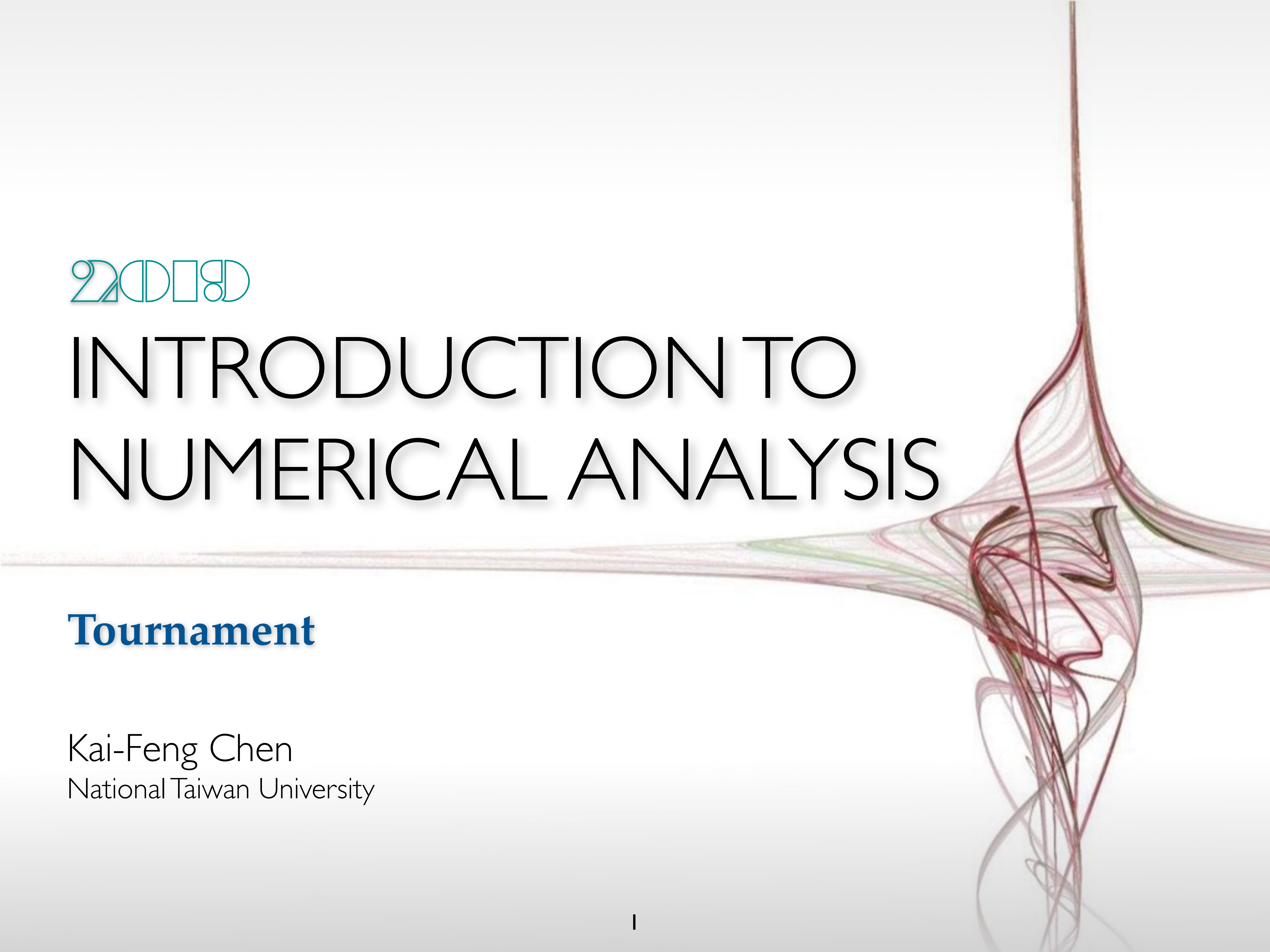
2018

INTRODUCTION TO NUMERICAL ANALYSIS

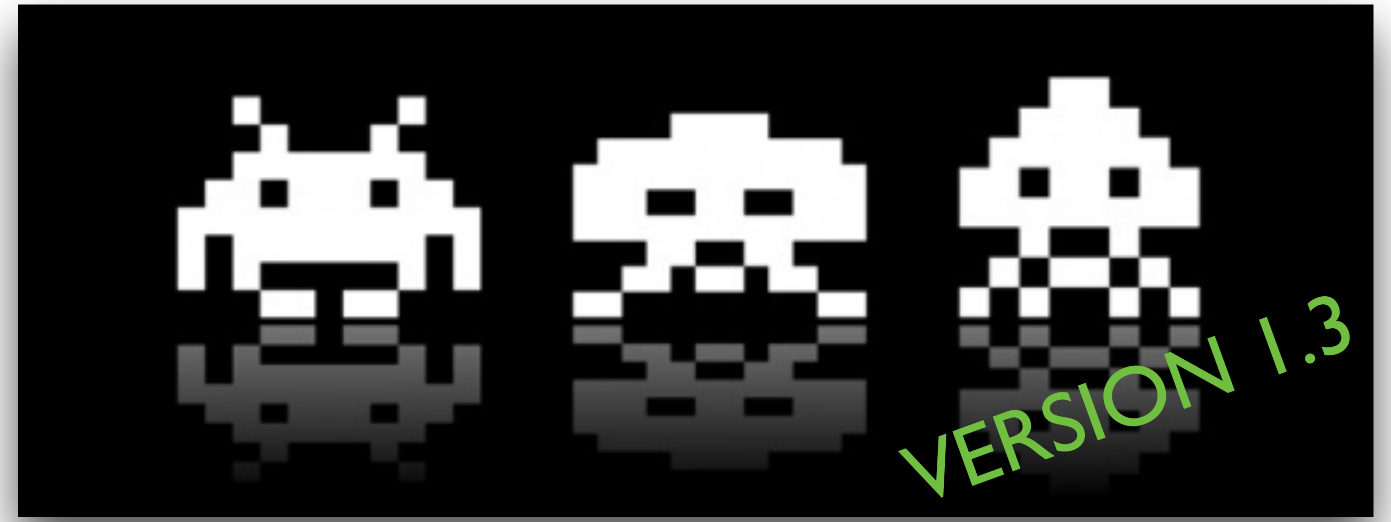
Tournament

Kai-Feng Chen
National Taiwan University



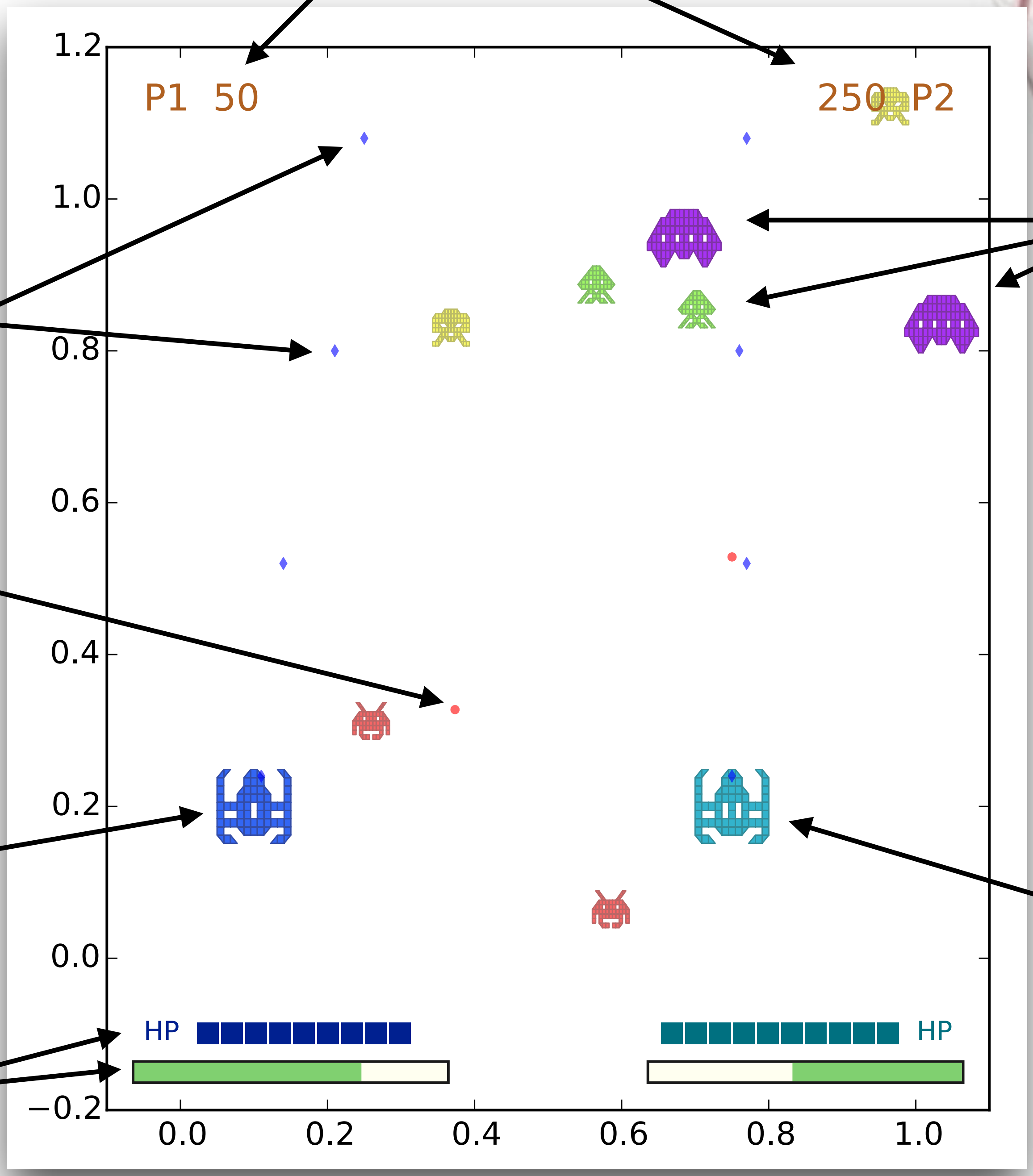
ALL YOU NEED TO KNOW

- We have the video game tournament!
- And we are going to play a not-so-classical **space invaders**.
- All you need to do is derive a good AI program to control your space battleship, hide from the attacks, and shoot those invaders down!
- We are going to run this tournament with pair of groups and who gets **higher scores** who win!



THE SETUP

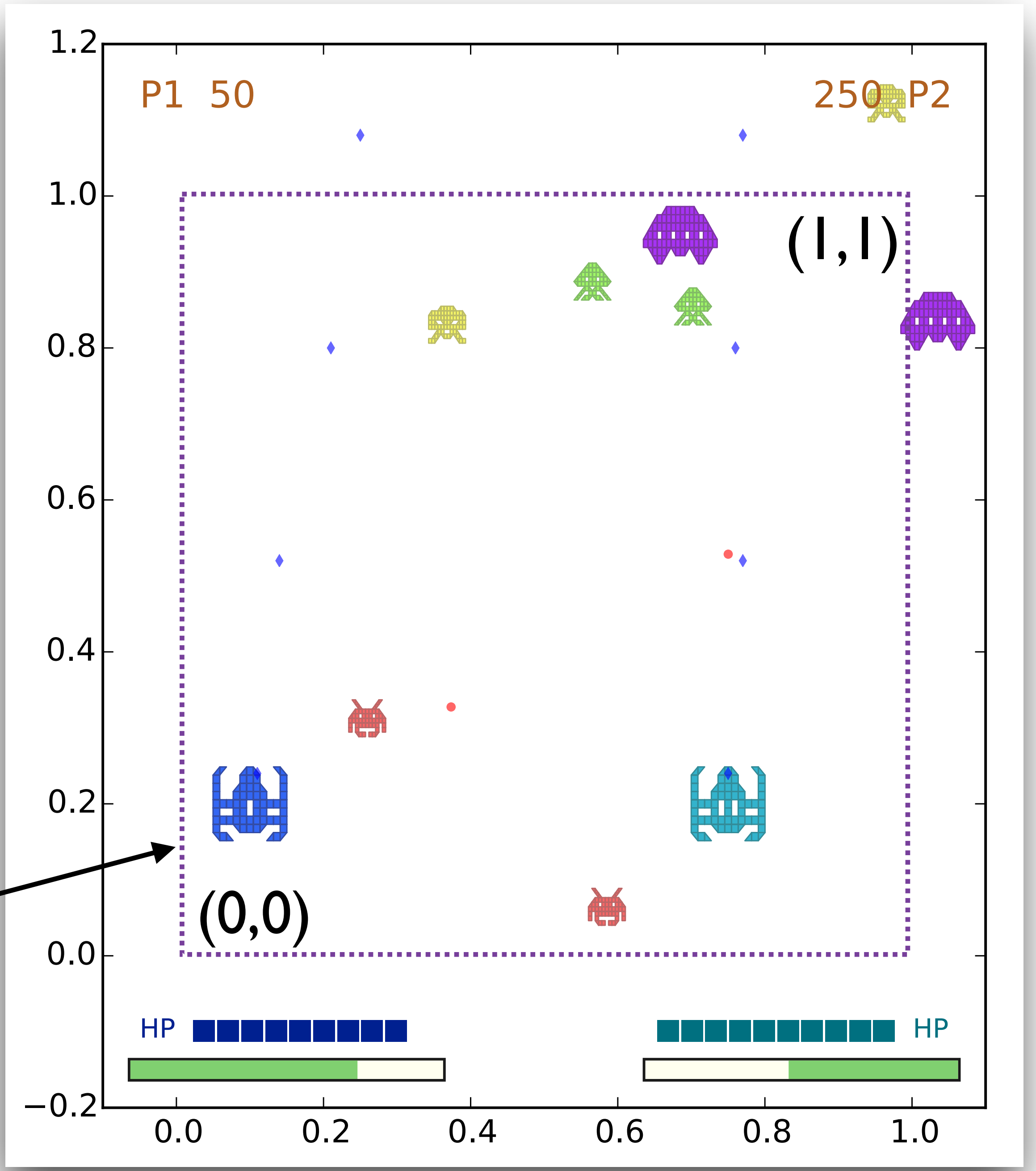
- Once you execute the `tournament.py` code:



COORDINATION SYSTEM

The invaders are basically falling from top

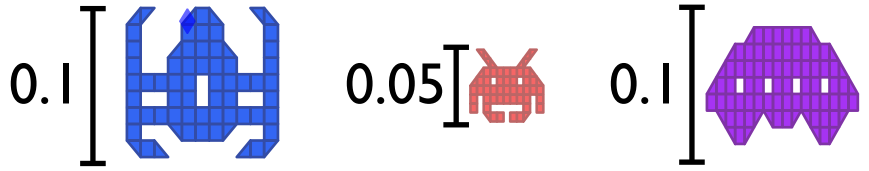
player's battleship are limited to move within this square



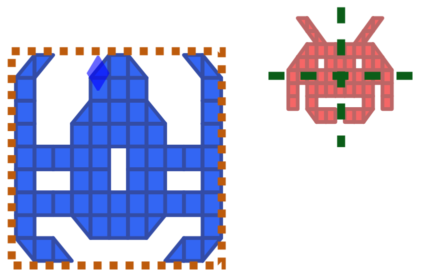
The maximum moving speed of your battleship is **0.01 unit per unit time frame** (as well as the invaders)

Your code needs to provide the speed scale (0.0–1.0) and the direction (0.0–2π) for every time frame

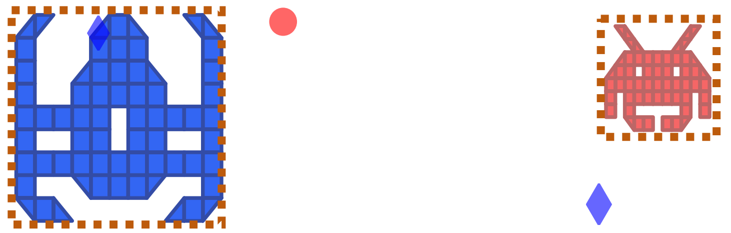
COORDINATION SYSTEM



The size of your battleship and the UFO are 0.1x0.1;
The size of invaders are 0.05x0.05



Collisions of **invaders** with <u>your battleship</u>:
whenever the center of the invader enter your square region.



Collisions of **bullets** with <u>your battleship</u> or <u>invaders</u>:
whenever it enters the square region.

TYPES OF THREATS

● type 0: bullet shoot from invaders / speed = 2x / 5 points*
(speed of your bullet is 4x!)

type 1: moving along a straight line / HP 1 / speed = 0.75x / 10 points

type 2: moving along a curve / HP 1 / speed = 0.75x / 10 points

type 3: heading toward you / HP 1 / speed = 0.3~0.78x / not shooting / 15 points

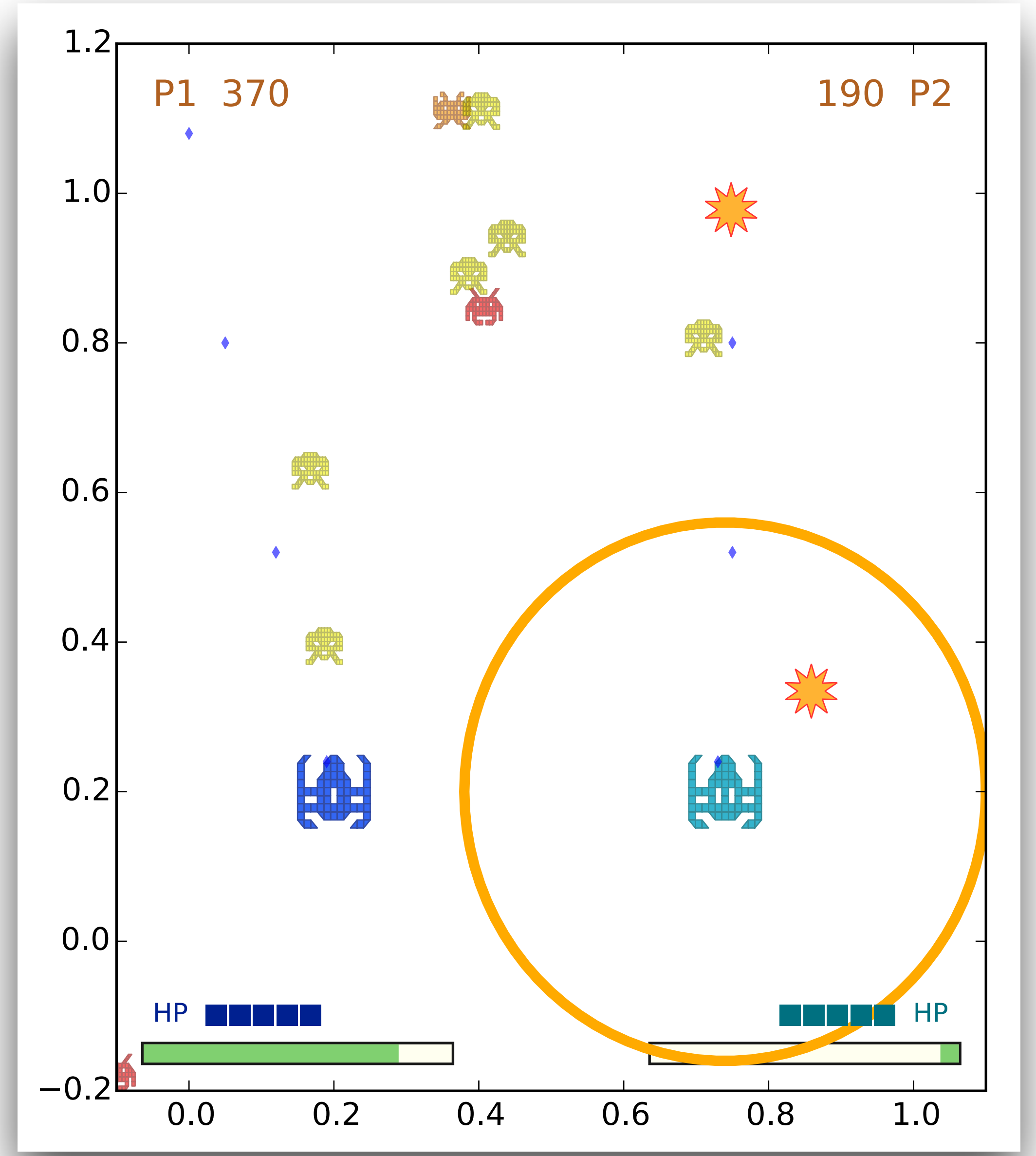
type 4: random walk / HP 1 / speed = 1x / not shooting / 15 points

type 5: moving horizontally / HP 5 / speed = 0.2x /
doubled shooting rate / 20 points per hit

* you can only "clear" those
bullets with the EMP bomb!

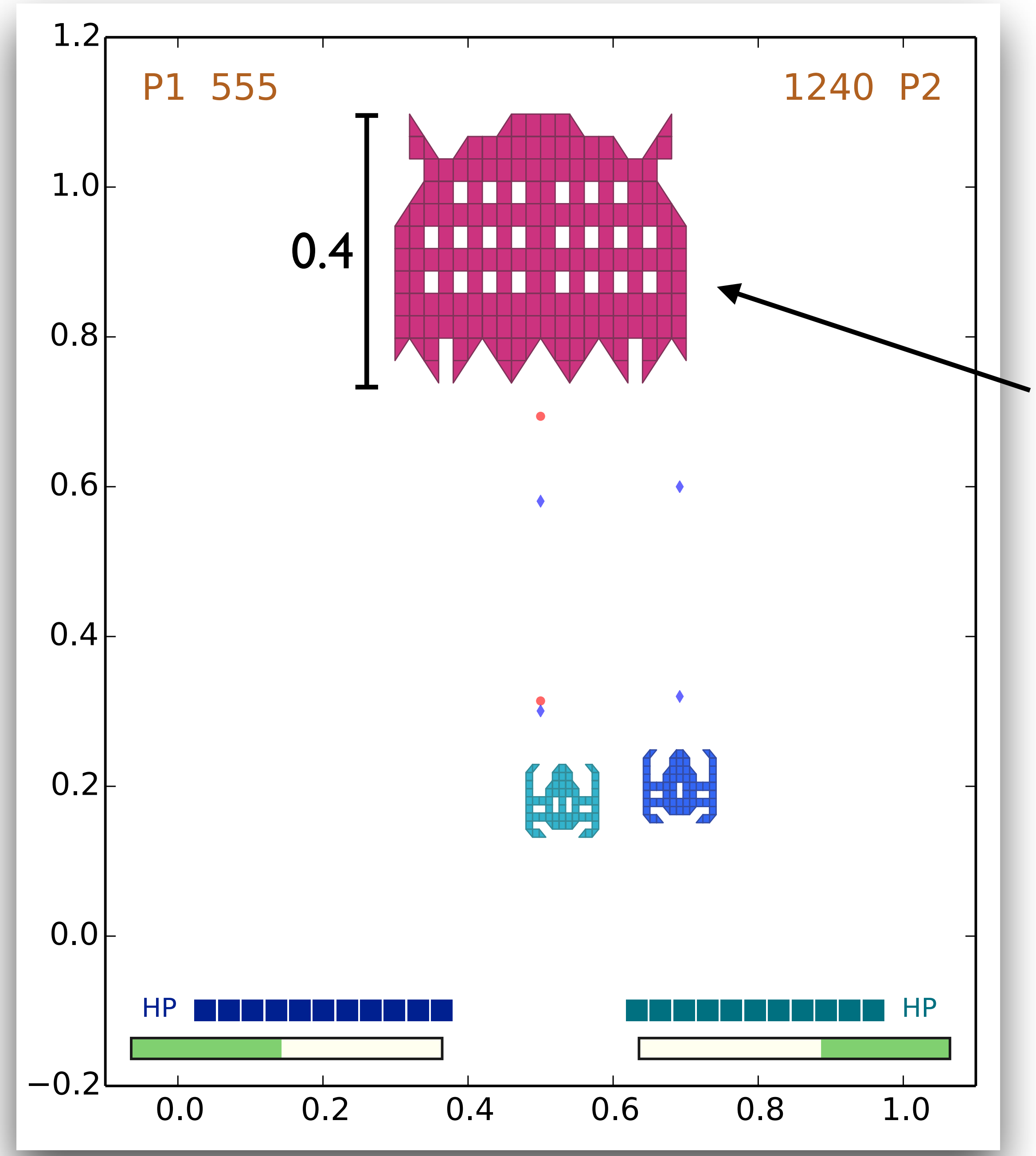
speed 1x = 0.01 unit per frame =
your maximum speed

RANGE ATTACK



- If your battleship moves slower (speed scale<1), the "energy gauge" can be accumulated. The amount of energy accumulation is 4*(1 – speed scale).
- When it is full (value = 1000), it will shoot an EMP bomb of maximum radius of 0.54.
- The EMP bomb will destroy any enemies within the ring (including the bullets), except the boss!
- However it also has some negative effects to your "friend"!

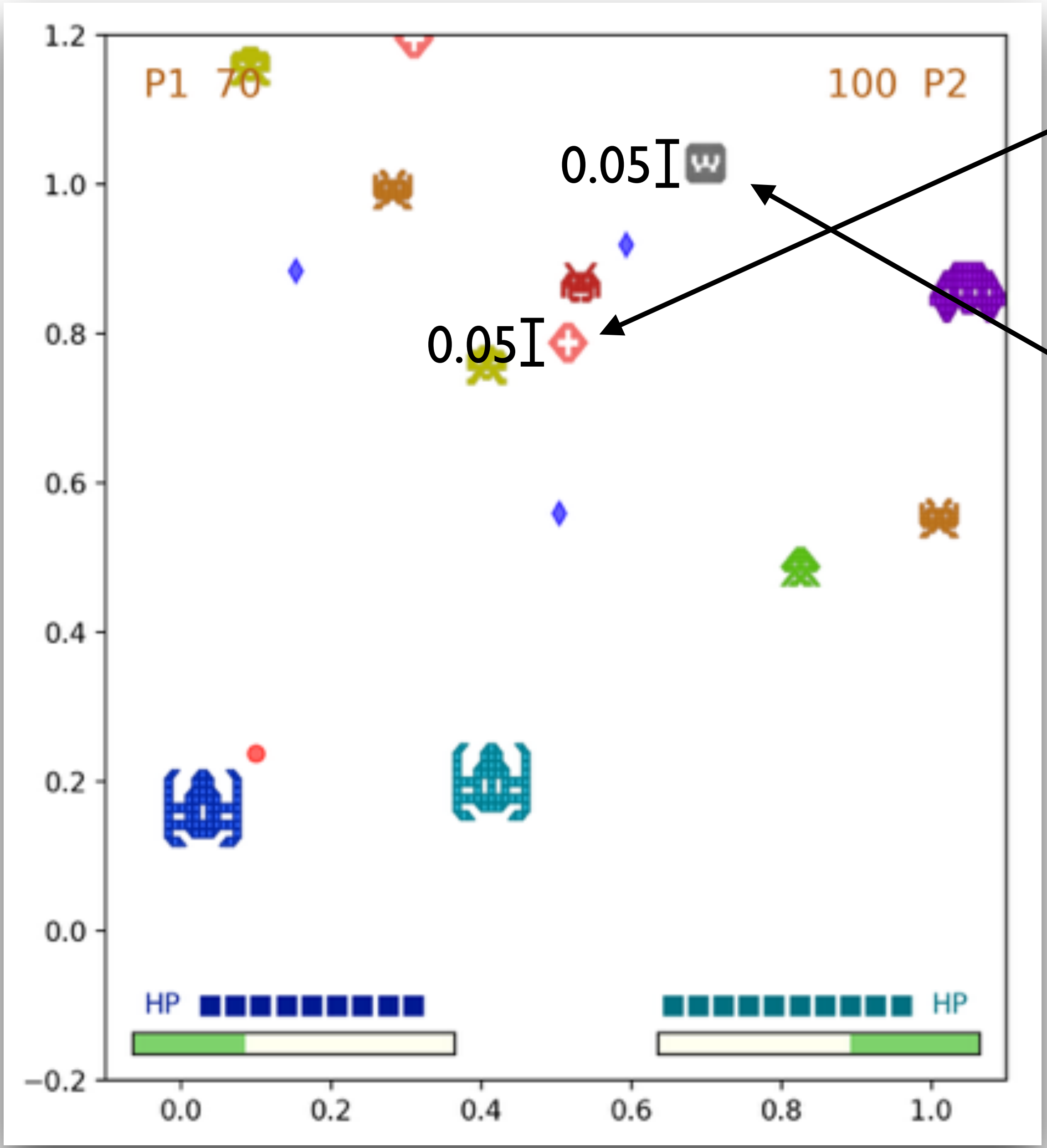
NEW SINCE VERSION 1.2



type 6: "Super UFO"
moving vertically / HP 120+ /
speed = 0.1x / 4x shooting rate /
10 points per hit

BOSS FIGHT WITH GIANT "SUPER UFO" BEFORE LEVEL UP!!

NEW SINCE VERSION 1.3



type 7: "Rescue capsule"
moving vertically / speed = 0.2x /
restore 1 HP (maximum HP=12)

type 8: "Weapon upgrade"
moving vertically / speed = 0.2x /
upgrade your weapon by 1 level
(maximum level=3)

If you get a hit, your weapon level will be downgraded as well!

PLAYER AI TEMPLATE

The **decision function** will be called by the main program **every frame** and you need to return the speed scale and direction of your movement.

```
import numpy as np

class player_module:

    # constructor, allocate any private date here
    def __init__(self):
        self.init_x, self.init_y = -1., -1.        ⇐ Constructor

    # Please update the banner according to your information
    def banner(self):
        print('-'*40)
        print('Author: your_name_here')     ⇐ Put your name and ID here
        print('ID: bxxxxxxxx')
        print('-'*40)

    # Decision making function for moving your ship, toward next frame:
    # simply return the speed and the angle
    def decision(self,player_data, enemy_data):  ⇐ the main decision function
```

player_template.py

```
def decision(self,player_data, enemy_data):

    speed, angle = 0., 0.

    # your data
    player1_x      = player_data[0][0]
    player1_y      = player_data[0][1]
    player1_hp     = player_data[0][2]
    player1_score  = player_data[0][3]
    player1_gauge  = player_data[0][4]
    player1_weapon = player_data[0][5]

    # data for another player
    player2_x      = player_data[1][0]
    player2_y      = player_data[1][1]
    player2_hp     = player_data[1][2]
    player2_score  = player_data[1][3]
    player2_gauge  = player_data[1][4]
    player2_weapon = player_data[1][5]
. . . . . .
    # loop over the enemies and bullets
    for data in enemy_data:
        type = data[0]
        x    = data[1]
        y    = data[2]
        dx   = data[3]
        dy   = data[4]
```

⇐ the information to be replied: speed scale (0 to 1), and the direction (0 to 2π)

Note the demo code only moves left & right, but you can actually move toward any direction.

⇐ your current data (coordination, HP, etc)

Note you are always the "player1" here.

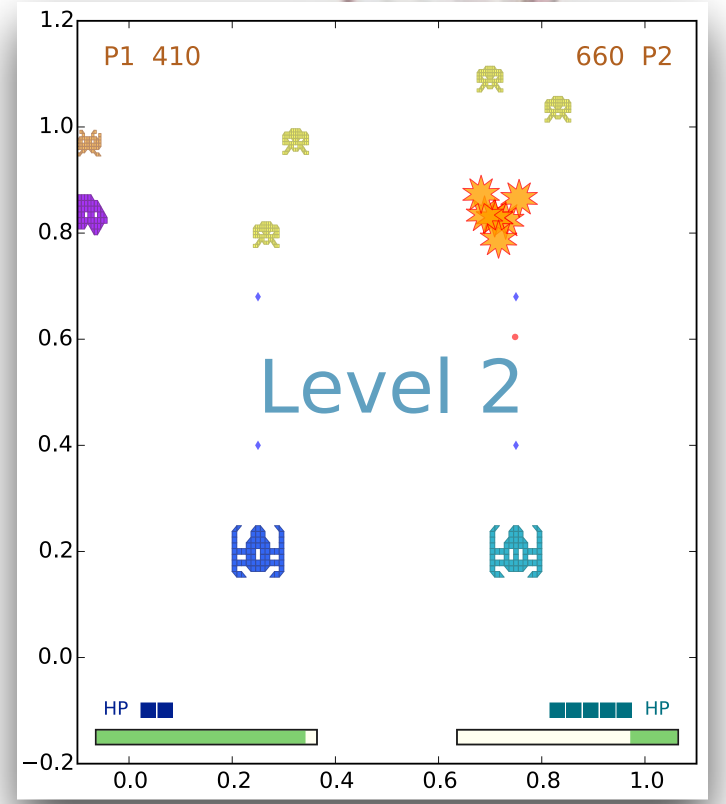
⇐ the data for another player

⇐ invader's information (including bullets)

player_template.py

HAVE FUN!

- Who gets **more scores** in the end win!
- We will have two rounds of tournament:
  - **Round match**: will reduce the # of players by half, the rest players enter the final match.
  - **Final match**: elimination game (targeting your championship!).
  - Anyone who enters the final match (≦~*50% of participants*) will get a level upgrade to your final score of this course!
- Please provide the first version of your code on **May/27** for the first round; the final match will be held on **June/10** (with your final code).



Game level up with higher scores, but with more enemies…