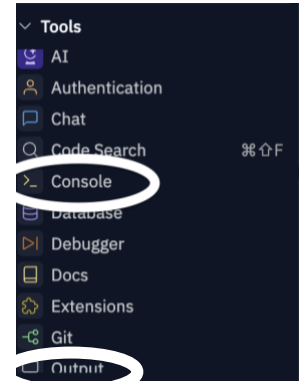


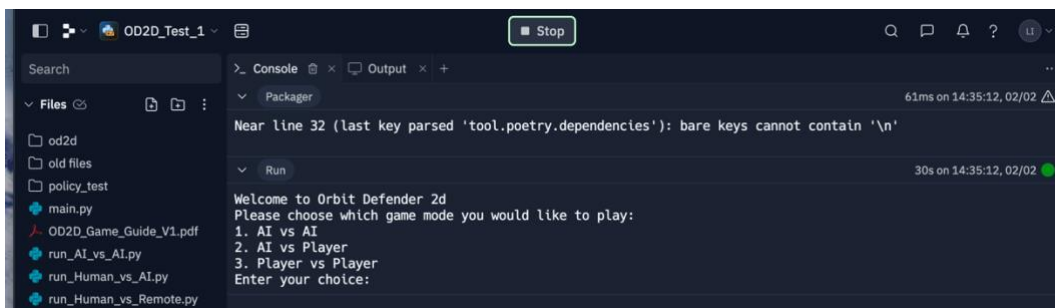
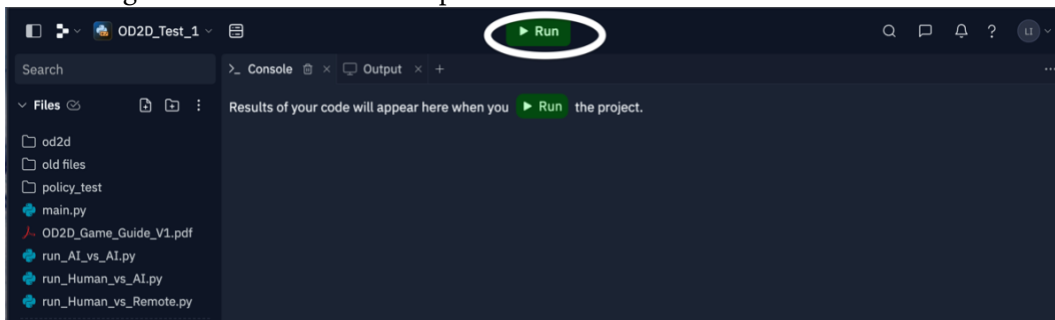
User Guide

The following steps are what you should take to launch OD2D in your browser

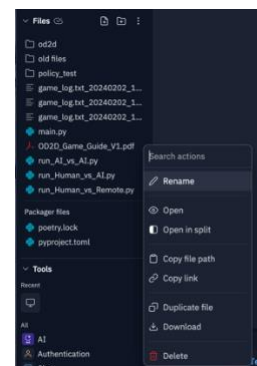
1. Go to the website <https://replit.com/~> and create an account through your Gmail or GitHub
2. Open <https://replit.com/@mpj1/OD2DTest1>
 - a. You should have the tab “Console” and “Output” open
 - b. If you can’t see either of these tabs, go to the “tools” dropdown and scroll until you find which one you do not currently see and click on it



3. Press the green run button at the top of the screen



4. Enter the number to the corresponding mode you would like to play
5. To view the game screen, click on the Output tab
6. To view the rule book while playing, press the three dots next to the OD2D Game Guide pdf to download it



The following steps are what you should take to install OD2D on your own device.

1. Go to Finder and figure out your unique file path to get to the “src” folder. This should be inside the folder with the GitHub repositories `od2d_learn` and `spacegym_od2d`. Here are some examples:
 - a. `Desktop/GitHub1/od2d_learn/src`
 - b. `Documents/GitHub/od2d_learn/src`
2. Open a new terminal window on your device. Next to your user ID in terminal, it should say (base).
3. Use “`cd [your pathway with back slashes]`” to navigate to your src folder.

```
Last login: Wed Jan 17 12:46:59 on ttys043
(base) lillyjohannan@dhcp-10-29-206-158 ~ % cd Documents/Github/od2d_learn/src
(base) lillyjohannan@dhcp-10-29-206-158 src % █
```

4. Activate `od2d_learn` using “`conda activate od2d_learn`”. Next to your user ID in the terminal, it should now say “`od2d_learn`”.

```
Last login: Wed Jan 17 12:46:59 on ttys043
(base) lillyjohannan@dhcp-10-29-206-158 ~ % cd Documents/Github/od2d_learn/src
(base) lillyjohannan@dhcp-10-29-206-158 src % conda activate od2d_learn
(od2d_learn) lillyjohannan@dhcp-10-29-206-158 src % █
```

5. Now type “`python [the name of the game file you are launching]`”. You can also press tab once you have typed a few characters to select which file you want.

```
Last login: Wed Jan 17 12:46:59 on ttys043
(base) lillyjohannan@dhcp-10-29-206-158 ~ % cd Documents/Github/od2d_learn/src
(base) lillyjohannan@dhcp-10-29-206-158 src % conda activate od2d_learn
(od2d_learn) lillyjohannan@dhcp-10-29-206-158 src % python koth_
koth_game_CLI_CLI.py          koth_game_rollout_inactive.py
koth_game_rollout.py          koth_random_valid.py
koth_game_rollout_CLI.py
```

OD2D Variations

Gameplay Variations

- **Human vs. Human (Local)**
 - File Name: `koth_game_rollout_CLI_CLI.py`
 - This game can be played on a local machine (Player 1 and Player 2 play on the same computer and pass it back and forth to make their moves).
 - Alpha’s (blue) phases will be before Beta’s (pink), and each player will complete their movement phase before moving onto the engagement phase.
- **Human vs. Human (Remote)**
 - File Name: `server_client_CLI.py` (for clients)

- File Name: run_2p_game_server.py (for server)
- The human vs human game can also be played on remote machines, which allows players to play on separate computers while a different machine is running the game server. Alternatively, Player 1 could run the server and Player 2 could join from a separate device.
- NOTE: you must know the IP address of the game server and ensure that the address is correctly set in the server_client_CLI.py file in order to play.
- **Human vs. AI**
 - File Name: koth_game_rollout_CLI.py
 - When playing against the computer, the AI is Alpha and the player is Beta.
- **AI vs. AI**
 - File Name: koth_game_rollout.py
 - The computer will run the game and play against itself. You can navigate through the game by using the bar on the side of the screen.
 - Use the play button to have the game run continuously. You can use the up and down arrows to shorten or lengthen the amount of time the game pauses before moving on to the next movement or action so that you can observe.
 - Use the forward arrow to step through the moves at your own time.

Game Variations

Implemented

Extra Ammo for Pawns

- Each Pawn is given 2 ammunitions instead of 1.
- With the current probability of shooting and colliding, and having only one ammo, this leads players to resort to colliding much more often since shooting is not worthwhile.
- Having more ammo to attack other satellites and the King would lead to increased self-preservation, prolonging the game and increasing the capabilities of the Pawns, as right now they are just used as means on collisions.

Varying Engagement Probabilities

- Very low probabilities (shoot/collide/guard)
 - Adjacent: 0.1/0.2/0.3 & Within: 0.3/0.4/0.5
 - This would really restrict how much players would want to use their ammo or their collision abilities. They would be more focused on the movement phases rather than the engagement phase and really plan ahead since the probabilities of success are so low. Players would also want to get their Pawns in the same square as a King before wasting shots/collisions.
- Very high probabilities (shoot/collide/guard)
 - Adjacent 0.5/0.6/0.7 & Within 0.85/0.9/0.95
 - Guard is extremely powerful, so while you are actively trying to attack the other player, the combination of your attacks and their guards (and vice versa) can lead to a lot of Pawns dying prematurely.

- Players are not as methodical and calculated in their rationale because there is almost no risk/loss to attempting a shot or collision.
- No randomization: all engagements have a probability of 1.0
 - AI will become more intelligent due to consistent reinforcement learning
 - Or AI will play same game every time...

Offensive (10 pawns, no ammo) v Defensive (5 pawns, 1 ammo)

- Playing Alpha (offensive)
 - Best plan of attack is to rush the defensive player with all your pawns (there is no point in keeping the pawns back near your king because the defensive player is likely not going to send any out)
 - Being able to get as many of your pawns into the same sector as the opponent's king as early as possible is crucial since Beta will likely win by points so it is a time game
 - Once in the sector, it is down to luck/probability and taking as many shots as possible at the king
- Playing Beta (defensive)
 - The first several turns for Beta do not involve any movement or engagement except for possibly moving the two side pawns into the goal sector
 - Once alpha pawns are nearby/in goal sector, you then use shoot/collide/guard to defend your king, but be careful of how much fuel you are using
 - Goal is to last long enough that your score can get to 250 before the opponent kills your king

Pending

Randomization Initial Placement of Goal Sector

- In the beginning of the game, the goal sector is placed in a random position.
- No restriction of which sector the goal sector could potentially be.
- Players will have to adjust their strategy such that getting 10 points for being in the goal sector is no longer a given/staying in place, but a long-term goal that can be achieved.

Randomization of Pawn Position

- In the beginning of the game, the Pawns' positions are random on the game board.
- This would prevent players from using the exact same strategy in the beginning of every game and moving their Pawns in the exact same pattern/path for the first few moves.
- This would make the game more interesting from the start, players would have to think critically about their movements and actions, and fuel would become extremely important if you had to travel farther.

Points for Destroying Enemy Satellites

- All initial conditions from regular game version are the same, except the following:
 - 10 points are added per turn if the King stays within the goal sector.
 - 3 points are added per turn if the King lies adjacent to the goal sector.

- Fuel is not counted as points.
- In addition, 3 points are added to your score if you successfully destroy one of the other player's Pawns. No points are subtracted if one of your Pawns gets obliterated.

Restriction of Number of Satellite Movement/Engagement per Turn

- Only a restricted number of satellites can be moved per turn, automatic NOOP for others.
- Adjusts strategy because you must think critically about which satellites require immediate attention and accomplish short term goals versus satellites that may help achieve long-term game success.

Asymmetric Game Variations

- **Offensive/Defense Asymmetry**
 - Scenario 1 – Probabilities:
 - The offensive player will have better probabilities for shooting and colliding, and zero probability for guard.
 - The defensive player will have very low probabilities for shooting and colliding, and a high probability for guard.
 - Fuel and the number of satellites remains the same for both players.
 - Scenario 2 – Scoring:
 - The offensive player will receive more points for destroying enemy Pawns, encouraging aggressive engagement.
 - The defensive player will receive more points for having its King stay in the goal sector, encouraging conservative action.
 - Scenario 3 – Number of Pawns (Trivial Case):
 - The offensive player will start with ten pawns.
 - The defensive player will start with three pawns.