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In [1]: import gym
import numpy as np
import sys
import math
import ipdb
from six import StringIO
from gym import spaces
from gym.utils import seeding
import random
from copy import deepcopy
from collections import namedtuple
from numba import jitclass, int64, float32, float64, bool_

import torch.nn as nn
import torch
import torch.nn.functional as F
from torch import optim
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In [2]: def weighted_mse_loss(input, target, weight):
        return torch.sum(weight * (input - target) ** 2)

def optimize_model(
    dqn_net,
    target_net,
    memory,
    learning_rate,
    batch_size,
    size_board,
    gamma,
    optimizer,
    device,
):
    tree_indexes, memory_batch, batch_ISWeights = memory.sample(batch_size)

    samples = Transition(*zip(*memory_batch))

    states_batch = samples.state
    actions_batch = samples.action
    rewards_batch = samples.reward
    next_states_batch = samples.next_state
    dones_batch = samples.done

    target_qs_batch = []

    torch_next_states_batch = (
        torch.from_numpy(np.asarray(next_states_batch)).float().to(device)
    )

    # Get Q values for next state
    q_next_state = dqn_net(torch_next_states_batch, batch_size, size_board)

    q_target_next_state = (
        target_net(torch_next_states_batch, batch_size, size_board).cpu().detach()
    )

    for i in range(0, len(memory_batch)):
        terminal = dones_batch[i]

        action = np.argmax(q_next_state[i].cpu().detach().numpy())

        if terminal:
            target_qs_batch.append(rewards_batch[i])
        else:
            target = rewards_batch[i] + gamma * q_target_next_state[i][action]
            target_qs_batch.append(target)

    targets_batch = np.array([each for each in target_qs_batch])

    torch_states_batch = torch.from_numpy(np.asarray(states_batch)).float().to(device)

    output = dqn_net(torch_states_batch, batch_size, size_board)

    torch_actions_batch = torch.from_numpy(np.asarray(actions_batch))
    torch_actions_batch = torch_actions_batch.unsqueeze(0)
    torch_actions_batch = torch_actions_batch.view(batch_size, 1)

    q_values = output.gather(1, torch_actions_batch.to(device))
    q_values = q_values.float()

    absolute_errors = (
        torch.abs(
            q_values
            - torch.from_numpy(targets_batch).view(batch_size, 1).float().to(device)
        )
        .cpu()
        .detach()
        .numpy()
    )

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    )

    torch_batch_ISWeights = torch.from_numpy(batch_ISWeights).to(device)

    diff_target = q_values - torch.from_numpy(targets_batch).view(
        batch_size, 1
    ).float().to(device)
    squared_diff = diff_target ** 2
    weighted_squared_diff = squared_diff * torch_batch_ISWeights

    loss = torch.mean(weighted_squared_diff)

    optimizer.zero_grad()

    loss.backward()
    optimizer.step()

    absolute_errors = np.squeeze(absolute_errors, 1)

    memory.batch_update(tree_indexes, absolute_errors)

    return loss.cpu().detach().numpy()

def pre_train(env, pre_train_len, memory):
    print("Starting pretrain...")
    board, valid_movements = env.reset()
    state = to_power_two_matrix(board)

    eps_threshold = 1

    for i in range(pre_train_len):
        action = selection_action(
            eps_threshold, valid_movements, None, None, None, None
        )

        new_board, reward, done, info = env.step(action)

        if done:
            next_state = np.zeros(state.shape)
            memory.store(state, action, reward, next_state, done)

            board, valid_movements = env.reset()

        else:
            next_state = to_power_two_matrix(new_board)
            memory.store(state, action, reward, next_state, done)

            state = next_state

            valid_movements = info["valid_movements"]

def train(
    dqn_net,
    target_net,
    env,
    memory,
    batch_size,
    size_board,
    episodes,
    ep_update_target,
    decay_rate,
    explore_start,
    explore_stop,
    learning_rate,
    gamma,
    interval_mean,
):
    device = torch.device("cuda" if torch.cuda.is_available() else "cpu")
    dqn_net.to(device)

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target_net.to(device)

print("Starting training...")
decay_step = 0

total_steps_per_episode = []
total_rewards_per_episode = []
total_loss_per_episode = []
total_score_per_episode = []

best_board = None
best_reward = 0
best_score = 0
best_steps = 0
best_ep = -1

optimizer = optim.RMSprop(dqn_net.parameters(), lr=learning_rate)

for ep in range(epochs):
    step = 0
    episode_rewards = []
    board, valid_movements = env.reset()
    state = to_power_two_matrix(board)
    done = False
    loss_ep = []

    while True:
        step += 1

        decay_step += 1

        eps_threshold = explore_start + (explore_end - explore_start) * np.exp(
            -decay_rate * decay_step
        )
        action = selection_action(
            eps_threshold, valid_movements, dqn_net, state, size_board, device
        )
        new_board, reward, done, info = env.step(action)

        episode_rewards.append(reward)

    if done:
        total_steps_per_episode.append(step)

        next_state = np.zeros((1, size_board, size_board, 16))

        total_reward = np.sum(episode_rewards)

        total_rewards_per_episode.append(total_reward)

        memory.store(state, action, reward, next_state, done)

        loss_total_ep = np.sum(loss_ep) / step
        total_loss_per_episode.append(loss_total_ep)

        total_score_per_episode.append(info["total_score"])

        print("Episode:", ep)
        print("Total Reward:", total_reward)
        print("Total episodes", step)
        print("Eps_threshold:", eps_threshold)
        print("Loss ep:", loss_total_ep)
        env.render()
        print("-----")

        if info["total_score"] > best_score:
            best_score = info["total_score"]
            best_reward = total_reward
            best_ep = ep
            best_board = deepcopy(new_board)
            best_steps = step

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        else:
            next_state = to_power_two_matrix(new_board)

            memory.store(state, action, reward, next_state, done)

            state = deepcopy(next_state)

            valid_movements = info["valid_movements"]

            board = deepcopy(new_board)

        loss = optimize_model(
            dqn_net,
            target_net,
            memory,
            learning_rate,
            batch_size,
            size_board,
            gamma,
            optimizer,
            device,
        )

        loss_ep.append(loss)

        if done:
            break

    if ep % ep_update_target == 0:
        target_net = deepcopy(dqn_net)

    print("*****")
    print("Best ep", best_ep)
    print("Best Board:")
    print(best_board)
    print("Best step", best_steps)
    print("Best score", best_score)
    print("*****")

    plot_info(
        total_steps_per_episode,
        total_rewards_per_episode,
        total_loss_per_episode,
        total_score_per_episode,
        interval_mean,
        episodes,
    )
```

In [3]: !pip install ipdb --user

Requirement already satisfied: ipdb in /home/duvvuri.s/.local/lib/python3.7/site-packages (0.13.9)  
 Requirement already satisfied: decorator; python\_version > "3.6" in /home/ood.discovery.neu.edu/software/anaconda3/2019.10/lib/python3.7/site-packages (from ipdb) (4.4.0)  
 Requirement already satisfied: setuptools in /home/ood.discovery.neu.edu/software/anaconda3/2019.10/lib/python3.7/site-packages (from ipdb) (41.4.0)  
 Requirement already satisfied: toml<=0.10.2; python\_version > "3.6" in /home/duvvuri.s/.local/lib/python3.7/site-packages (from ipdb) (0.10.2)  
 Requirement already satisfied: ipython>=7.17.0; python\_version > "3.6" in /home/duvvuri.s/.local/lib/python3.7/site-packages (from ipdb) (7.30.1)  
 Requirement already satisfied: backcall in /home/ood.discovery.neu.edu/software/anaconda3/2019.10/lib/python3.7/site-packages (from ipython>=7.17.0; python\_version > "3.6"->ipdb) (0.1.0)  
 Requirement already satisfied: matplotlib-inline in /home/duvvuri.s/.local/lib/python3.7/site-packages (from ipython>=7.17.0; python\_version > "3.6"->ipdb) (0.1.3)  
 Requirement already satisfied: traitlets<=4.2 in /home/ood.discovery.neu.edu/software/anaconda3/2019.10/lib/python3.7/site-packages (from ipython>=7.17.0; python\_version > "3.6"->ipdb) (4.3.3)  
 Requirement already satisfied: jedi>=0.16 in /home/duvvuri.s/.local/lib/python3.7/site-packages (from ipython>=7.17.0; python\_version > "3.6"->ipdb) (0.18.1)  
 Requirement already satisfied: pexpect>4.3; sys\_platform != "win32" in /home/ood.discovery.neu.edu/software/anaconda3/2019.10/lib/python3.7/site-packages (from ipython>=7.17.0; python\_version > "3.6"->ipdb) (4.7.0)  
 Requirement already satisfied: pygments in /home/ood.discovery.neu.edu/software/anaconda3/2019.10/lib/python3.7/site-packages (from ipython>=7.17.0; python\_version > "3.6"->ipdb) (2.4.2)  
 Requirement already satisfied: prompt-toolkit!=3.0.0,!<3.0.1,<3.1.0,>=2.0.0 in /home/ood.discovery.neu.edu/software/anaconda3/2019.10/lib/python3.7/site-packages (from ipython>=7.17.0; python\_version > "3.6"->ipdb) (2.0.10)  
 Requirement already satisfied: pickleshare in /home/ood.discovery.neu.edu/software/anaconda3/2019.10/lib/python3.7/site-packages (from ipython>=7.17.0; python\_version > "3.6"->ipdb) (0.7.5)  
 Requirement already satisfied: ipython-genutils in /home/ood.discovery.neu.edu/software/anaconda3/2019.10/lib/python3.7/site-packages (from traitlets<=4.2->ipython>=7.17.0; python\_version > "3.6"->ipdb) (0.2.0)  
 Requirement already satisfied: six in /home/ood.discovery.neu.edu/software/anaconda3/2019.10/lib/python3.7/site-packages (from traitlets<=4.2->ipython>=7.17.0; python\_version > "3.6"->ipdb) (1.12.0)  
 Requirement already satisfied: parso<0.9.0,>=0.8.0 in /home/duvvuri.s/.local/lib/python3.7/site-packages (from jedi>=0.16->ipython>=7.17.0; python\_version > "3.6"->ipdb) (0.8.3)  
 Requirement already satisfied: ptyprocess>=0.5 in /home/ood.discovery.neu.edu/software/anaconda3/2019.10/lib/python3.7/site-packages (from pexpect>4.3; sys\_platform != "win32"->ipython>=7.17.0; python\_version > "3.6"->ipdb) (0.6.0)  
 Requirement already satisfied: wcwidth in /home/ood.discovery.neu.edu/software/anaconda3/2019.10/lib/python3.7/site-packages (from prompt-toolkit!=3.0.0,!<3.0.1,<3.1.0,>=2.0.0->ipython>=7.17.0; python\_version > "3.6"->ipdb) (0.1.7)

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In [4]: spec = [
    ("__size_board", int64),
    ("__seed", int64),
    ("__board", float64[:, :]),
    ("__total_score", int64),
    ("__merged", int64),
    ("__scores_move", int64),
    ("__temp_board", float64[:, :]),
    ("__valid_movements", float64[:]),
]

@jitclass(spec)
class Game2048:

    def __init__(self, size_board, seed):

        self.__size_board = size_board
        self.__seed = seed

        self.__board = self.__init_board()
        self.__total_score = 0
        self.__merged = 0
        self.__scores_move = 0
        self.__temp_board = np.zeros((size_board, size_board))

        self.__valid_movements = np.zeros(4)

        if self.__seed:
            random.seed(self.__seed)

        self.__add_two_or_four()
        self.__add_two_or_four()

    def __init_board(self):
        return np.zeros((self.__size_board, self.__size_board))

    def __get_empty_spaces_index(self):
        return np.where(self.__board == 0)

    def __add_two_or_four(self):
        indexes = self.__get_empty_spaces_index()

        index = np.random.choice(np.arange(len(indexes[0])))

        sample = np.random.rand(1)

        if sample[0] >= 0.9:
            self.__board[indexes[0][index]][indexes[1][index]] = 4
        else:
            self.__board[indexes[0][index]][indexes[1][index]] = 2

    def __reverse_array(self, array):
        temp_array = np.zeros(len(array))
        for cell in range(len(array)):
            temp_array[cell] = array[len(array) - cell - 1]

        return temp_array

    def __merge(self, array, reverse):
        array = array[array != 0]

        temp_array = np.zeros(self.__size_board)
        if reverse:
            count_index = self.__size_board - 1
        else:
            count_index = 0
        i = 0
        while True:
            if i >= (len(array) - 1):
                if i == (len(array) - 1):

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        temp_array[count_index] = array[i]
    return temp_array

    if (array[i] == array[i + 1]) and array[i] != 0:
        temp_array[count_index] = array[i] + array[i + 1]
        self.__scores_move += temp_array[count_index]
        self.__merged += 1
        i = i + 2
        if reverse:
            count_index -= 1
        else:
            count_index += 1
    else:
        if array[i] != 0:
            temp_array[count_index] = array[i]
            if reverse:
                count_index -= 1
            else:
                count_index += 1
        i = i + 1

def __up(self):
    self.__temp_board = np.zeros((self.__size_board, self.__size_board))
    for column in range(self.__size_board):
        self.__temp_board[:, column] = self.__merge(
            self.__board[:, column].copy(), False
        )

def __down(self):
    self.__temp_board = np.zeros((self.__size_board, self.__size_board))
    for column in range(self.__size_board):
        self.__temp_board[:, column] = self.__merge(
            self.__reverse_array(self.__board[:, column].copy()), True
        )

def __right(self):
    self.__temp_board = np.zeros((self.__size_board, self.__size_board))
    for line in range(self.__size_board):
        self.__temp_board[line, :] = self.__merge(
            self.__reverse_array(self.__board[line, :].copy()), True
        )

def __left(self):
    self.__temp_board = np.zeros((self.__size_board, self.__size_board))
    for line in range(self.__size_board):
        self.__temp_board[line, :] = self.__merge(
            self.__board[line, :].copy(), False
        )

def __array_equal(self, a, b):
    for value_a, value_b in zip(a.flat, b.flat):
        if value_a != value_b:
            return False
    return True

def __check_available_moves(self):
    self.__valid_movements = np.zeros(4)
    for i in range(4):
        self.make_move(i)
        if self.__array_equal(self.__board, self.__temp_board) is False:
            self.__valid_movements[i] = 1

def make_move(self, move):
    self.__merged = 0
    self.__scores_move = 0
    if move == 0:
        self.__up()
    if move == 1:
        self.__down()
    if move == 2:
        self.__right()
    if move == 3:

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        self.__left()

def confirm_move(self):
    self.__board = self.__temp_board.copy()
    self.__total_score += self.__scores_move
    returned_move_scores = self.__scores_move
    returned_merged = self.__merged
    self.__add_two_or_four()
    self.__check_available_moves()

    return returned_move_scores, returned_merged, self.__valid_movements

def get_board(self):
    return self.__board

def get_total_score(self):
    return self.__total_score

def reset(self):
    self.__board = self.__init_board()
    self.__total_score = 0
    self.__add_two_or_four()
    self.__add_two_or_four()
    return self.get_board()
```

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In [5]: class InvalidMove(Exception):
        pass

class Game2048Env(gym.Env):
    metadata = {"render.modes": ["human", "ansi"]}

    def __init__(self, size_board, seed=None):
        self.__size_board = size_board
        self.__game = Game2048(size_board, seed)

        self.action_space = spaces.Discrete(4)

        self.observation_space = spaces.Box(
            0, 2 ** 16, (size_board * size_board,), dtype=np.int
        )

        self.reward_range = (0., np.inf)

        self.np_random, seed = seeding.np_random(seed)

        self.__actions_legends = {0: "UP", 1: "DOWN", 2: "RIGHT", 3: "LEFT"}

        self.__old_max = 0

        self.__last_action = None
        self.__last_scores_move = None

        print("Environment initialised...")

    def __reward_calculation(self, merged):
        reward = 0
        max_board = self.__game.get_board().max()
        if max_board > self.__old_max:
            self.__old_max = max_board
            reward += math.log(self.__old_max, 2) * 0.1

        reward += merged

        return reward

    def reset(self):
        self.__game.reset()
        valid_movements = np.ones(4)
        return (self.__game.get_board(), valid_movements)

    def step(self, action):
        done = False
        reward = 0
        try:
            self.__last_action = self.__actions_legends[action]

            self.__game.make_move(action)
            returned_move_scores, returned_merged, valid_movements = (
                self.__game.confirm_move()
            )

            reward = self.__reward_calculation(returned_merged)

            if len(np.nonzero(valid_movements)[0]) == 0:
                done = True

            self.__last_scores_move = returned_move_scores

            info = dict()
            info["valid_movements"] = valid_movements
            info["total_score"] = self.__game.get_total_score()
            info["last_action"] = self.__actions_legends[action]
            info["scores_move"] = returned_move_scores
            return self.__game.get_board(), reward, done, info

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except InvalidMove as e:
    print("Invalid move")
    done = False
    reward = 0

def render(self, mode="human"):
    outfile = StringIO() if mode == "ansi" else sys.stdout
    info_render = "Score: {}\n".format(self.__game.get_total_score())
    info_render += "Highest: {}\n".format(self.__game.get_board().max())
    npa = np.array(self.__game.get_board())
    grid = npa.reshape((self.__size_board, self.__size_board))
    info_render += "{}\n".format(grid)
    info_render += "Last action: {}\n".format(self.__last_action)
    info_render += "Last scores move: {}".format(self.__last_scores_move)
    info_render += "\n"
    outfile.write(info_render)
    return outfile

def get_actions_legends(self):
    return self.__actions_legends
```

```

In [6]: spec_sum_tree = [
    ("__capacity", int64),
    ("__data_pointer", int64),
    ("__tree", float64[:]),
    ("__state", float64[:, :, :, :, :]),
    ("__action", int64[:]),
    ("__reward", float64[:]),
    ("__next_state", float64[:, :, :, :, :]),
    ("__done", bool_[:]),
]

@jitclass(spec_sum_tree)
class SumTree:
    def __init__(self, capacity, size_board=4):
        self.__data_pointer = 0
        self.__capacity = capacity
        self.__tree = np.zeros(2 * capacity - 1)

        self.__state = np.zeros((capacity, 1, size_board, size_board, 16))
        self.__action = np.zeros(capacity, dtype=np.int64)
        self.__reward = np.zeros(capacity)
        self.__next_state = np.zeros((capacity, 1, size_board, size_board, 16))
        self.__done = np.zeros(capacity, dtype=np.bool_)

    def update(self, tree_index, priority):
        change = priority - self.__tree[tree_index]
        self.__tree[tree_index] = priority
        while tree_index != 0:
            tree_index = (tree_index - 1) // 2
            self.__tree[tree_index] += change

    def add(self, priority, state, action, reward, next_state, done):
        self.__state[self.__data_pointer] = state
        self.__action[self.__data_pointer] = action
        self.__reward[self.__data_pointer] = reward
        self.__next_state[self.__data_pointer] = next_state
        self.__done[self.__data_pointer] = done

        tree_index = self.__data_pointer + self.__capacity - 1
        self.update(tree_index, priority)

        self.__data_pointer += 1

        if self.__data_pointer >= self.__capacity:
            self.__data_pointer = 0

    def get_leaf(self, value):
        parent_index = 0

        while True:
            left_child_index = 2 * parent_index + 1
            right_child_index = left_child_index + 1
            if left_child_index >= len(self.__tree):
                leaf_index = parent_index
                break

            else:
                if value <= self.__tree[left_child_index]:
                    parent_index = left_child_index
                else:
                    value -= self.__tree[left_child_index]
                    parent_index = right_child_index

        data_index = leaf_index - self.__capacity + 1

        return (
            leaf_index,
            self.__tree[leaf_index],
            self.__state[data_index],
            self.__action[data_index],

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        self.__reward[data_index],
        self.__next_state[data_index],
        self.__done[data_index],
    )

    def total_priority(self):
        return self.__tree[0]

    def get_priotiry(self):
        return self.__tree[-self.__capacity:]

    def get_all_tree(self):
        return self.__tree

spec_memory = [
    ("__per_e", float64),
    ("__per_a", float64),
    ("__per_b", float64),
    ("__per_b_increment_per_sampling", float64),
    ("__absolute_error_upper", float64),
    ("__tree", SumTree),
]

Transition = namedtuple(
    "Transition", ("state", "action", "reward", "next_state", "done")
)

class Memory:
    def __init__(self, size_board, capacity):
        self.__capacity = capacity
        self.__per_e = 0.01
        self.__per_a = 0.6
        self.__per_b = 0.4
        self.__per_b_increment_per_sampling = 0.001
        self.__absolute_error_upper = 1.
        self.__tree = SumTree(capacity, size_board)
        spec_store = [("max_priority", float64)]

    def store(self, state, action, reward, next_state, done):
        max_priority = np.max(self.__tree.get_priotiry())
        if max_priority == 0:
            max_priority = self.__absolute_error_upper
        self.__tree.add(max_priority, state, action, reward, next_state, done)

    def sample(self, batch_size):
        memory_batch = []

        batch_idx, batch_ISWeights = (
            np.empty((batch_size,), dtype=np.int32),
            np.empty((batch_size, 1), dtype=np.float32),
        )
        priority_segment = self.__tree.total_priority() / batch_size
        self.__per_b = np.min(
            [1., self.__per_b + self.__per_b_increment_per_sampling]
        )
        p_min = np.min(self.__tree.get_priotiry()) / self.__tree.total_priority()
        max_weight = (p_min * batch_size) ** (-self.__per_b)

        for i in range(batch_size):
            limit_a, limit_b = priority_segment * i, priority_segment * (i + 1)
            value = np.random.uniform(limit_a, limit_b)

            index, priority, state, action, reward, next_state, done = self.__tree.get_leaf(
                value
            )

            sampling_probabilities = priority / self.__tree.total_priority()

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        batch_ISWeights[i, 0] = (  
            np.power(batch_size * sampling_probabilities, -self.__per_b)  
            / max_weight  
        )  
  
        batch_idx[i] = index  
        memory_batch.append(Transition(state, action, reward, next_state, done))  
  
    return batch_idx, memory_batch, batch_ISWeights  
  
def batch_update(self, tree_indexes, abs_errors):  
    abs_errors += self.__per_e  
    clipped_errors = np.minimum(abs_errors, self.__absolute_error_upper)  
    priorities = np.power(clipped_errors, self.__per_a)  
  
    for tree_index, priority in zip(tree_indexes, priorities):  
        self.__tree.update(tree_index, priority)
```

```
In [7]: import argparse  
import sys  
import matplotlib.pyplot as plt  
from numba import jit
```

```

In [8]: @jit(nopython=True)
def to_power_two_matrix(matrix):
    power_matrix = np.zeros(
        shape=(1, matrix.shape[0], matrix.shape[1], 16), dtype=np.float32
    )
    for i in range(matrix.shape[0]):
        for j in range(matrix.shape[1]):
            if matrix[i][j] == 0:
                power_matrix[0][i][j][0] = 1.0
            else:
                power = int(np.log(matrix[i][j]) / np.log(2))
                power_matrix[0][i][j][power] = 1.0

    return power_matrix

def selection_action(
    eps_threshold, valid_movements, dqn_net, state, size_board, device
):
    sample = np.random.rand(1)

    if sample > eps_threshold:
        with torch.no_grad():
            output = dqn_net(torch.from_numpy(state).float().to(device), 1, size_board)
            output_np = output.cpu().detach().numpy()
            ordered = np.flip(np.argsort(output_np), axis=1)[0]
            for x in ordered:
                if valid_movements[x] != 0:
                    return x

    else:
        return np.random.choice(np.nonzero(valid_movements)[0])

def parse_args():
    parser = argparse.ArgumentParser()
    parser.add_argument("--seed", type=int, default=10)
    parser.add_argument("--capacity", type=int, default=100000)
    parser.add_argument("--batch_size", type=int, default=128)
    parser.add_argument("--size_board", type=int, default=4)
    parser.add_argument("--num_episodes", type=int, default=1000)
    parser.add_argument("--learning_rate", type=float, default=0.00025)
    parser.add_argument("--ep_update_target", type=int, default=10)
    parser.add_argument("--decay_rate", type=float, default=0.00005)
    parser.add_argument("--interval_mean", type=int, default=5)

    args = parser.parse_args()

    return args

def get_mean_interval(array, interval_mean):
    interval_mean_list = []
    for x in range(interval_mean):
        interval_mean_list.append(0)

    for i in range(len(array)):
        if i + interval_mean == len(array):
            break
        else:
            interval_mean_list.append(np.mean(array[i: interval_mean + i]))

    return interval_mean_list

def plot_info(
    total_steps_per_episode,
    total_rewards_per_episode,
    total_loss_per_episode,
    total_score_per_episode,
    interval_mean,

```

```
episodes,
):

interval_steps = get_mean_interval(total_steps_per_episode, interval_mean)
plt.plot(range(episodes), total_steps_per_episode)
plt.plot(range(episodes), interval_steps)
plt.ylabel("Episode durations")
plt.xlabel("Episodes")
plt.savefig("episodes_durations.png", bbox_inches="tight")
plt.close()

interval_rewards = get_mean_interval(total_rewards_per_episode, interval_mean)
plt.plot(range(episodes), total_rewards_per_episode)
plt.plot(range(episodes), interval_rewards)
plt.ylabel("Reward")
plt.xlabel("Episodes")
plt.savefig("episodes_rewards.png", bbox_inches="tight")
plt.close()

interval_score = get_mean_interval(total_score_per_episode, interval_mean)
plt.plot(range(episodes), total_score_per_episode)
plt.plot(range(episodes), interval_score)
plt.ylabel("Score")
plt.xlabel("Episodes")
plt.savefig("episodes_scores.png", bbox_inches="tight")
plt.close()

interval_loss = get_mean_interval(total_loss_per_episode, interval_mean)
plt.plot(range(episodes), total_loss_per_episode)
plt.plot(range(episodes), interval_loss)
plt.ylabel("Loss")
plt.xlabel("Episodes")
plt.savefig("episodes_losses.png", bbox_inches="tight")
plt.close()
```



```

In [9]: class CNN_2048_MODEL(nn.Module):
    def __init__(self, c_in_1, c_in_2, c_out_1, c_out_2):
        super(CNN_2048_MODEL, self).__init__()
        self.__c_in_1 = c_in_1
        self.__c_in_2 = c_in_2
        self.__c_out_1 = c_out_1
        self.__c_out_2 = c_out_2

        self.__expanded_size = (
            2 * 4 * c_out_2 * 2 + 3 * 3 * c_out_2 * 2 + 4 * 3 * c_out_1 * 2
        )

        self.__dense_value_1 = nn.Linear(self.__expanded_size, 256)
        self.__dense_value_2 = nn.Linear(256, 1)
        self.__dense_advantage_1 = nn.Linear(self.__expanded_size, 256)
        self.__dense_advantage_2 = nn.Linear(256, 4)

        self.__cnn_1 = nn.Conv2d(
            c_in_1,
            c_out_1,
            kernel_size=(1, 2),
            stride=(1, 1),
            padding=(0, 0),
            dilation=(1, 1),
        )

        self.__cnn_1_2 = nn.Conv2d(
            c_out_1,
            c_out_2,
            kernel_size=(1, 2),
            stride=(1, 1),
            padding=(0, 0),
            dilation=(1, 1),
        )

        self.__cnn_2 = nn.Conv2d(
            c_in_2,
            c_out_2,
            kernel_size=(2, 1),
            stride=(1, 1),
            padding=(0, 0),
            dilation=(1, 1),
        )

        self.__cnn_2_2 = nn.Conv2d(
            c_out_1,
            c_out_2,
            kernel_size=(2, 1),
            stride=(1, 1),
            padding=(0, 0),
            dilation=(1, 1),
        )

    def forward(self, features, batch_size, size_board):
        features_view = features.view(batch_size, 16, size_board, size_board)
        conv1_output = F.elu(self.__cnn_1(features_view))
        conv2_output = F.elu(self.__cnn_2(features_view))
        conv1_2_1_output = F.elu(self.__cnn_1_2(conv1_output))
        conv1_2_2_output = F.elu(self.__cnn_1_2(conv2_output))
        conv2_2_1_output = F.elu(self.__cnn_2_2(conv1_output))
        conv2_2_2_output = F.elu(self.__cnn_2_2(conv2_output))

        conv1_output_shape = list(conv1_output.shape)
        conv2_output_shape = list(conv2_output.shape)
        conv1_2_1_output_shape = list(conv1_2_1_output.shape)
        conv1_2_2_output_shape = list(conv1_2_2_output.shape)
        conv2_2_1_output_shape = list(conv2_2_1_output.shape)
        conv2_2_2_output_shape = list(conv2_2_2_output.shape)

        hidden1 = conv1_output.view(
            batch_size,

```

```

        (conv1_output_shape[1] * conv1_output_shape[2] * conv1_output_shape[3]),
    )

    hidden2 = conv2_output.view(
        batch_size,
        (conv2_output_shape[1] * conv2_output_shape[2] * conv2_output_shape[3]),
    )

    hidden1_2_1 = conv1_2_1_output.view(
        batch_size,
        (
            conv1_2_1_output_shape[1]
            * conv1_2_1_output_shape[2]
            * conv1_2_1_output_shape[3]
        ),
    )

    hidden1_2_2 = conv1_2_2_output.view(
        batch_size,
        (
            conv1_2_2_output_shape[1]
            * conv1_2_2_output_shape[2]
            * conv1_2_2_output_shape[3]
        ),
    )

    hidden2_2_1 = conv2_2_1_output.view(
        batch_size,
        (
            conv2_2_1_output_shape[1]
            * conv2_2_1_output_shape[2]
            * conv2_2_1_output_shape[3]
        ),
    )

    hidden2_2_2 = conv2_2_2_output.view(
        batch_size,
        (
            conv2_2_2_output_shape[1]
            * conv2_2_2_output_shape[2]
            * conv2_2_2_output_shape[3]
        ),
    )

    hidden = torch.cat(
        (hidden1, hidden2, hidden1_2_1, hidden1_2_2, hidden2_2_1, hidden2_2_2), 1
    )

    hidden_value_1 = F.elu(self.__dense_value_1(hidden))
    hidden_value_2 = self.__dense_value_2(hidden_value_1)

    advantage_action_1 = F.elu(self.__dense_advantage_1(hidden))
    advantage_action_2 = self.__dense_advantage_2(advantage_action_1)

    reduced_mean = torch.mean(advantage_action_2, dim=1, keepdim=True)
    output = hidden_value_2 + (advantage_action_2 - reduced_mean)
    return output

```

In [10]: `import time`

In [ ]: `!pip install numba==0.47.0 --user`

```
In [12]: def main():
    seed = 10
    capacity = 100000
    size_board = 4
    batch_size = 128
    episodes = 1000
    ep_update_target = 100
    learning_rate = 0.00025
    decay_rate = 0.00005
    interval_mean = 5
    explore_start = 1.
    explore_stop = 0.01
    gamma = 0.95

    env = Game2048Env(size_board, seed)

    memory = Memory(size_board, capacity)

    c_in_1 = c_in_2 = size_board * size_board
    c_out_1 = c_out_2 = 128
    dqn_net = CNN_2048_MODEL(c_in_1, c_in_2, c_out_1, c_out_2)
    target_net = deepcopy(dqn_net)

    start = time.time()
    pre_train(env, capacity, memory)
    print("Execution pre-train (in seconds):", time.time() - start)

    start = time.time()
    train(
        dqn_net,
        target_net,
        env,
        memory,
        batch_size,
        size_board,
        episodes,
        ep_update_target,
        decay_rate,
        explore_start,
        explore_stop,
        learning_rate,
        gamma,
        interval_mean,
    )
    print("Execution train (in seconds)", time.time() - start)
```

```
In [ ]: main()
```

```
Environment initialised...
Starting pretrain...
Execution pre-train (in seconds): 18.706619262695312
Starting training...
Episode: 0
Total Reward: 108
Total episodes 122
Eps_threshold: 0.9939793815551794
Loss ep: 0.40106879687700114
Score: 1012
Highest: 64.0
[[ 2. 16. 32.  4.]
 [ 8. 64.  8. 64.]
 [ 4. 16.  2.  8.]
 [ 2.  4. 32.  2.]]
Last action: UP
Last scores move: 0
-----
Update target_net
Episode: 1
Total Reward: 171
Total episodes 185
Eps_threshold: 0.9849195386477164
Loss ep: 0.11639946602486276
Score: 2200
Highest: 256.0
[[ 2.  4.  8.  2.]
 [ 4. 64. 16.  4.]
 [ 8.  4. 256.  8.]
 [ 4.  8.  4.  2.]]
Last action: DOWN
Last scores move: 4
-----
Episode: 2
Total Reward: 73
Total episodes 87
Eps_threshold: 0.9806878492518778
Loss ep: 0.0816317700791633
Score: 632
Highest: 64.0
[[ 2.  8.  4.  2.]
 [ 4. 16.  8.  4.]
 [16. 64. 32.  8.]
 [ 8.  2. 16.  4.]]
Last action: DOWN
Last scores move: 4
-----
Episode: 3
Total Reward: 96
Total episodes 110
Eps_threshold: 0.9753637208553166
Loss ep: 0.06599243770946156
Score: 940
Highest: 64.0
[[ 2.  4. 32.  8.]
 [64. 16. 64. 32.]
 [ 2.  4.  2.  4.]
 [ 4.  8.  4.  2.]]
Last action: RIGHT
Last scores move: 0
-----
Episode: 4
Total Reward: 120
Total episodes 134
Eps_threshold: 0.9689174032042989
Loss ep: 0.04961230505758257
Score: 1256
Highest: 128.0
[[ 2.  4.  8.  2.]
 [32. 128. 32.  4.]
 [ 4. 16.  8. 16.]
```

```

[ 8. 32. 2. 8.]]
Last action: RIGHT
Last scores move: 4
-----
Episode: 5
Total Reward: 135
Total episodes 149
Eps_threshold: 0.9618000137455393
Loss ep: 0.04821200018761142
Score: 1436
Highest: 128.0
[[ 16. 2. 64. 2.]
 [ 2. 8. 32. 8.]
 [128. 32. 4. 2.]
 [ 2. 4. 16. 4.]]
Last action: DOWN
Last scores move: 32
-----
Episode: 6
Total Reward: 49
Total episodes 63
Eps_threshold: 0.9588065608657375
Loss ep: 0.047315442372882176
Score: 380
Highest: 32.0
[[ 2. 8. 4. 2.]
 [32. 16. 8. 4.]
 [ 2. 32. 4. 2.]
 [ 4. 2. 16. 4.]]
Last action: RIGHT
Last scores move: 0
-----
Episode: 7
Total Reward: 103
Total episodes 117
Eps_threshold: 0.9532722461384151
Loss ep: 0.05073599122528337
Score: 1112
Highest: 128.0
[[ 4. 2. 8. 4.]
 [ 2. 32. 128. 8.]
 [ 4. 16. 32. 2.]
 [ 2. 4. 2. 16.]]
Last action: UP
Last scores move: 0
-----
Episode: 8
Total Reward: 79
Total episodes 93
Eps_threshold: 0.9488962123574752
Loss ep: 0.050357705803327664
Score: 672
Highest: 64.0
[[ 2. 16. 8. 2.]
 [16. 4. 16. 4.]
 [ 4. 32. 64. 8.]
 [ 2. 8. 2. 16.]]
Last action: DOWN
Last scores move: 4
-----
Episode: 9
Total Reward: 91
Total episodes 105
Eps_threshold: 0.9439799237921774
Loss ep: 0.050755909511021206
Score: 984
Highest: 128.0
[[ 2. 4. 8. 4.]
 [ 4. 32. 2. 8.]
 [ 8. 4. 8. 128.]
 [ 4. 2. 16. 2.]]
Last action: DOWN

```

```
Last scores move: 8
-----
Episode: 10
Total Reward: 81
Total episodes 95
Eps_threshold: 0.9395540389522419
Loss ep: 0.05016230031063682
Score: 708
Highest: 64.0
[[ 2. 16.  8.  2.]
 [32.  2. 16.  8.]
 [ 4.  8. 64.  4.]
 [ 2.  4. 32.  2.]]
Last action: RIGHT
Last scores move: 4
-----
Episode: 11
Total Reward: 123
Total episodes 137
Eps_threshold: 0.9332083525742001
Loss ep: 0.04900519865272689
Score: 1296
Highest: 128.0
[[ 32.  4. 32. 16.]
 [ 8. 128. 16.  2.]
 [ 4. 16. 32.  4.]
 [ 2.  4. 16.  2.]]
Last action: LEFT
Last scores move: 0
-----
Episode: 12
Total Reward: 84
Total episodes 98
Eps_threshold: 0.9286956966825898
Loss ep: 0.04810601351212482
Score: 776
Highest: 64.0
[[ 2.  8. 32.  8.]
 [ 8. 32.  2. 16.]
 [ 2.  8. 64.  8.]
 [ 4.  2. 32.  2.]]
Last action: UP
Last scores move: 8
-----
Episode: 13
Total Reward: 104
Total episodes 118
Eps_threshold: 0.923291350570292
Loss ep: 0.045702675641593284
Score: 1080
Highest: 128.0
[[ 2.  8.  4.  8.]
 [ 4. 128.  8. 16.]
 [ 8. 16. 32.  8.]
 [ 2.  4. 16.  4.]]
Last action: UP
Last scores move: 8
-----
Episode: 14
Total Reward: 157
Total episodes 171
Eps_threshold: 0.9155159965278746
Loss ep: 0.044943176514921135
Score: 1796
Highest: 128.0
[[ 2. 16.  4.  2.]
 [16. 128. 32.  4.]
 [ 8.  2. 128.  8.]
 [ 2.  4. 16.  2.]]
Last action: RIGHT
Last scores move: 0
-----
```

```
Episode: 15
Total Reward: 90
Total episodes 104
Eps_threshold: 0.910819534729295
Loss ep: 0.04214364290237427
Score: 856
Highest: 64.0
[[ 2. 32.  8.  4.]
 [ 4. 64. 16.  8.]
 [ 8.  4. 64.  4.]
 [ 2.  8.  4.  2.]]
Last action: RIGHT
Last scores move: 4
-----
Episode: 16
Total Reward: 127
Total episodes 141
Eps_threshold: 0.9044910909852525
Loss ep: 0.041946140586907134
Score: 1360
Highest: 128.0
[[ 2. 16.  8.  2.]
 [ 4. 64. 32.  4.]
 [16. 128.  2.  8.]
 [ 2.  8. 16.  4.]]
Last action: RIGHT
Last scores move: 8
-----
Episode: 17
Total Reward: 117
Total episodes 131
Eps_threshold: 0.8986513204661305
Loss ep: 0.03975496219314692
Score: 1280
Highest: 128.0
[[ 2.  4. 16.  2.]
 [ 8.  2. 128.  4.]
 [64. 32.  4.  8.]
 [ 2.  4.  8.  4.]]
Last action: DOWN
Last scores move: 4
-----
Episode: 18
Total Reward: 79
Total episodes 93
Eps_threshold: 0.8945286843833278
Loss ep: 0.03940105950960549
Score: 688
Highest: 64.0
[[ 4.  8.  2.  8.]
 [ 8. 32. 16.  2.]
 [32.  4. 64.  8.]
 [ 2.  8.  2.  4.]]
Last action: LEFT
Last scores move: 0
-----
Episode: 19
Total Reward: 101
Total episodes 115
Eps_threshold: 0.8894572388269796
Loss ep: 0.03877915092136549
Score: 1076
Highest: 128.0
[[ 4.  8.  4.  2.]
 [ 8.  4. 32.  4.]
 [ 2. 128.  8. 32.]
 [ 4.  8.  2.  8.]]
Last action: UP
Last scores move: 4
-----
Episode: 20
Total Reward: 145
```



Total episodes 159  
Eps\_threshold: 0.8824932722238553  
Loss ep: 0.03866567551714819  
Score: 1496  
Highest: 128.0  
[[ 8. 2. 16. 4.]  
 [ 2. 32. 64. 2.]  
 [ 16. 128. 16. 8.]  
 [ 4. 32. 4. 2.]]  
Last action: DOWN  
Last scores move: 8

-----  
Episode: 21  
Total Reward: 101  
Total episodes 115  
Eps\_threshold: 0.8774908317078101  
Loss ep: 0.0373706983483356  
Score: 1044  
Highest: 128.0  
[[ 4. 8. 4. 2.]  
 [ 16. 32. 8. 16.]  
 [ 4. 2. 128. 8.]  
 [ 2. 4. 8. 4.]]  
Last action: LEFT  
Last scores move: 4

-----  
Episode: 22  
Total Reward: 158  
Total episodes 172  
Eps\_threshold: 0.8700623986013337  
Loss ep: 0.03575885018637014  
Score: 1908  
Highest: 128.0  
[[ 2. 4. 8. 2.]  
 [ 4. 128. 16. 4.]  
 [ 16. 64. 8. 2.]  
 [ 2. 128. 2. 4.]]  
Last action: RIGHT  
Last scores move: 4

-----  
Episode: 23  
Total Reward: 188  
Total episodes 202  
Eps\_threshold: 0.8614194885430674  
Loss ep: 0.035262723960498774  
Score: 2400  
Highest: 256.0  
[[ 4. 32. 8. 2.]  
 [ 2. 16. 64. 4.]  
 [ 4. 8. 256. 8.]  
 [ 2. 4. 32. 4.]]  
Last action: RIGHT  
Last scores move: 4

-----  
Episode: 24  
Total Reward: 108  
Total episodes 122  
Eps\_threshold: 0.8562416381622573  
Loss ep: 0.033799933605506774  
Score: 1148  
Highest: 128.0  
[[ 4. 16. 2. 4.]  
 [ 2. 32. 16. 2.]  
 [ 16. 128. 4. 32.]  
 [ 2. 8. 2. 4.]]  
Last action: DOWN  
Last scores move: 16

-----  
Episode: 25  
Total Reward: 79  
Total episodes 93  
Eps\_threshold: 0.8523157493103419

```
Loss ep: 0.032131446305141656
Score: 700
Highest: 64.0
[[ 2.  4.  8.  2.]
 [ 4. 16. 64. 32.]
 [ 8. 32.  4.  2.]
[16.  4.  2.  8.]]
Last action: RIGHT
Last scores move: 4
-----
Episode: 26
Total Reward: 130
Total episodes 144
Eps_threshold: 0.8462728564349336
Loss ep: 0.03238250811894735
Score: 1368
Highest: 128.0
[[ 2. 16.  4.  2.]
 [ 4. 64. 16.  4.]
 [ 8. 32. 128. 16.]
 [ 2.  4.  8.  2.]]
Last action: DOWN
Last scores move: 0
-----
Episode: 27
Total Reward: 138
Total episodes 152
Eps_threshold: 0.8399412732182427
Loss ep: 0.03227729860105013
Score: 1564
Highest: 128.0
[[ 2. 128.  4.  8.]
 [ 4.  8.  64. 32.]
 [16.  2.  8.  2.]
 [ 2.  4.  64.  8.]]
Last action: DOWN
Last scores move: 0
-----
Episode: 28
Total Reward: 83
Total episodes 97
Eps_threshold: 0.8359258034285286
Loss ep: 0.03184087497671855
Score: 716
Highest: 64.0
[[ 2.  4.  8. 32.]
 [ 4.  2. 64.  2.]
 [ 8. 16. 32. 16.]
 [ 2.  4.  8.  4.]]
Last action: UP
Last scores move: 0
-----
Episode: 29
Total Reward: 103
Total episodes 117
Eps_threshold: 0.8311082425830183
Loss ep: 0.03110084166893592
Score: 940
Highest: 64.0
[[ 2. 16.  4.  2.]
 [ 4. 64.  8. 32.]
[16.  8. 64.  4.]
 [ 2.  4. 16.  2.]]
Last action: RIGHT
Last scores move: 4
-----
Episode: 30
Total Reward: 68
Total episodes 82
Eps_threshold: 0.8277485907809331
Loss ep: 0.03015968276233208
Score: 636
```

```
Highest: 64.0
[[ 4. 32.  4.  2.]
 [ 8. 64.  2.  4.]
 [ 4.  8. 16. 32.]
 [ 2.  4.  8.  2.]]
Last action: UP
Last scores move: 4
-----
Episode: 31
Total Reward: 158
Total episodes 172
Eps_threshold: 0.8207461067401824
Loss ep: 0.03041832391605821
Score: 2040
Highest: 256.0
[[ 2.  4.  8.  4.]
 [ 8. 32.  4. 16.]
 [ 4.  8. 256.  8.]
 [ 2.  4. 16.  4.]]
Last action: DOWN
Last scores move: 0
-----
Episode: 32
Total Reward: 129
Total episodes 143
Eps_threshold: 0.8149699464576254
Loss ep: 0.02930493454833131
Score: 1364
Highest: 128.0
[[ 2.  8. 16.  2.]
 [ 4. 64.  4. 16.]
 [16. 128. 32.  4.]
 [ 2.  4.  8.  2.]]
Last action: DOWN
Last scores move: 4
-----
Episode: 33
Total Reward: 136
Total episodes 150
Eps_threshold: 0.808955255145453
Loss ep: 0.029599297841389975
Score: 1536
Highest: 128.0
[[ 2.  4.  8.  4.]
 [ 4. 64. 128.  8.]
 [ 8. 32.  4.  2.]
 [ 2. 64.  2.  8.]]
Last action: RIGHT
Last scores move: 4
-----
Episode: 34
Total Reward: 84
Total episodes 98
Eps_threshold: 0.8050499502062026
Loss ep: 0.02822121308774364
Score: 736
Highest: 64.0
[[ 4.  8.  4. 16.]
 [16.  4. 32.  2.]
 [ 4.  8. 64.  4.]
 [ 2. 16. 32.  2.]]
Last action: UP
Last scores move: 0
-----
Episode: 35
Total Reward: 163
Total episodes 177
Eps_threshold: 0.7980448016509042
Loss ep: 0.028466653015653966
Score: 1740
Highest: 128.0
[[ 2. 16.  4.  2.]
```

```

[ 4. 64. 8. 4.]
[ 32. 128. 32. 64.]
[ 2. 4. 16. 4.]]
Last action: LEFT
Last scores move: 4
-----
Episode: 36
Total Reward: 108
Total episodes 122
Eps_threshold: 0.7932523601679099
Loss ep: 0.027383401745655497
Score: 1212
Highest: 128.0
[[ 8. 4. 8. 4.]
 [ 16. 128. 16. 2.]
 [ 2. 64. 2. 4.]
 [ 16. 2. 4. 2.]]
Last action: LEFT
Last scores move: 0
-----
Episode: 37
Total Reward: 119
Total episodes 133
Eps_threshold: 0.7880610123355202
Loss ep: 0.028306378457779276
Score: 1304
Highest: 128.0
[[ 2. 8. 32. 4.]
 [ 4. 64. 4. 2.]
 [ 16. 2. 16. 128.]
 [ 4. 8. 2. 4.]]
Last action: DOWN
Last scores move: 4
-----
Episode: 38
Total Reward: 243
Total episodes 257
Eps_threshold: 0.7781268917469828
Loss ep: 0.026923994145968546
Score: 3108
Highest: 256.0
[[ 8. 16. 4. 2.]
 [ 4. 128. 8. 256.]
 [ 32. 2. 16. 2.]
 [ 2. 8. 64. 16.]]
Last action: LEFT
Last scores move: 4
-----
Episode: 39
Total Reward: 174
Total episodes 188
Eps_threshold: 0.7709403287277328
Loss ep: 0.027158706746202833
Score: 2232
Highest: 256.0
[[ 8. 2. 4. 2.]
 [ 2. 32. 16. 4.]
 [ 16. 256. 2. 32.]
 [ 2. 8. 32. 2.]]
Last action: DOWN
Last scores move: 0
-----
Episode: 40
Total Reward: 100
Total episodes 114
Eps_threshold: 0.7666153068762518
Loss ep: 0.026249776806747706
Score: 1068
Highest: 128.0
[[ 2. 16. 2. 4.]
 [ 4. 32. 4. 8.]
 [ 2. 16. 128. 16.]

```

```
[ 16.  2.  4.  2.]]
Last action: UP
Last scores move: 16
-----
Episode: 41
Total Reward: 212
Total episodes 226
Eps_threshold: 0.7581136785726826
Loss ep: 0.026303335628678315
Score: 2676
Highest: 256.0
[[ 2.  4.  8.  64.]
 [ 32.  8. 256.  4.]
 [ 8.  2. 32.  8.]
 [ 2.  4. 64.  2.]]
Last action: RIGHT
Last scores move: 8
-----
Episode: 42
Total Reward: 119
Total episodes 133
Eps_threshold: 0.7531552277321301
Loss ep: 0.025975463981915237
Score: 1320
Highest: 128.0
[[ 4.  2.  8.  2.]
 [ 2. 16.  2. 32.]
 [ 16. 64. 16.  4.]
 [ 2.  4. 128. 2.]]
Last action: LEFT
Last scores move: 8
-----
Episode: 43
Total Reward: 50
Total episodes 64
Eps_threshold: 0.7507809319027795
Loss ep: 0.024618610739707947
Score: 364
Highest: 32.0
[[ 2.  4. 32.  8.]
 [ 8. 16.  2. 16.]
 [ 2.  8. 16.  8.]
 [ 4. 16.  4.  2.]]
Last action: RIGHT
Last scores move: 4
-----
Episode: 44
Total Reward: 113
Total episodes 127
Eps_threshold: 0.7460918764923177
Loss ep: 0.02539849281311035
Score: 1236
Highest: 128.0
[[ 2. 16.  4.  2.]
 [ 16. 128. 32.  8.]
 [ 4. 32.  2. 32.]
 [ 2. 16.  4.  2.]]
Last action: DOWN
Last scores move: 0
-----
Episode: 45
Total Reward: 217
Total episodes 231
Eps_threshold: 0.7376389250834131
Loss ep: 0.02504760775215182
Score: 2856
Highest: 256.0
[[ 2.  4. 32.  2.]
 [ 32. 256.  8.  4.]
 [ 8.  4. 128.  8.]
 [ 16.  2. 16.  2.]]
Last action: RIGHT
```

```

Last scores move: 4
-----
Episode: 46
Total Reward: 118
Total episodes 132
Eps_threshold: 0.7328523213455564
Loss ep: 0.024814096364107998
Score: 1284
Highest: 128.0
[[ 2. 128.  8.  4.]
 [ 4.  32. 16.  8.]
 [ 2.  8.  64.  4.]
 [ 4.  2.  4.  2.]]
Last action: DOWN
Last scores move: 0
-----
Episode: 47
Total Reward: 129
Total episodes 143
Eps_threshold: 0.7277023602985669
Loss ep: 0.024850485208151224
Score: 1400
Highest: 128.0
[[ 2.  32.  4.  8.]
 [ 8.  16.  8.  4.]
 [ 4.  32.  64. 128.]
 [ 2.  8.  2.  4.]]
Last action: RIGHT
Last scores move: 0
-----
Episode: 48
Total Reward: 67
Total episodes 81
Eps_threshold: 0.7248015438577029
Loss ep: 0.02398171248259368
Score: 604
Highest: 64.0
[[ 2.  4. 16.  4.]
 [16.  8. 32.  8.]
 [ 4. 64. 16.  2.]
 [ 2.  4.  8.  4.]]
Last action: UP
Last scores move: 4
-----
Episode: 49
Total Reward: 118
Total episodes 132
Eps_threshold: 0.7200993878518751
Loss ep: 0.02446952010646011
Score: 1284
Highest: 128.0
[[ 2.  4. 128.  2.]
 [ 4.  64.  2.  8.]
 [ 8.  32. 16.  2.]
 [ 2.  4.  8.  4.]]
Last action: DOWN
Last scores move: 0
-----
Episode: 50
Total Reward: 117
Total episodes 131
Eps_threshold: 0.7154634361776596
Loss ep: 0.0240519956778024
Score: 1284
Highest: 128.0
[[ 4.  2.  8.  2.]
 [ 8.  16.  64.  8.]
 [ 4.  2.  8.  32.]
 [ 2.  4. 128.  4.]]
Last action: DOWN
Last scores move: 0
-----

```

Episode: 51  
Total Reward: 113  
Total episodes 127  
Eps\_threshold: 0.7109979363249636  
Loss ep: 0.02431234036843608  
Score: 1232  
Highest: 128.0  
[[ 2. 4. 2. 4.]  
 [ 16. 128. 8. 16.]  
 [ 2. 4. 64. 4.]  
 [ 4. 8. 16. 2.]]  
Last action: DOWN  
Last scores move: 0  
-----

Episode: 52  
Total Reward: 210  
Total episodes 224  
Eps\_threshold: 0.703190562345322  
Loss ep: 0.02383894579751151  
Score: 2756  
Highest: 256.0  
[[ 2. 4. 2. 4.]  
 [ 4. 16. 4. 16.]  
 [ 2. 256. 128. 8.]  
 [ 8. 2. 32. 4.]]  
Last action: RIGHT  
Last scores move: 128  
-----

Episode: 53  
Total Reward: 83  
Total episodes 97  
Eps\_threshold: 0.6998367277410744  
Loss ep: 0.023714512893834066  
Score: 924  
Highest: 128.0  
[[ 2. 8. 4. 8.]  
 [ 4. 16. 8. 128.]  
 [ 16. 2. 16. 2.]  
 [ 4. 8. 2. 4.]]  
Last action: DOWN  
Last scores move: 4  
-----

Episode: 54  
Total Reward: 63  
Total episodes 77  
Eps\_threshold: 0.697185962336921  
Loss ep: 0.023368148060588092  
Score: 568  
Highest: 64.0  
[[ 2. 4. 2. 8.]  
 [32. 2. 16. 4.]  
 [ 4. 16. 64. 2.]  
 [ 2. 8. 2. 8.]]  
Last action: RIGHT  
Last scores move: 0  
-----

Episode: 55  
Total Reward: 126  
Total episodes 140  
Eps\_threshold: 0.6923924574411601  
Loss ep: 0.02312466757638114  
Score: 1348  
Highest: 128.0  
[[128. 2. 4. 2.]  
 [ 2. 16. 2. 4.]  
 [ 16. 8. 16. 2.]  
 [ 4. 64. 32. 4.]]  
Last action: LEFT  
Last scores move: 4  
-----

Episode: 56  
Total Reward: 106

Total episodes 120  
Eps\_threshold: 0.6883103612314236  
Loss ep: 0.022976698478062947  
Score: 1128  
Highest: 128.0  
[[ 2. 8. 4. 2.]  
 [ 8. 32. 8. 16.]  
 [ 4. 128. 16. 2.]  
 [ 2. 4. 32. 4.]]  
Last action: DOWN  
Last scores move: 8

-----  
Episode: 57  
Total Reward: 148  
Total episodes 162  
Eps\_threshold: 0.6828382393179923  
Loss ep: 0.023254044261979467  
Score: 1660  
Highest: 128.0  
[[ 2. 4. 2. 4.]  
 [ 32. 64. 32. 16.]  
 [ 4. 128. 64. 4.]  
 [ 2. 8. 4. 2.]]  
Last action: LEFT  
Last scores move: 4

-----  
Episode: 58  
Total Reward: 102  
Total episodes 116  
Eps\_threshold: 0.6789470728210197  
Loss ep: 0.022539909543662237  
Score: 1088  
Highest: 128.0  
[[ 4. 8. 4. 2.]  
 [ 32. 128. 32. 4.]  
 [ 4. 16. 4. 8.]  
 [ 2. 4. 2. 4.]]  
Last action: LEFT  
Last scores move: 4

-----  
Episode: 59  
Total Reward: 83  
Total episodes 97  
Eps\_threshold: 0.6757105344676317  
Loss ep: 0.02243630910657116  
Score: 736  
Highest: 64.0  
[[ 2. 16. 4. 8.]  
 [ 4. 32. 64. 32.]  
 [16. 8. 16. 4.]  
 [ 2. 4. 8. 2.]]  
Last action: UP  
Last scores move: 0

-----  
Episode: 60  
Total Reward: 72  
Total episodes 86  
Eps\_threshold: 0.6728541248513458  
Loss ep: 0.02288115994874821  
Score: 620  
Highest: 64.0  
[[ 2. 16. 4. 2.]  
 [ 4. 32. 8. 16.]  
 [64. 4. 16. 4.]  
 [ 2. 8. 4. 2.]]  
Last action: UP  
Last scores move: 16

-----  
Episode: 61  
Total Reward: 74  
Total episodes 88  
Eps\_threshold: 0.6699439737295102



```
Loss ep: 0.02311905405738137
Score: 676
Highest: 64.0
[[ 2. 32.  4.  2.]
 [ 4.  2. 64. 16.]
 [ 2.  8. 32.  8.]
 [ 4. 16.  2.  4.]]
Last action: UP
Last scores move: 8
-----
Episode: 62
Total Reward: 138
Total episodes 152
Eps_threshold: 0.6649474105194652
Loss ep: 0.022224765074880498
Score: 1452
Highest: 128.0
[[ 2. 32.  4.  2.]
 [ 8. 16. 32.  4.]
 [16.  8. 128. 64.]
 [ 8.  4.  2.  4.]]
Last action: DOWN
Last scores move: 8
-----
Episode: 63
Total Reward: 134
Total episodes 148
Eps_threshold: 0.6601186879900304
Loss ep: 0.022180140018463135
Score: 1388
Highest: 128.0
[[ 2. 32.  8.  4.]
 [ 4. 16. 64. 16.]
 [128. 4.  8.  2.]
 [ 8.  2.  4. 16.]]
Last action: DOWN
Last scores move: 4
-----
Episode: 64
Total Reward: 120
Total episodes 134
Eps_threshold: 0.6557774521603542
Loss ep: 0.022183944929891557
Score: 1248
Highest: 128.0
[[ 4.  2.  8.  2.]
 [ 8.  4. 16.  4.]
 [ 4.  8. 128. 16.]
 [ 2.  4. 64.  8.]]
Last action: UP
Last scores move: 4
-----
Episode: 65
Total Reward: 61
Total episodes 75
Eps_threshold: 0.6533603216670021
Loss ep: 0.02252867380777995
Score: 456
Highest: 32.0
[[ 2. 16.  2.  4.]
 [ 8. 32.  4.  8.]
 [32.  8. 16.  4.]
 [ 2. 16.  8.  2.]]
Last action: DOWN
Last scores move: 0
-----
Episode: 66
Total Reward: 94
Total episodes 108
Eps_threshold: 0.6498955392619111
Loss ep: 0.021074749805309153
Score: 888
```

```
Highest: 64.0
[[ 2. 16. 64.  8.]
 [ 4.  2.  8.  2.]
 [ 8. 16. 64. 32.]
 [ 4.  2.  4.  2.]]
Last action: LEFT
Last scores move: 4
-----
Episode: 67
Total Reward: 119
Total episodes 133
Eps_threshold: 0.6456543515047609
Loss ep: 0.021945598430203318
Score: 1264
Highest: 128.0
[[ 8.  2. 16.  4.]
 [128. 16.  4.  2.]
 [ 8. 64. 16.  8.]
 [ 2.  4.  8.  2.]]
Last action: UP
Last scores move: 8
-----
Episode: 68
Total Reward: 173
Total episodes 187
Eps_threshold: 0.639738682169156
Loss ep: 0.021699477007044828
Score: 2268
Highest: 256.0
[[ 4.  2.  8.  2.]
 [ 2.  8. 64.  4.]
 [32. 256.  4.  2.]
 [ 4. 16.  2.  4.]]
Last action: DOWN
Last scores move: 0
-----
Episode: 69
Total Reward: 84
Total episodes 98
Eps_threshold: 0.6366605103064971
Loss ep: 0.020977438712606624
Score: 712
Highest: 64.0
[[ 2. 16.  8.  2.]
 [16.  8. 16.  4.]
 [ 4. 64. 32. 16.]
 [ 2. 16.  8.  2.]]
Last action: DOWN
Last scores move: 4
-----
Episode: 70
Total Reward: 89
Total episodes 103
Eps_threshold: 0.6334415047324417
Loss ep: 0.02139809525128707
Score: 792
Highest: 64.0
[[ 2. 32.  8.  2.]
 [ 4. 64. 32.  8.]
 [ 8. 32.  8. 16.]
 [ 2.  4.  2.  4.]]
Last action: LEFT
Last scores move: 0
-----
Episode: 71
Total Reward: 97
Total episodes 111
Eps_threshold: 0.6299909884209803
Loss ep: 0.021547854483664572
Score: 900
Highest: 64.0
[[ 2. 16.  4.  2.]
```

```
[ 8.  2.  8.  4.]
[64.  8. 32. 16.]
[ 2.  4. 64.  4.]]
Last action: LEFT
Last scores move: 4
-----
Episode: 72
Total Reward: 132
Total episodes 146
Eps_threshold: 0.6254815337408087
Loss ep: 0.021142995520813824
Score: 1412
Highest: 128.0
[[ 2.  4.  8.  2.]
 [ 32. 16. 32.  8.]
 [  4. 128.  8.  4.]
 [  2.  8.  64.  2.]]
Last action: RIGHT
Last scores move: 8
-----
Episode: 73
Total Reward: 96
Total episodes 110
Eps_threshold: 0.6221056774200832
Loss ep: 0.020740162242542614
Score: 1064
Highest: 128.0
[[ 2.  8.  4.  2.]
 [  4. 32. 128.  4.]
 [  2. 16.  2. 32.]
 [  4.  8.  4.  2.]]
Last action: LEFT
Last scores move: 0
-----
Episode: 74
Total Reward: 146
Total episodes 160
Eps_threshold: 0.6172283672536812
Loss ep: 0.02085104286670685
Score: 1608
Highest: 128.0
[[ 2.  4.  2.  8.]
 [ 16.  2. 64.  2.]
 [  8. 64. 128.  4.]
 [  2. 32. 16.  2.]]
Last action: LEFT
Last scores move: 64
-----
Episode: 75
Total Reward: 127
Total episodes 141
Eps_threshold: 0.6129624622485166
Loss ep: 0.021157645164652072
Score: 1356
Highest: 128.0
[[ 4.  8. 16.  2.]
 [  2. 16. 64.  4.]
 [  4. 128.  4.  8.]
 [ 32.  4.  2. 16.]]
Last action: DOWN
Last scores move: 4
-----
Episode: 76
Total Reward: 116
Total episodes 130
Eps_threshold: 0.6090559162726105
Loss ep: 0.02053183042086088
Score: 1276
Highest: 128.0
[[ 2.  4.  8.  2.]
 [ 32. 16.  2.  4.]
 [  8. 64. 128.  8.]
```

```
[ 2.  4.  2.  4.]]
Last action: LEFT
Last scores move: 0
-----
Episode: 77
Total Reward: 169
Total episodes 183
Eps_threshold: 0.6035995555572824
Loss ep: 0.020340704527057586
Score: 2148
Highest: 256.0
[[ 2. 16.  4.  2.]
 [ 4. 32. 256. 32.]
 [ 2.  4. 16.  8.]
 [ 8.  2.  8.  4.]]
Last action: UP
Last scores move: 16
-----
Episode: 78
Total Reward: 228
Total episodes 242
Eps_threshold: 0.5964602806531002
Loss ep: 0.020451131931021195
Score: 2788
Highest: 256.0
[[ 8.  4. 32.  4.]
 [ 64. 256. 64. 16.]
 [ 2. 32. 16.  4.]
 [ 4.  2.  4. 16.]]
Last action: UP
Last scores move: 0
-----
Episode: 79
Total Reward: 64
Total episodes 78
Eps_threshold: 0.5941775397965966
Loss ep: 0.0205341684512603
Score: 592
Highest: 64.0
[[ 2. 32.  8.  4.]
 [ 4. 16.  4.  2.]
 [ 2. 64. 16.  8.]
 [ 4. 16.  8.  2.]]
Last action: RIGHT
Last scores move: 0
-----
Episode: 80
Total Reward: 102
Total episodes 116
Eps_threshold: 0.5907991169628343
Loss ep: 0.019906763372750116
Score: 1092
Highest: 128.0
[[ 2.  4.  8.  2.]
 [ 16. 32.  4.  8.]
 [ 2.  4. 128. 32.]
 [ 4.  8.  4.  2.]]
Last action: RIGHT
Last scores move: 0
-----
Episode: 81
Total Reward: 190
Total episodes 204
Eps_threshold: 0.5849050766765143
Loss ep: 0.020551896562763287
Score: 2364
Highest: 256.0
[[ 2.  4. 16.  2.]
 [ 16. 64.  8.  4.]
 [ 8. 256. 32.  8.]
 [ 2.  4.  8.  4.]]
Last action: RIGHT
```

```
Last scores move: 4
-----
Episode: 82
Total Reward: 61
Total episodes 75
Eps_threshold: 0.5827532198921546
Loss ep: 0.019303897221883137
Score: 544
Highest: 64.0
[[ 2.  8.  4.  2.]
 [64.  2. 16.  4.]
 [ 2.  8. 32.  8.]
 [ 8.  2.  4.  2.]]
Last action: LEFT
Last scores move: 4
-----
Episode: 83
Total Reward: 131
Total episodes 145
Eps_threshold: 0.5786157754070479
Loss ep: 0.020288903137733197
Score: 1424
Highest: 128.0
[[ 8. 128. 32.  2.]
 [ 4. 32.  8.  4.]
 [ 8.  4. 64. 16.]
 [ 4. 16.  2.  4.]]
Last action: DOWN
Last scores move: 4
-----
Episode: 84
Total Reward: 104
Total episodes 118
Eps_threshold: 0.5752708196547691
Loss ep: 0.0205695810964552
Score: 1072
Highest: 128.0
[[ 4. 16.  8.  2.]
 [16.  4. 16.  4.]
 [ 4. 128. 32.  8.]
 [ 2.  8.  4.  2.]]
Last action: DOWN
Last scores move: 4
-----
Episode: 85
Total Reward: 123
Total episodes 137
Eps_threshold: 0.5714119462704623
Loss ep: 0.019803184662422126
Score: 1324
Highest: 128.0
[[ 4.  8. 16.  2.]
 [ 2.  4. 64.  8.]
 [ 4. 32. 128. 16.]
 [ 2.  4.  8.  2.]]
Last action: RIGHT
Last scores move: 4
-----
Episode: 86
Total Reward: 228
Total episodes 242
Eps_threshold: 0.5646597946197524
Loss ep: 0.019948486454230696
Score: 2904
Highest: 256.0
[[ 2. 16.  8.  2.]
 [ 8. 256. 32.  8.]
 [16.  4. 128.  4.]
 [ 4.  8. 32.  2.]]
Last action: DOWN
Last scores move: 4
-----
```

Episode: 87  
Total Reward: 139  
Total episodes 153  
Eps\_threshold: 0.5604328359222582  
Loss ep: 0.01906510583715501  
Score: 1452  
Highest: 128.0  
[[ 2. 8. 4. 2.]  
 [ 16. 32. 64. 4.]  
 [ 4. 128. 16. 8.]  
 [ 2. 4. 32. 4.]]  
Last action: RIGHT  
Last scores move: 4  
-----

Episode: 88  
Total Reward: 45  
Total episodes 59  
Eps\_threshold: 0.5588114517737478  
Loss ep: 0.019083025091785496  
Score: 324  
Highest: 32.0  
[[ 4. 8. 2. 16.]  
 [ 2. 16. 4. 2.]  
 [ 8. 2. 32. 8.]  
 [ 2. 8. 16. 2.]]  
Last action: DOWN  
Last scores move: 0  
-----

Episode: 89  
Total Reward: 158  
Total episodes 172  
Eps\_threshold: 0.5541119102817142  
Loss ep: 0.019221239311750547  
Score: 1888  
Highest: 128.0  
[[ 2. 4. 128. 4.]  
 [ 4. 64. 4. 16.]  
 [ 2. 8. 128. 4.]  
 [ 4. 2. 8. 2.]]  
Last action: UP  
Last scores move: 4  
-----

Episode: 90  
Total Reward: 229  
Total episodes 243  
Eps\_threshold: 0.547540949990494  
Loss ep: 0.019590534791043758  
Score: 3028  
Highest: 256.0  
[[ 2. 4. 8. 2.]  
 [ 16. 256. 128. 4.]  
 [ 2. 64. 16. 2.]  
 [ 8. 32. 2. 4.]]  
Last action: LEFT  
Last scores move: 16  
-----

Episode: 91  
Total Reward: 38  
Total episodes 52  
Eps\_threshold: 0.5461451588353159  
Loss ep: 0.01936954030623803  
Score: 280  
Highest: 32.0  
[[ 4. 16. 8. 2.]  
 [ 2. 8. 2. 4.]  
 [ 8. 16. 32. 8.]  
 [ 4. 8. 4. 2.]]  
Last action: LEFT  
Last scores move: 4  
-----

Episode: 92  
Total Reward: 129

Total episodes 143  
Eps\_threshold: 0.5423253928858974  
Loss ep: 0.019129002844537054  
Score: 1364  
Highest: 128.0  
[[ 4. 16. 4. 2.]  
 [ 16. 64. 8. 32.]  
 [ 4. 128. 2. 8.]  
 [ 2. 4. 16. 4.]]  
Last action: LEFT  
Last scores move: 4

-----  
Episode: 93  
Total Reward: 101  
Total episodes 115  
Eps\_threshold: 0.539273305038498  
Loss ep: 0.019254690667857295  
Score: 1048  
Highest: 128.0  
[[ 2. 4. 8. 2.]  
 [ 4. 8. 2. 8.]  
 [ 8. 32. 16. 128.]  
 [ 16. 4. 8. 2.]]  
Last action: RIGHT  
Last scores move: 4

-----  
Episode: 94  
Total Reward: 118  
Total episodes 132  
Eps\_threshold: 0.5357916034789579  
Loss ep: 0.019271677190607243  
Score: 1304  
Highest: 128.0  
[[ 2. 4. 16. 2.]  
 [ 4. 8. 32. 4.]  
 [128. 4. 64. 8.]  
 [ 4. 8. 16. 4.]]  
Last action: RIGHT  
Last scores move: 4

-----  
Episode: 95  
Total Reward: 79  
Total episodes 93  
Eps\_threshold: 0.5333523481865671  
Loss ep: 0.01880383619698145  
Score: 700  
Highest: 64.0  
[[ 2. 4. 16. 2.]  
 [ 4. 32. 8. 16.]  
 [ 8. 4. 64. 8.]  
 [ 2. 32. 4. 2.]]  
Last action: RIGHT  
Last scores move: 4

-----  
Episode: 96  
Total Reward: 182  
Total episodes 196  
Eps\_threshold: 0.5282485446589994  
Loss ep: 0.01918236576780981  
Score: 2084  
Highest: 128.0  
[[ 8. 2. 8. 2.]  
 [ 16. 8. 128. 16.]  
 [ 4. 32. 64. 128.]  
 [ 2. 8. 4. 8.]]  
Last action: DOWN  
Last scores move: 0

-----  
Episode: 97  
Total Reward: 137  
Total episodes 151  
Eps\_threshold: 0.5243505017752084

```
Loss ep: 0.019380580510524725
Score: 1444
Highest: 128.0
[[ 4.  8.  4.  2.]
 [ 2. 32. 128. 16.]
 [ 8. 64. 32.  4.]
 [ 4. 16.  4.  2.]]
Last action: RIGHT
Last scores move: 0
-----
Episode: 98
Total Reward: 77
Total episodes 91
Eps_threshold: 0.5220155230969477
Loss ep: 0.018551172790946542
Score: 692
Highest: 64.0
[[ 2.  4. 32.  8.]
 [ 8. 16. 64.  2.]
 [ 4. 32.  2.  8.]
 [ 2. 16.  4.  2.]]
Last action: UP
Last scores move: 4
-----
Episode: 99
Total Reward: 112
Total episodes 126
Eps_threshold: 0.5187999649450667
Loss ep: 0.018229844078185068
Score: 1260
Highest: 128.0
[[ 2.  8.  4.  2.]
 [ 16. 32. 128.  4.]
 [ 4. 64.  2.  8.]
 [ 2.  8.  4.  2.]]
Last action: RIGHT
Last scores move: 0
-----
Episode: 100
Total Reward: 76
Total episodes 90
Eps_threshold: 0.5165155089837451
Loss ep: 0.018981402450137668
Score: 688
Highest: 64.0
[[ 2.  4. 32.  2.]
 [ 8. 16.  4.  8.]
 [32. 64.  8.  4.]
 [16.  2.  4.  2.]]
Last action: RIGHT
Last scores move: 4
-----
Update target_net
Episode: 101
Total Reward: 128
Total episodes 142
Eps_threshold: 0.5129319854323405
Loss ep: 0.08868817880120076
Score: 1348
Highest: 128.0
[[ 2.  8.  2.  8.]
 [ 4. 64. 16.  2.]
 [16.  4. 128.  8.]
 [ 2.  8. 32.  4.]]
Last action: DOWN
Last scores move: 0
-----
Episode: 102
Total Reward: 131
Total episodes 145
Eps_threshold: 0.5092989143342809
Loss ep: 0.07375160743450296
```



```
Score: 1476
Highest: 128.0
[[ 2.  4. 16.  2.]
 [ 4. 128.  2.  4.]
 [ 2.  64.  8. 16.]
 [ 4.  2.  64.  4.]]
Last action: DOWN
Last scores move: 4
-----
Episode: 103
Total Reward: 77
Total episodes 91
Eps_threshold: 0.507032264812164
Loss ep: 0.06947870568914728
Score: 648
Highest: 64.0
[[ 2.  4. 32.  8.]
 [ 8. 16.  8. 16.]
 [ 4. 64. 16.  4.]
 [ 2.  8.  4.  2.]]
Last action: LEFT
Last scores move: 4
-----
Episode: 104
Total Reward: 119
Total episodes 133
Eps_threshold: 0.503737965935098
Loss ep: 0.06762633646341194
Score: 1324
Highest: 128.0
[[ 4. 16.  4.  2.]
 [ 16.  8. 128. 32.]
 [ 4.  64. 16.  4.]
 [ 2.  4.  8.  2.]]
Last action: LEFT
Last scores move: 4
-----
Episode: 105
Total Reward: 127
Total episodes 141
Eps_threshold: 0.5002693544971176
Loss ep: 0.06722200001385195
Score: 1464
Highest: 128.0
[[ 16.  2.  4.  2.]
 [ 8.  64. 16.  4.]
 [ 4. 128.  2.  8.]
 [ 2.  64.  4.  2.]]
Last action: UP
Last scores move: 0
-----
Episode: 106
Total Reward: 165
Total episodes 179
Eps_threshold: 0.49590102122525576
Loss ep: 0.061363752993791466
Score: 2132
Highest: 256.0
[[ 2.  32. 16.  8.]
 [ 4. 256.  8.  4.]
 [ 16. 32.  4.  2.]
 [ 2.  8.  2.  4.]]
Last action: RIGHT
Last scores move: 0
-----
Episode: 107
Total Reward: 220
Total episodes 234
Eps_threshold: 0.4902491074465848
Loss ep: 0.06209617190890842
Score: 2860
Highest: 256.0
```

```
[[ 2.  4.  2.  4.]
 [ 32.  2.  4. 16.]
 [ 2. 256. 32.  4.]
 [ 16. 128.  8.  2.]]
Last action: UP
Last scores move: 4
-----
Episode: 108
Total Reward: 182
Total episodes 196
Eps_threshold: 0.4855656526055197
Loss ep: 0.05871995127930933
Score: 2288
Highest: 256.0
[[ 2. 16.  2.  8.]
 [ 8.  4. 256. 16.]
 [ 4.  8. 64.  8.]
 [ 8. 16.  4.  2.]]
Last action: LEFT
Last scores move: 8
-----
Episode: 109
Total Reward: 202
Total episodes 216
Eps_threshold: 0.480457178969283
Loss ep: 0.056209820288198965
Score: 2524
Highest: 256.0
[[ 4. 256.  2.  8.]
 [ 64.  8. 32.  2.]
 [ 16. 32.  8. 32.]
 [ 2.  4.  2.  4.]]
Last action: RIGHT
Last scores move: 0
-----
Episode: 110
Total Reward: 193
Total episodes 207
Eps_threshold: 0.47561305873195775
Loss ep: 0.055783663394946406
Score: 2436
Highest: 256.0
[[ 4. 16. 64.  2.]
 [ 32. 256.  4.  8.]
 [ 2.  4. 32.  2.]
 [ 4. 16.  4.  8.]]
Last action: DOWN
Last scores move: 0
-----
Episode: 111
Total Reward: 146
Total episodes 160
Eps_threshold: 0.47190301422700476
Loss ep: 0.056135493516922
Score: 1536
Highest: 128.0
[[ 2. 64.  2.  8.]
 [ 32.  4.  8.  2.]
 [ 8. 16. 32. 128.]
 [ 2.  4.  8. 32.]]
Last action: RIGHT
Last scores move: 4
-----
Episode: 112
Total Reward: 77
Total episodes 91
Eps_threshold: 0.46980612954249085
Loss ep: 0.051700864519391744
Score: 736
Highest: 64.0
[[ 4.  2.  8.  2.]
 [ 2.  8. 64.  4.]
```

```
[ 4. 16.  8.  2.]
[ 2.  8. 64.  4.]]
Last action: LEFT
Last scores move: 0
-----
Episode: 113
Total Reward: 72
Total episodes 86
Eps_threshold: 0.4678332080067025
Loss ep: 0.0528420182161553
Score: 652
Highest: 64.0
[[ 4. 16.  2.  8.]
 [ 2. 32. 64.  4.]
 [ 4.  8.  4.  8.]
 [ 2.  4. 32.  2.]]
Last action: RIGHT
Last scores move: 4
-----
Episode: 114
Total Reward: 120
Total episodes 134
Eps_threshold: 0.46477597866791936
Loss ep: 0.05108980634319248
Score: 1312
Highest: 128.0
[[ 4. 64.  8.  2.]
 [ 2. 16. 128.  4.]
 [ 32.  4.  8. 16.]
 [ 2.  8.  2.  4.]]
Last action: DOWN
Last scores move: 4
-----
Episode: 115
Total Reward: 147
Total episodes 161
Eps_threshold: 0.46112972788951817
Loss ep: 0.05220144283697472
Score: 1568
Highest: 128.0
[[ 2. 16.  4.  2.]
 [ 64.  8. 128.  8.]
 [ 8. 16.  4. 16.]
 [ 2.  4. 64.  4.]]
Last action: LEFT
Last scores move: 0
-----
Episode: 116
Total Reward: 73
Total episodes 87
Eps_threshold: 0.4591715756420973
Loss ep: 0.04940247261661223
Score: 656
Highest: 64.0
[[ 2. 16.  8.  4.]
 [ 8. 32.  4. 32.]
 [ 4.  2. 64.  4.]
 [ 2.  8.  4.  2.]]
Last action: LEFT
Last scores move: 4
-----
Episode: 117
Total Reward: 122
Total episodes 136
Eps_threshold: 0.45612757027553563
Loss ep: 0.05094692636938656
Score: 1320
Highest: 128.0
[[ 4.  2.  4.  2.]
 [ 16. 32. 64. 16.]
 [ 4.  8. 128.  8.]
 [ 2.  4.  8.  2.]]
```

```
Last action: RIGHT
Last scores move: 4
-----
Episode: 118
Total Reward: 92
Total episodes 106
Eps_threshold: 0.4537693489597626
Loss ep: 0.04859182519732781
Score: 776
Highest: 64.0
[[ 2.  8. 16.  2.]
 [ 8. 64.  8.  4.]
 [16. 32. 16. 32.]
 [ 4.  8.  4.  2.]]
Last action: UP
Last scores move: 0
-----
Episode: 119
Total Reward: 127
Total episodes 141
Eps_threshold: 0.4506517774019187
Loss ep: 0.05072498321533203
Score: 1344
Highest: 128.0
[[ 4.  8. 16.  2.]
 [ 2. 64.  2.  8.]
 [ 4.  8. 128.  4.]
 [16.  2.  8. 32.]]
Last action: LEFT
Last scores move: 4
-----
Episode: 120
Total Reward: 133
Total episodes 147
Eps_threshold: 0.4474248602855815
Loss ep: 0.04997623210050622
Score: 1432
Highest: 128.0
[[ 2.  4.  2. 32.]
 [ 4. 16. 128.  4.]
 [ 2.  8. 32. 64.]
 [ 8.  4.  8. 16.]]
Last action: RIGHT
Last scores move: 4
-----
Episode: 121
Total Reward: 228
Total episodes 242
Eps_threshold: 0.44216391239863373
Loss ep: 0.048906566682925895
Score: 2824
Highest: 256.0
[[ 2. 16.  2.  4.]
 [ 4. 32. 64. 32.]
 [ 8. 256. 32.  8.]
 [ 2.  8. 64.  2.]]
Last action: DOWN
Last scores move: 4
-----
Episode: 122
Total Reward: 110
Total episodes 124
Eps_threshold: 0.4394927851926062
Loss ep: 0.05000291716667914
Score: 1188
Highest: 128.0
[[ 2. 32.  4.  2.]
 [ 8.  2. 16. 32.]
 [ 2.  8.  4.  2.]
 [ 4. 128.  2. 32.]]
Last action: LEFT
Last scores move: 4
```

-----  
Episode: 123  
Total Reward: 135  
Total episodes 149  
Eps\_threshold: 0.4363049533608673  
Loss ep: 0.04893560537555874  
Score: 1496  
Highest: 128.0  
[[ 2. 4. 2. 4.]  
 [ 8. 64. 8. 2.]  
 [ 16. 4. 16. 64.]  
 [ 4. 128. 4. 2.]]  
Last action: LEFT  
Last scores move: 0  
-----

Episode: 124  
Total Reward: 61  
Total episodes 75  
Eps\_threshold: 0.43470930349915643  
Loss ep: 0.04653848012288411  
Score: 456  
Highest: 32.0  
[[ 2. 16. 2. 8.]  
 [ 4. 8. 32. 2.]  
 [ 8. 32. 16. 8.]  
 [ 2. 16. 4. 2.]]  
Last action: LEFT  
Last scores move: 4  
-----

Episode: 125  
Total Reward: 136  
Total episodes 150  
Eps\_threshold: 0.4315358988656089  
Loss ep: 0.04687396685282389  
Score: 1444  
Highest: 128.0  
[[ 4. 16. 8. 2.]  
 [ 16. 64. 32. 4.]  
 [ 8. 128. 4. 8.]  
 [ 2. 4. 32. 4.]]  
Last action: DOWN  
Last scores move: 4  
-----

Episode: 126  
Total Reward: 90  
Total episodes 104  
Eps\_threshold: 0.4293496014911359  
Loss ep: 0.04507907078816341  
Score: 868  
Highest: 64.0  
[[ 2. 64. 2. 4.]  
 [ 4. 8. 32. 2.]  
 [ 16. 64. 16. 8.]  
 [ 4. 2. 4. 2.]]  
Last action: DOWN  
Last scores move: 4  
-----

Episode: 127  
Total Reward: 224  
Total episodes 238  
Eps\_threshold: 0.42438891585302435  
Loss ep: 0.0476338562845182  
Score: 2888  
Highest: 256.0  
[[ 8. 128. 16. 32.]  
 [ 2. 16. 8. 2.]  
 [ 8. 2. 256. 32.]  
 [ 2. 8. 4. 2.]]  
Last action: LEFT  
Last scores move: 0  
-----

Episode: 128

Total Reward: 201  
Total episodes 215  
Eps\_threshold: 0.41995809334822926  
Loss ep: 0.045682978075604105  
Score: 2584  
Highest: 256.0  
[[ 2. 4. 8. 4.]  
 [ 8. 16. 4. 32.]  
 [ 64. 256. 64. 4.]  
 [ 4. 8. 2. 8.]]  
Last action: RIGHT  
Last scores move: 4  
-----

Episode: 129  
Total Reward: 179  
Total episodes 193  
Eps\_threshold: 0.4160210246562833  
Loss ep: 0.045512095634183736  
Score: 2312  
Highest: 256.0  
[[ 4. 8. 2. 8.]  
 [256. 64. 16. 2.]  
 [ 2. 4. 32. 4.]  
 [ 4. 2. 16. 2.]]  
Last action: UP  
Last scores move: 0  
-----

Episode: 130  
Total Reward: 82  
Total episodes 96  
Eps\_threshold: 0.41407679362532956  
Loss ep: 0.045196865995725  
Score: 744  
Highest: 64.0  
[[32. 2. 8. 2.]  
 [ 2. 8. 64. 8.]  
 [ 8. 2. 32. 4.]  
 [ 2. 32. 4. 2.]]  
Last action: LEFT  
Last scores move: 8  
-----

Episode: 131  
Total Reward: 139  
Total episodes 153  
Eps\_threshold: 0.41099739985307854  
Loss ep: 0.0466617696425494  
Score: 1512  
Highest: 128.0  
[[ 2. 4. 16. 4.]  
 [ 4. 128. 4. 8.]  
 [ 64. 4. 64. 4.]  
 [ 2. 8. 16. 2.]]  
Last action: LEFT  
Last scores move: 0  
-----

Episode: 132  
Total Reward: 114  
Total episodes 128  
Eps\_threshold: 0.40843921142892003  
Loss ep: 0.04584650322794914  
Score: 1236  
Highest: 128.0  
[[ 4. 2. 16. 2.]  
 [ 2. 4. 64. 4.]  
 [ 8. 16. 128. 16.]  
 [ 4. 8. 4. 2.]]  
Last action: LEFT  
Last scores move: 4  
-----

Episode: 133  
Total Reward: 185  
Total episodes 199

Eps\_threshold: 0.4044943992612052  
Loss ep: 0.04480523919340354  
Score: 2364  
Highest: 256.0  
[[ 2. 8. 16. 2.]  
[ 16. 64. 8. 32.]  
[ 4. 8. 256. 2.]  
[ 2. 4. 8. 16.]]  
Last action: DOWN  
Last scores move: 0

-----  
Episode: 134  
Total Reward: 205  
Total episodes 219  
Eps\_threshold: 0.40019824993336617  
Loss ep: 0.0444976075054848  
Score: 2540  
Highest: 256.0  
[[ 8. 32. 4. 2.]  
[ 4. 8. 256. 32.]  
[ 8. 16. 8. 2.]  
[ 2. 64. 32. 4.]]  
Last action: UP  
Last scores move: 8

-----  
Episode: 135  
Total Reward: 166  
Total episodes 180  
Eps\_threshold: 0.3967022214104795  
Loss ep: 0.04478823873731825  
Score: 2136  
Highest: 256.0  
[[ 4. 32. 8. 2.]  
[ 8. 16. 2. 4.]  
[ 4. 8. 256. 16.]  
[ 2. 32. 2. 4.]]  
Last action: UP  
Last scores move: 4

-----  
Episode: 136  
Total Reward: 197  
Total episodes 211  
Eps\_threshold: 0.39264395795549323  
Loss ep: 0.0440886529136043  
Score: 2480  
Highest: 256.0  
[[ 2. 16. 8. 4.]  
[ 8. 32. 64. 8.]  
[ 16. 256. 32. 4.]  
[ 8. 16. 4. 2.]]  
Last action: LEFT  
Last scores move: 4

-----  
Episode: 137  
Total Reward: 131  
Total episodes 145  
Eps\_threshold: 0.38987982136294735  
Loss ep: 0.04232154056943696  
Score: 1380  
Highest: 128.0  
[[ 8. 4. 16. 4.]  
[ 16. 8. 64. 8.]  
[ 8. 128. 32. 4.]  
[ 4. 16. 4. 2.]]  
Last action: RIGHT  
Last scores move: 0

-----  
Episode: 138  
Total Reward: 139  
Total episodes 153  
Eps\_threshold: 0.38698482819688707  
Loss ep: 0.042986542570824716

```
Score: 1476
Highest: 128.0
[[ 32.  2. 64.  4.]
 [  4.  8. 32. 16.]
 [  2. 16. 128.  8.]
 [ 16.  8.  4.  2.]]
Last action: LEFT
Last scores move: 4
-----
Episode: 139
Total Reward: 126
Total episodes 140
Eps_threshold: 0.3843551490144951
Loss ep: 0.043630668095179966
Score: 1372
Highest: 128.0
[[  2. 16.  4.  2.]
 [  4. 64. 32. 16.]
 [ 16.  8. 128.  8.]
 [  2. 16.  4.  2.]]
Last action: LEFT
Last scores move: 0
-----
Episode: 140
Total Reward: 186
Total episodes 200
Eps_threshold: 0.3806302530449459
Loss ep: 0.04234699249267578
Score: 2396
Highest: 256.0
[[  8. 32.  2.  4.]
 [  2.  8.  4. 32.]
 [ 64. 256.  8.  2.]
 [  4.  8. 16.  4.]]
Last action: RIGHT
Last scores move: 4
-----
Episode: 141
Total Reward: 188
Total episodes 202
Eps_threshold: 0.37690572800217076
Loss ep: 0.04250450417546943
Score: 2368
Highest: 256.0
[[  2. 64.  2. 16.]
 [  4.  8.  4.  2.]
 [ 16. 32. 16.  4.]
 [  4. 256.  8.  2.]]
Last action: UP
Last scores move: 0
-----
Episode: 142
Total Reward: 124
Total episodes 138
Eps_threshold: 0.37438279261577706
Loss ep: 0.041997764421545944
Score: 1344
Highest: 128.0
[[  2.  4. 32.  2.]
 [ 16. 64. 16.  4.]
 [  8. 128.  8.  2.]
 [ 16.  4.  2.  4.]]
Last action: DOWN
Last scores move: 0
-----
Episode: 143
Total Reward: 208
Total episodes 222
Eps_threshold: 0.37036050859278596
Loss ep: 0.04208088780308629
Score: 2648
Highest: 256.0
```



```
[[ 4. 64. 16. 2.]
 [ 16. 2. 256. 32.]
 [ 8. 16. 64. 8.]
 [ 4. 8. 4. 2.]]
Last action: LEFT
Last scores move: 4
-----
Episode: 144
Total Reward: 136
Total episodes 150
Eps_threshold: 0.36766791462723325
Loss ep: 0.04145762125651042
Score: 1440
Highest: 128.0
[[ 4. 2. 4. 2.]
 [ 16. 32. 64. 8.]
 [ 4. 128. 8. 2.]
 [ 2. 4. 16. 32.]]
Last action: RIGHT
Last scores move: 4
-----
Episode: 145
Total Reward: 89
Total episodes 103
Eps_threshold: 0.36583065985864616
Loss ep: 0.040315618792783864
Score: 760
Highest: 64.0
[[ 4. 16. 8. 2.]
 [ 2. 8. 32. 16.]
 [ 8. 4. 64. 4.]
 [ 4. 2. 32. 16.]]
Last action: LEFT
Last scores move: 0
-----
Episode: 146
Total Reward: 99
Total episodes 113
Eps_threshold: 0.3638258854512603
Loss ep: 0.040931659462177646
Score: 908
Highest: 64.0
[[ 4. 8. 64. 2.]
 [ 2. 64. 4. 16.]
 [ 32. 16. 2. 8.]
 [ 4. 2. 8. 4.]]
Last action: DOWN
Last scores move: 4
-----
Episode: 147
Total Reward: 144
Total episodes 158
Eps_threshold: 0.36104167307529
Loss ep: 0.04204280768768697
Score: 1476
Highest: 128.0
[[ 16. 8. 4. 2.]
 [ 4. 32. 128. 4.]
 [ 8. 64. 4. 8.]
 [ 4. 16. 32. 2.]]
Last action: LEFT
Last scores move: 4
-----
Episode: 148
Total Reward: 156
Total episodes 170
Eps_threshold: 0.35807046438023477
Loss ep: 0.0414638968075023
Score: 1720
Highest: 128.0
[[ 2. 8. 4. 2.]
 [ 128. 32. 64. 16.]
```

```
[ 8. 64. 16. 4.]
[ 4. 32. 8. 2.]]
Last action: LEFT
Last scores move: 8
-----
Episode: 149
Total Reward: 143
Total episodes 157
Eps_threshold: 0.3553488077135264
Loss ep: 0.04134541711989482
Score: 1520
Highest: 128.0
[[ 32. 4. 8. 2.]
 [ 2. 16. 64. 4.]
 [128. 32. 8. 32.]
 [ 4. 8. 4. 2.]]
Last action: LEFT
Last scores move: 4
-----
Episode: 150
Total Reward: 113
Total episodes 127
Eps_threshold: 0.3531627907339233
Loss ep: 0.04043932036152036
Score: 1216
Highest: 128.0
[[ 4. 16. 8. 2.]
 [128. 64. 4. 8.]
 [ 4. 16. 2. 4.]
 [ 2. 8. 4. 2.]]
Last action: LEFT
Last scores move: 8
-----
Episode: 151
Total Reward: 194
Total episodes 208
Eps_threshold: 0.34961239178569276
Loss ep: 0.04106559203221248
Score: 2440
Highest: 256.0
[[ 2. 4. 64. 2.]
 [ 4. 8. 16. 32.]
 [ 16. 256. 32. 4.]
 [ 4. 8. 4. 2.]]
Last action: RIGHT
Last scores move: 4
-----
Episode: 152
Total Reward: 154
Total episodes 168
Eps_threshold: 0.34677159574193783
Loss ep: 0.041699733052934916
Score: 1600
Highest: 128.0
[[ 4. 16. 4. 2.]
 [ 32. 64. 128. 8.]
 [ 16. 32. 16. 32.]
 [ 8. 2. 4. 2.]]
Last action: UP
Last scores move: 8
-----
Episode: 153
Total Reward: 132
Total episodes 146
Eps_threshold: 0.3443221145770016
Loss ep: 0.04194201835214275
Score: 1424
Highest: 128.0
[[ 2. 4. 32. 16.]
 [ 8. 16. 128. 4.]
 [ 2. 8. 32. 64.]
 [ 4. 2. 4. 2.]]
```

```
Last action: UP
Last scores move: 8
-----
Episode: 154
Total Reward: 229
Total episodes 243
Eps_threshold: 0.3402846779801352
Loss ep: 0.041019957742573304
Score: 2956
Highest: 256.0
[[ 32.  8. 32.  2.]
 [  4. 32. 16.  8.]
 [  2. 256. 128.  4.]
 [  8.  2.  8.  2.]]
Last action: LEFT
Last scores move: 0
-----
Episode: 155
Total Reward: 193
Total episodes 207
Eps_threshold: 0.33688386114875574
Loss ep: 0.04052045149503699
Score: 2156
Highest: 128.0
[[  2.  4. 16.  2.]
 [ 16. 128. 32.  8.]
 [ 64.  8. 128. 16.]
 [  2.  4. 16.  4.]]
Last action: DOWN
Last scores move: 8
-----
Episode: 156
Total Reward: 99
Total episodes 113
Eps_threshold: 0.3350421749959133
Loss ep: 0.039857944556042156
Score: 1072
Highest: 128.0
[[  4. 32.  2.  4.]
 [  2. 16.  4.  8.]
 [  4.  2. 32.  4.]
 [  2. 128.  4.  2.]]
Last action: UP
Last scores move: 4
-----
Episode: 157
Total Reward: 183
Total episodes 197
Eps_threshold: 0.3318562261293898
Loss ep: 0.03971262510657916
Score: 2316
Highest: 256.0
[[  8.  4. 32.  2.]
 [  4.  8. 256.  8.]
 [  2. 16. 64.  4.]
 [  8.  2.  4.  2.]]
Last action: DOWN
Last scores move: 0
-----
Episode: 158
Total Reward: 72
Total episodes 86
Eps_threshold: 0.3304752156574544
Loss ep: 0.03954461009003395
Score: 636
Highest: 64.0
[[  2.  4. 16.  2.]
 [ 16. 32. 64.  4.]
 [  4. 16.  4.  2.]
 [  2.  8.  2. 16.]]
Last action: DOWN
Last scores move: 0
```

```
-----  
Episode: 159  
Total Reward: 185  
Total episodes 199  
Eps_threshold: 0.3273022987007053  
Loss ep: 0.03941023888899453  
Score: 2356  
Highest: 256.0  
[[ 4. 32.  8.  2.]  
 [ 16. 64. 16.  4.]  
 [  4. 256.  4.  8.]  
 [  2. 16.  2.  4.]]  
Last action: LEFT  
Last scores move: 0  
-----
```

```
Episode: 160  
Total Reward: 165  
Total episodes 179  
Eps_threshold: 0.3244751136524489  
Loss ep: 0.040118750247209435  
Score: 1800  
Highest: 128.0  
[[ 2. 32. 64.  2.]  
 [  8. 128.  2.  4.]  
 [  4. 32. 64. 16.]  
 [  2.  8. 32.  2.]]  
Last action: UP  
Last scores move: 4  
-----
```

```
Episode: 161  
Total Reward: 276  
Total episodes 290  
Eps_threshold: 0.3199481244922446  
Loss ep: 0.03942982574989056  
Score: 3484  
Highest: 256.0  
[[ 4.  8.  2.  4.]  
 [ 32. 128. 16.  8.]  
 [  2. 16. 256. 32.]  
 [  4. 64.  8. 64.]]  
Last action: LEFT  
Last scores move: 4  
-----
```

```
Episode: 162  
Total Reward: 145  
Total episodes 159  
Eps_threshold: 0.31749380574612346  
Loss ep: 0.038959017339742406  
Score: 1516  
Highest: 128.0  
[[ 2.  4. 32.  2.]  
 [ 16. 128. 16.  4.]  
 [ 32. 16. 64.  8.]  
 [  4.  8. 16.  2.]]  
Last action: DOWN  
Last scores move: 4  
-----
```

```
Episode: 163  
Total Reward: 215  
Total episodes 229  
Eps_threshold: 0.31399308156233996  
Loss ep: 0.03941186130307127  
Score: 2824  
Highest: 256.0  
[[ 8.  2. 128.  2.]  
 [  2. 32.  4. 16.]  
 [  4.  8. 256.  4.]  
 [  2. 32.  4.  2.]]  
Last action: RIGHT  
Last scores move: 0  
-----
```

```
Episode: 164
```

Total Reward: 134  
Total episodes 148  
Eps\_threshold: 0.3117518355963957  
Loss ep: 0.039301717603528824  
Score: 1436  
Highest: 128.0  
[[ 2. 32. 4. 2.]  
 [ 64. 8. 128. 16.]  
 [ 2. 32. 16. 8.]  
 [ 4. 2. 8. 2.]]  
Last action: LEFT  
Last scores move: 4  
-----

Episode: 165  
Total Reward: 121  
Total episodes 135  
Eps\_threshold: 0.3097218695490514  
Loss ep: 0.03822435449670862  
Score: 1300  
Highest: 128.0  
[[ 2. 8. 128. 2.]  
 [ 16. 64. 4. 8.]  
 [ 2. 4. 8. 32.]  
 [ 4. 8. 2. 4.]]  
Last action: UP  
Last scores move: 0  
-----

Episode: 166  
Total Reward: 110  
Total episodes 124  
Eps\_threshold: 0.3078693427252581  
Loss ep: 0.03843636666574786  
Score: 1152  
Highest: 128.0  
[[ 2. 4. 8. 2.]  
 [ 4. 8. 16. 8.]  
 [ 32. 128. 32. 2.]  
 [ 8. 16. 8. 4.]]  
Last action: RIGHT  
Last scores move: 4  
-----

Episode: 167  
Total Reward: 334.9  
Total episodes 348  
Eps\_threshold: 0.30273124722617595  
Loss ep: 0.039232001907524024  
Score: 4972  
Highest: 512.0  
[[ 4. 32. 4. 2.]  
 [ 64. 512. 64. 32.]  
 [ 4. 8. 16. 8.]  
 [ 2. 4. 8. 2.]]  
Last action: RIGHT  
Last scores move: 8  
-----

Episode: 168  
Total Reward: 106  
Total episodes 120  
Eps\_threshold: 0.30098011838273264  
Loss ep: 0.037837886810302736  
Score: 1124  
Highest: 128.0  
[[ 2. 16. 2. 32.]  
 [ 16. 8. 4. 2.]  
 [ 2. 4. 32. 128.]  
 [ 4. 2. 8. 4.]]  
Last action: RIGHT  
Last scores move: 0  
-----

Episode: 169  
Total Reward: 200  
Total episodes 214

Eps\_threshold: 0.2978832290209717  
Loss ep: 0.03850922183455708  
Score: 2532  
Highest: 256.0  
[[ 2. 16. 4. 2.]  
[ 4. 256. 32. 8.]  
[ 8. 32. 64. 2.]  
[ 4. 16. 32. 4.]]  
Last action: LEFT  
Last scores move: 4

-----  
Episode: 170  
Total Reward: 180  
Total episodes 194  
Eps\_threshold: 0.2951042614814222  
Loss ep: 0.03877707854988649  
Score: 2320  
Highest: 256.0  
[[ 2. 8. 4. 2.]  
[ 4. 16. 64. 4.]  
[ 8. 32. 4. 8.]  
[ 4. 256. 2. 16.]]  
Last action: LEFT  
Last scores move: 4

-----  
Episode: 171  
Total Reward: 124  
Total episodes 138  
Eps\_threshold: 0.29314381340114887  
Loss ep: 0.03869653093642083  
Score: 1316  
Highest: 128.0  
[[ 4. 2. 8. 2.]  
[ 8. 32. 2. 8.]  
[ 4. 8. 64. 16.]  
[ 2. 128. 8. 2.]]  
Last action: LEFT  
Last scores move: 8

-----  
Episode: 172  
Total Reward: 114  
Total episodes 128  
Eps\_threshold: 0.2913374794297059  
Loss ep: 0.03825711831450462  
Score: 1168  
Highest: 128.0  
[[ 2. 8. 2. 128.]  
[ 4. 32. 8. 2.]  
[ 16. 8. 16. 8.]  
[ 2. 4. 8. 32.]]  
Last action: LEFT  
Last scores move: 8

-----  
Episode: 173  
Total Reward: 191  
Total episodes 205  
Eps\_threshold: 0.28846849890919724  
Loss ep: 0.0384530881556069  
Score: 2408  
Highest: 256.0  
[[ 2. 4. 8. 4.]  
[ 16. 2. 64. 32.]  
[ 4. 256. 8. 4.]  
[ 2. 4. 32. 2.]]  
Last action: UP  
Last scores move: 16

-----  
Episode: 174  
Total Reward: 134  
Total episodes 148  
Eps\_threshold: 0.286415437712491  
Loss ep: 0.03934215210579537

```
Score: 1436
Highest: 128.0
[[ 2.  8.  4.  2.]
 [ 4. 128. 32.  8.]
 [ 8.  2. 64.  2.]
 [32. 16.  2. 16.]]
Last action: DOWN
Last scores move: 4
-----
Episode: 175
Total Reward: 72
Total episodes 86
Eps_threshold: 0.28522940313215606
Loss ep: 0.037905221761659134
Score: 648
Highest: 64.0
[[ 4.  2.  4.  2.]
 [ 2.  8. 32.  4.]
 [ 4. 16. 64.  2.]
 [ 2.  8.  2. 32.]]
Last action: DOWN
Last scores move: 0
-----
Episode: 176
Total Reward: 237
Total episodes 251
Eps_threshold: 0.28179685839382707
Loss ep: 0.037950675326039594
Score: 3028
Highest: 256.0
[[ 16.  4.  2.  4.]
 [  2. 16. 64. 16.]
 [128.  4.  8.  4.]
 [  2. 16. 256.  2.]]
Last action: UP
Last scores move: 0
-----
Episode: 177
Total Reward: 146
Total episodes 160
Eps_threshold: 0.2796311578791257
Loss ep: 0.03750195801258087
Score: 1692
Highest: 128.0
[[ 2. 16.  8.  2.]
 [ 4. 128.  2. 128.]
 [ 8. 16.  4.  8.]
 [ 4.  8. 16.  2.]]
Last action: DOWN
Last scores move: 4
-----
Episode: 178
Total Reward: 193
Total episodes 207
Eps_threshold: 0.27685486748143784
Loss ep: 0.03862928998643073
Score: 2444
Highest: 256.0
[[ 8. 16.  4.  2.]
 [32.  8. 32.  8.]
 [ 4. 256.  8. 64.]
 [ 2. 16.  2.  4.]]
Last action: LEFT
Last scores move: 4
-----
Episode: 179
Total Reward: 220
Total episodes 234
Eps_threshold: 0.27375085938814236
Loss ep: 0.037833633585872814
Score: 2756
Highest: 256.0
```

```
[ [ 2.  4. 256.  2.]
  [ 64. 32. 16.  4.]
  [  4. 16. 64.  8.]
  [ 16.  4. 32.  4.]]
Last action: RIGHT
Last scores move: 4
-----
Episode: 180
Total Reward: 150
Total episodes 164
Eps_threshold: 0.27159694545736
Loss ep: 0.03753374262553889
Score: 1624
Highest: 128.0
[ [ 2.  4.  2.  4.]
  [  4. 64. 32.  2.]
  [  8. 16. 64. 16.]
  [  2.  4.  8. 128.]]
Last action: UP
Last scores move: 0
-----
Episode: 181
Total Reward: 132
Total episodes 146
Eps_threshold: 0.26969424107609846
Loss ep: 0.03757120158574353
Score: 1384
Highest: 128.0
[ [ 16.  2. 16.  2.]
  [  8. 32. 64.  8.]
  [  2.  8. 16. 128.]
  [  8.  4.  2.  4.]]
Last action: DOWN
Last scores move: 8
-----
Episode: 182
Total Reward: 198
Total episodes 212
Eps_threshold: 0.26695602032947446
Loss ep: 0.03628854031832713
Score: 2480
Highest: 256.0
[ [  4.  8. 32.  2.]
  [  2.  4. 64. 16.]
  [ 16. 256. 32.  8.]
  [  8. 16.  4.  2.]]
Last action: LEFT
Last scores move: 0
-----
Episode: 183
Total Reward: 102
Total episodes 116
Eps_threshold: 0.26546998906806024
Loss ep: 0.03731160739372517
Score: 1112
Highest: 128.0
[ [  2. 16.  8.  4.]
  [  8. 128. 32.  2.]
  [ 16.  8.  2.  4.]
  [  4. 32.  4.  2.]]
Last action: RIGHT
Last scores move: 0
-----
Episode: 184
Total Reward: 100
Total episodes 114
Eps_threshold: 0.2640179523663594
Loss ep: 0.035802431273878665
Score: 1040
Highest: 128.0
[ [  8. 16.  8.  2.]
  [  4.  2. 128.  8.]
```



```

[ 2. 16. 32. 4.]
[ 4. 2. 8. 2.]]
Last action: RIGHT
Last scores move: 0
-----
Episode: 185
Total Reward: 237
Total episodes 251
Eps_threshold: 0.2608499478729674
Loss ep: 0.03724665090857274
Score: 3044
Highest: 256.0
[[ 2. 4. 8. 2.]
 [ 8. 128. 64. 4.]
 [256. 32. 2. 8.]
 [ 2. 4. 16. 2.]]
Last action: UP
Last scores move: 0
-----
Episode: 186
Total Reward: 123
Total episodes 137
Eps_threshold: 0.2591374975683631
Loss ep: 0.03662292452624245
Score: 1340
Highest: 128.0
[[ 8. 16. 2. 4.]
 [ 2. 128. 64. 32.]
 [ 4. 8. 4. 16.]
 [ 2. 4. 16. 4.]]
Last action: RIGHT
Last scores move: 0
-----
Episode: 187
Total Reward: 186
Total episodes 200
Eps_threshold: 0.2566585380482416
Loss ep: 0.03749699115753174
Score: 2372
Highest: 256.0
[[ 2. 256. 4. 2.]
 [ 4. 16. 2. 4.]
 [ 16. 32. 16. 2.]
 [ 4. 64. 4. 16.]]
Last action: DOWN
Last scores move: 4
-----
Episode: 188
Total Reward: 70
Total episodes 84
Eps_threshold: 0.25562474467420027
Loss ep: 0.03701062713350568
Score: 612
Highest: 64.0
[[ 4. 8. 4. 2.]
 [16. 4. 16. 64.]
 [ 8. 2. 32. 2.]
 [ 4. 16. 2. 4.]]
Last action: LEFT
Last scores move: 4
-----
Episode: 189
Total Reward: 206
Total episodes 220
Eps_threshold: 0.2529376784415933
Loss ep: 0.036746705662120474
Score: 2856
Highest: 256.0
[[ 4. 2. 8. 2.]
 [ 8. 256. 64. 8.]
 [ 4. 128. 16. 4.]
 [ 2. 8. 4. 2.]]

```

```
Last action: UP
Last scores move: 4
-----
Episode: 190
Total Reward: 133
Total episodes 147
Eps_threshold: 0.25115863250788917
Loss ep: 0.03636871714170287
Score: 1432
Highest: 128.0
[[ 2.  4. 32.  4.]
 [ 64.  8. 16.  8.]
 [ 8. 128. 32.  4.]
 [ 2.  4. 16.  2.]]
Last action: UP
Last scores move: 8
-----
Episode: 191
Total Reward: 128
Total episodes 142
Eps_threshold: 0.2494524702603591
Loss ep: 0.036345656488982726
Score: 1396
Highest: 128.0
[[ 2. 32.  8.  2.]
 [ 4. 64. 16.  8.]
 [ 2. 32.  8. 128.]
 [ 8.  2.  4.  2.]]
Last action: UP
Last scores move: 8
-----
Episode: 192
Total Reward: 178
Total episodes 192
Eps_threshold: 0.24716472529156425
Loss ep: 0.03643055011828741
Score: 2044
Highest: 128.0
[[ 4.  8.  4. 16.]
 [ 2. 64. 16.  4.]
 [128. 16. 128. 16.]
 [ 2.  4. 16.  2.]]
Last action: UP
Last scores move: 16
-----
Episode: 193
Total Reward: 246
Total episodes 260
Eps_threshold: 0.24410153772174784
Loss ep: 0.03670156185443585
Score: 3116
Highest: 256.0
[[ 4.  2. 32.  4.]
 [ 16.  8.  2.  8.]
 [ 2. 64. 128. 16.]
 [ 4. 256. 16.  2.]]
Last action: UP
Last scores move: 16
-----
Episode: 194
Total Reward: 150
Total episodes 164
Eps_threshold: 0.2421897541374737
Loss ep: 0.03644292529036359
Score: 1628
Highest: 128.0
[[ 4.  8.  4.  2.]
 [ 2. 16. 32.  4.]
 [128. 64.  8. 16.]
 [ 2.  8. 64.  4.]]
Last action: LEFT
Last scores move: 4
```

```
-----  
Episode: 195  
Total Reward: 231  
Total episodes 245  
Eps_threshold: 0.23936278021636584  
Loss ep: 0.036583686361507495  
Score: 3040  
Highest: 256.0  
[[ 8. 256. 16.  2.]  
 [ 2. 32. 64.  4.]  
 [ 4.  8. 128.  8.]  
 [ 2.  4. 16.  4.]]  
Last action: RIGHT  
Last scores move: 0  
-----
```

```
Episode: 196  
Total Reward: 182  
Total episodes 196  
Eps_threshold: 0.2371260030798587  
Loss ep: 0.036028073758495094  
Score: 2236  
Highest: 256.0  
[[ 2. 16.  4.  2.]  
 [ 8. 256. 32. 16.]  
 [ 2. 32. 16.  8.]  
 [16.  2.  4.  2.]]  
Last action: DOWN  
Last scores move: 0  
-----
```

```
Episode: 197  
Total Reward: 134  
Total episodes 148  
Eps_threshold: 0.23545147405588362  
Loss ep: 0.03576269665279904  
Score: 1436  
Highest: 128.0  
[[ 8.  4.  2.  4.]  
 [ 4. 128.  8. 32.]  
 [16. 32. 16.  4.]  
 [ 2. 64.  8.  2.]]  
Last action: UP  
Last scores move: 0  
-----
```

```
Episode: 198  
Total Reward: 202  
Total episodes 216  
Eps_threshold: 0.2330296992595853  
Loss ep: 0.03650423774012813  
Score: 2604  
Highest: 256.0  
[[ 2.  4.  8.  2.]  
 [64. 32. 256. 16.]  
 [ 8.  4. 64.  8.]  
 [ 4.  2. 16.  2.]]  
Last action: RIGHT  
Last scores move: 0  
-----
```

```
Episode: 199  
Total Reward: 237  
Total episodes 251  
Eps_threshold: 0.23024816715592056  
Loss ep: 0.03574203779972882  
Score: 3064  
Highest: 256.0  
[[ 2.  8. 256.  4.]  
 [ 8. 32. 64.  8.]  
 [ 4. 128. 16.  4.]  
 [ 2. 16.  4.  2.]]  
Last action: DOWN  
Last scores move: 0  
-----
```

```
Episode: 200
```

Total Reward: 133  
Total episodes 147  
Eps\_threshold: 0.2286352777568859  
Loss ep: 0.0357584336987969  
Score: 1428  
Highest: 128.0  
[[ 4. 2. 4. 32.]  
 [ 64. 4. 128. 4.]  
 [ 2. 8. 16. 2.]  
 [ 4. 16. 32. 8.]]  
Last action: DOWN  
Last scores move: 4

-----  
Update target\_net  
Episode: 201  
Total Reward: 226  
Total episodes 240  
Eps\_threshold: 0.2260273338529024  
Loss ep: 0.053022301197052  
Score: 2972  
Highest: 256.0  
[[ 4. 256. 4. 2.]  
 [ 2. 8. 64. 16.]  
 [128. 16. 8. 4.]  
 [ 2. 8. 16. 2.]]  
Last action: UP  
Last scores move: 4

-----  
Episode: 202  
Total Reward: 145  
Total episodes 159  
Eps\_threshold: 0.22431672476370026  
Loss ep: 0.04961321488866266  
Score: 1544  
Highest: 128.0  
[[ 2. 16. 2. 4.]  
 [ 4. 32. 64. 32.]  
 [ 8. 128. 32. 8.]  
 [ 2. 4. 16. 2.]]  
Last action: UP  
Last scores move: 0

-----  
Episode: 203  
Total Reward: 191  
Total episodes 205  
Eps\_threshold: 0.22213119829274205  
Loss ep: 0.048590506576910254  
Score: 2416  
Highest: 256.0  
[[ 4. 8. 4. 2.]  
 [ 8. 32. 64. 8.]  
 [ 4. 256. 8. 4.]  
 [ 2. 32. 2. 16.]]  
Last action: LEFT  
Last scores move: 4

-----  
Episode: 204  
Total Reward: 262  
Total episodes 276  
Eps\_threshold: 0.21922389429267075  
Loss ep: 0.04806296721748684  
Score: 3336  
Highest: 256.0  
[[ 4. 128. 4. 2.]  
 [ 2. 64. 32. 4.]  
 [ 8. 256. 64. 16.]  
 [ 2. 8. 4. 2.]]  
Last action: DOWN  
Last scores move: 32

-----  
Episode: 205  
Total Reward: 77

Total episodes 91  
Eps\_threshold: 0.2182740880215191  
Loss ep: 0.0475612053504357  
Score: 664  
Highest: 64.0  
[[ 2. 8. 4. 2.]  
 [ 4. 16. 8. 16.]  
 [64. 32. 2. 4.]  
 [16. 8. 16. 2.]]  
Last action: LEFT  
Last scores move: 4

-----  
Episode: 206  
Total Reward: 134  
Total episodes 148  
Eps\_threshold: 0.21673854827439748  
Loss ep: 0.04626773821341025  
Score: 1392  
Highest: 128.0  
[[ 4. 8. 16. 8.]  
 [ 2. 128. 32. 16.]  
 [ 4. 64. 4. 8.]  
 [ 2. 8. 16. 4.]]  
Last action: RIGHT  
Last scores move: 4

-----  
Episode: 207  
Total Reward: 254  
Total episodes 268  
Eps\_threshold: 0.21398673008563493  
Loss ep: 0.04651476731940882  
Score: 3220  
Highest: 256.0  
[[ 4. 128. 16. 8.]  
 [ 8. 256. 32. 4.]  
 [ 4. 16. 64. 32.]  
 [ 2. 4. 16. 8.]]  
Last action: RIGHT  
Last scores move: 4

-----  
Episode: 208  
Total Reward: 225  
Total episodes 239  
Eps\_threshold: 0.2115635957246535  
Loss ep: 0.045085260558826654  
Score: 2892  
Highest: 256.0  
[[ 8. 4. 8. 2.]  
 [ 32. 128. 32. 16.]  
 [ 4. 8. 16. 256.]  
 [ 2. 4. 8. 2.]]  
Last action: UP  
Last scores move: 4

-----  
Episode: 209  
Total Reward: 198  
Total episodes 212  
Eps\_threshold: 0.20943830554767326  
Loss ep: 0.04450004505661299  
Score: 2456  
Highest: 256.0  
[[ 2. 8. 4. 2.]  
 [ 4. 32. 16. 4.]  
 [ 16. 4. 64. 32.]  
 [ 4. 256. 8. 4.]]  
Last action: DOWN  
Last scores move: 4

-----  
Episode: 210  
Total Reward: 190  
Total episodes 204  
Eps\_threshold: 0.20741437442725355

```
Loss ep: 0.04452593653809791
Score: 2384
Highest: 256.0
[[ 2.  4.  8.  2.]
 [ 4.  8. 32.  8.]
 [16. 64. 256. 16.]
 [ 4. 16.  8.  4.]]
Last action: DOWN
Last scores move: 4
-----
Episode: 211
Total Reward: 199
Total episodes 213
Eps_threshold: 0.20532306731670297
Loss ep: 0.044823498793051274
Score: 2528
Highest: 256.0
[[ 32.  4.  8.  2.]
 [  2. 256. 32.  4.]
 [16. 64. 16. 32.]
 [ 4.  8.  4.  2.]]
Last action: LEFT
Last scores move: 4
-----
Episode: 212
Total Reward: 252
Total episodes 266
Eps_threshold: 0.20274246953667766
Loss ep: 0.04383930765596548
Score: 3280
Highest: 256.0
[[ 2.  8. 64.  2.]
 [ 4. 64.  8.  4.]
 [128. 256. 32.  8.]
 [ 2.  4.  2.  4.]]
Last action: DOWN
Last scores move: 0
-----
Episode: 213
Total Reward: 165
Total episodes 179
Eps_threshold: 0.2010251210325242
Loss ep: 0.04409887004830984
Score: 1884
Highest: 128.0
[[ 4.  8.  4.  2.]
 [16.  4. 128.  8.]
 [ 8. 32. 16.  2.]
 [ 2. 128. 32.  8.]]
Last action: LEFT
Last scores move: 4
-----
Episode: 214
Total Reward: 242
Total episodes 256
Eps_threshold: 0.19859558170621594
Loss ep: 0.04345951974391937
Score: 3084
Highest: 256.0
[[ 4.  2.  4.  2.]
 [ 8. 256. 128.  8.]
 [32.  8.  64. 16.]
 [ 2. 16.  4.  2.]]
Last action: LEFT
Last scores move: 4
-----
Episode: 215
Total Reward: 211
Total episodes 225
Eps_threshold: 0.19648577134714998
Loss ep: 0.0427597173055013
Score: 2668
```

```
Highest: 256.0
[[ 2.  8. 64.  2.]
 [ 8.  4. 256.  4.]
 [ 4. 32.  8. 32.]
 [ 2. 64.  4.  2.]]
Last action: UP
Last scores move: 0
-----
Episode: 216
Total Reward: 112
Total episodes 126
Eps_threshold: 0.19531460403831905
Loss ep: 0.04233967690240769
Score: 1172
Highest: 128.0
[[ 2. 16.  4.  2.]
 [ 4.  8. 32.  8.]
 [ 8. 16. 128.  4.]
 [ 4. 32. 16.  2.]]
Last action: LEFT
Last scores move: 4
-----
Episode: 217
Total Reward: 145
Total episodes 159
Eps_threshold: 0.19384719362128125
Loss ep: 0.042433576763800857
Score: 1592
Highest: 128.0
[[ 4.  2.  8.  2.]
 [ 8. 64. 128. 64.]
 [ 4. 16. 32.  4.]
 [ 8.  2.  8.  2.]]
Last action: LEFT
Last scores move: 8
-----
Episode: 218
Total Reward: 106
Total episodes 120
Eps_threshold: 0.19274741310045562
Loss ep: 0.04224346081415812
Score: 1128
Highest: 128.0
[[ 2.  8.  2.  4.]
 [ 4. 16. 32.  2.]
 [ 2. 32. 128.  8.]
 [ 16. 8.  4.  2.]]
Last action: LEFT
Last scores move: 4
-----
Episode: 219
Total Reward: 141
Total episodes 155
Eps_threshold: 0.1913365946319259
Loss ep: 0.04236053959015877
Score: 1464
Highest: 128.0
[[ 4. 16.  8.  4.]
 [ 16. 64. 32.  8.]
 [ 4. 32. 128.  4.]
 [ 2.  8.  4.  2.]]
Last action: UP
Last scores move: 4
-----
Episode: 220
Total Reward: 123
Total episodes 137
Eps_threshold: 0.19009868364431584
Loss ep: 0.04238315220296818
Score: 1332
Highest: 128.0
[[ 2.  8.  2.  8.]
```

```
[ 4. 64. 8. 4.]
[ 8. 32. 128. 16.]
[ 2. 16. 8. 2.]]
Last action: DOWN
Last scores move: 4
-----
Episode: 221
Total Reward: 188
Total episodes 202
Eps_threshold: 0.18828884202482252
Loss ep: 0.04177392827402247
Score: 2384
Highest: 256.0
[[ 4. 32. 2. 8.]
 [ 2. 8. 64. 2.]
 [ 8. 256. 8. 4.]
 [ 4. 2. 32. 2.]]
Last action: UP
Last scores move: 8
-----
Episode: 222
Total Reward: 135
Total episodes 149
Eps_threshold: 0.18696552562593183
Loss ep: 0.04121038577700621
Score: 1424
Highest: 128.0
[[ 2. 32. 8. 4.]
 [ 4. 64. 32. 8.]
 [ 8. 16. 128. 4.]
 [ 2. 4. 8. 2.]]
Last action: DOWN
Last scores move: 4
-----
Episode: 223
Total Reward: 134
Total episodes 148
Eps_threshold: 0.18566081412268998
Loss ep: 0.040664601970363305
Score: 1436
Highest: 128.0
[[ 8. 2. 32. 2.]
 [ 4. 8. 64. 4.]
 [ 16. 128. 8. 16.]
 [ 2. 32. 4. 2.]]
Last action: LEFT
Last scores move: 8
-----
Episode: 224
Total Reward: 231
Total episodes 245
Eps_threshold: 0.1835220955460236
Loss ep: 0.04172357831682478
Score: 3036
Highest: 256.0
[[ 2. 16. 8. 2.]
 [ 64. 128. 256. 4.]
 [ 8. 2. 4. 16.]
 [ 2. 4. 32. 4.]]
Last action: RIGHT
Last scores move: 4
-----
Episode: 225
Total Reward: 133
Total episodes 147
Eps_threshold: 0.18225138373026387
Loss ep: 0.041615226641804184
Score: 1404
Highest: 128.0
[[ 4. 2. 16. 2.]
 [ 16. 32. 128. 8.]
 [ 8. 64. 8. 2.]
```



```
[ 4. 16. 2. 16.]]
Last action: UP
Last scores move: 0
-----
Episode: 226
Total Reward: 153
Total episodes 167
Eps_threshold: 0.18081907289586444
Loss ep: 0.04067442659846323
Score: 1644
Highest: 128.0
[[ 4. 8. 2. 4.]
 [ 16. 32. 64. 8.]
 [ 4. 8. 128. 16.]
 [ 2. 64. 8. 2.]]
Last action: LEFT
Last scores move: 8
-----
Episode: 227
Total Reward: 220
Total episodes 234
Eps_threshold: 0.17883213598981423
Loss ep: 0.04048128209562383
Score: 2740
Highest: 256.0
[[ 32. 2. 64. 2.]
 [ 2. 4. 8. 4.]
 [256. 64. 32. 16.]
 [ 16. 8. 4. 2.]]
Last action: LEFT
Last scores move: 8
-----
Episode: 228
Total Reward: 101
Total episodes 115
Eps_threshold: 0.17786413687237324
Loss ep: 0.040148714314336365
Score: 1088
Highest: 128.0
[[ 2. 4. 2. 8.]
 [ 8. 2. 32. 2.]
 [ 2. 128. 8. 16.]
 [ 4. 32. 2. 4.]]
Last action: DOWN
Last scores move: 32
-----
Episode: 229
Total Reward: 206
Total episodes 220
Eps_threshold: 0.1760277500113761
Loss ep: 0.04037427035245028
Score: 2624
Highest: 256.0
[[ 8. 64. 8. 2.]
 [ 2. 32. 16. 4.]
 [ 16. 64. 8. 256.]
 [ 2. 8. 4. 2.]]
Last action: UP
Last scores move: 0
-----
Episode: 230
Total Reward: 232
Total episodes 246
Eps_threshold: 0.17399811652074332
Loss ep: 0.04040875473642737
Score: 3060
Highest: 256.0
[[ 2. 32. 2. 64.]
 [ 4. 8. 16. 2.]
 [ 8. 128. 256. 4.]
 [ 2. 16. 4. 16.]]
Last action: DOWN
```

```

Last scores move: 4
-----
Episode: 231
Total Reward: 111
Total episodes 125
Eps_threshold: 0.17297632471801522
Loss ep: 0.03892781066894531
Score: 1148
Highest: 128.0
[[ 2.  4. 32.  2.]
 [ 32. 16.  8.  4.]
 [ 2.  8. 128.  8.]
 [ 4.  2. 16.  4.]]
Last action: DOWN
Last scores move: 4
-----
Episode: 232
Total Reward: 244
Total episodes 258
Eps_threshold: 0.17088743245190238
Loss ep: 0.040360118067541785
Score: 3112
Highest: 256.0
[[ 2.  4. 16.  8.]
 [ 4. 16.  2. 32.]
 [ 8. 64. 128. 256.]
 [ 4.  8. 16.  2.]]
Last action: DOWN
Last scores move: 4
-----
Episode: 233
Total Reward: 260
Total episodes 274
Eps_threshold: 0.1686983043941867
Loss ep: 0.04013054562311103
Score: 3272
Highest: 256.0
[[ 32. 16.  8.  4.]
 [ 4. 32. 128.  2.]
 [ 8. 64. 32.  4.]
 [256.  8.  4.  2.]]
Last action: LEFT
Last scores move: 4
-----
Episode: 234
Total Reward: 223
Total episodes 237
Eps_threshold: 0.16682882801101362
Loss ep: 0.040078271793413764
Score: 2928
Highest: 256.0
[[ 2.  8.  4.  2.]
 [ 4. 16. 128.  4.]
 [ 8. 256.  8.  2.]
 [ 2.  8.  64.  8.]]
Last action: DOWN
Last scores move: 0
-----
Episode: 235
Total Reward: 126
Total episodes 140
Eps_threshold: 0.16573485957150894
Loss ep: 0.038874973569597515
Score: 1356
Highest: 128.0
[[ 2.  4.  8.  2.]
 [ 32.  8. 16.  4.]
 [ 4. 128. 64. 16.]
 [ 8. 16.  2.  4.]]
Last action: LEFT
Last scores move: 0
-----

```

Episode: 236  
Total Reward: 155  
Total episodes 169  
Eps\_threshold: 0.16442444430984474  
Loss ep: 0.0392361703003652  
Score: 2072  
Highest: 256.0  
[[ 8. 4. 32. 2.]  
 [ 4. 8. 2. 4.]  
 [ 2. 16. 32. 8.]  
 [ 4. 256. 4. 2.]]  
Last action: LEFT  
Last scores move: 0  
-----

Episode: 237  
Total Reward: 243  
Total episodes 257  
Eps\_threshold: 0.16245278524034965  
Loss ep: 0.03907022587520139  
Score: 3132  
Highest: 256.0  
[[128. 4. 2. 4.]  
 [ 4. 16. 32. 2.]  
 [ 8. 256. 64. 4.]  
 [ 4. 32. 8. 2.]]  
Last action: LEFT  
Last scores move: 4  
-----

Episode: 238  
Total Reward: 240  
Total episodes 254  
Eps\_threshold: 0.1605288775405442  
Loss ep: 0.03862914888877568  
Score: 3080  
Highest: 256.0  
[[ 2. 4. 8. 2.]  
 [ 16. 256. 32. 8.]  
 [ 8. 64. 16. 128.]  
 [ 4. 2. 8. 2.]]  
Last action: LEFT  
Last scores move: 4  
-----

Episode: 239  
Total Reward: 216  
Total episodes 230  
Eps\_threshold: 0.15880771112436737  
Loss ep: 0.03894445170526919  
Score: 2832  
Highest: 256.0  
[[ 2. 4. 8. 2.]  
 [ 8. 128. 16. 4.]  
 [ 2. 256. 4. 32.]  
 [ 4. 32. 8. 2.]]  
Last action: DOWN  
Last scores move: 4  
-----

Episode: 240  
Total Reward: 370  
Total episodes 384  
Eps\_threshold: 0.15597785660674537  
Loss ep: 0.03915459414323171  
Score: 5420  
Highest: 512.0  
[[ 2. 4. 2. 16.]  
 [ 4. 8. 16. 2.]  
 [ 16. 512. 128. 16.]  
 [ 4. 64. 4. 32.]]  
Last action: RIGHT  
Last scores move: 16  
-----

Episode: 241  
Total Reward: 251

Total episodes 265  
Eps\_threshold: 0.15405640771671775  
Loss ep: 0.03823983534327093  
Score: 3196  
Highest: 256.0  
[[ 2. 16. 4. 2.]  
 [ 32. 64. 16. 4.]  
 [ 4. 32. 256. 128.]  
 [ 16. 2. 4. 2.]]  
Last action: DOWN  
Last scores move: 4  
-----

Episode: 242  
Total Reward: 197  
Total episodes 211  
Eps\_threshold: 0.1525446014158359  
Loss ep: 0.039623210780428485  
Score: 2460  
Highest: 256.0  
[[ 2. 4. 8. 2.]  
 [ 16. 8. 256. 16.]  
 [ 32. 64. 32. 8.]  
 [ 2. 4. 8. 2.]]  
Last action: RIGHT  
Last scores move: 4  
-----

Episode: 243  
Total Reward: 161  
Total episodes 175  
Eps\_threshold: 0.1513027770581004  
Loss ep: 0.0394880975995745  
Score: 2112  
Highest: 256.0  
[[ 2. 4. 2. 4.]  
 [ 4. 16. 8. 2.]  
 [ 32. 256. 32. 4.]  
 [ 2. 4. 8. 16.]]  
Last action: DOWN  
Last scores move: 4  
-----

Episode: 244  
Total Reward: 97  
Total episodes 111  
Eps\_threshold: 0.1505207188643602  
Loss ep: 0.039384781777321756  
Score: 904  
Highest: 64.0  
[[ 4. 16. 4. 2.]  
 [64. 8. 64. 8.]  
 [ 8. 32. 8. 4.]  
 [ 2. 4. 16. 2.]]  
Last action: RIGHT  
Last scores move: 4  
-----

Episode: 245  
Total Reward: 179  
Total episodes 193  
Eps\_threshold: 0.1491712157522441  
Loss ep: 0.03832156423460017  
Score: 2320  
Highest: 256.0  
[[ 2. 64. 2. 8.]  
 [ 8. 32. 16. 2.]  
 [ 2. 4. 256. 8.]  
 [ 16. 2. 8. 4.]]  
Last action: RIGHT  
Last scores move: 4  
-----

Episode: 246  
Total Reward: 245  
Total episodes 259  
Eps\_threshold: 0.1473805679772017

```
Loss ep: 0.03849501591391545
Score: 3096
Highest: 256.0
[[ 4.  8. 128.  4.]
 [ 16. 64.  4. 32.]
 [ 8. 16. 256.  4.]
 [ 2.  8.  4.  2.]]
Last action: LEFT
Last scores move: 4
-----
Episode: 247
Total Reward: 265
Total episodes 279
Eps_threshold: 0.14547741441313247
Loss ep: 0.039002145063065284
Score: 3580
Highest: 256.0
[[ 2.  4. 64.  4.]
 [256.  8. 128.  2.]
 [ 2. 128.  2.  4.]
 [ 4.  2.  8.  2.]]
Last action: UP
Last scores move: 4
-----
Episode: 248
Total Reward: 223
Total episodes 237
Eps_threshold: 0.14388148162944245
Loss ep: 0.038104000976820034
Score: 2884
Highest: 256.0
[[ 4. 16.  4.  2.]
 [ 32.  4. 32.  8.]
 [ 8. 256. 16.  2.]
 [ 2.  8. 128.  8.]]
Last action: LEFT
Last scores move: 4
-----
Episode: 249
Total Reward: 251
Total episodes 265
Eps_threshold: 0.14211925254722518
Loss ep: 0.037699692204313455
Score: 3192
Highest: 256.0
[[ 32.  8. 32.  4.]
 [ 64. 16. 128. 16.]
 [ 8. 256.  8.  4.]
 [ 2.  8.  4.  2.]]
Last action: UP
Last scores move: 4
-----
Episode: 250
Total Reward: 213
Total episodes 227
Eps_threshold: 0.1406281768921303
Loss ep: 0.03763565618036077
Score: 2728
Highest: 256.0
[[ 2.  4. 16.  2.]
 [ 4. 16. 64.  4.]
 [ 64. 32. 256. 32.]
 [ 2.  8. 16.  4.]]
Last action: RIGHT
Last scores move: 0
-----
Episode: 251
Total Reward: 250
Total episodes 264
Eps_threshold: 0.13891521537529425
Loss ep: 0.03804051514827844
Score: 3184
```

```
Highest: 256.0
[[ 2.  8. 32. 16.]
 [ 4. 16. 64.  2.]
 [128. 32. 256.  8.]
 [ 4.  8.  2.  4.]]
Last action: DOWN
Last scores move: 4
-----
Episode: 252
Total Reward: 106
Total episodes 120
Eps_threshold: 0.1381440399229246
Loss ep: 0.03712954123814901
Score: 1124
Highest: 128.0
[[ 2. 16. 32.  4.]
 [ 4. 32. 128.  2.]
 [ 8.  4. 16.  4.]
 [ 4.  2.  4.  8.]]
Last action: UP
Last scores move: 4
-----
Episode: 253
Total Reward: 177
Total episodes 191
Eps_threshold: 0.1369260893124898
Loss ep: 0.03788540625447378
Score: 2056
Highest: 128.0
[[ 2.  8.  4.  2.]
 [ 32. 128. 16.  8.]
 [ 8. 16. 64.  4.]
 [ 2.  4. 128.  2.]]
Last action: LEFT
Last scores move: 4
-----
Episode: 254
Total Reward: 110
Total episodes 124
Eps_threshold: 0.13614158204432034
Loss ep: 0.03708603689747472
Score: 1156
Highest: 128.0
[[ 32. 16.  4.  2.]
 [ 2.  4. 128. 16.]
 [ 8. 32.  2.  4.]
 [ 2.  4. 16.  2.]]
Last action: LEFT
Last scores move: 16
-----
Episode: 255
Total Reward: 86
Total episodes 100
Eps_threshold: 0.13551244827920633
Loss ep: 0.03765269994735718
Score: 836
Highest: 64.0
[[ 4.  2.  4.  2.]
 [64.  8.  2.  4.]
 [ 8. 32. 16.  8.]
 [ 4. 64.  4.  2.]]
Last action: LEFT
Last scores move: 4
-----
Episode: 256
Total Reward: 173
Total episodes 187
Eps_threshold: 0.13434437613470782
Loss ep: 0.03823303028861469
Score: 2296
Highest: 256.0
[[ 2.  8. 64.  4.]
```

```
[ 4. 32. 4. 16.]
[ 8. 256. 16. 8.]
[ 2. 4. 8. 4.]]
Last action: RIGHT
Last scores move: 4
-----
Episode: 257
Total Reward: 132
Total episodes 146
Eps_threshold: 0.1334399672975056
Loss ep: 0.03777805093216569
Score: 1408
Highest: 128.0
[[ 2. 8. 64. 2.]
 [ 4. 32. 16. 8.]
 [ 2. 128. 32. 4.]
 [ 4. 8. 4. 2.]]
Last action: UP
Last scores move: 0
-----
Episode: 258
Total Reward: 83
Total episodes 97
Eps_threshold: 0.132842732920181
Loss ep: 0.036645837665833146
Score: 824
Highest: 64.0
[[ 2. 4. 2. 8.]
 [ 8. 32. 64. 2.]
 [64. 2. 16. 4.]
 [ 2. 4. 8. 2.]]
Last action: LEFT
Last scores move: 0
-----
Episode: 259
Total Reward: 150
Total episodes 164
Eps_threshold: 0.13183954121742802
Loss ep: 0.03726573106719226
Score: 2032
Highest: 256.0
[[ 2. 256. 32. 4.]
 [ 4. 2. 8. 2.]
 [ 2. 8. 32. 4.]
 [ 4. 2. 4. 8.]]
Last action: RIGHT
Last scores move: 32
-----
Episode: 260
Total Reward: 125
Total episodes 139
Eps_threshold: 0.13099569217804424
Loss ep: 0.03700412777688006
Score: 1272
Highest: 128.0
[[ 32. 4. 8. 2.]
 [ 16. 32. 128. 4.]
 [ 32. 4. 16. 8.]
 [ 4. 8. 4. 2.]]
Last action: LEFT
Last scores move: 4
-----
Episode: 261
Total Reward: 152
Total episodes 166
Eps_threshold: 0.12999558412284262
Loss ep: 0.03880455982254212
Score: 1636
Highest: 128.0
[[ 2. 8. 64. 2.]
 [ 4. 16. 128. 16.]
 [ 32. 8. 64. 4.]
```

```

[ 2.  4.  8.  2.]]
Last action: RIGHT
Last scores move: 4
-----
Episode: 262
Total Reward: 134
Total episodes 148
Eps_threshold: 0.12911089419021565
Loss ep: 0.03720245490203033
Score: 1432
Highest: 128.0
[[ 2.  4. 16.  4.]
 [ 8. 32. 64. 16.]
 [ 4. 128. 32.  4.]
 [ 2.  4.  8.  2.]]
Last action: UP
Last scores move: 0
-----
Episode: 263
Total Reward: 78
Total episodes 92
Eps_threshold: 0.12856424234012498
Loss ep: 0.036678233872289245
Score: 680
Highest: 64.0
[[ 8.  4.  2.  4.]
 [ 2.  8. 64.  8.]
 [32.  4. 16.  4.]
 [ 4.  8. 32.  2.]]
Last action: UP
Last scores move: 0
-----
Episode: 264
Total Reward: 110
Total episodes 124
Eps_threshold: 0.12783141814011495
Loss ep: 0.03650542228452621
Score: 1144
Highest: 128.0
[[ 2. 16. 32.  4.]
 [ 4. 32.  4.  8.]
 [128.  4. 16.  4.]
 [ 8.  2.  4.  8.]]
Last action: DOWN
Last scores move: 0
-----
Episode: 265
Total Reward: 130
Total episodes 144
Eps_threshold: 0.12698607880298254
Loss ep: 0.03661890824635824
Score: 1376
Highest: 128.0
[[ 2. 16.  8.  4.]
 [ 4.  8. 64.  2.]
 [ 8. 32. 128. 16.]
 [ 4. 16.  4.  8.]]
Last action: DOWN
Last scores move: 4
-----
Episode: 266
Total Reward: 224
Total episodes 238
Eps_threshold: 0.12560219490536256
Loss ep: 0.0371063376675133
Score: 2740
Highest: 256.0
[[ 2.  4. 32.  4.]
 [ 4.  8. 256. 64.]
 [ 8. 32.  64.  4.]
 [ 4.  8.  2. 16.]]
Last action: DOWN

```



```
Last scores move: 4
-----
Episode: 267
Total Reward: 137
Total episodes 151
Eps_threshold: 0.12473268486458096
Loss ep: 0.03785401148511874
Score: 1512
Highest: 128.0
[[ 2.  4. 64.  2.]
 [ 4.  8. 128.  8.]
 [ 8. 16. 64. 16.]
 [ 2.  4.  2.  8.]]
Last action: DOWN
Last scores move: 4
-----
Episode: 268
Total Reward: 133
Total episodes 147
Eps_threshold: 0.12389249112526204
Loss ep: 0.03734106595824365
Score: 1416
Highest: 128.0
[[ 2.  8. 32.  2.]
 [ 4. 64. 128.  4.]
 [ 8. 32.  8. 16.]
 [ 2.  8.  4.  2.]]
Last action: DOWN
Last scores move: 0
-----
Episode: 269
Total Reward: 189
Total episodes 203
Eps_threshold: 0.12274232928603679
Loss ep: 0.03839913260173328
Score: 2436
Highest: 256.0
[[ 4.  2.  8.  2.]
 [ 32.  4. 16.  4.]
 [ 16. 256. 64. 16.]
 [ 2. 32.  4.  2.]]
Last action: DOWN
Last scores move: 0
-----
Episode: 270
Total Reward: 175
Total episodes 189
Eps_threshold: 0.1216819325402359
Loss ep: 0.03591061647606905
Score: 2288
Highest: 256.0
[[ 2.  4.  2.  4.]
 [ 64. 16. 32.  2.]
 [ 4. 256.  4. 16.]
 [ 2.  4.  2.  4.]]
Last action: DOWN
Last scores move: 0
-----
Episode: 271
Total Reward: 123
Total episodes 137
Eps_threshold: 0.12091952552752176
Loss ep: 0.03608767655644104
Score: 1328
Highest: 128.0
[[ 4.  2. 128.  8.]
 [ 8. 64. 16.  2.]
 [ 2.  4. 32.  8.]
 [ 4. 16.  8.  4.]]
Last action: RIGHT
Last scores move: 4
-----
```

Episode: 272  
Total Reward: 47  
Total episodes 61  
Eps\_threshold: 0.1205817363649926  
Loss ep: 0.03609681520305696  
Score: 396  
Highest: 32.0  
[[16. 2. 16. 2.]  
 [ 4. 8. 32. 8.]  
 [16. 32. 2. 4.]  
 [ 2. 8. 4. 2.]]  
Last action: UP  
Last scores move: 0  
-----

Episode: 273  
Total Reward: 103  
Total episodes 117  
Eps\_threshold: 0.11993672171460991  
Loss ep: 0.0367678210266635  
Score: 1072  
Highest: 128.0  
[[ 2. 4. 2. 16.]  
 [ 4. 8. 16. 8.]  
 [ 8. 16. 128. 32.]  
 [ 2. 8. 4. 2.]]  
Last action: LEFT  
Last scores move: 4  
-----

Episode: 274  
Total Reward: 234  
Total episodes 248  
Eps\_threshold: 0.11858192347387826  
Loss ep: 0.0367916630160424  
Score: 3028  
Highest: 256.0  
[[ 4. 32. 4. 8.]  
 [ 2. 128. 64. 4.]  
 [ 4. 2. 256. 16.]  
 [ 2. 4. 8. 2.]]  
Last action: RIGHT  
Last scores move: 4  
-----

Episode: 275  
Total Reward: 102  
Total episodes 116  
Eps\_threshold: 0.11795397113985713  
Loss ep: 0.036206985342091526  
Score: 972  
Highest: 64.0  
[[ 4. 8. 4. 2.]  
 [ 2. 64. 32. 8.]  
 [ 8. 32. 64. 2.]  
 [ 2. 4. 8. 16.]]  
Last action: RIGHT  
Last scores move: 4  
-----

Episode: 276  
Total Reward: 124  
Total episodes 138  
Eps\_threshold: 0.11721165268281505  
Loss ep: 0.03611333473868992  
Score: 1344  
Highest: 128.0  
[[ 2. 16. 4. 2.]  
 [ 4. 8. 16. 64.]  
 [ 8. 2. 128. 4.]  
 [ 4. 32. 16. 2.]]  
Last action: RIGHT  
Last scores move: 8  
-----

Episode: 277  
Total Reward: 67

Total episodes 81  
Eps\_threshold: 0.11677832357320318  
Loss ep: 0.03579112629831573  
Score: 584  
Highest: 64.0  
[[ 2. 16. 2. 8.]  
 [ 4. 8. 32. 16.]  
 [ 2. 64. 2. 4.]  
 [ 4. 8. 4. 2.]]  
Last action: UP  
Last scores move: 8

-----  
Episode: 278  
Total Reward: 104  
Total episodes 118  
Eps\_threshold: 0.11615018629122363  
Loss ep: 0.03629360764713611  
Score: 1068  
Highest: 128.0  
[[ 4. 2. 4. 2.]  
 [ 8. 4. 16. 128.]  
 [ 4. 32. 4. 16.]  
 [ 2. 16. 8. 2.]]  
Last action: UP  
Last scores move: 4

-----  
Episode: 279  
Total Reward: 159  
Total episodes 173  
Eps\_threshold: 0.11523594696535447  
Loss ep: 0.035999989923025145  
Score: 1860  
Highest: 128.0  
[[ 2. 8. 16. 2.]  
 [ 8. 16. 8. 128.]  
 [ 2. 128. 32. 4.]  
 [ 8. 32. 4. 2.]]  
Last action: LEFT  
Last scores move: 8

-----  
Episode: 280  
Total Reward: 135  
Total episodes 149  
Eps\_threshold: 0.11445485235062443  
Loss ep: 0.036134335818706745  
Score: 1436  
Highest: 128.0  
[[ 2. 128. 32. 4.]  
 [ 4. 8. 64. 2.]  
 [ 16. 4. 32. 16.]  
 [ 4. 8. 4. 2.]]  
Last action: LEFT  
Last scores move: 4

-----  
Episode: 281  
Total Reward: 204  
Total episodes 218  
Eps\_threshold: 0.11332247711646506  
Loss ep: 0.036951318793340564  
Score: 2608  
Highest: 256.0  
[[ 2. 16. 64. 2.]  
 [ 4. 256. 4. 8.]  
 [ 32. 16. 64. 2.]  
 [ 4. 2. 4. 8.]]  
Last action: DOWN  
Last scores move: 0

-----  
Episode: 282  
Total Reward: 142  
Total episodes 156  
Eps\_threshold: 0.1125196967086397

Loss ep: 0.036585129224337064

Score: 1548

Highest: 128.0

```
[[ 2.  4.  8.  4.]
 [ 8. 16. 64.  2.]
 [16. 64.128. 16.]
 [ 4.  8.  2.  4.]]
```

Last action: RIGHT

Last scores move: 4

-----  
Episode: 283

Total Reward: 211

Total episodes 225

Eps\_threshold: 0.11137281343509023

Loss ep: 0.03616083780924479

Score: 2656

Highest: 256.0

```
[[ 2. 16.  4.  2.]
 [16.  2. 64.  4.]
 [64.256. 16.  8.]
 [ 4.  8. 32.  2.]]
```

Last action: DOWN

Last scores move: 4

-----  
Episode: 284

Total Reward: 144

Total episodes 158

Eps\_threshold: 0.11057512323389722

Loss ep: 0.035529353950597066

Score: 1536

Highest: 128.0

```
[[ 4. 32.  4.  2.]
 [16.  2.  8.  4.]
 [ 4. 64.128. 32.]
 [ 2. 32. 16.  4.]]
```

Last action: DOWN

Last scores move: 0

-----  
Episode: 285

Total Reward: 140

Total episodes 154

Eps\_threshold: 0.10980366869658935

Loss ep: 0.035917226370278894

Score: 1464

Highest: 128.0

```
[[32.  4.  2.  4.]
 [ 2.  8. 16.  8.]
 [ 8. 64.128. 32.]
 [ 2. 16.  8.  2.]]
```

Last action: DOWN

Last scores move: 8

-----  
Episode: 286

Total Reward: 244

Total episodes 258

Eps\_threshold: 0.10852446994161251

Loss ep: 0.03562872908836187

Score: 3132

Highest: 256.0

```
[[ 2. 32.  2. 32.]
 [128. 64.  4.  2.]
 [ 8.  4.  2.256.]
 [ 4. 16.  4.  2.]]
```

Last action: LEFT

Last scores move: 0

-----  
Episode: 287

Total Reward: 130

Total episodes 144

Eps\_threshold: 0.1078176413942999

Loss ep: 0.03602055377430386

Score: 1444

```
Highest: 128.0
[[ 32.  2. 32.  2.]
 [  2.  4. 64.  4.]
 [  4. 128. 32.  2.]
 [  2.  8.  2.  8.]]
Last action: UP
Last scores move: 0
-----
Episode: 288
Total Reward: 145
Total episodes 159
Eps_threshold: 0.10704307412963691
Loss ep: 0.03548306039294357
Score: 1592
Highest: 128.0
[[  2.  8.  2.  8.]
 [  4. 32.  8.  2.]
 [ 64. 16. 128.  4.]
 [  8. 64.  4.  2.]]
Last action: LEFT
Last scores move: 0
-----
Episode: 289
Total Reward: 150
Total episodes 164
Eps_threshold: 0.10625057461043659
Loss ep: 0.03624298805143775
Score: 1564
Highest: 128.0
[[  4. 32. 16.  2.]
 [  8.  2. 32.  8.]
 [ 32. 64. 16.  4.]
 [  4. 128.  4.  2.]]
Last action: LEFT
Last scores move: 4
-----
Episode: 290
Total Reward: 95
Total episodes 109
Eps_threshold: 0.10572743582687176
Loss ep: 0.03574922325414255
Score: 836
Highest: 64.0
[[  4. 32.  2.  4.]
 [  8. 16. 32.  8.]
 [  4. 32.  8. 16.]
 [  2.  8. 64.  4.]]
Last action: RIGHT
Last scores move: 4
-----
Episode: 291
Total Reward: 191
Total episodes 205
Eps_threshold: 0.10475124115411698
Loss ep: 0.03628310226812595
Score: 2428
Highest: 256.0
[[  2. 32.  8.  4.]
 [  4. 256. 64.  8.]
 [ 16. 32.  4.  2.]
 [  2.  4. 16.  4.]]
Last action: RIGHT
Last scores move: 4
-----
Episode: 292
Total Reward: 104
Total episodes 118
Eps_threshold: 0.10419385473811905
Loss ep: 0.036204091573165634
Score: 964
Highest: 64.0
[[16.  2. 16.  2.]
```

```

[ 4. 64. 8. 64.]
[ 2. 32. 16. 4.]
[16. 8. 4. 2.]]
Last action: LEFT
Last scores move: 8
-----
Episode: 293
Total Reward: 195
Total episodes 209
Eps_threshold: 0.103214654189883
Loss ep: 0.035224332763817895
Score: 2448
Highest: 256.0
[[ 4. 2. 32. 2.]
 [ 8. 16. 256. 4.]
 [ 32. 8. 64. 8.]
 [ 4. 16. 4. 2.]]
Last action: LEFT
Last scores move: 4
-----
Episode: 294
Total Reward: 157
Total episodes 171
Eps_threshold: 0.10242106631913915
Loss ep: 0.035958772514298645
Score: 1656
Highest: 128.0
[[ 2. 32. 8. 4.]
 [ 16. 64. 16. 2.]
 [ 4. 128. 64. 8.]
 [ 2. 4. 8. 4.]]
Last action: DOWN
Last scores move: 0
-----
Episode: 295
Total Reward: 131
Total episodes 145
Eps_threshold: 0.10175343667015735
Loss ep: 0.03641272577746161
Score: 1404
Highest: 128.0
[[ 2. 4. 8. 2.]
 [ 8. 16. 128. 32.]
 [ 4. 64. 4. 2.]
 [ 2. 8. 32. 4.]]
Last action: UP
Last scores move: 4
-----
Episode: 296
Total Reward: 130
Total episodes 144
Eps_threshold: 0.10109518447767217
Loss ep: 0.03594215710957845
Score: 1368
Highest: 128.0
[[ 2. 16. 128. 4.]
 [ 4. 64. 2. 8.]
 [ 16. 32. 16. 4.]
 [ 2. 8. 4. 2.]]
Last action: UP
Last scores move: 4
-----
Episode: 297
Total Reward: 109
Total episodes 123
Eps_threshold: 0.10053666829078128
Loss ep: 0.03568843903580332
Score: 1112
Highest: 128.0
[[ 2. 8. 2. 16.]
 [ 16. 128. 32. 2.]
 [ 2. 8. 16. 4.]

```

```
[ 4.  2.  8. 16.]]
Last action: RIGHT
Last scores move: 8
-----
Episode: 298
Total Reward: 110
Total episodes 124
Eps_threshold: 0.09997707747147305
Loss ep: 0.03389110488276328
Score: 1164
Highest: 128.0
[[ 16.  8.  4.  2.]
 [ 4. 32. 128.  8.]
 [ 16.  4. 32. 16.]
 [ 4.  8.  2.  4.]]
Last action: LEFT
Last scores move: 4
-----
Episode: 299
Total Reward: 134
Total episodes 148
Eps_threshold: 0.09931370460497892
Loss ep: 0.03540651218311207
Score: 1416
Highest: 128.0
[[ 2.  8.  4.  2.]
 [ 8.  4. 32.  4.]
 [ 2. 32. 64. 16.]
 [ 4.  8. 128.  2.]]
Last action: DOWN
Last scores move: 4
-----
Episode: 300
Total Reward: 124
Total episodes 138
Eps_threshold: 0.09869956127430712
Loss ep: 0.0352809671042622
Score: 1344
Highest: 128.0
[[ 16.  2.  4.  2.]
 [ 4. 128. 16.  4.]
 [ 2. 16. 32. 64.]
 [ 8.  4.  8.  4.]]
Last action: DOWN
Last scores move: 4
-----
Update target_net
Episode: 301
Total Reward: 89
Total episodes 103
Eps_threshold: 0.09824393278414005
Loss ep: 0.050633388815574276
Score: 808
Highest: 64.0
[[ 2. 32.  4. 16.]
 [ 4. 16.  8.  4.]
 [ 8. 32.  2. 32.]
 [ 2. 64.  8.  2.]]
Last action: LEFT
Last scores move: 0
-----
Episode: 302
Total Reward: 182
Total episodes 196
Eps_threshold: 0.09738336590794142
Loss ep: 0.04619671373951192
Score: 2344
Highest: 256.0
[[ 2.  4.  2.  4.]
 [ 4. 64.  4. 32.]
 [ 16.  8. 16. 256.]
 [ 4.  2.  8. 16.]]
```

```
Last action: DOWN
Last scores move: 0
-----
Episode: 303
Total Reward: 130
Total episodes 144
Eps_threshold: 0.09675646522407476
Loss ep: 0.04506320423550076
Score: 1400
Highest: 128.0
[[ 2. 32.  8.  2.]
 [ 8. 128.  4.  8.]
 [ 16. 32. 64.  4.]
 [ 4.  2.  4.  2.]]
Last action: UP
Last scores move: 4
-----
Episode: 304
Total Reward: 157
Total episodes 171
Eps_threshold: 0.09601785948542998
Loss ep: 0.04503790537516276
Score: 1672
Highest: 128.0
[[ 2.  4.  8.  4.]
 [ 4.  2. 16. 64.]
 [ 64. 32. 128. 16.]
 [ 2.  4. 16.  8.]]
Last action: RIGHT
Last scores move: 4
-----
Episode: 305
Total Reward: 197
Total episodes 211
Eps_threshold: 0.09511514127928004
Loss ep: 0.04410603148112365
Score: 2236
Highest: 128.0
[[ 2.  4.  8. 16.]
 [ 32. 128. 16.  4.]
 [ 2. 16. 64. 32.]
 [ 4.  2. 128. 16.]]
Last action: RIGHT
Last scores move: 4
-----
Episode: 306
Total Reward: 382
Total episodes 396
Eps_threshold: 0.09344643617868562
Loss ep: 0.04311041398481889
Score: 5572
Highest: 512.0
[[ 8. 16.  2.  8.]
 [ 16. 32. 64. 32.]
 [ 4. 128. 512.  8.]
 [ 2. 32.  4.  2.]]
Last action: UP
Last scores move: 8
-----
Episode: 307
Total Reward: 182
Total episodes 196
Eps_threshold: 0.09263265514415413
Loss ep: 0.04327941427425462
Score: 2380
Highest: 256.0
[[ 2.  8. 32.  4.]
 [ 8. 256. 64.  8.]
 [ 16.  8. 32.  2.]
 [ 2.  4.  2.  4.]]
Last action: DOWN
Last scores move: 8
```



```
-----  
Episode: 308  
Total Reward: 124  
Total episodes 138  
Eps_threshold: 0.09206445237754696  
Loss ep: 0.04151636621226435  
Score: 1328  
Highest: 128.0  
[[ 2. 32.  2.  4.]  
 [ 8.  4. 128. 16.]  
 [ 4.  8.  64.  4.]  
 [ 16. 2.  8.  2.]]  
Last action: DOWN  
Last scores move: 4  
-----
```

```
Episode: 309  
Total Reward: 231  
Total episodes 245  
Eps_threshold: 0.09106529516846544  
Loss ep: 0.04197744252730389  
Score: 2956  
Highest: 256.0  
[[ 2. 32.  4.  2.]  
 [ 4. 128. 32.  4.]  
 [ 32. 16. 256.  8.]  
 [ 2.  4.  8.  4.]]  
Last action: RIGHT  
Last scores move: 4  
-----
```

```
Episode: 310  
Total Reward: 125  
Total episodes 139  
Eps_threshold: 0.0905038446674889  
Loss ep: 0.041100392238699275  
Score: 1352  
Highest: 128.0  
[[ 2. 16.  8.  4.]  
 [128.  2. 16. 32.]  
 [ 2. 64.  8.  4.]  
 [ 8. 16.  4.  2.]]  
Last action: LEFT  
Last scores move: 4  
-----
```

```
Episode: 311  
Total Reward: 140  
Total episodes 154  
Eps_threshold: 0.08988634548635414  
Loss ep: 0.039582497113710875  
Score: 1476  
Highest: 128.0  
[[ 2. 16. 32. 16.]  
 [ 8. 64. 128.  2.]  
 [ 4. 16. 32.  4.]  
 [ 2.  8.  4.  2.]]  
Last action: LEFT  
Last scores move: 4  
-----
```

```
Episode: 312  
Total Reward: 308  
Total episodes 322  
Eps_threshold: 0.08861047365206563  
Loss ep: 0.040658186681522344  
Score: 3928  
Highest: 256.0  
[[ 2.  4. 16.  4.]  
 [ 8. 128. 32. 64.]  
 [ 32. 256. 16.  4.]  
 [ 2.  8. 128.  2.]]  
Last action: UP  
Last scores move: 4  
-----
```

```
Episode: 313
```

Total Reward: 143  
 Total episodes 157  
 Eps\_threshold: 0.08799579719547745  
 Loss ep: 0.040110111236572266  
 Score: 1516  
 Highest: 128.0  
 [[128. 8. 4. 32.]  
 [ 2. 32. 64. 4.]  
 [ 4. 16. 32. 2.]  
 [ 2. 4. 8. 4.]]  
 Last action: RIGHT  
 Last scores move: 4  
 -----

Episode: 314  
 Total Reward: 190  
 Total episodes 204  
 Eps\_threshold: 0.08720428364559857  
 Loss ep: 0.04026298429451737  
 Score: 2488  
 Highest: 256.0  
 [[ 2. 8. 4. 2.]  
 [ 4. 16. 2. 64.]  
 [ 8. 256. 16. 8.]  
 [ 4. 2. 64. 4.]]  
 Last action: DOWN  
 Last scores move: 4  
 -----

Episode: 315  
 Total Reward: 269  
 Total episodes 283  
 Eps\_threshold: 0.08611953572275217  
 Loss ep: 0.03945754694854413  
 Score: 3384  
 Highest: 256.0  
 [[ 8. 256. 4. 2.]  
 [ 32. 64. 16. 4.]  
 [ 8. 16. 128. 2.]  
 [ 4. 2. 64. 4.]]  
 Last action: UP  
 Last scores move: 0  
 -----

Episode: 316  
 Total Reward: 107  
 Total episodes 121  
 Eps\_threshold: 0.08566040280914336  
 Loss ep: 0.03931835269139818  
 Score: 952  
 Highest: 64.0  
 [[16. 8. 4. 32.]  
 [ 2. 32. 64. 8.]  
 [ 8. 16. 32. 4.]  
 [ 4. 32. 8. 2.]]  
 Last action: UP  
 Last scores move: 4  
 -----

Episode: 317  
 Total Reward: 125  
 Total episodes 139  
 Eps\_threshold: 0.08513638607703869  
 Loss ep: 0.039496854054842066  
 Score: 1336  
 Highest: 128.0  
 [[ 4. 8. 2. 8.]  
 [ 2. 128. 32. 16.]  
 [ 16. 64. 8. 4.]  
 [ 2. 8. 4. 2.]]  
 Last action: UP  
 Last scores move: 4  
 -----

Episode: 318  
 Total Reward: 117  
 Total episodes 131

Eps\_threshold: 0.08464585100436094  
Loss ep: 0.037333037107045414  
Score: 1284  
Highest: 128.0  
[[ 2. 64. 2. 4.]  
 [ 8. 4. 32. 8.]  
 [ 4. 128. 16. 2.]  
 [ 2. 8. 4. 8.]]  
Last action: UP  
Last scores move: 4  
-----

Episode: 319  
Total Reward: 129  
Total episodes 143  
Eps\_threshold: 0.08411403667155744  
Loss ep: 0.03835762797535716  
Score: 1368  
Highest: 128.0  
[[ 2. 8. 16. 4.]  
 [ 4. 32. 128. 64.]  
 [ 8. 16. 8. 16.]  
 [ 2. 4. 2. 4.]]  
Last action: RIGHT  
Last scores move: 0  
-----

Episode: 320  
Total Reward: 97  
Total episodes 111  
Eps\_threshold: 0.08370384310808399  
Loss ep: 0.037775765668164506  
Score: 1028  
Highest: 128.0  
[[ 2. 8. 2. 16.]  
 [ 8. 128. 4. 2.]  
 [ 16. 32. 2. 8.]  
 [ 2. 4. 8. 2.]]  
Last action: LEFT  
Last scores move: 8  
-----

Episode: 321  
Total Reward: 134  
Total episodes 148  
Eps\_threshold: 0.08316044771174269  
Loss ep: 0.03720866667257773  
Score: 1496  
Highest: 128.0  
[[ 2. 4. 2. 8.]  
 [ 64. 16. 64. 2.]  
 [ 4. 8. 128. 4.]  
 [ 8. 2. 4. 16.]]  
Last action: RIGHT  
Last scores move: 0  
-----

Episode: 322  
Total Reward: 121  
Total episodes 135  
Eps\_threshold: 0.08266827763241302  
Loss ep: 0.03775493480541088  
Score: 1288  
Highest: 128.0  
[[ 2. 16. 8. 2.]  
 [ 4. 2. 128. 4.]  
 [ 8. 64. 8. 16.]  
 [ 16. 2. 16. 4.]]  
Last action: DOWN  
Last scores move: 4  
-----

Episode: 323  
Total Reward: 149  
Total episodes 163  
Eps\_threshold: 0.08207843803096622  
Loss ep: 0.03751667584378295

```
Score: 1580
Highest: 128.0
[[ 16.  2.  8.  2.]
 [  4.  8. 128. 16.]
 [  2. 64. 16. 64.]
 [  8.  2.  8.  4.]]
Last action: DOWN
Last scores move: 4
-----
Episode: 324
Total Reward: 67
Total episodes 81
Eps_threshold: 0.08178711069300812
Loss ep: 0.0369474681807153
Score: 628
Highest: 64.0
[[32.  4.  2.  8.]
 [  4.  2. 32.  4.]
 [  2.  8. 16. 64.]
 [  4.  2.  4.  2.]]
Last action: UP
Last scores move: 0
-----
Episode: 325
Total Reward: 160
Total episodes 174
Eps_threshold: 0.08116527175161815
Loss ep: 0.0383623578082556
Score: 1672
Highest: 128.0
[[  4.  8. 16.  4.]
 [ 32. 128. 32.  2.]
 [  8. 16. 64. 32.]
 [  2.  4. 32.  4.]]
Last action: RIGHT
Last scores move: 4
-----
Episode: 326
Total Reward: 228
Total episodes 242
Eps_threshold: 0.08030936066828079
Loss ep: 0.03727584239865137
Score: 2932
Highest: 256.0
[[  8. 16.  4. 16.]
 [ 16. 256. 32.  4.]
 [ 32. 128. 16.  2.]
 [  2.  4.  2.  4.]]
Last action: UP
Last scores move: 16
-----
Episode: 327
Total Reward: 173
Total episodes 187
Eps_threshold: 0.07965503189993882
Loss ep: 0.03803685132194968
Score: 2028
Highest: 128.0
[[  4. 16.  2.  4.]
 [  2. 128.  4. 16.]
 [ 32.  4. 64. 128.]
 [  4.  2.  4.  2.]]
Last action: UP
Last scores move: 32
-----
Episode: 328
Total Reward: 56
Total episodes 70
Eps_threshold: 0.07941166542805136
Loss ep: 0.03760075569152832
Score: 504
Highest: 64.0
```

```
[[ 2.  8.  4.  2.]
 [ 4.  2.  8.  4.]
 [ 8. 32.  2.  8.]
 [ 4. 64.  4.  2.]]
Last action: DOWN
Last scores move: 4
-----
Episode: 329
Total Reward: 230
Total episodes 244
Eps_threshold: 0.07856998778304616
Loss ep: 0.037449219187752146
Score: 2920
Highest: 256.0
[[ 2. 32.  8.  2.]
 [ 4. 16. 128. 16.]
 [ 32.  4. 256.  4.]
 [ 4.  2. 16.  2.]]
Last action: LEFT
Last scores move: 0
-----
Episode: 330
Total Reward: 69
Total episodes 83
Eps_threshold: 0.07828601199107918
Loss ep: 0.038606939545596936
Score: 640
Highest: 64.0
[[ 8.  4.  2.  4.]
 [ 4. 32.  4. 16.]
 [ 2.  8. 64. 32.]
 [ 8.  2.  4.  2.]]
Last action: LEFT
Last scores move: 0
-----
Episode: 331
Total Reward: 83
Total episodes 97
Eps_threshold: 0.07795562666496209
Loss ep: 0.03640222057853777
Score: 784
Highest: 64.0
[[ 4.  2.  8.  2.]
 [16.  8. 64.  8.]
 [ 2. 16.  8. 64.]
 [ 4.  8.  4.  2.]]
Last action: DOWN
Last scores move: 8
-----
Episode: 332
Total Reward: 106
Total episodes 120
Eps_threshold: 0.07754911366351494
Loss ep: 0.03775818347930908
Score: 1112
Highest: 128.0
[[ 4.  8.  4.  2.]
 [ 8. 16. 32.  8.]
 [ 4.  2.  8. 128.]
 [ 2.  4. 32.  4.]]
Last action: LEFT
Last scores move: 4
-----
Episode: 333
Total Reward: 150
Total episodes 164
Eps_threshold: 0.07699747573797654
Loss ep: 0.03481936454772949
Score: 1648
Highest: 128.0
[[ 2.  4. 32.  2.]
 [ 64. 32.  4. 128.]
```

```
[ 2.  4. 64.  8.]
[ 4.  2.  4.  2.]]
Last action: UP
Last scores move: 4
-----
Episode: 334
Total Reward: 168
Total episodes 182
Eps_threshold: 0.07639056434379307
Loss ep: 0.03615541772528009
Score: 2208
Highest: 256.0
[[ 4. 64.  8. 16.]
 [ 2.  8.  2.  8.]
 [ 4. 16. 256.  4.]
 [ 2.  8.  4.  2.]]
Last action: RIGHT
Last scores move: 0
-----
Episode: 335
Total Reward: 194
Total episodes 208
Eps_threshold: 0.07570368046190565
Loss ep: 0.037546359575711764
Score: 2420
Highest: 256.0
[[ 8.  2.  4. 256.]
 [ 32. 64.  8.  2.]
 [ 4.  2. 16.  4.]
 [ 2. 32.  4.  2.]]
Last action: UP
Last scores move: 0
-----
Episode: 336
Total Reward: 248
Total episodes 262
Eps_threshold: 0.07484857541459436
Loss ep: 0.0365582640844447
Score: 3176
Highest: 256.0
[[ 2.  4.  8. 16.]
 [ 4. 256. 32.  4.]
 [ 32.  4. 16. 64.]
 [ 8. 128.  4.  8.]]
Last action: DOWN
Last scores move: 4
-----
Episode: 337
Total Reward: 213
Total episodes 227
Eps_threshold: 0.07411670530328168
Loss ep: 0.036370037935903946
Score: 2824
Highest: 256.0
[[ 2.  8.  2. 32.]
 [ 8. 16. 128.  4.]
 [ 4.  8. 32. 256.]
 [ 2.  4.  2.  8.]]
Last action: UP
Last scores move: 4
-----
Episode: 338
Total Reward: 186
Total episodes 200
Eps_threshold: 0.07347873342605843
Loss ep: 0.036748223304748535
Score: 2364
Highest: 256.0
[[ 4.  2.  8. 16.]
 [ 2.  4. 16.  8.]
 [ 16. 64. 256.  4.]
 [ 4.  8.  4. 32.]]
```

```

Last action: RIGHT
Last scores move: 0
-----
Episode: 339
Total Reward: 189
Total episodes 203
Eps_threshold: 0.07283768311565027
Loss ep: 0.03555202953921163
Score: 2404
Highest: 256.0
[[ 2.  4.  8.  2.]
 [ 4.  8. 32.  4.]
 [ 8. 256. 2. 64.]
 [ 4. 32.  4. 16.]]
Last action: RIGHT
Last scores move: 4
-----
Episode: 340
Total Reward: 220
Total episodes 234
Eps_threshold: 0.07210676642375789
Loss ep: 0.035397415487175315
Score: 2764
Highest: 256.0
[[ 8.  2. 16.  2.]
 [16. 32.  8.  4.]
 [ 8. 64. 256. 32.]
 [ 2. 16. 64.  4.]]
Last action: UP
Last scores move: 0
-----
Episode: 341
Total Reward: 171
Total episodes 185
Eps_threshold: 0.07153492766591679
Loss ep: 0.03644273345534866
Score: 2280
Highest: 256.0
[[ 4.  2. 32.  4.]
 [ 2.  4. 64.  8.]
 [ 4. 16. 256.  4.]
 [ 2.  8. 16.  2.]]
Last action: LEFT
Last scores move: 0
-----
Episode: 342
Total Reward: 192
Total episodes 206
Eps_threshold: 0.07090437085318127
Loss ep: 0.0353615538587848
Score: 2404
Highest: 256.0
[[ 2. 16.  2. 16.]
 [ 4. 64. 16.  2.]
 [ 8. 16. 256.  4.]
 [ 2. 32.  8.  2.]]
Last action: LEFT
Last scores move: 16
-----
Episode: 343
Total Reward: 250
Total episodes 264
Eps_threshold: 0.07010571587719736
Loss ep: 0.03558166821797689
Score: 3132
Highest: 256.0
[[16.  4.  8.  4.]
 [ 4. 32. 64. 128.]
 [16.  4. 256. 16.]
 [ 2.  8.  4.  2.]]
Last action: LEFT
Last scores move: 4

```

```
-----  
Episode: 344  
Total Reward: 142  
Total episodes 156  
Eps_threshold: 0.06963871496460654  
Loss ep: 0.03571859078529554  
Score: 1548  
Highest: 128.0  
[[ 4. 64. 8. 4.]  
 [ 16. 2. 16. 8.]  
 [ 2. 64. 128. 4.]  
 [ 8. 2. 16. 2.]]  
Last action: UP  
Last scores move: 4  
-----
```

```
Episode: 345  
Total Reward: 141  
Total episodes 155  
Eps_threshold: 0.06917830133092519  
Loss ep: 0.035029580516199914  
Score: 1508  
Highest: 128.0  
[[ 4. 2. 4. 2.]  
 [ 8. 128. 16. 8.]  
 [ 4. 32. 64. 32.]  
 [ 2. 4. 32. 4.]]  
Last action: UP  
Last scores move: 4  
-----
```

```
Episode: 346  
Total Reward: 135  
Total episodes 149  
Eps_threshold: 0.06873906118712077  
Loss ep: 0.034490246100713745  
Score: 1440  
Highest: 128.0  
[[ 2. 8. 4. 2.]  
 [ 8. 16. 64. 4.]  
 [ 32. 128. 8. 32.]  
 [ 2. 4. 16. 4.]]  
Last action: LEFT  
Last scores move: 4  
-----
```

```
Episode: 347  
Total Reward: 130  
Total episodes 144  
Eps_threshold: 0.06831765881556776  
Loss ep: 0.0356637438138326  
Score: 1380  
Highest: 128.0  
[[ 2. 4. 8. 4.]  
 [ 32. 2. 4. 2.]  
 [ 2. 8. 128. 4.]  
 [ 64. 32. 8. 2.]]  
Last action: RIGHT  
Last scores move: 4  
-----
```

```
Episode: 348  
Total Reward: 124  
Total episodes 138  
Eps_threshold: 0.06791665203412944  
Loss ep: 0.03479208116946013  
Score: 1440  
Highest: 128.0  
[[ 2. 4. 2. 8.]  
 [ 4. 128. 4. 2.]  
 [ 16. 8. 64. 4.]  
 [ 8. 64. 8. 2.]]  
Last action: DOWN  
Last scores move: 4  
-----
```

```
Episode: 349
```



Total Reward: 168  
Total episodes 182  
Eps\_threshold: 0.06739200128206317  
Loss ep: 0.03519533230708195  
Score: 1768  
Highest: 128.0  
[[ 2. 32. 16. 2.]  
 [ 4. 8. 64. 8.]  
 [ 16. 32. 8. 64.]  
 [128. 4. 2. 4.]]  
Last action: DOWN  
Last scores move: 4  
-----

Episode: 350  
Total Reward: 119  
Total episodes 133  
Eps\_threshold: 0.06701161067412646  
Loss ep: 0.034884624911430184  
Score: 1312  
Highest: 128.0  
[[ 2. 4. 8. 2.]  
 [ 64. 128. 16. 8.]  
 [ 8. 2. 8. 4.]  
 [ 2. 4. 16. 32.]]  
Last action: UP  
Last scores move: 0  
-----

Episode: 351  
Total Reward: 123  
Total episodes 137  
Eps\_threshold: 0.06662241565577895  
Loss ep: 0.035240549240669196  
Score: 1340  
Highest: 128.0  
[[ 2. 16. 4. 2.]  
 [ 8. 128. 2. 32.]  
 [ 16. 2. 64. 8.]  
 [ 2. 4. 16. 2.]]  
Last action: DOWN  
Last scores move: 8  
-----

Episode: 352  
Total Reward: 232  
Total episodes 246  
Eps\_threshold: 0.06593022563858225  
Loss ep: 0.03445556687145698  
Score: 3012  
Highest: 256.0  
[[ 4. 128. 8. 4.]  
 [ 64. 16. 2. 16.]  
 [ 16. 256. 8. 4.]  
 [ 4. 2. 16. 2.]]  
Last action: UP  
Last scores move: 4  
-----

Episode: 353  
Total Reward: 252  
Total episodes 266  
Eps\_threshold: 0.065191278528535  
Loss ep: 0.03550977993728523  
Score: 3184  
Highest: 256.0  
[[ 4. 32. 2. 4.]  
 [ 8. 4. 16. 64.]  
 [256. 128. 32. 4.]  
 [ 2. 4. 16. 2.]]  
Last action: RIGHT  
Last scores move: 0  
-----

Episode: 354  
Total Reward: 130  
Total episodes 144

Eps\_threshold: 0.06479532845390107  
Loss ep: 0.03511009944809808  
Score: 1376  
Highest: 128.0  
[[ 2. 4. 32. 16.]  
[ 16. 8. 64. 8.]  
[ 8. 128. 16. 4.]  
[ 2. 4. 8. 2.]]  
Last action: UP  
Last scores move: 8

-----  
Episode: 355  
Total Reward: 126  
Total episodes 140  
Eps\_threshold: 0.06441310051327878  
Loss ep: 0.03477888107299805  
Score: 1336  
Highest: 128.0  
[[ 2. 4. 2. 4.]  
[ 4. 64. 8. 32.]  
[ 16. 8. 128. 8.]  
[ 2. 4. 16. 4.]]  
Last action: RIGHT  
Last scores move: 4

-----  
Episode: 356  
Total Reward: 203  
Total episodes 217  
Eps\_threshold: 0.063825909643631  
Loss ep: 0.0349997177651401  
Score: 2588  
Highest: 256.0  
[[ 2. 8. 4. 2.]  
[ 4. 32. 64. 4.]  
[ 8. 256. 4. 8.]  
[ 2. 16. 64. 2.]]  
Last action: LEFT  
Last scores move: 4

-----  
Episode: 357  
Total Reward: 123  
Total episodes 137  
Eps\_threshold: 0.06345846210717977  
Loss ep: 0.03492888568961707  
Score: 1328  
Highest: 128.0  
[[ 8. 2. 8. 4.]  
[ 2. 64. 16. 2.]  
[ 16. 128. 32. 8.]  
[ 4. 8. 4. 2.]]  
Last action: LEFT  
Last scores move: 0

-----  
Episode: 358  
Total Reward: 215  
Total episodes 229  
Eps\_threshold: 0.06284985364863739  
Loss ep: 0.03546091354570014  
Score: 2800  
Highest: 256.0  
[[ 32. 2. 8. 2.]  
[ 2. 16. 128. 16.]  
[ 8. 256. 16. 8.]  
[ 2. 4. 2. 4.]]  
Last action: RIGHT  
Last scores move: 4

-----  
Episode: 359  
Total Reward: 154  
Total episodes 168  
Eps\_threshold: 0.062407774211050746  
Loss ep: 0.034303500538780576

```
Score: 1664
Highest: 128.0
[[ 2.  4.  8.  4.]
 [ 4. 32. 16.  2.]
 [16. 64. 128. 16.]
 [ 4.  8. 64.  8.]]
Last action: DOWN
Last scores move: 4
-----
Episode: 360
Total Reward: 166
Total episodes 180
Eps_threshold: 0.061938220404763475
Loss ep: 0.03473413785298665
Score: 1948
Highest: 128.0
[[ 2.  8.  4.  8.]
 [ 4. 128. 64. 128.]
 [16.  8.  4.  8.]
 [ 2.  4. 16.  2.]]
Last action: UP
Last scores move: 8
-----
Episode: 361
Total Reward: 130
Total episodes 144
Eps_threshold: 0.061565608231356664
Loss ep: 0.033852994441986084
Score: 1404
Highest: 128.0
[[ 2.  4.  8.  4.]
 [ 4. 32. 16.  8.]
 [ 2. 64. 32. 128.]
 [ 4.  8.  4.  8.]]
Last action: DOWN
Last scores move: 0
-----
Episode: 362
Total Reward: 200
Total episodes 214
Eps_threshold: 0.06101679759627959
Loss ep: 0.03410068850650966
Score: 2488
Highest: 256.0
[[ 2.  8. 16.  2.]
 [32. 256.  2.  4.]
 [ 4.  8. 32. 16.]
 [ 2. 16. 64.  8.]]
Last action: RIGHT
Last scores move: 8
-----
Episode: 363
Total Reward: 87
Total episodes 101
Eps_threshold: 0.06075981220268449
Loss ep: 0.03434400983376078
Score: 784
Highest: 64.0
[[32.  4.  8.  2.]
 [ 8. 16. 64. 32.]
 [ 4. 32.  8.  4.]
 [ 2.  8.  4.  2.]]
Last action: LEFT
Last scores move: 4
-----
Episode: 364
Total Reward: 71
Total episodes 85
Eps_threshold: 0.0605445407766317
Loss ep: 0.03285019537981819
Score: 648
Highest: 64.0
```

```
[[ 4. 32.  4.  2.]
 [ 8.  2. 64.  8.]
 [16.  4. 32.  4.]
 [ 2.  8.  4.  2.]]
Last action: UP
Last scores move: 4
-----
Episode: 365
Total Reward: 126
Total episodes 140
Eps_threshold: 0.06019196444803087
Loss ep: 0.03459534985678536
Score: 1344
Highest: 128.0
[[ 4.  8.  2.  8.]
 [ 8. 128. 16.  2.]
 [16.  32. 64.  8.]
 [ 2.  8.  2.  4.]]
Last action: RIGHT
Last scores move: 8
-----
Episode: 366
Total Reward: 123
Total episodes 137
Eps_threshold: 0.05984932437360978
Loss ep: 0.033951860274711664
Score: 1340
Highest: 128.0
[[ 4.  2.  4.  2.]
 [ 2.  8.  2. 16.]
 [ 8.  64. 16. 32.]
 [16.  2. 128.  2.]]
Last action: LEFT
Last scores move: 0
-----
Episode: 367
Total Reward: 76
Total episodes 90
Eps_threshold: 0.05962550638210215
Loss ep: 0.03465749952528212
Score: 640
Highest: 64.0
[[ 4.  8.  4.  2.]
 [ 8. 32. 16.  4.]
 [64.  4.  8. 16.]
 [ 4.  2. 16.  2.]]
Last action: LEFT
Last scores move: 4
-----
Episode: 368
Total Reward: 133
Total episodes 147
Eps_threshold: 0.05926209607908359
Loss ep: 0.03408381403708945
Score: 1432
Highest: 128.0
[[ 4. 16.  8.  4.]
 [ 2. 32. 16.  8.]
 [ 8.  64. 128.  4.]
 [ 2.  4.  32.  2.]]
Last action: LEFT
Last scores move: 8
-----
Episode: 369
Total Reward: 166
Total episodes 180
Eps_threshold: 0.05882072635736119
Loss ep: 0.033902430534362794
Score: 1984
Highest: 128.0
[[ 4.  2.  4.  2.]
 [ 2.  4. 128.  4.]
```

```

[ 64.  2. 32.  8.]
[  4. 16. 128.  2.]]
Last action: DOWN
Last scores move: 4
-----
Episode: 370
Total Reward: 153
Total episodes 167
Eps_threshold: 0.05841477051659768
Loss ep: 0.0342583056695447
Score: 1652
Highest: 128.0
[[  2. 16.  4.  2.]
 [  4. 128. 16. 64.]
 [  2.  8. 64.  4.]
 [ 16.  2.  4. 32.]]
Last action: DOWN
Last scores move: 16
-----
Episode: 371
Total Reward: 151
Total episodes 165
Eps_threshold: 0.05801699175338285
Loss ep: 0.03430307272708777
Score: 1572
Highest: 128.0
[[  2.  4.  2.  4.]
 [ 32. 64. 32.  8.]
 [  8. 16. 128. 16.]
 [  2. 32.  8.  2.]]
Last action: DOWN
Last scores move: 8
-----
Episode: 372
Total Reward: 237
Total episodes 251
Eps_threshold: 0.05741814413565825
Loss ep: 0.03434998105721645
Score: 3056
Highest: 256.0
[[  2.  4. 16.  2.]
 [ 64. 32. 128.  4.]
 [  8. 256. 16.  2.]
 [  2.  4.  2.  4.]]
Last action: UP
Last scores move: 16
-----
Episode: 373
Total Reward: 195
Total episodes 209
Eps_threshold: 0.05692520462423191
Loss ep: 0.03551280555542576
Score: 2464
Highest: 256.0
[[  4.  2. 32. 16.]
 [ 16.  4. 256.  2.]
 [  8. 32. 16.  8.]
 [  4. 64.  4.  2.]]
Last action: LEFT
Last scores move: 4
-----
Episode: 374
Total Reward: 240
Total episodes 254
Eps_threshold: 0.05633302283923417
Loss ep: 0.03425047341294176
Score: 2956
Highest: 256.0
[[ 16.  2.  8.  2.]
 [ 64.  8. 64.  8.]
 [ 16. 256. 32.  2.]
 [  4. 64.  8.  4.]]

```

```
Last action: LEFT
Last scores move: 8
-----
Episode: 375
Total Reward: 153
Total episodes 167
Eps_threshold: 0.055947752839272766
Loss ep: 0.033860180906192985
Score: 2080
Highest: 256.0
[[ 4. 16. 32. 16.]
 [ 8.  4. 256.  8.]
 [ 4.  2. 32.  2.]
 [ 2.  4.  2.  4.]]
Last action: UP
Last scores move: 4
-----
Episode: 376
Total Reward: 166
Total episodes 180
Eps_threshold: 0.05553607837759573
Loss ep: 0.033689726723564996
Score: 1772
Highest: 128.0
[[ 4.  2. 32.  2.]
 [ 8. 128.  2. 16.]
 [ 16. 64. 32. 64.]
 [ 2.  4. 16.  4.]]
Last action: DOWN
Last scores move: 4
-----
Episode: 377
Total Reward: 254
Total episodes 268
Eps_threshold: 0.05492996495670592
Loss ep: 0.03454137915995584
Score: 3260
Highest: 256.0
[[ 2.  4. 16.  2.]
 [ 4. 256. 64.  8.]
 [ 2. 128.  8. 16.]
 [ 8. 64.  2.  4.]]
Last action: DOWN
Last scores move: 4
-----
Episode: 378
Total Reward: 83
Total episodes 97
Eps_threshold: 0.05471258220595178
Loss ep: 0.03428484729884826
Score: 732
Highest: 64.0
[[ 4.  2. 16.  4.]
 [16. 32.  4.  8.]
 [ 4. 64. 16.  2.]
 [ 2. 32.  8.  4.]]
Last action: LEFT
Last scores move: 4
-----
Episode: 379
Total Reward: 139
Total episodes 153
Eps_threshold: 0.0543718359682108
Loss ep: 0.03316494062835095
Score: 1476
Highest: 128.0
[[ 2.  8. 32.  8.]
 [ 16. 64. 128.  2.]
 [ 4. 32. 16.  4.]
 [ 2. 16.  4.  8.]]
Last action: RIGHT
Last scores move: 0
```

```
-----
Episode: 380
Total Reward: 127
Total episodes 141
Eps_threshold: 0.05406011463344968
Loss ep: 0.03337088375226826
Score: 1384
Highest: 128.0
[[ 2.  4.  8.  2.]
 [ 4.  8. 16.  4.]
 [ 64. 128.  4. 32.]
 [ 2.  4. 32.  2.]]
Last action: DOWN
Last scores move: 4
-----
Episode: 381
Total Reward: 135
Total episodes 149
Eps_threshold: 0.053733086471904216
Loss ep: 0.03518802847638226
Score: 1456
Highest: 128.0
[[ 2.  8.  4.  2.]
 [ 4. 16. 32. 64.]
 [ 8. 128. 16.  2.]
 [ 2. 16. 32.  4.]]
Last action: LEFT
Last scores move: 4
-----
Episode: 382
Total Reward: 217
Total episodes 231
Eps_threshold: 0.05323087517639308
Loss ep: 0.03319501670408043
Score: 2680
Highest: 256.0
[[ 2.  4. 16.  2.]
 [ 4. 32. 64.  4.]
 [ 8. 64. 256. 16.]
 [ 4. 16.  2.  8.]]
Last action: DOWN
Last scores move: 4
-----
Episode: 383
Total Reward: 123
Total episodes 137
Eps_threshold: 0.05293575561989384
Loss ep: 0.03325781160897582
Score: 1328
Highest: 128.0
[[ 2.  4. 32.  2.]
 [ 4. 128.  8.  4.]
 [ 8. 64. 16.  8.]
 [ 2. 16.  8.  4.]]
Last action: DOWN
Last scores move: 4
-----
Episode: 384
Total Reward: 67
Total episodes 81
Eps_threshold: 0.0527622174616087
Loss ep: 0.033891766159622756
Score: 596
Highest: 64.0
[[ 2. 16.  4.  2.]
 [ 4. 32. 16.  4.]
 [ 2.  4.  8. 16.]
 [ 64.  2.  4.  2.]]
Last action: LEFT
Last scores move: 0
-----
Episode: 385
```

Total Reward: 143  
Total episodes 157  
Eps\_threshold: 0.052427848171054704  
Loss ep: 0.03276643935282519  
Score: 1504  
Highest: 128.0  
[[ 2. 8. 4. 2.]  
 [ 8. 2. 32. 4.]  
 [ 32. 128. 8. 64.]  
 [ 2. 8. 32. 4.]]  
Last action: DOWN  
Last scores move: 4

-----  
Episode: 386  
Total Reward: 225  
Total episodes 239  
Eps\_threshold: 0.05192385275565379  
Loss ep: 0.03259845358557282  
Score: 2884  
Highest: 256.0  
[[ 32. 2. 4. 2.]  
 [ 2. 256. 8. 16.]  
 [ 8. 16. 32. 4.]  
 [ 4. 128. 4. 2.]]  
Last action: LEFT  
Last scores move: 0

-----  
Episode: 387  
Total Reward: 218  
Total episodes 232  
Eps\_threshold: 0.051440345825594765  
Loss ep: 0.0332502661080196  
Score: 2676  
Highest: 256.0  
[[ 8. 64. 8. 4.]  
 [ 16. 4. 16. 32.]  
 [ 8. 64. 256. 8.]  
 [ 2. 4. 8. 4.]]  
Last action: RIGHT  
Last scores move: 4

-----  
Episode: 388  
Total Reward: 152  
Total episodes 166  
Eps\_threshold: 0.051097814426960084  
Loss ep: 0.03252256060221109  
Score: 1636  
Highest: 128.0  
[[ 4. 2. 4. 64.]  
 [ 2. 16. 8. 4.]  
 [ 8. 64. 128. 32.]  
 [ 16. 8. 4. 2.]]  
Last action: DOWN  
Last scores move: 8

-----  
Episode: 389  
Total Reward: 191  
Total episodes 205  
Eps\_threshold: 0.050678713391202446  
Loss ep: 0.03272736246992902  
Score: 2416  
Highest: 256.0  
[[ 2. 4. 8. 2.]  
 [ 8. 64. 32. 4.]  
 [ 4. 32. 256. 8.]  
 [ 2. 16. 8. 4.]]  
Last action: DOWN  
Last scores move: 4

-----  
Episode: 390  
Total Reward: 160  
Total episodes 174



Eps\_threshold: 0.05032634361579157  
Loss ep: 0.033567231276939655  
Score: 1708  
Highest: 128.0  
[[ 2. 8. 16. 32.]  
[ 8. 4. 64. 16.]  
[ 64. 128. 16. 2.]  
[ 2. 8. 2. 16.]]  
Last action: RIGHT  
Last scores move: 8  
-----

Episode: 391  
Total Reward: 246  
Total episodes 260  
Eps\_threshold: 0.04980549400652452  
Loss ep: 0.03317279448876014  
Score: 3148  
Highest: 256.0  
[[ 8. 16. 8. 4.]  
[ 2. 32. 64. 32.]  
[ 4. 256. 8. 4.]  
[ 2. 4. 128. 2.]]  
Last action: UP  
Last scores move: 4  
-----

Episode: 392  
Total Reward: 173  
Total episodes 187  
Eps\_threshold: 0.04943504717527802  
Loss ep: 0.03255891799926758  
Score: 2244  
Highest: 256.0  
[[ 2. 8. 2. 16.]  
[ 4. 256. 8. 2.]  
[ 16. 4. 16. 64.]  
[ 4. 8. 4. 2.]]  
Last action: DOWN  
Last scores move: 4  
-----

Episode: 393  
Total Reward: 232  
Total episodes 246  
Eps\_threshold: 0.048952966966119345  
Loss ep: 0.033045268640285584  
Score: 3076  
Highest: 256.0  
[[ 4. 32. 8. 4.]  
[ 2. 128. 256. 8.]  
[ 8. 64. 32. 2.]  
[ 2. 4. 8. 4.]]  
Last action: LEFT  
Last scores move: 0  
-----

Episode: 394  
Total Reward: 120  
Total episodes 134  
Eps\_threshold: 0.04869285443745424  
Loss ep: 0.03211587934351679  
Score: 1276  
Highest: 128.0  
[[ 2. 4. 32. 4.]  
[ 4. 32. 8. 2.]  
[ 32. 128. 32. 4.]  
[ 2. 8. 4. 2.]]  
Last action: LEFT  
Last scores move: 0  
-----

Episode: 395  
Total Reward: 196  
Total episodes 210  
Eps\_threshold: 0.048288704963714575  
Loss ep: 0.0330571038382394

```
Score: 2452
Highest: 256.0
[[ 16.  2. 32.  2.]
 [  8.  4. 256.  8.]
 [  2. 16. 32. 64.]
 [  4.  8.  4.  2.]]
Last action: LEFT
Last scores move: 0
-----
Episode: 396
Total Reward: 138
Total episodes 152
Eps_threshold: 0.04799881378780033
Loss ep: 0.03420080009259676
Score: 1680
Highest: 128.0
[[  2. 32. 128.  2.]
 [128.  8.  4.  8.]
 [  4.  2. 16.  2.]
 [  2.  4.  2.  4.]]
Last action: DOWN
Last scores move: 0
-----
Episode: 397
Total Reward: 137
Total episodes 151
Eps_threshold: 0.04771300303694625
Loss ep: 0.03363948468340943
Score: 1556
Highest: 128.0
[[ 64.  4.  8.  4.]
 [  4.  8. 64.  8.]
 [  2. 32. 128.  4.]
 [  4.  2. 16.  2.]]
Last action: UP
Last scores move: 4
-----
Episode: 398
Total Reward: 137
Total episodes 151
Eps_threshold: 0.04742934203175947
Loss ep: 0.0328881156365603
Score: 1468
Highest: 128.0
[[  8. 128.  8.  2.]
 [ 16. 64. 32.  4.]
 [ 32. 16.  4.  2.]
 [  8.  4.  2. 16.]]
Last action: DOWN
Last scores move: 0
-----
Episode: 399
Total Reward: 240
Total episodes 254
Eps_threshold: 0.04695699513944113
Loss ep: 0.033039690002681706
Score: 3080
Highest: 256.0
[[  8. 256.  8. 16.]
 [  2.  8. 128.  2.]
 [  4. 64. 32. 16.]
 [  2.  4.  8.  2.]]
Last action: LEFT
Last scores move: 0
-----
Episode: 400
Total Reward: 211
Total episodes 225
Eps_threshold: 0.046543558883513324
Loss ep: 0.03300763448079427
Score: 2644
Highest: 256.0
```

```
[[ 2. 16. 32. 4.]
 [ 4. 256. 8. 64.]
 [ 2. 16. 64. 8.]
 [ 8. 2. 8. 2.]]
Last action: DOWN
Last scores move: 0
-----
Update target_net
Episode: 401
Total Reward: 244
Total episodes 258
Eps_threshold: 0.046075174548180664
Loss ep: 0.04638005781543347
Score: 3196
Highest: 256.0
[[ 8. 64. 2. 4.]
 [ 2. 4. 128. 2.]
 [ 4. 256. 64. 4.]
 [ 2. 4. 8. 16.]]
Last action: RIGHT
Last scores move: 4
-----
Episode: 402
Total Reward: 208
Total episodes 222
Eps_threshold: 0.04567695432167075
Loss ep: 0.04302839330724768
Score: 2736
Highest: 256.0
[[ 4. 8. 16. 2.]
 [ 8. 2. 256. 4.]
 [ 2. 128. 8. 32.]
 [ 4. 8. 4. 2.]]
Last action: LEFT
Last scores move: 4
-----
Episode: 403
Total Reward: 139
Total episodes 153
Eps_threshold: 0.04540506691639475
Loss ep: 0.042659616158678644
Score: 1428
Highest: 128.0
[[ 2. 8. 16. 4.]
 [ 16. 32. 128. 8.]
 [ 8. 64. 4. 16.]
 [ 2. 4. 16. 4.]]
Last action: RIGHT
Last scores move: 4
-----
Episode: 404
Total Reward: 179
Total episodes 193
Eps_threshold: 0.04506505123490318
Loss ep: 0.04194969216776635
Score: 2424
Highest: 256.0
[[ 2. 4. 64. 2.]
 [ 4. 8. 2. 8.]
 [ 8. 256. 4. 2.]
 [ 2. 4. 16. 64.]]
Last action: RIGHT
Last scores move: 0
-----
Episode: 405
Total Reward: 147
Total episodes 161
Eps_threshold: 0.04478391068140594
Loss ep: 0.04053737213892966
Score: 1552
Highest: 128.0
[[ 2. 16. 2. 8.]
```

```
[ 64.  4. 16.  2.]
[  8. 64. 128.  8.]
[  4.  2.  8.  4.]]
Last action: RIGHT
Last scores move: 4
-----
Episode: 406
Total Reward: 165
Total episodes 179
Eps_threshold: 0.044473983672994585
Loss ep: 0.04013773848890592
Score: 1752
Highest: 128.0
[[  4. 64.  4.  2.]
 [ 64. 16. 32.  8.]
 [  4. 32. 128.  2.]
 [ 16.  4.  2.  8.]]
Last action: DOWN
Last scores move: 0
-----
Episode: 407
Total Reward: 145
Total episodes 159
Eps_threshold: 0.04420100204253398
Loss ep: 0.04036764228868785
Score: 1596
Highest: 128.0
[[  4.  8. 16.  8.]
 [  8. 64. 128.  2.]
 [  4. 32.  8. 64.]
 [  2.  4.  2.  8.]]
Last action: UP
Last scores move: 4
-----
Episode: 408
Total Reward: 119
Total episodes 133
Eps_threshold: 0.043974319932337726
Loss ep: 0.03863156827768885
Score: 1304
Highest: 128.0
[[  2.  4.  8.  4.]
 [  4. 16. 128.  8.]
 [  2. 64.  4. 16.]
 [  4.  2. 32.  2.]]
Last action: UP
Last scores move: 0
-----
Episode: 409
Total Reward: 240
Total episodes 254
Eps_threshold: 0.043545574366224055
Loss ep: 0.0394454565573865
Score: 3056
Highest: 256.0
[[  4. 16.  4.  2.]
 [  8.  4. 32.  8.]
 [ 64. 256. 128.  4.]
 [  2.  8.  4.  2.]]
Last action: UP
Last scores move: 4
-----
Episode: 410
Total Reward: 121
Total episodes 135
Eps_threshold: 0.04331990423279301
Loss ep: 0.03849013646443685
Score: 1312
Highest: 128.0
[[  4. 16.  2.  4.]
 [  8. 128.  4. 32.]
 [  2. 16. 64.  8.]
```

```
[ 4.  2.  4.  2.]]
Last action: UP
Last scores move: 16
-----
Episode: 411
Total Reward: 135
Total episodes 149
Eps_threshold: 0.04307259332326014
Loss ep: 0.03771280762333198
Score: 1472
Highest: 128.0
[[ 2. 128. 32.  8.]
 [ 4.  8.  2. 32.]
 [ 8. 32. 64.  2.]
 [ 2.  4.  8.  4.]]
Last action: DOWN
Last scores move: 4
-----
Episode: 412
Total Reward: 134
Total episodes 148
Eps_threshold: 0.04282875943076456
Loss ep: 0.03813894052763243
Score: 1436
Highest: 128.0
[[ 2.  4.  8.  4.]
 [ 8. 16. 32. 16.]
 [ 4. 128. 64.  4.]
 [ 2.  4.  8. 32.]]
Last action: UP
Last scores move: 4
-----
Episode: 413
Total Reward: 139
Total episodes 153
Eps_threshold: 0.042578577586776856
Loss ep: 0.038502605911952995
Score: 1500
Highest: 128.0
[[ 2. 16.  2.  4.]
 [ 8. 32. 128.  2.]
 [ 4. 64.  8. 32.]
 [ 2. 32.  4.  2.]]
Last action: UP
Last scores move: 0
-----
Episode: 414
Total Reward: 145
Total episodes 159
Eps_threshold: 0.0423206046959127
Loss ep: 0.03620748999733595
Score: 1600
Highest: 128.0
[[ 4. 16.  4.  2.]
 [ 2. 32. 128.  4.]
 [ 4. 16. 64.  2.]
 [ 64.  4.  8.  4.]]
Last action: LEFT
Last scores move: 0
-----
Episode: 415
Total Reward: 184
Total episodes 198
Eps_threshold: 0.042002209366791915
Loss ep: 0.0369913602116132
Score: 2336
Highest: 256.0
[[ 4. 32.  4.  2.]
 [ 8. 64.  8.  4.]
 [ 4. 256. 16.  8.]
 [ 2. 16.  4.  2.]]
Last action: LEFT
```

```
Last scores move: 4
-----
Episode: 416
Total Reward: 129
Total episodes 143
Eps_threshold: 0.04177420964016754
Loss ep: 0.03659762202442943
Score: 1412
Highest: 128.0
[[ 64.  32.   8.   2.]
 [  2.   4. 128.   4.]
 [  8.   2.  32.  16.]
 [  4.  16.   4.   2.]]
Last action: LEFT
Last scores move: 4
-----
Episode: 417
Total Reward: 135
Total episodes 149
Eps_threshold: 0.041538371366717036
Loss ep: 0.038009112313289774
Score: 1424
Highest: 128.0
[[  2.   8.  16.   4.]
 [  8.  32.   2.   8.]
 [  4.   2. 128.  64.]
 [  2.  32.   8.   2.]]
Last action: LEFT
Last scores move: 0
-----
Episode: 418
Total Reward: 156
Total episodes 170
Eps_threshold: 0.04127143131252988
Loss ep: 0.036121396457447726
Score: 1828
Highest: 128.0
[[  8.   2.   8.   4.]
 [ 32.  16.  32.   2.]
 [  4. 128.   8. 128.]
 [  2.   8.   4.   2.]]
Last action: LEFT
Last scores move: 4
-----
Episode: 419
Total Reward: 183
Total episodes 197
Eps_threshold: 0.04096491976169505
Loss ep: 0.0356210234201499
Score: 2332
Highest: 256.0
[[  2.   8.   2.   8.]
 [  4.  16.   4.   2.]
 [  2. 256.   8.  32.]
 [ 16.   4.  64.   2.]]
Last action: DOWN
Last scores move: 0
-----
Episode: 420
Total Reward: 160
Total episodes 174
Eps_threshold: 0.040696693436119966
Loss ep: 0.03512417585000224
Score: 1832
Highest: 128.0
[[  2.   8.   2.   4.]
 [ 16. 128.   4.  16.]
 [128.  16.   8.   4.]
 [  2.  32.  16.   8.]]
Last action: UP
Last scores move: 16
-----
```

Episode: 421  
Total Reward: 122  
Total episodes 136  
Eps\_threshold: 0.04048866402236718  
Loss ep: 0.03659349329331342  
Score: 1320  
Highest: 128.0  
[[ 2. 4. 2. 4.]  
[ 4. 8. 64. 8.]  
[ 32. 16. 4. 16.]  
[ 8. 2. 128. 2.]]  
Last action: DOWN  
Last scores move: 4  
-----

Episode: 422  
Total Reward: 134  
Total episodes 148  
Eps\_threshold: 0.04026388063290327  
Loss ep: 0.03605471108410809  
Score: 1436  
Highest: 128.0  
[[ 2. 4. 8. 2.]  
[ 4. 8. 16. 4.]  
[128. 32. 4. 2.]  
[ 32. 8. 64. 16.]]  
Last action: RIGHT  
Last scores move: 4  
-----

Episode: 423  
Total Reward: 138  
Total episodes 152  
Eps\_threshold: 0.04003474695098024  
Loss ep: 0.03439806009593763  
Score: 1468  
Highest: 128.0  
[[ 2. 4. 16. 4.]  
[ 16. 128. 32. 64.]  
[ 8. 32. 8. 4.]  
[ 2. 4. 16. 2.]]  
Last action: RIGHT  
Last scores move: 0  
-----

Episode: 424  
Total Reward: 132  
Total episodes 146  
Eps\_threshold: 0.03981629163028145  
Loss ep: 0.03590405477236395  
Score: 1428  
Highest: 128.0  
[[ 4. 2. 8. 2.]  
[ 8. 64. 16. 4.]  
[128. 32. 4. 16.]  
[ 8. 4. 2. 32.]]  
Last action: RIGHT  
Last scores move: 0  
-----

Episode: 425  
Total Reward: 138  
Total episodes 152  
Eps\_threshold: 0.03959054673109263  
Loss ep: 0.035038540237828306  
Score: 1496  
Highest: 128.0  
[[ 2. 4. 8. 2.]  
[ 8. 2. 32. 4.]  
[ 32. 4. 64. 16.]  
[ 4. 128. 32. 2.]]  
Last action: DOWN  
Last scores move: 0  
-----

Episode: 426  
Total Reward: 135

Total episodes 149  
Eps\_threshold: 0.039370916297148006  
Loss ep: 0.03509637973452574  
Score: 1440  
Highest: 128.0  
[[ 4. 8. 2. 4.]  
 [ 8. 64. 16. 2.]  
 [ 16. 128. 32. 4.]  
 [ 4. 32. 4. 8.]]  
Last action: UP  
Last scores move: 4

-----  
Episode: 427  
Total Reward: 217  
Total episodes 231  
Eps\_threshold: 0.039033633770029406  
Loss ep: 0.034174902614576994  
Score: 2712  
Highest: 256.0  
[[ 4. 64. 8. 2.]  
 [ 2. 8. 2. 256.]  
 [ 8. 64. 32. 4.]  
 [ 2. 4. 16. 32.]]  
Last action: RIGHT  
Last scores move: 0

-----  
Episode: 428  
Total Reward: 220  
Total episodes 234  
Eps\_threshold: 0.03869591973449203  
Loss ep: 0.035385319310375765  
Score: 2880  
Highest: 256.0  
[[ 4. 2. 4. 2.]  
 [ 32. 16. 2. 256.]  
 [ 16. 128. 16. 8.]  
 [ 2. 32. 4. 2.]]  
Last action: DOWN  
Last scores move: 0

-----  
Episode: 429  
Total Reward: 233  
Total episodes 247  
Eps\_threshold: 0.03834370453136758  
Loss ep: 0.03337546591816643  
Score: 3044  
Highest: 256.0  
[[ 4. 16. 128. 2.]  
 [ 32. 8. 64. 4.]  
 [ 4. 256. 8. 2.]  
 [ 2. 4. 16. 4.]]  
Last action: UP  
Last scores move: 4

-----  
Episode: 430  
Total Reward: 210  
Total episodes 224  
Eps\_threshold: 0.038028026139495304  
Loss ep: 0.03394812345504761  
Score: 2652  
Highest: 256.0  
[[ 2. 4. 64. 2.]  
 [ 16. 64. 16. 4.]  
 [ 8. 256. 32. 8.]  
 [ 4. 16. 2. 4.]]  
Last action: DOWN  
Last scores move: 4

-----  
Episode: 431  
Total Reward: 253  
Total episodes 267  
Eps\_threshold: 0.03765633852559739



```
Loss ep: 0.03400357564290365
Score: 3196
Highest: 256.0
[[ 4. 16. 8. 2.]
 [ 8. 128. 64. 4.]
 [ 32. 16. 256. 32.]
 [ 8. 4. 2. 4.]]
Last action: DOWN
Last scores move: 0
-----
Episode: 432
Total Reward: 175
Total episodes 189
Eps_threshold: 0.03739621713588487
Loss ep: 0.03327473130806413
Score: 2296
Highest: 256.0
[[ 2. 256. 8. 4.]
 [ 4. 64. 16. 2.]
 [ 16. 32. 2. 4.]
 [ 4. 8. 4. 2.]]
Last action: RIGHT
Last scores move: 4
-----
Episode: 433
Total Reward: 183
Total episodes 197
Eps_threshold: 0.03712768906892803
Loss ep: 0.03281232427219449
Score: 2364
Highest: 256.0
[[ 4. 2. 16. 8.]
 [ 16. 64. 4. 2.]
 [ 4. 32. 256. 16.]
 [ 2. 16. 4. 2.]]
Last action: UP
Last scores move: 4
-----
Episode: 434
Total Reward: 136
Total episodes 150
Eps_threshold: 0.03692499246332153
Loss ep: 0.032856680552164716
Score: 1448
Highest: 128.0
[[ 8. 64. 8. 2.]
 [ 4. 8. 32. 16.]
 [ 32. 16. 128. 4.]
 [ 4. 8. 4. 2.]]
Last action: LEFT
Last scores move: 8
-----
Episode: 435
Total Reward: 74
Total episodes 88
Eps_threshold: 0.03680678274856699
Loss ep: 0.03409726511348377
Score: 844
Highest: 128.0
[[ 4. 16. 2. 4.]
 [ 2. 8. 4. 2.]
 [ 8. 2. 128. 4.]
 [ 4. 8. 4. 2.]]
Last action: DOWN
Last scores move: 4
-----
Episode: 436
Total Reward: 153
Total episodes 167
Eps_threshold: 0.036583878034917264
Loss ep: 0.03291788500940015
Score: 1788
```

```
Highest: 128.0
[[ 2.  4.  2.  4.]
 [ 32.  2.  4.  8.]
 [ 4. 128. 32. 128.]
 [ 2.  8.  4.  2.]]
Last action: DOWN
Last scores move: 4
-----
Episode: 437
Total Reward: 192
Total episodes 206
Eps_threshold: 0.036311469403922284
Loss ep: 0.03359537680172226
Score: 2392
Highest: 256.0
[[ 4.  8. 32.  2.]
 [ 16. 64.  8. 256.]
 [ 4.  8. 16.  8.]
 [ 2. 16.  4.  2.]]
Last action: UP
Last scores move: 4
-----
Episode: 438
Total Reward: 118
Total episodes 132
Eps_threshold: 0.036138385510997136
Loss ep: 0.03411251125913678
Score: 1280
Highest: 128.0
[[ 2.  4. 16.  4.]
 [ 8. 64.  2. 128.]
 [ 2.  4. 32.  4.]
 [ 8.  2.  4.  2.]]
Last action: LEFT
Last scores move: 0
-----
Episode: 439
Total Reward: 88
Total episodes 102
Eps_threshold: 0.03600541909745017
Loss ep: 0.0327606995900472
Score: 792
Highest: 64.0
[[ 4.  8.  4.  2.]
 [32.  4.  2.  8.]
 [64.  8. 32.  2.]
 [ 8. 32. 16.  8.]]
Last action: LEFT
Last scores move: 4
-----
Episode: 440
Total Reward: 77
Total episodes 91
Eps_threshold: 0.035887363221345815
Loss ep: 0.03468024599683154
Score: 672
Highest: 64.0
[[ 4.  2.  8.  4.]
 [ 2.  8.  4.  2.]
 [ 4. 32.  8. 32.]
 [64.  4. 16.  2.]]
Last action: LEFT
Last scores move: 4
-----
Episode: 441
Total Reward: 99
Total episodes 113
Eps_threshold: 0.03574151203673607
Loss ep: 0.03132009928205372
Score: 912
Highest: 64.0
[[ 2.  4.  8. 16.]
```

```
[ 4.  8. 64.  4.]
[ 8. 32.  2. 16.]
[ 4.  8. 64.  2.]]
Last action: RIGHT
Last scores move: 4
-----
Episode: 442
Total Reward: 177
Total episodes 191
Eps_threshold: 0.035496850714075136
Loss ep: 0.033331978383488683
Score: 2304
Highest: 256.0
[[ 16. 32. 64.  8.]
 [ 4. 256.  4.  2.]
 [ 2. 16.  8.  4.]
 [ 4.  2.  4.  2.]]
Last action: RIGHT
Last scores move: 0
-----
Episode: 443
Total Reward: 133
Total episodes 147
Eps_threshold: 0.035310135878912005
Loss ep: 0.03274699619838169
Score: 1432
Highest: 128.0
[[ 2. 64.  4.  2.]
 [ 8.  2.  8. 32.]
 [ 2. 128. 16.  8.]
 [ 16. 32.  2.  4.]]
Last action: DOWN
Last scores move: 8
-----
Episode: 444
Total Reward: 140
Total episodes 154
Eps_threshold: 0.03511599622950529
Loss ep: 0.03183649112651875
Score: 1464
Highest: 128.0
[[ 4.  2.  8.  2.]
 [ 64. 32. 16.  8.]
 [ 8. 16. 128.  4.]
 [ 4. 32.  8.  2.]]
Last action: LEFT
Last scores move: 8
-----
Episode: 445
Total Reward: 175
Total episodes 189
Eps_threshold: 0.034879768001492166
Loss ep: 0.033140798094411374
Score: 2324
Highest: 256.0
[[ 2.  4.  8.  4.]
 [ 4. 32.  2. 256.]
 [ 2. 64. 32.  2.]
 [ 4.  2.  8.  4.]]
Last action: UP
Last scores move: 0
-----
Episode: 446
Total Reward: 152
Total episodes 166
Eps_threshold: 0.03467412054461225
Loss ep: 0.032840306500354445
Score: 1624
Highest: 128.0
[[ 8. 16.  2.  8.]
 [ 2.  8. 64. 32.]
 [ 8. 64. 128.  4.]
```

```
[ 2.  4.  8.  2.]]
Last action: UP
Last scores move: 4
-----
Episode: 447
Total Reward: 127
Total episodes 141
Eps_threshold: 0.03450077973906763
Loss ep: 0.03351524704737021
Score: 1388
Highest: 128.0
[[ 2.  4. 32.  4.]
 [ 4. 64.  8.  2.]
 [32.  8. 128. 16.]
 [ 2.  4.  8.  2.]]
Last action: LEFT
Last scores move: 8
-----
Episode: 448
Total Reward: 131
Total episodes 145
Eps_threshold: 0.03432379144377476
Loss ep: 0.03349769855367726
Score: 1456
Highest: 128.0
[[ 2.  4.  8.  4.]
 [32.  8. 64.  2.]
 [ 8.  2. 32.  8.]
 [ 2. 32. 128.  2.]]
Last action: UP
Last scores move: 8
-----
Episode: 449
Total Reward: 133
Total episodes 147
Eps_threshold: 0.034145666985938884
Loss ep: 0.03201472353773052
Score: 1536
Highest: 128.0
[[ 4.  2.  4. 128.]
 [ 2. 64.  8.  4.]
 [ 4.  8. 32. 64.]
 [ 2.  4. 16.  4.]]
Last action: RIGHT
Last scores move: 0
-----
Episode: 450
Total Reward: 237
Total episodes 251
Eps_threshold: 0.033844532437003236
Loss ep: 0.03333728531917253
Score: 3000
Highest: 256.0
[[ 2.  4. 32.  4.]
 [16.  8. 256. 16.]
 [32. 128.  8.  4.]
 [ 4.  2. 32.  2.]]
Last action: UP
Last scores move: 4
-----
Episode: 451
Total Reward: 226
Total episodes 240
Eps_threshold: 0.03356010800742165
Loss ep: 0.03144658009211222
Score: 2960
Highest: 256.0
[[ 2.  8.  4. 64.]
 [ 8. 16.  8.  2.]
 [ 4.  8. 256. 128.]
 [ 2. 16.  8.  2.]]
Last action: UP
```

```
Last scores move: 4
-----
Episode: 452
Total Reward: 212
Total episodes 226
Eps_threshold: 0.03329537733220177
Loss ep: 0.033190233517537075
Score: 2648
Highest: 256.0
[[ 2.  8.  4.  2.]
 [ 8. 32.  8. 16.]
 [256. 16. 64.  4.]
 [ 4. 64.  8.  2.]]
Last action: LEFT
Last scores move: 0
-----
Episode: 453
Total Reward: 182
Total episodes 196
Eps_threshold: 0.03306819763306392
Loss ep: 0.03128970885763363
Score: 1908
Highest: 128.0
[[ 4. 32.  4.  2.]
 [ 8. 16.  8. 16.]
 [ 64. 128.  64.  32.]
 [ 4. 16.  32.  4.]]
Last action: LEFT
Last scores move: 4
-----
Episode: 454
Total Reward: 287
Total episodes 301
Eps_threshold: 0.032723620704014175
Loss ep: 0.03217773817702385
Score: 4476
Highest: 512.0
[[ 2.  8.  4.  2.]
 [ 8. 64.  8. 16.]
 [ 16. 512.  2.  4.]
 [ 4.  8.  4.  2.]]
Last action: LEFT
Last scores move: 4
-----
Episode: 455
Total Reward: 111
Total episodes 125
Eps_threshold: 0.03258204097214739
Loss ep: 0.0321408576965332
Score: 1212
Highest: 128.0
[[ 2.  4.  8.  2.]
 [ 8. 128.  16.  8.]
 [ 2.  4.  64.  4.]
 [ 4.  8.  16.  2.]]
Last action: UP
Last scores move: 0
-----
Episode: 456
Total Reward: 201
Total episodes 215
Eps_threshold: 0.03234058418719062
Loss ep: 0.03116397414096566
Score: 2700
Highest: 256.0
[[ 4.  8. 32.  2.]
 [ 2. 128.  2.  4.]
 [ 4.  8. 16. 256.]
 [ 2.  4.  2.  4.]]
Last action: UP
Last scores move: 32
-----
```

Episode: 457  
Total Reward: 261  
Total episodes 275  
Eps\_threshold: 0.032035503391682214  
Loss ep: 0.03193153381347656  
Score: 3336  
Highest: 256.0  
[[ 16. 2. 4. 2.]  
 [ 4. 8. 64. 256.]  
 [ 2. 64. 32. 8.]  
 [ 8. 128. 2. 4.]]  
Last action: RIGHT  
Last scores move: 32  
-----

Episode: 458  
Total Reward: 139  
Total episodes 153  
Eps\_threshold: 0.03186757493604395  
Loss ep: 0.03137968724070032  
Score: 1472  
Highest: 128.0  
[[ 2. 32. 4. 2.]  
 [ 4. 16. 128. 8.]  
 [ 16. 64. 8. 32.]  
 [ 2. 4. 16. 4.]]  
Last action: RIGHT  
Last scores move: 4  
-----

Episode: 459  
Total Reward: 222  
Total episodes 236  
Eps\_threshold: 0.03161105400180166  
Loss ep: 0.030559400380667994  
Score: 2772  
Highest: 256.0  
[[ 2. 4. 8. 16.]  
 [ 16. 8. 32. 64.]  
 [ 4. 64. 8. 256.]  
 [ 2. 32. 4. 16.]]  
Last action: RIGHT  
Last scores move: 4  
-----

Episode: 460  
Total Reward: 137  
Total episodes 151  
Eps\_threshold: 0.03144850493894153  
Loss ep: 0.03198701340631144  
Score: 1504  
Highest: 128.0  
[[ 2. 4. 8. 4.]  
 [ 8. 64. 16. 64.]  
 [ 4. 16. 4. 128.]  
 [ 2. 4. 2. 4.]]  
Last action: UP  
Last scores move: 4  
-----

Episode: 461  
Total Reward: 171  
Total episodes 185  
Eps\_threshold: 0.03125102103939108  
Loss ep: 0.032196233079240126  
Score: 2216  
Highest: 256.0  
[[ 2. 4. 8. 4.]  
 [ 16. 64. 4. 8.]  
 [ 4. 8. 256. 4.]  
 [ 2. 16. 4. 2.]]  
Last action: LEFT  
Last scores move: 4  
-----

Episode: 462  
Total Reward: 150

Total episodes 164  
Eps\_threshold: 0.031077475177336722  
Loss ep: 0.03088668497597299  
Score: 1564  
Highest: 128.0  
[[ 2. 32. 4. 2.]  
 [ 4. 128. 64. 8.]  
 [ 32. 8. 32. 16.]  
 [ 2. 4. 16. 4.]]  
Last action: RIGHT  
Last scores move: 4

-----  
Episode: 463  
Total Reward: 140  
Total episodes 154  
Eps\_threshold: 0.03091580185954486  
Loss ep: 0.030657285219663148  
Score: 1568  
Highest: 128.0  
[[ 2. 4. 64. 2.]  
 [ 64. 8. 32. 4.]  
 [ 8. 128. 2. 8.]  
 [ 2. 16. 4. 2.]]  
Last action: LEFT  
Last scores move: 0

-----  
Episode: 464  
Total Reward: 191  
Total episodes 205  
Eps\_threshold: 0.03070250987929575  
Loss ep: 0.031847381591796876  
Score: 2476  
Highest: 256.0  
[[ 2. 4. 8. 2.]  
 [ 8. 64. 256. 4.]  
 [ 4. 8. 64. 8.]  
 [ 2. 4. 2. 16.]]  
Last action: DOWN  
Last scores move: 4

-----  
Episode: 465  
Total Reward: 201  
Total episodes 215  
Eps\_threshold: 0.0304811498400435  
Loss ep: 0.03138369626777117  
Score: 2496  
Highest: 256.0  
[[ 2. 4. 8. 16.]  
 [ 4. 8. 32. 4.]  
 [ 16. 32. 64. 16.]  
 [ 8. 256. 8. 4.]]  
Last action: RIGHT  
Last scores move: 4

-----  
Episode: 466  
Total Reward: 87  
Total episodes 101  
Eps\_threshold: 0.030377980754547854  
Loss ep: 0.03234788686922281  
Score: 836  
Highest: 64.0  
[[ 4. 2. 8. 4.]  
 [ 2. 16. 64. 32.]  
 [ 4. 64. 4. 2.]  
 [ 2. 4. 2. 8.]]  
Last action: RIGHT  
Last scores move: 16

-----  
Episode: 467  
Total Reward: 110  
Total episodes 124  
Eps\_threshold: 0.03025202813047228

```
Loss ep: 0.03212138722019811
Score: 1164
Highest: 128.0
[[ 2. 16.  4.  2.]
 [ 4. 32.  8.  4.]
 [ 8. 128. 16. 32.]
 [ 4. 16.  8.  2.]]
Last action: DOWN
Last scores move: 4
-----
Episode: 468
Total Reward: 134
Total episodes 148
Eps_threshold: 0.030102716257595655
Loss ep: 0.03263022448565509
Score: 1496
Highest: 128.0
[[ 2. 16.  2.  4.]
 [ 4. 64.  8. 64.]
 [ 2.  8. 16.  4.]
 [ 4.  2. 128. 8.]]
Last action: RIGHT
Last scores move: 8
-----
Episode: 469
Total Reward: 229
Total episodes 243
Eps_threshold: 0.02985994607047377
Loss ep: 0.03109341491887599
Score: 2908
Highest: 256.0
[[ 2.  4. 16.  2.]
 [ 8. 128. 32.  8.]
 [ 4. 256.  8. 16.]
 [ 2.  4. 32.  8.]]
Last action: RIGHT
Last scores move: 4
-----
Episode: 470
Total Reward: 145
Total episodes 159
Eps_threshold: 0.02970268543849683
Loss ep: 0.03124293441292625
Score: 1548
Highest: 128.0
[[ 2.  8. 16.  4.]
 [ 32. 128.  2. 32.]
 [ 8. 32. 16.  8.]
 [ 4. 64.  4.  2.]]
Last action: LEFT
Last scores move: 4
-----
Episode: 471
Total Reward: 197
Total episodes 211
Eps_threshold: 0.029495914740390948
Loss ep: 0.031165190782592195
Score: 2412
Highest: 256.0
[[ 16.  4. 16.  2.]
 [ 8. 64. 32.  8.]
 [ 2. 16.  8.  4.]
 [ 8.  2. 256. 2.]]
Last action: DOWN
Last scores move: 0
-----
Episode: 472
Total Reward: 166
Total episodes 180
Eps_threshold: 0.02932123872884089
Loss ep: 0.030816033151414658
Score: 2156
```



```
Highest: 256.0
[[ 2.  8. 32.  2.]
 [ 4. 256. 16.  4.]
 [ 32. 16.  2. 16.]
 [ 8.  2.  4.  8.]]
Last action: DOWN
Last scores move: 0
-----
Episode: 473
Total Reward: 95
Total episodes 109
Eps_threshold: 0.029216224401742256
Loss ep: 0.03053874050805328
Score: 892
Highest: 64.0
[[ 8.  2.  4.  2.]
 [ 4. 32. 16.  8.]
 [ 2. 64.  8.  4.]
 [64. 16.  4.  2.]]
Last action: LEFT
Last scores move: 4
-----
Episode: 474
Total Reward: 203
Total episodes 217
Eps_threshold: 0.02900885537826505
Loss ep: 0.0305293210640481
Score: 2604
Highest: 256.0
[[ 4. 64.  2.  4.]
 [ 2. 16.  4.  2.]
 [ 4. 32. 256.  8.]
 [ 8. 64. 16.  2.]]
Last action: DOWN
Last scores move: 4
-----
Episode: 475
Total Reward: 245
Total episodes 259
Eps_threshold: 0.028764277759213502
Loss ep: 0.030855837936106797
Score: 3160
Highest: 256.0
[[ 4. 32.  4.  2.]
 [256. 128.  8.  4.]
 [ 4. 16. 64.  8.]
 [ 2. 32. 16.  2.]]
Last action: LEFT
Last scores move: 4
-----
Episode: 476
Total Reward: 236
Total episodes 250
Eps_threshold: 0.028531184157300334
Loss ep: 0.030263332366943358
Score: 2996
Highest: 256.0
[[ 8. 32.  4.  8.]
 [ 4. 128. 16.  2.]
 [ 32. 16. 256.  4.]
 [ 4. 32.  4.  2.]]
Last action: LEFT
Last scores move: 4
-----
Episode: 477
Total Reward: 151
Total episodes 165
Eps_threshold: 0.02837893079667622
Loss ep: 0.030424999468254322
Score: 1632
Highest: 128.0
[[ 4.  2.  8.  4.]
```

```
[ 8.  4. 16. 64.]
[ 64. 128.  4. 32.]
[  2. 16.  8.  4.]]
Last action: UP
Last scores move: 0
-----
Episode: 478
Total Reward: 201
Total episodes 215
Eps_threshold: 0.02818241545306393
Loss ep: 0.030507770804471746
Score: 2488
Highest: 256.0
[[ 2.  4. 16.  2.]
 [  4.  8. 256. 32.]
 [ 64.  2. 32. 16.]
 [  2.  4. 16.  8.]]
Last action: DOWN
Last scores move: 4
-----
Episode: 479
Total Reward: 244
Total episodes 258
Eps_threshold: 0.02794936867719098
Loss ep: 0.03121980400972588
Score: 3156
Highest: 256.0
[[ 2. 16.  4.  2.]
 [ 32.  2. 256. 32.]
 [  8. 128. 64.  8.]
 [  2. 16.  4.  2.]]
Last action: RIGHT
Last scores move: 16
-----
Episode: 480
Total Reward: 240
Total episodes 254
Eps_threshold: 0.02772285311337068
Loss ep: 0.030284352189912572
Score: 3076
Highest: 256.0
[[ 4.  8.  4.  2.]
 [  2. 16.  8. 32.]
 [  8. 128. 64. 256.]
 [  2.  4. 16.  4.]]
Last action: LEFT
Last scores move: 4
-----
Episode: 481
Total Reward: 80
Total episodes 94
Eps_threshold: 0.02763975114633717
Loss ep: 0.03013120306299088
Score: 716
Highest: 64.0
[[ 2. 16.  4.  2.]
 [ 32.  2. 16.  4.]
 [ 16. 64. 32.  2.]
 [  2.  4.  8.  4.]]
Last action: RIGHT
Last scores move: 0
-----
Episode: 482
Total Reward: 221
Total episodes 235
Eps_threshold: 0.027433697009114223
Loss ep: 0.030880240176586395
Score: 2748
Highest: 256.0
[[ 2.  8. 16. 32.]
 [  4. 64. 256.  4.]
 [  8.  2. 64.  8.]
```

```
[ 2. 32. 4. 16.]]
Last action: DOWN
Last scores move: 4
-----
Episode: 483
Total Reward: 226
Total episodes 240
Eps_threshold: 0.027225742865311403
Loss ep: 0.029942158857981363
Score: 2940
Highest: 256.0
[[ 32. 4. 8. 2.]
 [128. 32. 256. 16.]
 [ 32. 8. 4. 8.]
 [ 2. 4. 2. 4.]]
Last action: RIGHT
Last scores move: 4
-----
Episode: 484
Total Reward: 208
Total episodes 222
Eps_threshold: 0.027035594395857315
Loss ep: 0.03078217549366994
Score: 2624
Highest: 256.0
[[ 2. 8. 2. 4.]
 [ 16. 64. 4. 8.]
 [ 2. 16. 256. 4.]
 [ 64. 4. 32. 2.]]
Last action: UP
Last scores move: 4
-----
Episode: 485
Total Reward: 116
Total episodes 130
Eps_threshold: 0.026925222130747925
Loss ep: 0.031200144841120794
Score: 1232
Highest: 128.0
[[ 32. 4. 2. 8.]
 [ 2. 16. 32. 4.]
 [ 8. 4. 128. 2.]
 [ 16. 32. 2. 4.]]
Last action: UP
Last scores move: 0
-----
Episode: 486
Total Reward: 143
Total episodes 157
Eps_threshold: 0.026792879262387367
Loss ep: 0.030047027928054713
Score: 1536
Highest: 128.0
[[ 8. 16. 4. 2.]
 [ 16. 32. 64. 32.]
 [ 4. 8. 128. 4.]
 [ 2. 4. 32. 2.]]
Last action: LEFT
Last scores move: 0
-----
Episode: 487
Total Reward: 151
Total episodes 165
Eps_threshold: 0.02665490792280377
Loss ep: 0.030191340590968275
Score: 1652
Highest: 128.0
[[ 64. 4. 8. 4.]
 [ 8. 16. 32. 16.]
 [ 4. 64. 8. 2.]
 [ 2. 16. 128. 4.]]
Last action: RIGHT
```

```
Last scores move: 4
-----
Episode: 488
Total Reward: 201
Total episodes 215
Eps_threshold: 0.026476826564889692
Loss ep: 0.029217515989791516
Score: 2300
Highest: 128.0
[[ 4. 16. 128.  2.]
 [ 2.  8.  2.  4.]
 [ 8. 16. 64.  2.]
 [16. 64.  8. 128.]]
Last action: DOWN
Last scores move: 8
-----
Episode: 489
Total Reward: 183
Total episodes 197
Eps_threshold: 0.02631532651672218
Loss ep: 0.03147907063440623
Score: 2300
Highest: 256.0
[[ 4.  8.  4.  2.]
 [ 2. 16. 256. 16.]
 [16. 64. 16.  4.]
 [ 4.  2.  8.  2.]]
Last action: LEFT
Last scores move: 8
-----
Episode: 490
Total Reward: 298
Total episodes 312
Eps_threshold: 0.026062782388832986
Loss ep: 0.03002760349175869
Score: 4064
Highest: 256.0
[[ 2.  8.  4.  2.]
 [32. 256.  8.  4.]
 [ 8. 16. 256.  8.]
 [ 2. 64.  8.  2.]]
Last action: LEFT
Last scores move: 4
-----
Episode: 491
Total Reward: 210
Total episodes 224
Eps_threshold: 0.025883882933121764
Loss ep: 0.030348752226148332
Score: 2640
Highest: 256.0
[[ 8. 64.  2.  4.]
 [32. 256.  8.  2.]
 [64.  8. 16.  8.]
 [ 2. 16.  2.  4.]]
Last action: DOWN
Last scores move: 4
-----
Episode: 492
Total Reward: 204
Total episodes 218
Eps_threshold: 0.025711688772190135
Loss ep: 0.03089572311541356
Score: 2544
Highest: 256.0
[[ 4.  8.  2. 32.]
 [32. 256.  4.  2.]
 [ 4. 16. 32. 16.]
 [ 2. 64.  4.  2.]]
Last action: LEFT
Last scores move: 4
-----
```

Episode: 493  
Total Reward: 159  
Total episodes 173  
Eps\_threshold: 0.02557636876708016  
Loss ep: 0.029836671200790848  
Score: 1708  
Highest: 128.0  
[[ 4. 2. 128. 2.]  
 [ 32. 8. 16. 4.]  
 [ 8. 32. 2. 64.]  
 [ 4. 2. 64. 4.]]  
Last action: RIGHT  
Last scores move: 0  
-----

Episode: 494  
Total Reward: 224  
Total episodes 238  
Eps\_threshold: 0.02539210850175017  
Loss ep: 0.03027596593904896  
Score: 2756  
Highest: 256.0  
[[ 2. 4. 64. 4.]  
 [ 32. 8. 4. 32.]  
 [ 4. 64. 256. 8.]  
 [ 16. 4. 16. 4.]]  
Last action: RIGHT  
Last scores move: 4  
-----

Episode: 495  
Total Reward: 233  
Total episodes 247  
Eps\_threshold: 0.025203184965839193  
Loss ep: 0.030268084182430377  
Score: 2964  
Highest: 256.0  
[[ 4. 16. 4. 2.]  
 [ 8. 4. 32. 4.]  
 [256. 32. 128. 8.]  
 [ 2. 4. 32. 2.]]  
Last action: UP  
Last scores move: 0  
-----

Episode: 496  
Total Reward: 250  
Total episodes 264  
Eps\_threshold: 0.025003821617138964  
Loss ep: 0.029169445688074284  
Score: 3180  
Highest: 256.0  
[[ 32. 8. 4. 2.]  
 [ 16. 256. 32. 4.]  
 [ 4. 128. 16. 64.]  
 [ 2. 4. 8. 4.]]  
Last action: RIGHT  
Last scores move: 4  
-----

Episode: 497  
Total Reward: 225  
Total episodes 239  
Eps\_threshold: 0.02482559298583896  
Loss ep: 0.02941098073536382  
Score: 2968  
Highest: 256.0  
[[ 2. 4. 2. 16.]  
 [ 4. 128. 16. 4.]  
 [ 8. 16. 64. 8.]  
 [ 2. 4. 8. 256.]]  
Last action: UP  
Last scores move: 0  
-----

Episode: 498  
Total Reward: 216

Total episodes 230  
Eps\_threshold: 0.024656075261638433  
Loss ep: 0.029780045799587086  
Score: 2616  
Highest: 256.0  
[[ 4. 32. 8. 2.]  
 [ 16. 64. 256. 8.]  
 [ 4. 32. 16. 32.]  
 [ 2. 16. 4. 2.]]  
Last action: LEFT  
Last scores move: 4

-----  
Episode: 499  
Total Reward: 131  
Total episodes 145  
Eps\_threshold: 0.024550202966802638  
Loss ep: 0.030025163190118196  
Score: 1372  
Highest: 128.0  
[[ 4. 128. 4. 2.]  
 [ 16. 32. 8. 16.]  
 [ 8. 2. 16. 4.]  
 [ 2. 64. 4. 2.]]  
Last action: LEFT  
Last scores move: 4

-----  
Episode: 500  
Total Reward: 214  
Total episodes 228  
Eps\_threshold: 0.024385272542591714  
Loss ep: 0.02899286203217088  
Score: 2692  
Highest: 256.0  
[[ 16. 64. 32. 2.]  
 [ 2. 256. 64. 4.]  
 [ 4. 32. 8. 2.]  
 [ 2. 4. 2. 4.]]  
Last action: RIGHT  
Last scores move: 0

-----  
Update target\_net  
Episode: 501  
Total Reward: 132  
Total episodes 146  
Eps\_threshold: 0.024280642417631434  
Loss ep: 0.04769662308366331  
Score: 1424  
Highest: 128.0  
[[ 2. 4. 32. 2.]  
 [ 32. 8. 64. 16.]  
 [ 2. 128. 8. 4.]  
 [ 4. 2. 16. 2.]]  
Last action: RIGHT  
Last scores move: 0

-----  
Episode: 502  
Total Reward: 155  
Total episodes 169  
Eps\_threshold: 0.0241604793929758  
Loss ep: 0.04468413358609352  
Score: 1696  
Highest: 128.0  
[[ 2. 32. 4. 2.]  
 [ 64. 4. 8. 4.]  
 [ 16. 8. 128. 64.]  
 [ 4. 32. 8. 2.]]  
Last action: LEFT  
Last scores move: 4

-----  
Episode: 503  
Total Reward: 203  
Total episodes 217

Eps\_threshold: 0.024007668688734433  
Loss ep: 0.04150520271969281  
Score: 2684  
Highest: 256.0  
[[ 2. 8. 4. 2.]  
[ 4. 256. 16. 8.]  
[ 2. 16. 128. 16.]  
[ 4. 8. 4. 2.]]  
Last action: LEFT  
Last scores move: 0

-----  
Episode: 504  
Total Reward: 127  
Total episodes 141  
Eps\_threshold: 0.023909261915941157  
Loss ep: 0.04219865798950195  
Score: 1344  
Highest: 128.0  
[[ 16. 8. 4. 2.]  
[ 2. 32. 128. 4.]  
[ 8. 16. 64. 8.]  
[ 4. 2. 8. 4.]]  
Last action: LEFT  
Last scores move: 4

-----  
Episode: 505  
Total Reward: 234  
Total episodes 248  
Eps\_threshold: 0.023737852005952097  
Loss ep: 0.04089766933071998  
Score: 3036  
Highest: 256.0  
[[ 4. 2. 8. 2.]  
[ 2. 32. 256. 4.]  
[ 8. 128. 16. 64.]  
[ 2. 8. 4. 8.]]  
Last action: DOWN  
Last scores move: 8

-----  
Episode: 506  
Total Reward: 73  
Total episodes 87  
Eps\_threshold: 0.023678222138716266  
Loss ep: 0.037698688178226865  
Score: 628  
Highest: 64.0  
[[ 2. 8. 2. 4.]  
[ 4. 2. 16. 2.]  
[16. 64. 32. 4.]  
[ 8. 16. 8. 2.]]  
Last action: LEFT  
Last scores move: 8

-----  
Episode: 507  
Total Reward: 228  
Total episodes 242  
Eps\_threshold: 0.023513712938642677  
Loss ep: 0.037535667419433594  
Score: 2952  
Highest: 256.0  
[[ 2. 4. 32. 8.]  
[ 4. 8. 128. 32.]  
[ 16. 256. 32. 4.]  
[ 8. 2. 8. 2.]]  
Last action: UP  
Last scores move: 0

-----  
Episode: 508  
Total Reward: 124  
Total episodes 138  
Eps\_threshold: 0.023420789274681053  
Loss ep: 0.0389194004777549

```
Score: 1344
Highest: 128.0
[[ 16.  4.  2.  4.]
 [  2.  8. 32.  8.]
 [ 16. 64. 16.  4.]
 [  2.  4. 128. 2.]]
Last action: UP
Last scores move: 4
-----
Episode: 509
Total Reward: 149
Total episodes 163
Eps_threshold: 0.023311854354867458
Loss ep: 0.03589955429357985
Score: 1620
Highest: 128.0
[[  2. 16.  4.  8.]
 [ 16. 64. 32.  2.]
 [  4. 128.  8.  4.]
 [  2.  4.  64. 2.]]
Last action: UP
Last scores move: 0
-----
Episode: 510
Total Reward: 76
Total episodes 90
Eps_threshold: 0.023252085590849347
Loss ep: 0.03752227094438341
Score: 684
Highest: 64.0
[[ 2.  4. 16. 64.]
 [ 4. 32.  4.  8.]
 [ 2.  8. 32.  2.]
 [ 4.  2.  4. 16.]]
Last action: RIGHT
Last scores move: 0
-----
Episode: 511
Total Reward: 133
Total episodes 147
Eps_threshold: 0.023155039841771908
Loss ep: 0.03609547647489172
Score: 1400
Highest: 128.0
[[ 4. 16.  4.  2.]
 [ 16. 64. 128.  8.]
 [  2. 16. 32. 16.]
 [  4.  2.  8.  4.]]
Last action: DOWN
Last scores move: 4
-----
Episode: 512
Total Reward: 125
Total episodes 139
Eps_threshold: 0.02306392929077495
Loss ep: 0.036099454481824694
Score: 1316
Highest: 128.0
[[ 4.  2. 32.  4.]
 [  2. 32.  8. 32.]
 [  4. 128. 16.  4.]
 [  2.  8. 32.  2.]]
Last action: UP
Last scores move: 4
-----
Episode: 513
Total Reward: 217
Total episodes 231
Eps_threshold: 0.02291390894273021
Loss ep: 0.03636702417811274
Score: 2792
Highest: 256.0
```



```
[ [ 2.  4.  8.  2.]
  [ 4.  8. 16.  4.]
  [ 8. 32. 128. 256.]
  [ 4.  8. 16.  4.]]
Last action: DOWN
Last scores move: 4
-----
Episode: 514
Total Reward: 182
Total episodes 196
Eps_threshold: 0.022787970740207615
Loss ep: 0.03569253853389195
Score: 2344
Highest: 256.0
[[ 2.  8. 16.  2.]
 [ 4. 32.  4. 16.]
 [ 8. 256. 64.  2.]
 [ 2.  4. 16.  4.]]
Last action: LEFT
Last scores move: 0
-----
Episode: 515
Total Reward: 134
Total episodes 148
Eps_threshold: 0.022693689029298927
Loss ep: 0.03806820109083846
Score: 1436
Highest: 128.0
[[ 2.  4. 16.  8.]
 [ 16. 128. 64. 32.]
 [ 2.  8.  4.  2.]
 [ 4. 32.  8.  4.]]
Last action: RIGHT
Last scores move: 0
-----
Episode: 516
Total Reward: 270
Total episodes 284
Eps_threshold: 0.02251471238663984
Loss ep: 0.035097716559826485
Score: 3332
Highest: 256.0
[[ 4. 32.  8.  2.]
 [ 64. 256. 32.  4.]
 [ 8.  32. 128. 16.]
 [ 4. 16.  8.  2.]]
Last action: LEFT
Last scores move: 4
-----
Episode: 517
Total Reward: 144
Total episodes 158
Eps_threshold: 0.022416235654039697
Loss ep: 0.03544706936124005
Score: 1524
Highest: 128.0
[[128.  2.  4.  2.]
 [ 2. 32. 64.  8.]
 [ 4. 16. 32.  4.]
 [ 8. 32.  8.  2.]]
Last action: UP
Last scores move: 0
-----
Episode: 518
Total Reward: 108
Total episodes 122
Eps_threshold: 0.022340727151621564
Loss ep: 0.03390420460310139
Score: 1200
Highest: 128.0
[[ 4. 64.  8.  4.]
 [ 2.  8.  4.  2.]
```

```
[ 8. 128. 16. 4.]
[ 2. 16. 8. 2.]]
Last action: UP
Last scores move: 8
-----
Episode: 519
Total Reward: 194
Total episodes 208
Eps_threshold: 0.022213048668165335
Loss ep: 0.03349891992715689
Score: 2460
Highest: 256.0
[[ 8. 256. 4. 2.]
 [ 16. 32. 64. 16.]
 [ 4. 16. 32. 4.]
 [ 2. 4. 2. 8.]]
Last action: UP
Last scores move: 4
-----
Episode: 520
Total Reward: 79
Total episodes 93
Eps_threshold: 0.022156389825759074
Loss ep: 0.03467247306659658
Score: 700
Highest: 64.0
[[ 4. 16. 4. 2.]
 [ 8. 32. 8. 32.]
 [ 2. 64. 16. 8.]
 [ 4. 2. 4. 2.]]
Last action: LEFT
Last scores move: 4
-----
Episode: 521
Total Reward: 70
Total episodes 84
Eps_threshold: 0.02210544005789953
Loss ep: 0.033026996113005136
Score: 604
Highest: 64.0
[[ 8. 2. 16. 8.]
 [ 2. 32. 4. 64.]
 [ 8. 16. 8. 2.]
 [ 4. 2. 4. 8.]]
Last action: DOWN
Last scores move: 0
-----
Episode: 522
Total Reward: 110
Total episodes 124
Eps_threshold: 0.02203061851599862
Loss ep: 0.03326692504267539
Score: 1144
Highest: 128.0
[[ 4. 16. 2. 4.]
 [ 8. 32. 8. 2.]
 [ 2. 128. 4. 8.]
 [ 32. 4. 16. 2.]]
Last action: UP
Last scores move: 8
-----
Episode: 523
Total Reward: 148
Total episodes 162
Eps_threshold: 0.021933564107019802
Loss ep: 0.033218601603566864
Score: 1756
Highest: 128.0
[[ 2. 4. 16. 2.]
 [ 4. 16. 128. 4.]
 [ 2. 128. 2. 16.]
 [ 32. 2. 8. 4.]]
```

```
Last action: LEFT
Last scores move: 0
-----
Episode: 524
Total Reward: 176
Total episodes 190
Eps_threshold: 0.021820732048869154
Loss ep: 0.03296893270392167
Score: 2304
Highest: 256.0
[[ 2.  8.  2.  4.]
 [ 32. 64.  8.  2.]
 [  8.  4.  2. 16.]
 [  2. 256. 16.  4.]]
Last action: RIGHT
Last scores move: 0
-----
Episode: 525
Total Reward: 211
Total episodes 225
Eps_threshold: 0.021688494046775895
Loss ep: 0.03282901340060764
Score: 2648
Highest: 256.0
[[ 64.  8. 16.  2.]
 [  8.  4. 256.  8.]
 [  4.  8. 64. 32.]
 [  2.  4. 16.  8.]]
Last action: UP
Last scores move: 4
-----
Episode: 526
Total Reward: 130
Total episodes 144
Eps_threshold: 0.021604639129593893
Loss ep: 0.03181549244456821
Score: 1380
Highest: 128.0
[[  4.  8. 16.  2.]
 [  8.  4. 128.  8.]
 [ 64.  8. 16. 32.]
 [  4. 16.  8.  2.]]
Last action: LEFT
Last scores move: 4
-----
Episode: 527
Total Reward: 146
Total episodes 160
Eps_threshold: 0.02151217237672411
Loss ep: 0.03232999444007874
Score: 1592
Highest: 128.0
[[  2.  4.  2.  4.]
 [  8. 128.  8. 16.]
 [  2.  4. 32.  4.]
 [ 64.  8. 64.  2.]]
Last action: RIGHT
Last scores move: 4
-----
Episode: 528
Total Reward: 187
Total episodes 201
Eps_threshold: 0.02139705448069687
Loss ep: 0.03221565692578975
Score: 2164
Highest: 128.0
[[  2.  8.  2.  4.]
 [ 32. 64.  4. 16.]
 [  8. 32. 128.  8.]
 [  2. 128. 16.  2.]]
Last action: LEFT
Last scores move: 8
```

```
-----
Episode: 529
Total Reward: 101
Total episodes 115
Eps_threshold: 0.02133170946439377
Loss ep: 0.032284241137297255
Score: 936
Highest: 64.0
[[ 4. 64. 16.  2.]
 [16.  4.  8. 32.]
 [ 4. 64. 16.  8.]
 [ 2.  8.  4.  2.]]
Last action: UP
Last scores move: 4
-----
Episode: 530
Total Reward: 185
Total episodes 199
Eps_threshold: 0.021219518033194426
Loss ep: 0.032961402107123755
Score: 2340
Highest: 256.0
[[ 4. 16.  8.  4.]
 [ 2.  4. 16. 32.]
 [ 8. 256.  8.  4.]
 [ 2.  4. 64.  2.]]
Last action: UP
Last scores move: 4
-----
Episode: 531
Total Reward: 208
Total episodes 222
Eps_threshold: 0.02109567001115524
Loss ep: 0.03217691129392332
Score: 2744
Highest: 256.0
[[ 2.  8.  4.  8.]
 [32. 256. 16.  2.]
 [ 8. 128.  8.  4.]
 [ 2.  8.  4.  8.]]
Last action: RIGHT
Last scores move: 0
-----
Episode: 532
Total Reward: 152
Total episodes 166
Eps_threshold: 0.021003957085213326
Loss ep: 0.031920203243393494
Score: 2012
Highest: 256.0
[[ 2. 16.  4.  2.]
 [ 4.  2.  8. 32.]
 [ 2.  8. 256.  2.]
 [ 4. 16.  8.  4.]]
Last action: RIGHT
Last scores move: 0
-----
Episode: 533
Total Reward: 123
Total episodes 137
Eps_threshold: 0.020928837557295507
Loss ep: 0.031972738948181596
Score: 1324
Highest: 128.0
[[ 4.  8.  2. 64.]
 [ 2. 16. 128.  4.]
 [ 8. 32. 16.  2.]
 [ 2.  4.  8.  4.]]
Last action: RIGHT
Last scores move: 4
-----
Episode: 534
```

Total Reward: 87  
Total episodes 101  
Eps\_threshold: 0.02087378604968376  
Loss ep: 0.03248276096759456  
Score: 764  
Highest: 64.0  
[[16. 2. 16. 4.]  
 [32. 4. 32. 2.]  
 [ 2. 16. 64. 4.]  
 [16. 8. 4. 2.]]  
Last action: LEFT  
Last scores move: 4  
-----

Episode: 535  
Total Reward: 131  
Total episodes 145  
Eps\_threshold: 0.02079523618813612  
Loss ep: 0.030909636925006735  
Score: 1408  
Highest: 128.0  
[[ 2. 128. 4. 2.]  
 [ 4. 32. 8. 32.]  
 [ 64. 8. 16. 8.]  
 [ 2. 4. 8. 4.]]  
Last action: DOWN  
Last scores move: 0  
-----

Episode: 536  
Total Reward: 210  
Total episodes 224  
Eps\_threshold: 0.020675004099349678  
Loss ep: 0.03157833218574524  
Score: 2608  
Highest: 256.0  
[[ 2. 4. 16. 4.]  
 [ 16. 64. 8. 2.]  
 [ 8. 16. 256. 16.]  
 [ 4. 8. 64. 2.]]  
Last action: LEFT  
Last scores move: 4  
-----

Episode: 537  
Total Reward: 141  
Total episodes 155  
Eps\_threshold: 0.020592592574724074  
Loss ep: 0.03118585155856225  
Score: 1528  
Highest: 128.0  
[[ 2. 4. 8. 4.]  
 [ 8. 64. 16. 2.]  
 [ 4. 128. 64. 4.]  
 [ 2. 8. 16. 8.]]  
Last action: RIGHT  
Last scores move: 4  
-----

Episode: 538  
Total Reward: 72  
Total episodes 86  
Eps\_threshold: 0.020547142214957667  
Loss ep: 0.030968638353569562  
Score: 668  
Highest: 64.0  
[[32. 2. 4. 2.]  
 [ 2. 8. 32. 16.]  
 [ 4. 2. 64. 2.]  
 [ 8. 16. 2. 4.]]  
Last action: LEFT  
Last scores move: 0  
-----

Episode: 539  
Total Reward: 208  
Total episodes 222

Eps\_threshold: 0.02043071629562461  
Loss ep: 0.030680581256076023  
Score: 2632  
Highest: 256.0  
[[ 64. 32. 8. 4.]  
[ 4. 16. 256. 8.]  
[ 8. 64. 16. 4.]  
[ 2. 4. 2. 8.]]  
Last action: RIGHT  
Last scores move: 0

-----  
Episode: 540  
Total Reward: 144  
Total episodes 158  
Eps\_threshold: 0.020348638271956338  
Loss ep: 0.03213082989559898  
Score: 1556  
Highest: 128.0  
[[ 2. 4. 8. 4.]  
[ 8. 2. 16. 2.]  
[ 64. 16. 64. 16.]  
[ 4. 128. 8. 4.]]  
Last action: UP  
Last scores move: 4

-----  
Episode: 541  
Total Reward: 67  
Total episodes 81  
Eps\_threshold: 0.020306811044263566  
Loss ep: 0.03117673779711311  
Score: 600  
Highest: 64.0  
[[ 2. 4. 8. 2.]  
[16. 2. 32. 16.]  
[ 2. 8. 16. 4.]  
[ 4. 64. 4. 2.]]  
Last action: DOWN  
Last scores move: 16

-----  
Episode: 542  
Total Reward: 151  
Total episodes 165  
Eps\_threshold: 0.020222129644225324  
Loss ep: 0.03117965351451527  
Score: 1572  
Highest: 128.0  
[[ 2. 16. 8. 4.]  
[ 32. 128. 32. 8.]  
[ 16. 64. 8. 2.]  
[ 2. 32. 2. 4.]]  
Last action: UP  
Last scores move: 16

-----  
Episode: 543  
Total Reward: 156  
Total episodes 170  
Eps\_threshold: 0.020135609772624817  
Loss ep: 0.029377297794117647  
Score: 1840  
Highest: 128.0  
[[ 2. 16. 4. 2.]  
[ 4. 32. 2. 128.]  
[128. 8. 32. 8.]  
[ 4. 16. 4. 2.]]  
Last action: LEFT  
Last scores move: 4

-----  
Episode: 544  
Total Reward: 250  
Total episodes 264  
Eps\_threshold: 0.020002698865474126  
Loss ep: 0.031184304844249378

```
Score: 3180
Highest: 256.0
[[ 2. 256.  8.  2.]
 [ 4. 16. 64. 32.]
 [32. 128. 16.  4.]
 [ 2.  8.  4.  2.]]
Last action: RIGHT
Last scores move: 0
-----
Episode: 545
Total Reward: 173
Total episodes 187
Eps_threshold: 0.019909609502030457
Loss ep: 0.031025942634133732
Score: 1836
Highest: 128.0
[[ 2.  4. 32.  8.]
 [128.  8. 64. 32.]
 [ 8. 32. 16.  4.]
 [ 2.  4. 64.  2.]]
Last action: UP
Last scores move: 4
-----
Episode: 546
Total Reward: 135
Total episodes 149
Eps_threshold: 0.01983605723363436
Loss ep: 0.02986222465566341
Score: 1444
Highest: 128.0
[[ 8. 16.  4.  2.]
 [ 4. 128.  8. 32.]
 [ 2. 16. 32.  8.]
 [ 8. 64.  4.  2.]]
Last action: LEFT
Last scores move: 0
-----
Episode: 547
Total Reward: 163
Total episodes 177
Eps_threshold: 0.019749392185605424
Loss ep: 0.031209732853086654
Score: 1792
Highest: 128.0
[[ 8.  2.  4. 16.]
 [32. 128. 32.  2.]
 [64. 32. 64.  4.]
 [ 4.  2.  8.  2.]]
Last action: DOWN
Last scores move: 0
-----
Episode: 548
Total Reward: 149
Total episodes 163
Eps_threshold: 0.01967025755095514
Loss ep: 0.030702830823652584
Score: 1656
Highest: 128.0
[[ 2.  8.  2.  8.]
 [ 4. 64. 32. 64.]
 [32.  8.  2.  4.]
 [ 2.  4. 128.  8.]]
Last action: DOWN
Last scores move: 4
-----
Episode: 549
Total Reward: 152
Total episodes 166
Eps_threshold: 0.019590326585658013
Loss ep: 0.03020847849099033
Score: 1668
Highest: 128.0
```

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[[ 2. 64. 4. 2.]
 [ 4. 16. 32. 16.]
 [ 8. 64. 16. 2.]
 [ 4. 16. 2. 128.]]
Last action: RIGHT
Last scores move: 16
-----
Episode: 550
Total Reward: 244
Total episodes 258
Eps_threshold: 0.019467405915622425
Loss ep: 0.030546399049980695
Score: 3160
Highest: 256.0
[[ 2. 8. 32. 4.]
 [ 4. 256. 8. 16.]
 [ 8. 32. 128. 64.]
 [ 2. 16. 2. 4.]]
Last action: DOWN
Last scores move: 4
-----
Episode: 551
Total Reward: 198
Total episodes 212
Eps_threshold: 0.019367581417445465
Loss ep: 0.02963313066734458
Score: 2508
Highest: 256.0
[[ 2. 4. 16. 4.]
 [ 32. 256. 32. 8.]
 [ 4. 8. 64. 2.]
 [ 2. 32. 8. 4.]]
Last action: UP
Last scores move: 4
-----
Episode: 552
Total Reward: 161
Total episodes 175
Eps_threshold: 0.019285972639128297
Loss ep: 0.031146812438964843
Score: 1740
Highest: 128.0
[[ 2. 16. 64. 2.]
 [ 4. 32. 128. 4.]
 [ 8. 64. 16. 8.]
 [ 4. 8. 32. 4.]]
Last action: DOWN
Last scores move: 4
-----
Episode: 553
Total Reward: 168
Total episodes 182
Eps_threshold: 0.019201853610184522
Loss ep: 0.03113573200100071
Score: 1968
Highest: 128.0
[[ 2. 16. 128. 2.]
 [ 4. 128. 16. 4.]
 [ 64. 8. 2. 8.]
 [ 4. 16. 4. 2.]]
Last action: LEFT
Last scores move: 4
-----
Episode: 554
Total Reward: 136
Total episodes 150
Eps_threshold: 0.019133097864446908
Loss ep: 0.030151023864746093
Score: 1440
Highest: 128.0
[[ 2. 8. 4. 2.]
 [ 4. 128. 16. 4.]
```



```
[ 16. 32. 4. 32.]
[ 4. 64. 8. 4.]]
Last action: DOWN
Last scores move: 16
-----
Episode: 555
Total Reward: 243
Total episodes 257
Eps_threshold: 0.0190164883774094
Loss ep: 0.029630015332411237
Score: 3104
Highest: 256.0
[[ 4. 8. 4. 2.]
 [ 2. 32. 64. 16.]
 [ 16. 128. 256. 8.]
 [ 4. 16. 4. 2.]]
Last action: LEFT
Last scores move: 4
-----
Episode: 556
Total Reward: 129
Total episodes 143
Eps_threshold: 0.018952250409911622
Loss ep: 0.030206703639530635
Score: 1364
Highest: 128.0
[[ 2. 64. 16. 4.]
 [ 4. 16. 128. 16.]
 [ 8. 4. 8. 4.]
 [ 4. 2. 32. 2.]]
Last action: UP
Last scores move: 4
-----
Episode: 557
Total Reward: 182
Total episodes 196
Eps_threshold: 0.018864946842095224
Loss ep: 0.02901938010235222
Score: 2064
Highest: 128.0
[[ 8. 128. 32. 2.]
 [ 2. 8. 128. 8.]
 [ 8. 64. 16. 4.]
 [ 4. 8. 4. 2.]]
Last action: UP
Last scores move: 4
-----
Episode: 558
Total Reward: 232
Total episodes 246
Eps_threshold: 0.018756575843860514
Loss ep: 0.029537348243279186
Score: 2936
Highest: 256.0
[[ 64. 8. 4. 2.]
 [ 16. 64. 256. 64.]
 [ 4. 16. 32. 16.]
 [ 2. 4. 8. 4.]]
Last action: UP
Last scores move: 4
-----
Episode: 559
Total Reward: 148
Total episodes 162
Eps_threshold: 0.018685934064963276
Loss ep: 0.029766936361053844
Score: 1596
Highest: 128.0
[[ 2. 8. 32. 2.]
 [ 16. 128. 64. 4.]
 [ 4. 2. 4. 64.]
 [ 2. 4. 8. 4.]]
```

```
Last action: RIGHT
Last scores move: 8
-----
Episode: 560
Total Reward: 97
Total episodes 111
Eps_threshold: 0.018637860658005406
Loss ep: 0.03005585799346099
Score: 844
Highest: 64.0
[[ 2.  8.  2.  4.]
 [ 4. 16.  8. 32.]
 [ 8. 32. 64.  8.]
 [ 2. 16. 32.  4.]]
Last action: DOWN
Last scores move: 4
-----
Episode: 561
Total Reward: 169
Total episodes 183
Eps_threshold: 0.018559184724292778
Loss ep: 0.028965892687521345
Score: 2148
Highest: 256.0
[[ 8. 32.  4.  2.]
 [ 2. 256.  2. 16.]
 [ 8. 32. 16.  4.]
 [ 2.  4.  8.  2.]]
Last action: RIGHT
Last scores move: 0
-----
```

In [ ]:

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