REINFORCEMENT LEARNING RAINBOW SNAKE

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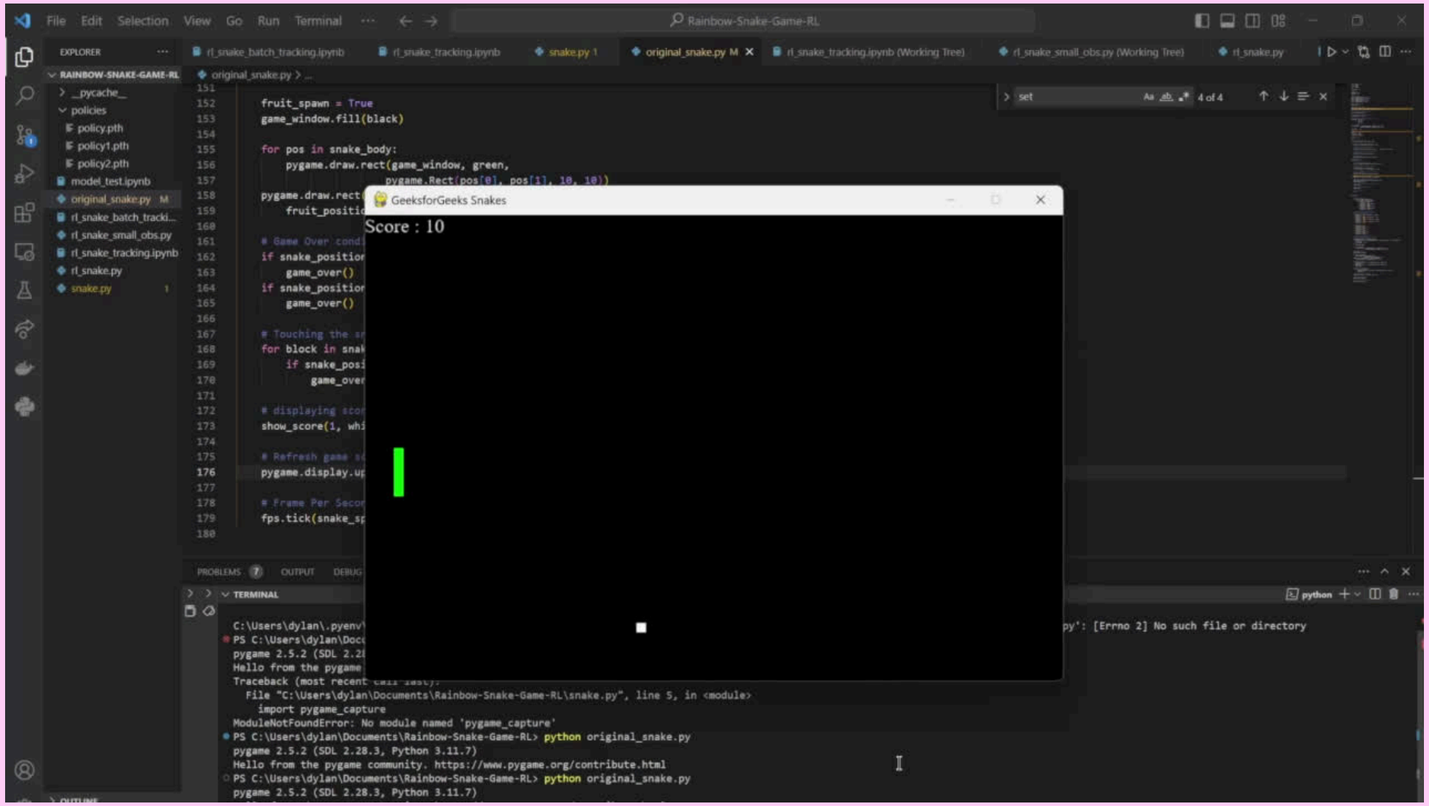
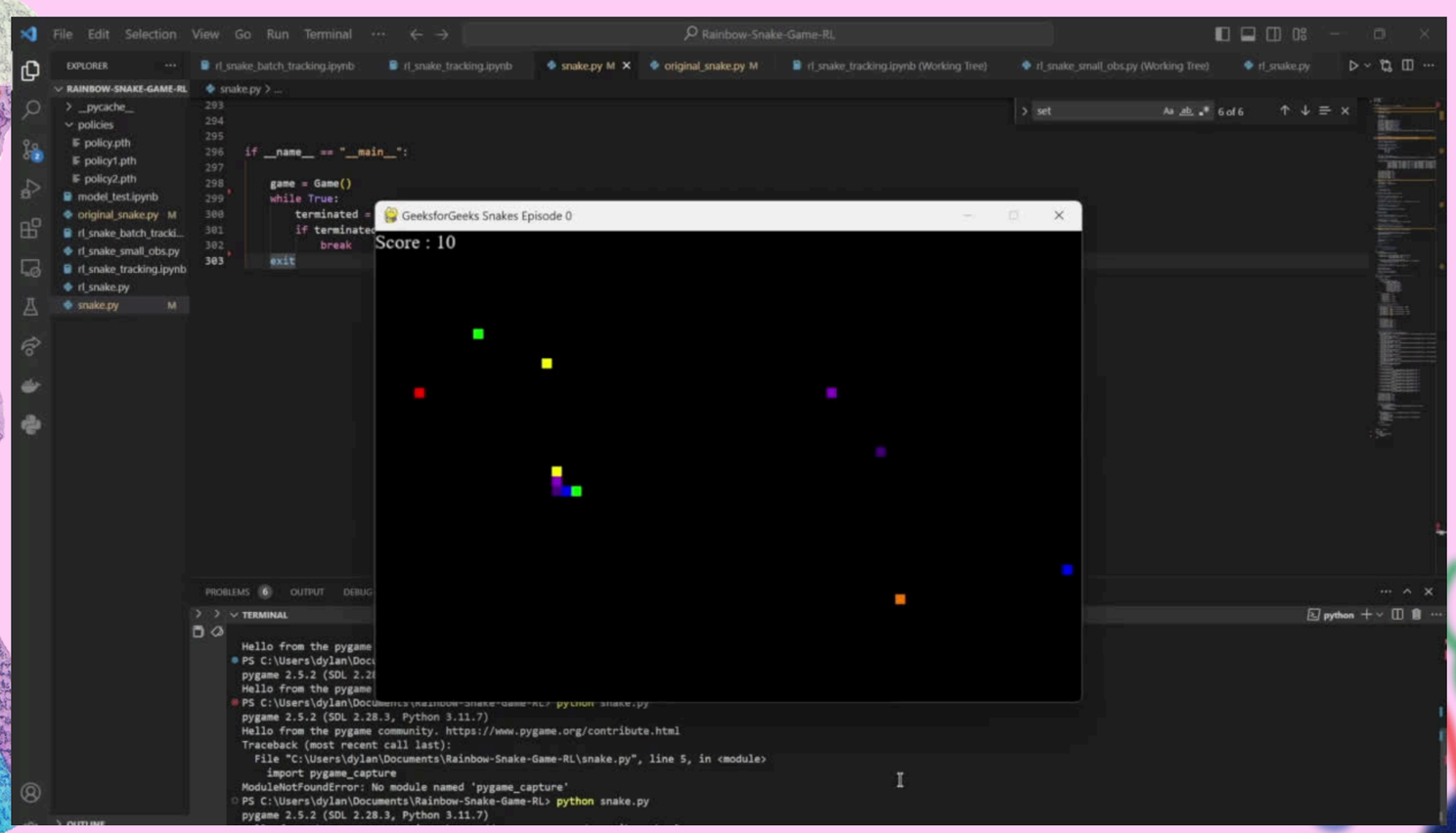
THE GAME:



https://www.geeksforgeeks.org/snake-game-in-python-using-pygame-module/

MAKE IT RAINBOW ROAD



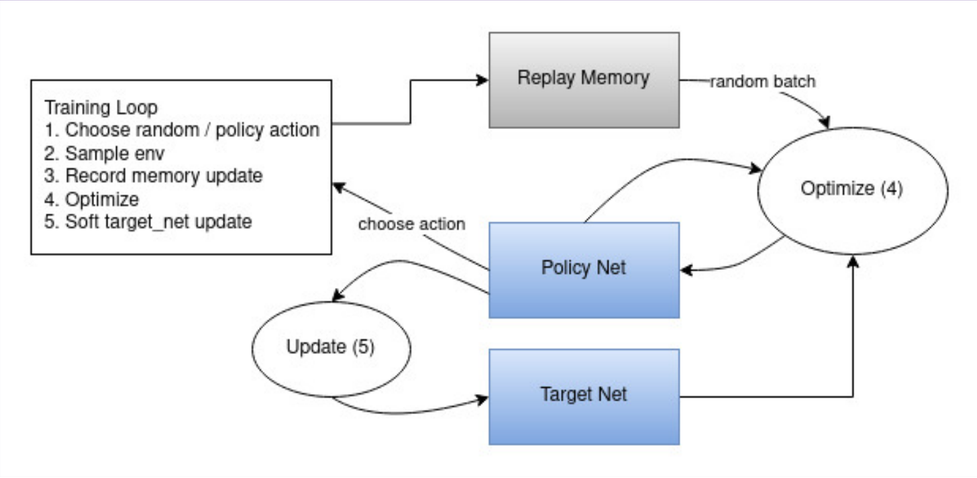
MODEL ARCHITECTURE

Double DQN

```python
class DQN(nn.Module):
    def __init__(self, n_observations, n_actions):
        super(DQN, self).__init__()
        self.fc1 = nn.Linear(n_observations, 128)
        self.fc2 = nn.Linear(128, 128)
        self.fc3 = nn.Linear(128, 128)
        self.fc4 = nn.Linear(128, n_actions)

    def forward(self, x):
        x = F.relu(self.fc1(x))
        x = F.relu(self.fc2(x))
        x = F.relu(self.fc3(x))
        x = self.fc4(x)
        return x
```

```python
# hyperparameters
batch_size = None
gamma = 0.99
epsilon = 0.90
epsilon_start = 0.90
epsilon_end = 0.05
epsilon_decay = 50
tau = 0.005
lr = 1e-3
batch_size = 128

# action space and observation space size
x_window_size = 720
y_window_size = 480
x_axis_size = int(x_window_size / 10)
y_axis_size = int(y_window_size / 10)
n_actions = 4  # up down left right
n_observations = 28  # length of obs vectpr

# initialize neural networks
policy_net = DQN(n_observations, n_actions)  #.to(device)
target_net = DQN(n_observations, n_actions)  #.to(device)

# set target net to have the same weights as policy net
target_net.load_state_dict(policy_net.state_dict())

# set optimizer
optimizer = optim.AdamW(policy_net.parameters(), lr=lr, amsgrad=True)
```

MODEL ARCHITECTURE



Q-Target

$$y_j = r_j + \gamma \max_{a'} \hat{Q}\left(\phi_{j+1}, a'; \theta^-\right)$$

$$R_{t+1} + \gamma max_a Q(S_{t+1}, a)$$

Immediate Reward — Discounted Estimate optimal Q-value of next state

TD Target

Q-Loss

$$y_j - Q\left(\phi_j, a_j; \theta\right)$$

$$[R_{t+1} + \gamma max_a Q(S_{t+1}, a) - Q(S_t, A_t)]$$

Immediate Reward — Discounted Estimate optimal Q-value of next state — Former Q-value estimation

TD Target

TD Error

STRUGGLES

- Designing Reward
- Snake not Learning T-T

CREDITS

- https://pytorch.org/tutorials/intermediate/reinforcement_q_learning.html
- https://www.geeksforgeeks.org/snake-game-in-python-using-pygame-module/
- https://huggingface.co/learn/deep-rl-course/unit0/introduction