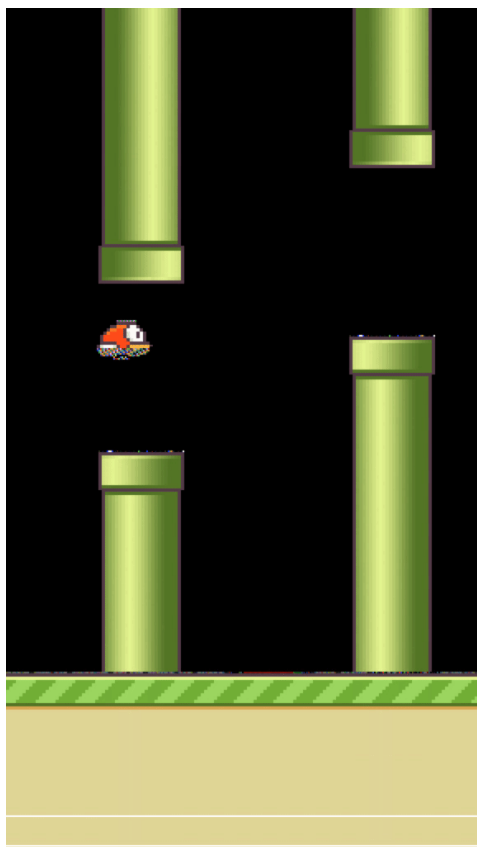


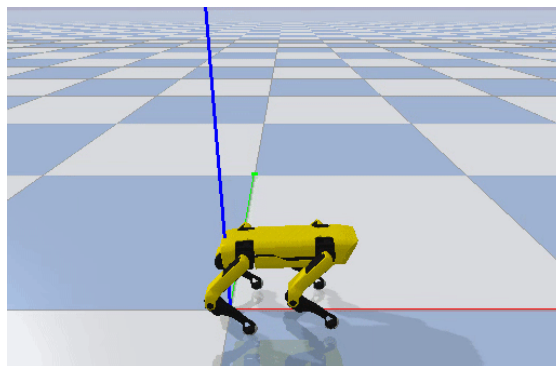
# 1.0 Concept of DRL

## ➤ Deep Reinforcement Learning (DRL)

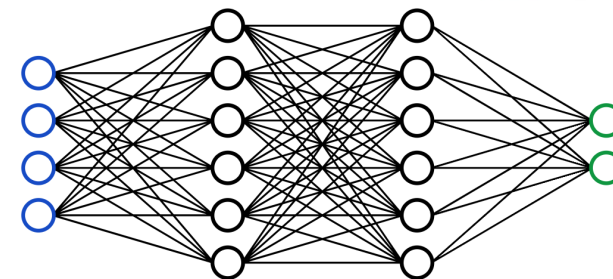
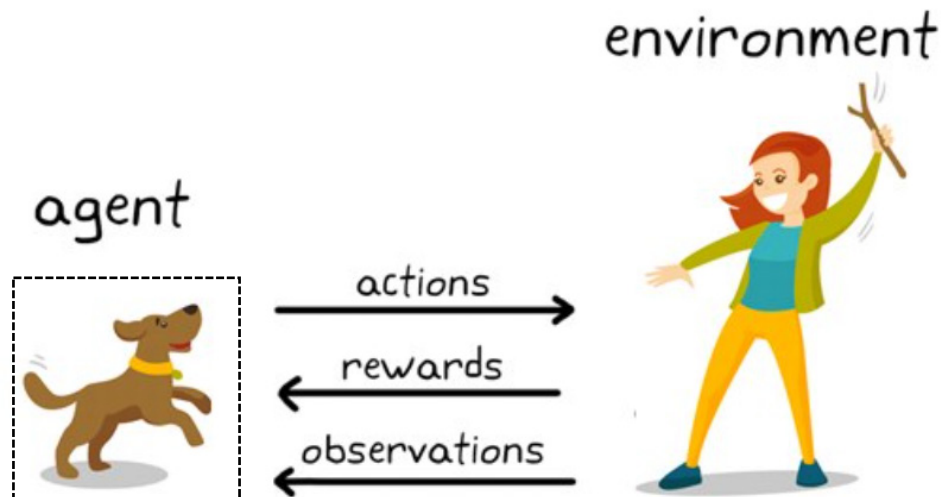
Flappy bird game



Quadruped Robots



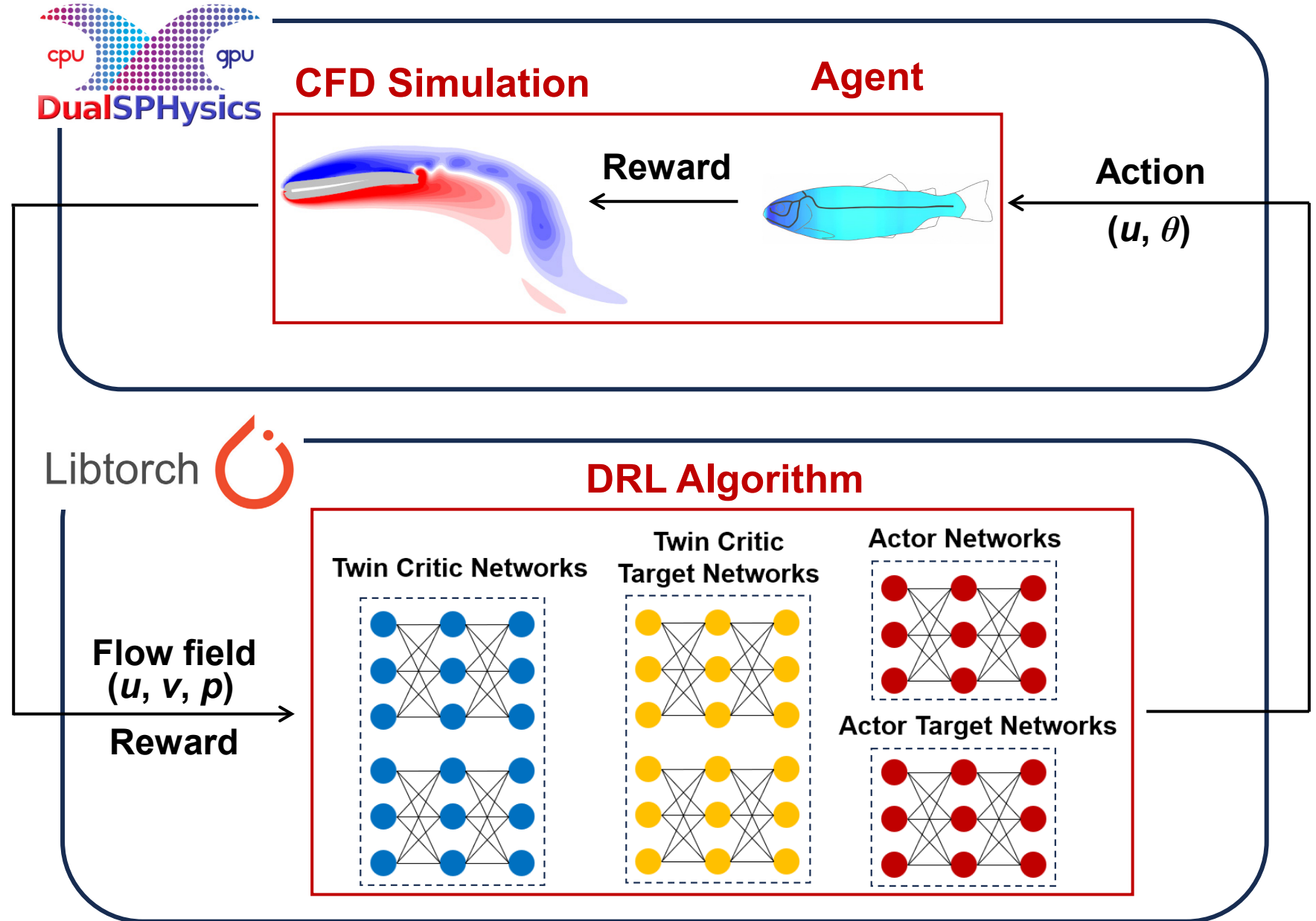
AlphaGo



- Make decisions by interacting with its environment
- Agent takes suitable action to maximize reward in a particular situation

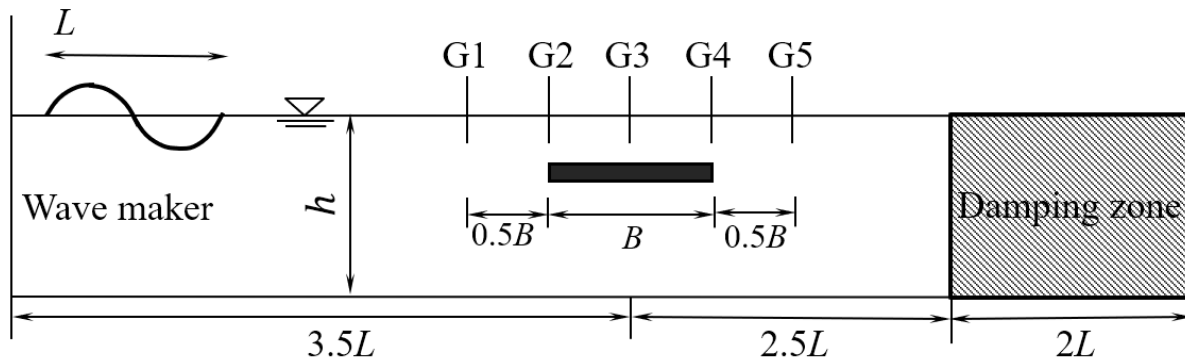
# 1.1 Coupling DualSPHysics+ and DRL

- Libtorch is linked to DualSPHysics+ as a dynamic library
- All codes are in C++ and can be parallelized using GPU

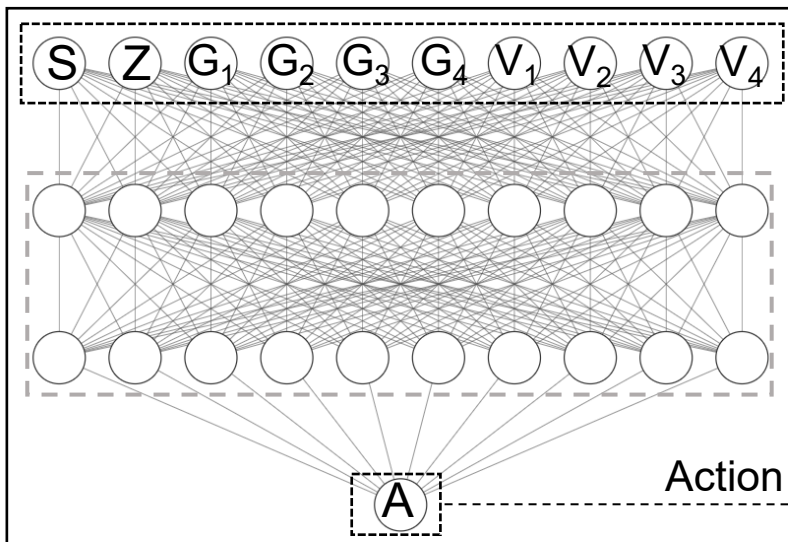


# 1.2 Numerical validations

## ➤ Active controlled plate breakwater



### DRL ANN



### State

- Last action (S)
- Position of plate (Z)
- Wave height (G1-G4) and its change rate (V1-V4)

### Environment

- Fluid-structure interaction simulated by SPH

Observation

Reward G5

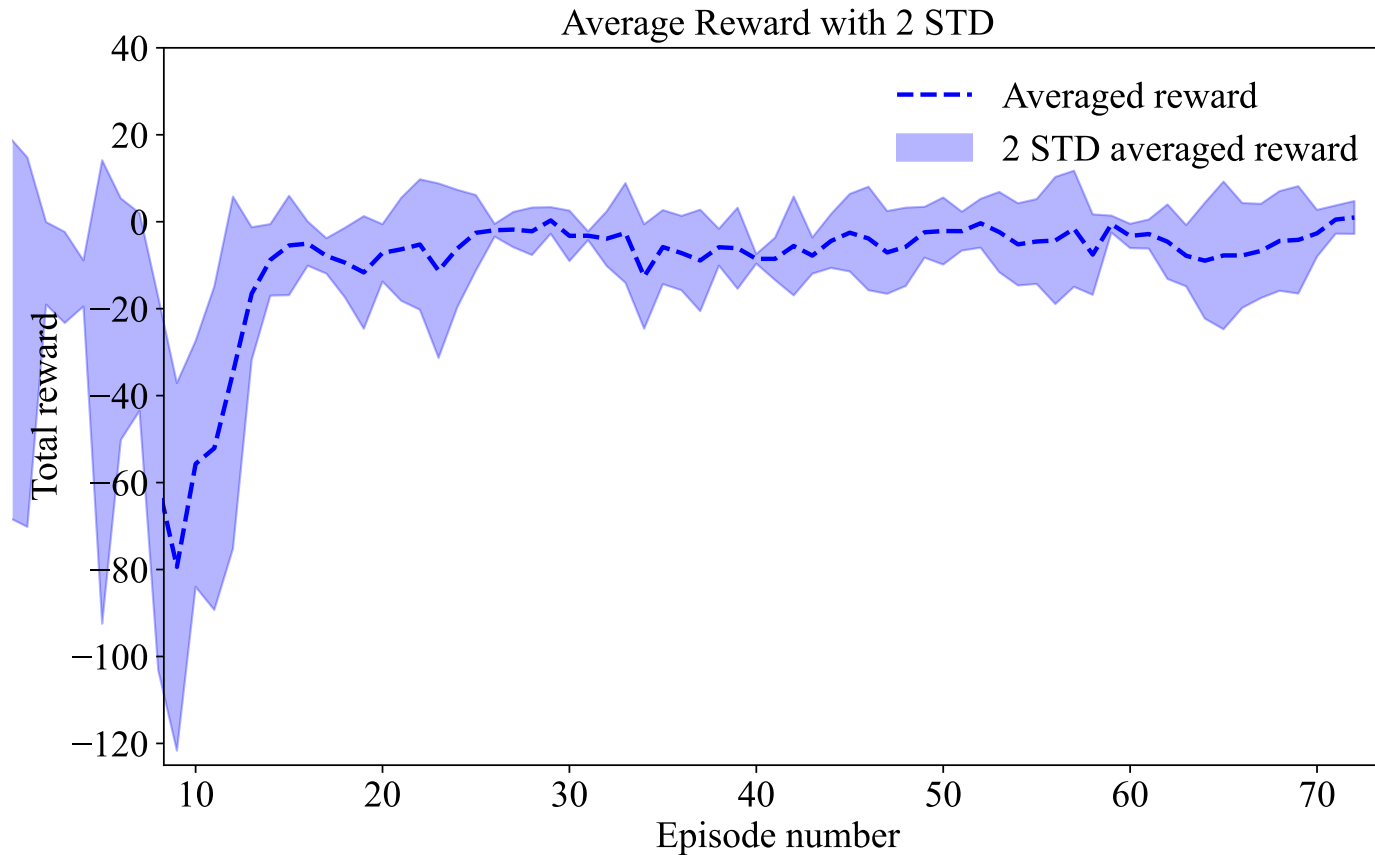
Action

- The SPH solver acts as an environment during training
- The reinforcement learning model is built based on the Libtorch framework

# 1.2 Numerical validations



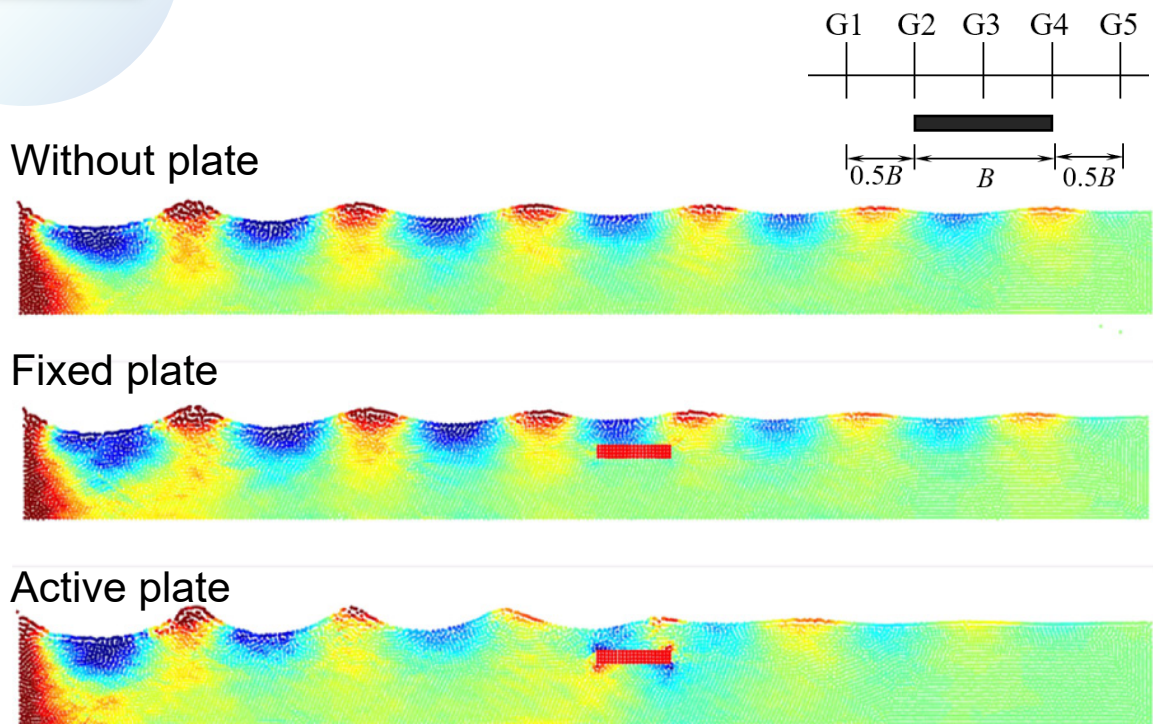
## ➤ Total reward



- The learning process of agent performs good stability
- The average reward keeps convergence and tuning slightly after 20 episodes



# 1.2 Numerical validations



- Active control plate has a significant effect in reducing wave height
- Pulling the water body downward when the wave crest arrives

