Carwyn Collinsworth

09/29/21

CSE495 - Senior Honors Research Project

Professor Fodor, Jesse McKinney

**Purpose of document:**

1. General outline of project process (with dates for progress completion)
2. Subtasks for each main goal

**General Project Outline:**

1. 2-Dimensional collision avoidance model/simulation
   1. General Subtasks
      1. Research must be done to ensure this step is beneficial to further steps (integration with a 3D environment).
      2. Familiarize with TensorFlow.js
   2. Sequential Plan of Action
      1. Build a simple browser application with UI controls as an environment for a 2D drone to fly in.
         1. Must include border intersection, random obstacle generation, simple UI controls, obstacle intersection, perhaps score
      2. Read through TensorFlow.js documentation
      3. Follow a simple tutorial to familiarize with js tensor functions
      4. Build a simple model ([resource 1](https://medium.com/@pierrerouhard/reinforcement-learning-in-the-browser-an-introduction-to-tensorflow-js-9a02b143c099), [resource 2](https://storage.googleapis.com/tfjs-vis/mnist/dist/index.html)) for drone
         1. Remove arrow key control (replace with in-code events).
         2. Choose method of calculating reward (inverse distance from center, include way to negate ball and border intersections)
         3. Choice actions: rotate right, rotate left, power up, power down, do nothing.
      5. Train and Evaluate
      6. Beautify

Transform to 3D model? Possible?

Plan for integrating the tf model with Unreal Engine?

Need 2 way communication

Reasonable Date of Completion - 10/11/21 (Two weeks from now)

1. 3-Dimensional drone control and obstacle generation, as well as interactions
   1. General Subtasks
      1. Note: this does not include any ML or other algorithm for collision avoidance
      2. Familiarize with Unreal game engine
      3. Build simple environment with UI controllable drone
      4. Programmatic method of object generation (TCP/IP Socket?)
         1. Object generation initiated outside UE4
         2. Drone control from external source as well, enabling tf learning in familiar environment

Reasonable Date of Completion - 11/03/21 (3 weeks after previous deadline)

1. 3-Dimensional drone control with ML avoidance algorithm
   1. General Subtasks
      1. Expand 2D TensorFlow.js to train and evaluate on 3D data
      2. Research and execute tensorflow integration with UE4 platform
      3. Drone control from external source as well, enabling tf learning in familiar environment (Again)

Reasonable Date of Completion - 11/19/21 (Before Thanksgiving Break/Semester End)

This would be a nice point to present 1’st semester findings

Definitely need more information on how this works. Couldn’t find on the web.

1. 3-D drone control with interfacing with flight controller
   1. General Subtasks
      1. Flight controller research (f7, Pix hawk)
      2. Flight controller interfacing with simulator (UE4)

Reasonable Date of Completion - 02/16/22 (2+ weeks after semester start)

Method for vision analysis (on-board computing or offsite)

1. Mechanical drone build, sensor training
   1. General Subtasks
      1. Choose appropriate hardware
      2. Purchase/Source Drone Parts
      3. Vision Subsystem
      4. Wiring and Electronics

Reasonable Date of Completion - 04/15/22 (~2 months)

1. Report, Presentation, Evaluation

Reasonable Date of Completion - 05/01/22 (31 weeks total)

2’nd semester findings presented during finals week