test the performance by changing the number of drones that are available while it performs partitioning and observe the effects on the frame per seconds(FPS). To ensure the results observed are tested at the same time we will note down the FPS up to the 5th partitioning that occurs.

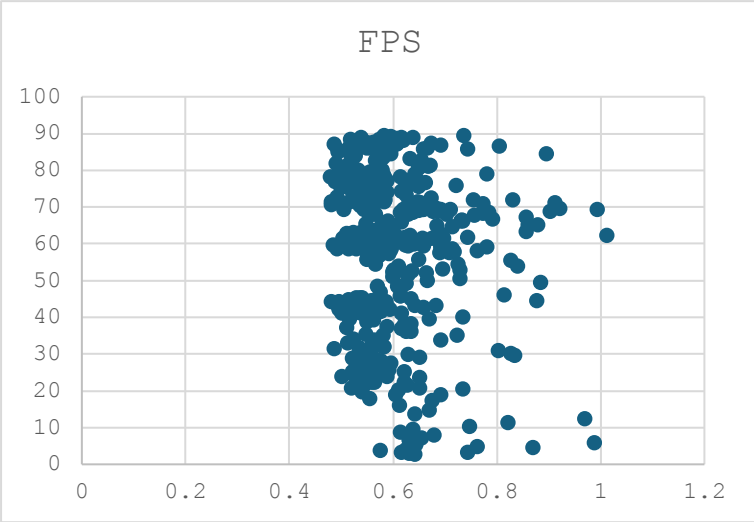
10 Drones



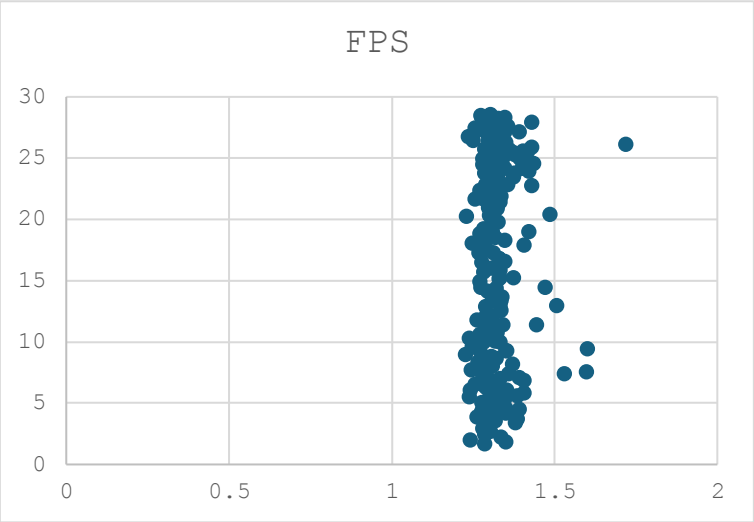
500 Drones



1000 Drones



2500 Drones



Analysis

In our experiment, we observed a steady decrease in FPS and a increase in the time taken it takes to process the drones to partition in the swarm. In our initial testing of ten drones, the FPS peaked at around 350 and was constant between 220FPS and 350FPS. The time taken was also low since there were only 10 drones excluding some anomalies where the time(ms) had exceeded 0.04ms.

When we increased the quantity of drones to 500 drones, we can note a significant decrease in FPS as the FPS peaked at around 130 FPS and the runtime also increased as all recorded values exceed 0.2ms unlike the previous 10 drones where the runtime did not even go over 0.04ms.

At 1000 Drones the FPS continues to decrease as expected running at a maximum of 90 FPS and the average time is between 0.5ms and 0.7ms. During our test we also observe more stutters in the frames as the program seem to freeze momentarily to complete the tasks; largely partitioning and changing the colour of each drone to match the partition. This can also be seen in the graph as more FPS is

being recorded below the peak(between 20-60FPS) rather than all at the top of the graph.

Our final test of 2500 drones, we can note a more stable trend across the FPS plots as between 1 to 30FPS, the plot seems to be the same rather than being at a steady 30FPS, the program flunctuates regularly between 1FPS and 30FPS. The time taken has also increased to above 1.25ms. Therefore we can note that the FPS becomes increasingly unstable as it flunctuates between 1FPS and 30FPS mainly because of the large number of drones that needs to be processed.

Conclusion

Overall, we can notice a trend in how the machine performs when we manipulate the number of drones that exist in the program.The first pattern we can recognize is the decrease in performance as more drones are required to be processed for partitioning. The smaller sample size including only 10 drones is able to run the program at a stable 350FPS however as the drones increased to 2500 drones, the performance also worsened down to 30FPS and flunctuates down to 1FPS. Therefore we can also state that as we increase the sample in a O(n) program the performance also becomes much more unstable as we can observe in the program that as we increased the sample the FPS became increasingly less stable and more likely to flunctuate to lower numbers.