RL agent Donor agnostic no penalty no u donors

DQN without recurring neural network

format shortG

seed = 1

seed =

1

epsilondecay = 0.0003125;

numepisodes = 2000;

learnrate = 0.01;

hiddenlayers = 64;

batchsize = 64;

agentnumber = 5;

No U donors

allmodelfoldincs = readmatrix("allmodelfoldincs.txt")

allmodelfoldincs = 6×132

1 1 1 1 1 1 ⋯

1 1 1 1 1 1

6.6308 6.6213 6.6118 6.6023 6.5929 6.5835

5.7066 5.6616 5.6173 5.5739 5.5313 5.4894

3.2195 3.1525 3.0894 3.0299 2.9736 2.9204

1.4817 1.4605 1.441 1.4231 1.4066 1.3914

modelinitcons = readmatrix("modelinitcons.txt")

modelinitcons = 1×11

400000 420000 440000 460000 480000 500000 ⋯

rawfoldincs = readmatrix("rawfoldincs.txt")

rawfoldincs = 6×37

1 1 1 1 1 1 ⋯

1.078 1.53 1.358 1.548 1.052 1.052

6.1224 4.6158 4.2724 6.3406 5.555 5.555

5.4756 4.7525 3.882 3.027 4.5 4.5

NaN 2.3012 1.6283 1.3062 2.5181 2.5181

NaN NaN 1.3772 1.2429 NaN 1.1327

rawinitcons = readmatrix("rawinitcons.txt")

rawinitcons = 1×37

500000 500000 500000 500000 500000 500000 ⋯

truecon = readtable("true con.xlsx");

truecon(:,1)=[];

rawdonornames = truecon.Properties.VariableNames;

rawdonornames = string(rawdonornames);

rawdonornames = strrep(rawdonornames,"\_","-")

rawdonornames = 1×37 string

"T054-1" "T046-1" "T051-1" "T062-1" "T031-1" "T031-2" ⋯

% rawdonornames = ["T054","T046","T051","T062","T031","T031","T052","T038","T036","T036","T036","T066","T066","T066","UA4","UA4","UA4","UA4","UA4","UA4","UA4","UA4","UA4","UA4","UA4","UA4","UA4","UA141","UA141","UA141","UA141","UA141","UA6","UA6","UA6","UA6","UA6"]

donorlist = ["T054","T046","T051","T062","T031","T052","T038","T036","T066","UA4","UA141","UA6"]

donorlist = 1×12 string

"T054" "T046" "T051" "T062" "T031" "T052" ⋯

donoridxmap = {1,2,3,4,5:6,7,8,9:11,12:14,15:27,28:32,33:37}

donoridxmap = 1×12 cell

|  | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **⋯** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1** | 1 | 2 | 3 | 4 | [5,6] | 7 | 8 |  |

Run training and validation

Randomization:

-6:3 training:validation split for tall the T donors

u donors never included

numdonors = 6

All validation set printed

initializedatasets(seed,allmodelfoldincs,modelinitcons,rawfoldincs,rawinitcons,rawdonornames,donoridxmap,donorlist);

trainingset = 1×6 string

"T054" "T046" "T051" "T062" "T031" "T038"

validationset = 1×6 string

"T052" "T036" "T066" "UA4" "UA141" "UA6"

numdonors = 6;

dqnagent = dqninittraining(seed,numdonors,epsilondecay,numepisodes,hiddenlayers,batchsize,learnrate);

save("Hyperparameter Tuning/DQN 2022/agent\_248\_"+agentnumber,"dqnagent")

rawfoldincs(:,15:end) = []

rawfoldincs = 6×14

1 1 1 1 1 1 ⋯

1.078 1.53 1.358 1.548 1.052 1.052

6.1224 4.6158 4.2724 6.3406 5.555 5.555

5.4756 4.7525 3.882 3.027 4.5 4.5

NaN 2.3012 1.6283 1.3062 2.5181 2.5181

NaN NaN 1.3772 1.2429 NaN 1.1327

rawinitcons(15:end) = []

rawinitcons = 1×14

500000 500000 500000 500000 500000 500000 ⋯

% dqnagent = load("agent\_248\_hailmary"+seed,"dqnagent").dqnagent

[simulationPlots,simulationResults] = simwithset(rawfoldincs,rawinitcons,rawdonornames,dqnagent);

env3 =

modelEnv241 with properties:

useCustom: 1

expLen: 6

modelInfo: "T054-1"

initcon: [400000 420000 440000 460000 480000 500000 520000 540000 560000 580000 600000]

foldExModel: [6×66 double]

numdonors: 8

foldExMap: [4×1 double]

initialState: [0.1 1]

concentrationThreshold: 2.5

concentrationStopThreshold: 3.5

Reward1: 1

Penalty1: -2.5

timeStepStart: 0

timeStep: 0

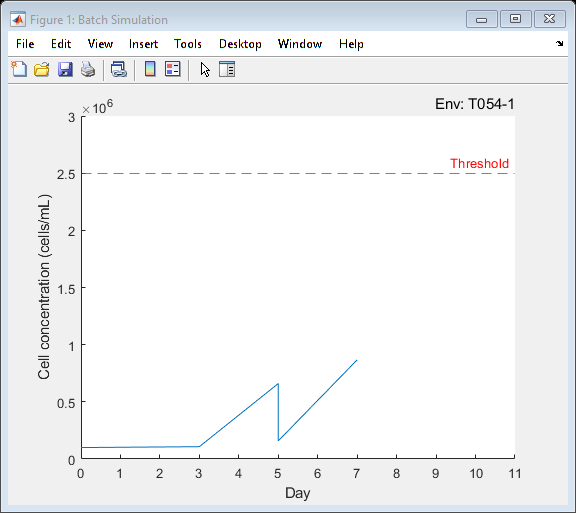
Figure: []

ConcentrationPlot: []

State: [0.5 1]

diluted: 0

overthreshold: 0



env3 =

modelEnv241 with properties:

useCustom: 1

expLen: 6

modelInfo: "T046-1"

initcon: [400000 420000 440000 460000 480000 500000 520000 540000 560000 580000 600000]

foldExModel: [6×66 double]

numdonors: 8

foldExMap: [5×1 double]

initialState: [0.1 1]

concentrationThreshold: 2.5

concentrationStopThreshold: 3.5

Reward1: 1

Penalty1: -2.5

timeStepStart: 0

timeStep: 0

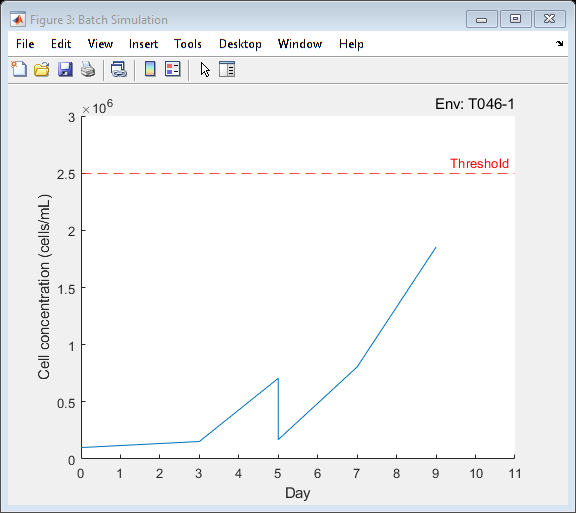
Figure: []

ConcentrationPlot: []

State: [0.5 1]

diluted: 0

overthreshold: 0



env3 =

modelEnv241 with properties:

useCustom: 1

expLen: 6

modelInfo: "T051-1"

initcon: [400000 420000 440000 460000 480000 500000 520000 540000 560000 580000 600000]

foldExModel: [6×66 double]

numdonors: 8

foldExMap: [6×1 double]

initialState: [0.1 1]

concentrationThreshold: 2.5

concentrationStopThreshold: 3.5

Reward1: 1

Penalty1: -2.5

timeStepStart: 0

timeStep: 0

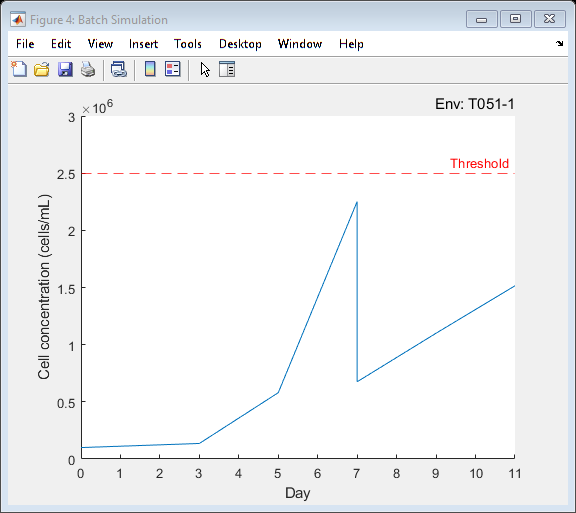
Figure: []

ConcentrationPlot: []

State: [0.5 1]

diluted: 0

overthreshold: 0



env3 =

modelEnv241 with properties:

useCustom: 1

expLen: 6

modelInfo: "T062-1"

initcon: [400000 420000 440000 460000 480000 500000 520000 540000 560000 580000 600000]

foldExModel: [6×66 double]

numdonors: 8

foldExMap: [6×1 double]

initialState: [0.1 1]

concentrationThreshold: 2.5

concentrationStopThreshold: 3.5

Reward1: 1

Penalty1: -2.5

timeStepStart: 0

timeStep: 0

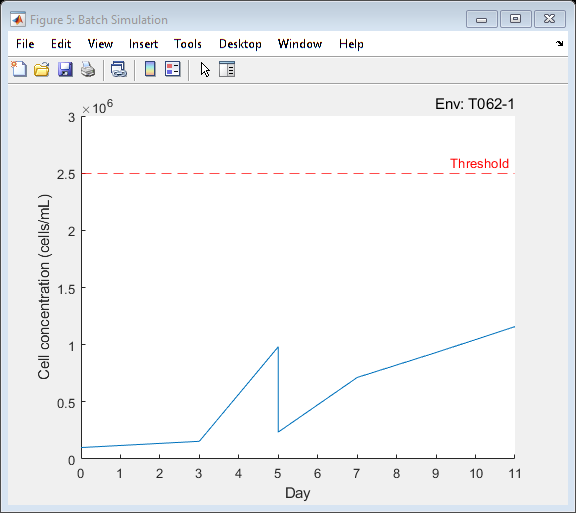
Figure: []

ConcentrationPlot: []

State: [0.5 1]

diluted: 0

overthreshold: 0



env3 =

modelEnv241 with properties:

useCustom: 1

expLen: 6

modelInfo: "T031-1"

initcon: [400000 420000 440000 460000 480000 500000 520000 540000 560000 580000 600000]

foldExModel: [6×66 double]

numdonors: 8

foldExMap: [5×1 double]

initialState: [0.1 1]

concentrationThreshold: 2.5

concentrationStopThreshold: 3.5

Reward1: 1

Penalty1: -2.5

timeStepStart: 0

timeStep: 0

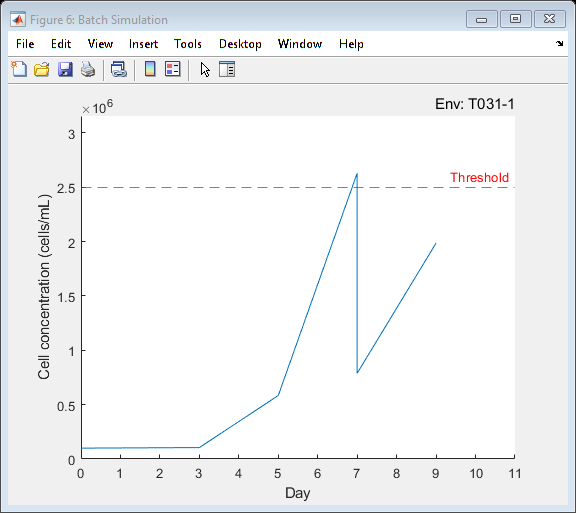
Figure: []

ConcentrationPlot: []

State: [0.5 1]

diluted: 0

overthreshold: 0



env3 =

modelEnv241 with properties:

useCustom: 1

expLen: 6

modelInfo: "T031-2"

initcon: [400000 420000 440000 460000 480000 500000 520000 540000 560000 580000 600000]

foldExModel: [6×66 double]

numdonors: 8

foldExMap: [6×1 double]

initialState: [0.1 1]

concentrationThreshold: 2.5

concentrationStopThreshold: 3.5

Reward1: 1

Penalty1: -2.5

timeStepStart: 0

timeStep: 0

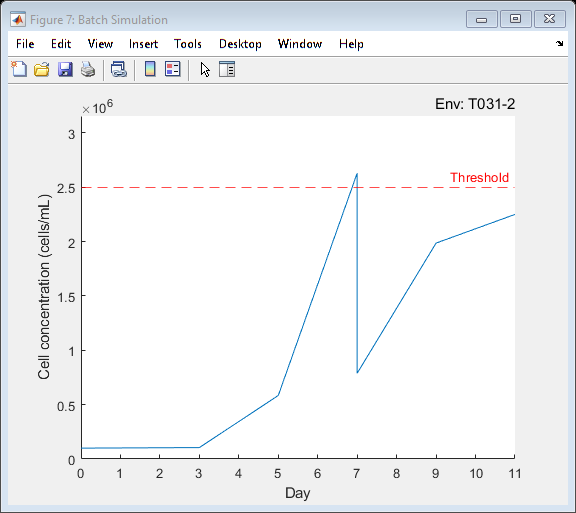
Figure: []

ConcentrationPlot: []

State: [0.5 1]

diluted: 0

overthreshold: 0



env3 =

modelEnv241 with properties:

useCustom: 1

expLen: 6

modelInfo: "T052-1"

initcon: [400000 420000 440000 460000 480000 500000 520000 540000 560000 580000 600000]

foldExModel: [6×66 double]

numdonors: 8

foldExMap: [6×1 double]

initialState: [0.1 1]

concentrationThreshold: 2.5

concentrationStopThreshold: 3.5

Reward1: 1

Penalty1: -2.5

timeStepStart: 0

timeStep: 0

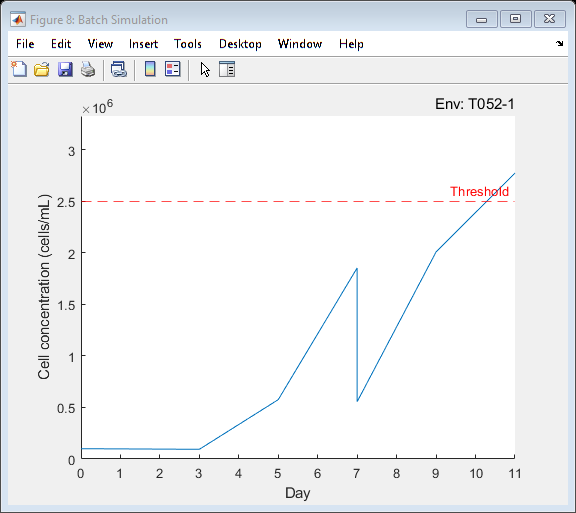
Figure: []

ConcentrationPlot: []

State: [0.5 1]

diluted: 0

overthreshold: 0



env3 =

modelEnv241 with properties:

useCustom: 1

expLen: 6

modelInfo: "T038-1"

initcon: [400000 420000 440000 460000 480000 500000 520000 540000 560000 580000 600000]

foldExModel: [6×66 double]

numdonors: 8

foldExMap: [6×1 double]

initialState: [0.1 1]

concentrationThreshold: 2.5

concentrationStopThreshold: 3.5

Reward1: 1

Penalty1: -2.5

timeStepStart: 0

timeStep: 0

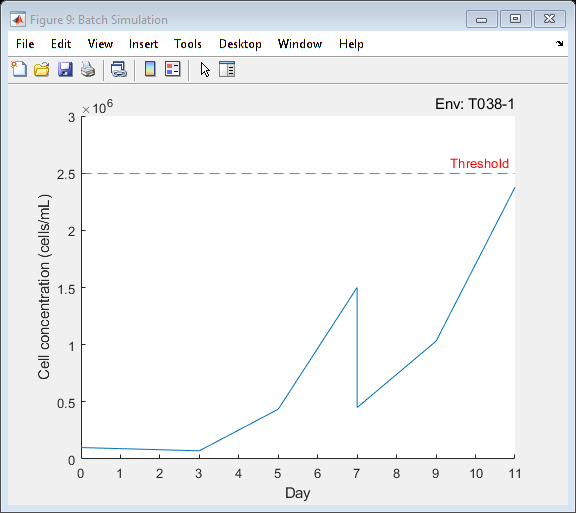
Figure: []

ConcentrationPlot: []

State: [0.5 1]

diluted: 0

overthreshold: 0



env3 =

modelEnv241 with properties:

useCustom: 1

expLen: 6

modelInfo: "T036-1"

initcon: [400000 420000 440000 460000 480000 500000 520000 540000 560000 580000 600000]

foldExModel: [6×66 double]

numdonors: 8

foldExMap: [6×1 double]

initialState: [0.1 1]

concentrationThreshold: 2.5

concentrationStopThreshold: 3.5

Reward1: 1

Penalty1: -2.5

timeStepStart: 0

timeStep: 0

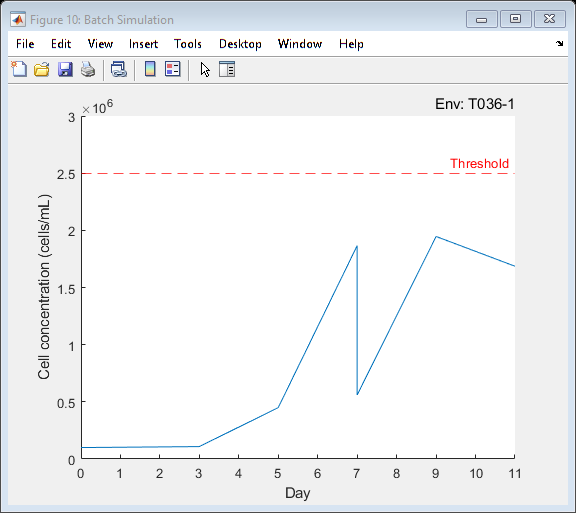
Figure: []

ConcentrationPlot: []

State: [0.5 1]

diluted: 0

overthreshold: 0



env3 =

modelEnv241 with properties:

useCustom: 1

expLen: 6

modelInfo: "T036-2"

initcon: [400000 420000 440000 460000 480000 500000 520000 540000 560000 580000 600000]

foldExModel: [6×66 double]

numdonors: 8

foldExMap: [6×1 double]

initialState: [0.1 1]

concentrationThreshold: 2.5

concentrationStopThreshold: 3.5

Reward1: 1

Penalty1: -2.5

timeStepStart: 0

timeStep: 0

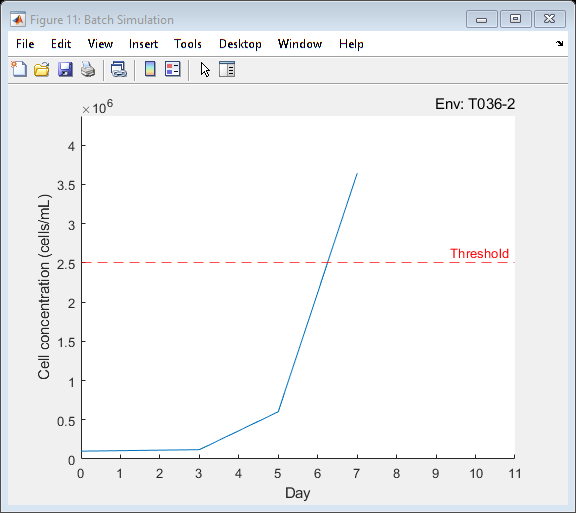
Figure: []

ConcentrationPlot: []

State: [0.5 1]

diluted: 0

overthreshold: 0



env3 =

modelEnv241 with properties:

useCustom: 1

expLen: 6

modelInfo: "T036-3"

initcon: [400000 420000 440000 460000 480000 500000 520000 540000 560000 580000 600000]

foldExModel: [6×66 double]

numdonors: 8

foldExMap: [6×1 double]

initialState: [0.1 1]

concentrationThreshold: 2.5

concentrationStopThreshold: 3.5

Reward1: 1

Penalty1: -2.5

timeStepStart: 0

timeStep: 0

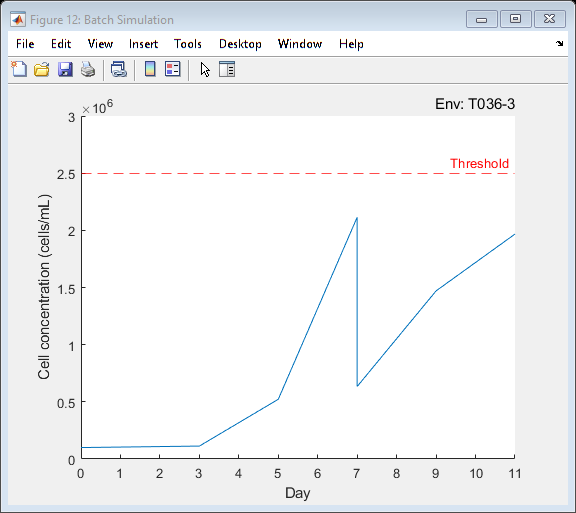
Figure: []

ConcentrationPlot: []

State: [0.5 1]

diluted: 0

overthreshold: 0



env3 =

modelEnv241 with properties:

useCustom: 1

expLen: 6

modelInfo: "T066-1"

initcon: [400000 420000 440000 460000 480000 500000 520000 540000 560000 580000 600000]

foldExModel: [6×66 double]

numdonors: 8

foldExMap: [6×1 double]

initialState: [0.1 1]

concentrationThreshold: 2.5

concentrationStopThreshold: 3.5

Reward1: 1

Penalty1: -2.5

timeStepStart: 0

timeStep: 0

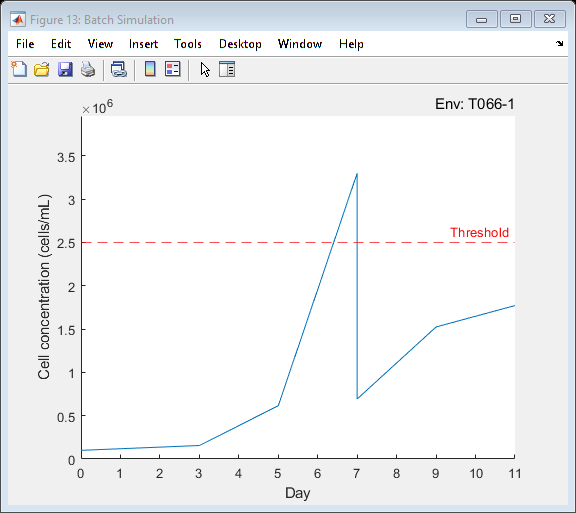
Figure: []

ConcentrationPlot: []

State: [0.5 1]

diluted: 0

overthreshold: 0



env3 =

modelEnv241 with properties:

useCustom: 1

expLen: 6

modelInfo: "T066-2"

initcon: [400000 420000 440000 460000 480000 500000 520000 540000 560000 580000 600000]

foldExModel: [6×66 double]

numdonors: 8

foldExMap: [6×1 double]

initialState: [0.1 1]

concentrationThreshold: 2.5

concentrationStopThreshold: 3.5

Reward1: 1

Penalty1: -2.5

timeStepStart: 0

timeStep: 0

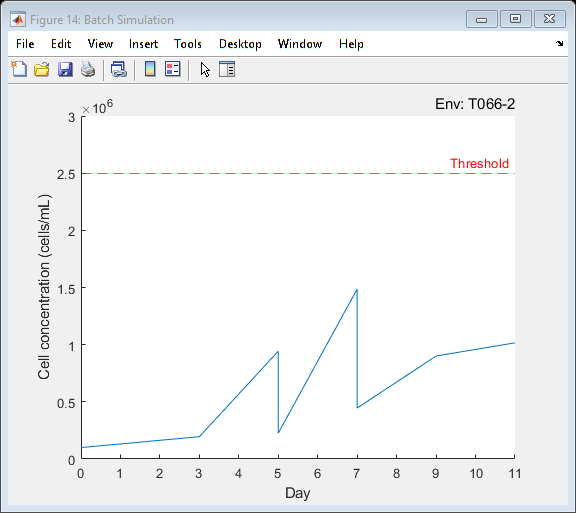
Figure: []

ConcentrationPlot: []

State: [0.5 1]

diluted: 0

overthreshold: 0



env3 =

modelEnv241 with properties:

useCustom: 1

expLen: 6

modelInfo: "T066-3"

initcon: [400000 420000 440000 460000 480000 500000 520000 540000 560000 580000 600000]

foldExModel: [6×66 double]

numdonors: 8

foldExMap: [6×1 double]

initialState: [0.1 1]

concentrationThreshold: 2.5

concentrationStopThreshold: 3.5

Reward1: 1

Penalty1: -2.5

timeStepStart: 0

timeStep: 0

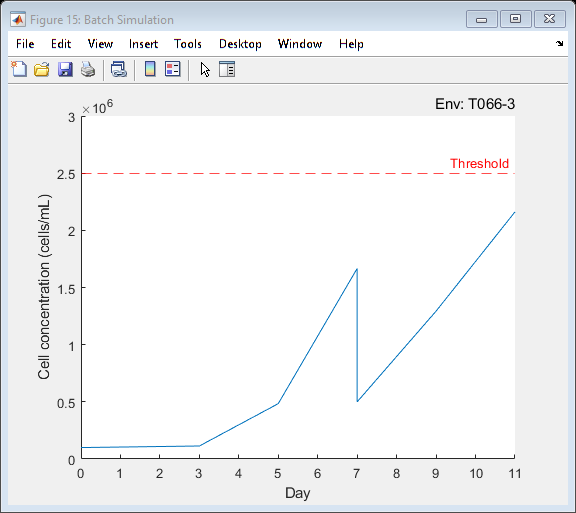
Figure: []

ConcentrationPlot: []

State: [0.5 1]

diluted: 0

overthreshold: 0



[rewardMatrix,totalRewards,totalReward,averageReward] = calculatescore(6,simulationResults)

rewardMatrix = 5×15

0 0.1078 0.153 0.1358 0.1548 0.1052 ⋯

1 0.66 0.70622 0.58019 0.98152 0.58439

2 -1.6327 -1.6945 2.2523 -1.7869 1.9809

3 0 1.8537 -1.3998 0.93136 -0.51343

4 0 0 1.5152 1.1576 0

totalRewards = 1×14

-0.86486 1.0184 3.0838 1.4383 2.1571 4.4073 ⋯

totalReward =

27.121

averageReward =

1.9372

writematrix(rewardMatrix,"Hyperparameter Tuning/DQN 2022/rewardMatrix\_248\_"+agentnumber+".xlsx")

writematrix(totalRewards,"Hyperparameter Tuning/DQN 2022/totalRewards\_248\_"+agentnumber+".xlsx")

function [trialfoldincs, trialinitcons, trialdonornames] = initializedatasets(seed,allmodelfoldincs,modelinitcons,rawfoldincs,rawinitcons,rawdonornames,donoridxmap,donorlist)

rng(seed);

trainingvector = sort(randperm(9,6),"ascend");

trainingset = donorlist(trainingvector)

validationvector = [];

for i=1:12

if ismember(i,trainingvector)==false

validationvector = [validationvector i];

end

end

validationvector = sort(validationvector,"ascend");

validationset = donorlist(validationvector)

availmodelfoldincs = [allmodelfoldincs(:,1:numel(modelinitcons)\*9)];

trialmodelfoldincs = [];

for i=trainingvector

trialmodelfoldincs = [trialmodelfoldincs availmodelfoldincs(:,(numel(modelinitcons)\*(i-1)+1):(numel(modelinitcons)\*(i-1)+numel(modelinitcons)))];

end

writematrix(trialmodelfoldincs, "modelfoldincs.txt")

% trialfoldincs = [];

% trialinitcons = [];

% trialdonornames = [];

% for i=validationvector

% trialfoldincs = [trialfoldincs rawfoldincs(:,donoridxmap{i})];

% trialinitcons = [trialinitcons rawinitcons(donoridxmap{i})];

% % POTENTIALLY BETTER IF ALL NORMALIZED TO 500000

% trialdonornames = [trialdonornames rawdonornames(donoridxmap{i})];

% end

end

function dqnagent = dqninittraining(seed,numdonors,epsilondecay,numepisodes,hiddenlayers,batchsize,learnrate)

rng(0);

% create first environment

env = modelEnv241;

env.useCustom = false;

env.numdonors = numdonors;

obs = getObservationInfo(env);

acts = getActionInfo(env);

validateEnvironment(env)

% hyperparameters

discountFactor = 1;

epsilon = 1;

initOpts = rlAgentInitializationOptions;

initOpts.NumHiddenUnit = hiddenlayers;

initOpts.UseRNN = false;

criticOpts = rlOptimizerOptions('LearnRate',learnrate);

dqnagentoptions = rlDQNAgentOptions;

dqnagentoptions.DiscountFactor = discountFactor;

dqnagentoptions.EpsilonGreedyExploration.Epsilon = epsilon;

dqnagentoptions.EpsilonGreedyExploration.EpsilonDecay = epsilondecay;

dqnagentoptions.SequenceLength = 1;

dqnagentoptions.UseDoubleDQN = false;

dqnagentoptions.MiniBatchSize = batchsize;

dqnagentoptions.CriticOptimizerOptions = criticOpts;

dqnagent = rlDQNAgent(obs,acts,initOpts,dqnagentoptions);

% plot(layerGraph(getModel(getCritic(dqnagent)).Layers));

trainopts = rlTrainingOptions;

trainopts.MaxEpisodes = numepisodes;

trainopts.StopTrainingCriteria = "EpisodeCount";

trainopts.StopTrainingValue = numepisodes;

% trainopts.StopTrainingCriteria = "AverageReward";

% trainopts.StopTrainingValue = 15;

%trainopts.Plots = 'none';

%trainopts.Verbose = true;

plot(env)

results = train(dqnagent,env,trainopts);

end

function [plots,experiences] = simwithset(foldExMaps,day3cons,donornames,sarsaagent3)

plots = cell(size(foldExMaps,2),1);

experiences = cell(size(foldExMaps,2),1);

for i=1:size(foldExMaps,2)

%creating foldexmap

foldExMap1 = foldExMaps(:,i);

foldExMap1 = foldExMap1(~isnan(foldExMap1));

idx = foldExMap1==1;

idx(1) = false;

foldExMap1(idx) = [];

%creating new env

env3 = modelEnv241;

env3.useCustom = true;

env3.foldExMap = foldExMap1;

%NORMALIZED INIT CONS

%

env3.initialState = [100000/1000000,1];

env3.modelInfo = donornames(i)

validateEnvironment(env3)

% plot now

plot(env3);

experiences{i} = sim(sarsaagent3,env3);

plots{i} = env3.Figure;

end

end

function [rewardMatrix,totalRewards,totalReward,averageReward] = calculatescore(maxSeriesLength,simulationResults)

maxSeriesLength = 5;

rewardMatrix = [0:(maxSeriesLength-1)]';

for i=1:size(simulationResults,1)

seriesRewards = simulationResults{i}.Reward.Data;

if size(seriesRewards,1)<maxSeriesLength

numZeros = maxSeriesLength - size(seriesRewards,1);

for j=1:numZeros

seriesRewards = [seriesRewards; 0];

end

end

rewardMatrix = [rewardMatrix seriesRewards];

end

totalRewards = [];

for i=2:size(rewardMatrix,2)

totalRewards = [totalRewards sum(rewardMatrix(:,i))];

end

totalReward = sum(totalRewards);

averageReward = mean(totalRewards);

end