```
Last login: Wed Apr  8 21:25:20 on ttys000
Run-Mac:~ mac$ cd ~/.ssh
Run-Mac:.ssh mac$ ssh -i "Runzhe.pem" ubuntu@ec2-3-216-29-87.compute-1.amazonaws.com
ssh: connect to host ec2-3-216-29-87.compute-1.amazonaws.com port 22: Connection refused
Run-Mac:.ssh mac$ ssh -i "Runzhe.pem" ubuntu@ec2-3-216-29-87.compute-1.amazonaws.com

The authenticity of host 'ec2-3-216-29-87.compute-1.amazonaws.com (3.216.29.87)' can't be established.
ECDSA key fingerprint is SHA256:Mug5PX3ukaMcCitZMz2QK3cZSQHI42S1rOrYH76elMk.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added 'ec2-3-216-29-87.compute-1.amazonaws.com,3.216.29.87' (ECDSA) to the list of known hosts.
Welcome to Ubuntu 18.04.3 LTS (GNU/Linux 4.15.0-1060-aws x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/advantage

  System information as of Thu Apr  9 03:06:46 UTC 2020

  System load:  0.75               Processes:           381
  Usage of /:   28.0% of 30.96GB   Users logged in:     0
  Memory usage: 0%                 IP address for ens5: 172.31.9.59
  Swap usage:   0%

 * Kubernetes 1.18 GA is now available! See https://microk8s.io for docs or
   install it with:

     sudo snap install microk8s --channel=1.18 --classic

 * Multipass 1.1 adds proxy support for developers behind enterprise
   firewalls. Rapid prototyping for cloud operations just got easier.

     https://multipass.run/

 * Canonical Livepatch is available for installation.
   - Reduce system reboots and improve kernel security. Activate at:
     https://ubuntu.com/livepatch

89 packages can be updated.
39 updates are security updates.


Last login: Fri Apr  3 19:45:17 2020 from 107.13.161.147
ubuntu@ip-172-31-9-59:~$ export openblas_num_threads=1; export OMP_NUM_THREADS=1; python EC2.py
23:08, 04/08; num of cores:36

final sd_R trend for[10] the same

Basic setting:[T, rep_times, sd_O, sd_D, sd_u_O, w_O, w_A, [M_in_R, mean_reversion, poisO, u_O_u_D], sd_R_range, t_func] = [None, 36, No
ne, None, 30, 0.5, 1, [True, False, True, 10], [10], None]


---------------------------------------
[pattern_seed, day, sd_R] = [2, 4, 10]

max(u_O) =  168.8
O_threshold = 80
number of reward locations:  15
O_threshold = 90
number of reward locations:  12
O_threshold = 100
number of reward locations:  9
O_threshold = 110
number of reward locations:  6
target 1 in 4 DONE!
target 2 in 4 DONE!
target 3 in 4 DONE!
target 4 in 4 DONE!

---------------------------------------
Value of Behaviour policy:57.65
O_threshold = 80
MC for this TARGET:[68.368, 0.175]
   [DR/QV/IS]; [DR_NO_MARL, DR_NO_MF, V_behav]
bias:[[-68.37, -0.65, -68.37]][[-68.37, -68.37, -10.72]]
std:[[0.0, 0.72, 0.0]][[0.0, 0.0, 0.29]]
MSE:[[68.37, 0.97, 68.37]][[68.37, 68.37, 10.72]]
MSE(-DR):[[0.0, -67.4, 0.0]][[0.0, 0.0, -57.65]]
***
==============
O_threshold = 90
MC for this TARGET:[66.727, 0.165]
   [DR/QV/IS]; [DR_NO_MARL, DR_NO_MF, V_behav]
bias:[[-66.73, -0.38, -66.73]][[-66.73, -66.73, -9.08]]
std:[[0.0, 0.52, 0.0]][[0.0, 0.0, 0.29]]
MSE:[[66.73, 0.64, 66.73]][[66.73, 66.73, 9.08]]
MSE(-DR):[[0.0, -66.09, 0.0]][[0.0, 0.0, -57.65]]
***
==============
O_threshold = 100
```

```
MC for this TARGET:[66.955, 0.162]
   [DR/QV/IS]; [DR_NO_MARL, DR_NO_MF, V_behav]
bias:[[-66.96, -2.92, -66.96]][[-66.96, -66.96, -9.3]]
std:[[0.0, 0.55, 0.0]][[0.0, 0.0, 0.29]]
MSE:[[66.96, 2.97, 66.96]][[66.96, 66.96, 9.3]]
MSE(-DR):[[0.0, -63.99, 0.0]][[0.0, 0.0, -57.66]]
***
==============
O_threshold = 110
MC for this TARGET:[65.971, 0.178]
   [DR/QV/IS]; [DR_NO_MARL, DR_NO_MF, V_behav]
bias:[[-65.97, -5.34, -65.97]][[-65.97, -65.97, -8.32]]
std:[[0.0, 0.94, 0.0]][[0.0, 0.0, 0.29]]
MSE:[[65.97, 5.42, 65.97]][[65.97, 65.97, 8.33]]
MSE(-DR):[[0.0, -60.55, 0.0]][[0.0, 0.0, -57.64]]
***
==============
******************** THIS SETTING IS GOOD ********************
[[68.37  0.97 68.37 68.37 68.37 10.72]
 [66.73  0.64 66.73 66.73 66.73  9.08]
 [66.96  2.97 66.96 66.96 66.96  9.3 ]
 [65.97  5.42 65.97 65.97 65.97  8.33]]


time spent until now: 1.5 mins

23:10, 04/08

--------------------------------------
[pattern_seed, day, sd_R] = [2, 8, 10]

max(u_O) =  168.8
O_threshold = 80
number of reward locations:  15
O_threshold = 90
number of reward locations:  12
O_threshold = 100
number of reward locations:  9
O_threshold = 110
number of reward locations:  6
target 1 in 4 DONE!
^CProcess Process-70:
Process Process-54:
Process Process-69:
Process Process-65:
Process Process-53:
Process Process-67:
Process Process-43:
Process Process-71:
Process Process-68:
Process Process-62:
Process Process-63:
Process Process-57:
Traceback (most recent call last):
  File "EC2.py", line 100, in <module>
Process Process-37:
Process Process-64:
Process Process-59:
Process Process-38:
Process Process-40:
    with_MF = with_MF, with_NO_MARL = with_NO_MARL
  File "/home/ubuntu/simu_funs.py", line 62, in simu
    value_reps = parmap(once, range(OPE_rep_times), n_cores)
  File "/home/ubuntu/_uti_basic.py", line 80, in parmap
Process Process-42:
    [q_in.put((None, None)) for _ in range(nprocs)]
  File "/home/ubuntu/_uti_basic.py", line 80, in <listcomp>
    [q_in.put((None, None)) for _ in range(nprocs)]
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/queues.py", line 82, in put
Process Process-72:
Process Process-44:
Process Process-51:
Process Process-39:
Process Process-46:
Process Process-49:
Process Process-47:
Process Process-66:
Process Process-55:
Process Process-58:
Process Process-60:
Process Process-45:
Process Process-41:
Process Process-50:
Process Process-56:
Process Process-61:
Process Process-52:
Process Process-48:
Traceback (most recent call last):
Traceback (most recent call last):
```

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  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 297, in _bootstrap
    self.run()
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 297, in _bootstrap
    self.run()
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 99, in run
    self._target(*self._args, **self._kwargs)
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 99, in run
    self._target(*self._args, **self._kwargs)
  File "/home/ubuntu/_uti_basic.py", line 67, in fun
    q_out.put((i, f(x)))
  File "/home/ubuntu/_uti_basic.py", line 67, in fun
    q_out.put((i, f(x)))
  File "/home/ubuntu/simu_funs.py", line 60, in once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/simu_funs.py", line 60, in once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/simu_funs.py", line 212, in simu_once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 297, in _bootstrap
    self.run()
  File "/home/ubuntu/simu_funs.py", line 212, in simu_once
    inner_parallel = inner_parallel)
Traceback (most recent call last):
  File "/home/ubuntu/main.py", line 156, in V_DR
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 297, in _bootstrap
    self.run()
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 297, in _bootstrap
    self.run()
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    self.run()
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 99, in run
    self._target(*self._args, **self._kwargs)
  File "/home/ubuntu/main.py", line 156, in V_DR
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 156, in <listcomp>
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 99, in run
    self._target(*self._args, **self._kwargs)
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 99, in run
    self._target(*self._args, **self._kwargs)
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 99, in run
    self._target(*self._args, **self._kwargs)
  File "/home/ubuntu/_uti_basic.py", line 67, in fun
    q_out.put((i, f(x)))
  File "/home/ubuntu/_uti_basic.py", line 67, in fun
    q_out.put((i, f(x)))
  File "/home/ubuntu/main.py", line 156, in <listcomp>
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 79, in getOneRegionValue
    CV_QV = CV_QV, penalty_range = penalty, spatial = True)
  File "/home/ubuntu/_uti_basic.py", line 67, in fun
    q_out.put((i, f(x)))
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 297, in _bootstrap
    self.run()
  File "/home/ubuntu/_uti_basic.py", line 67, in fun
    q_out.put((i, f(x)))
  File "/home/ubuntu/simu_funs.py", line 60, in once
    inner_parallel = inner_parallel)
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    inner_parallel = inner_parallel)
  File "/home/ubuntu/main.py", line 79, in getOneRegionValue
    CV_QV = CV_QV, penalty_range = penalty, spatial = True)
  File "/home/ubuntu/main.py", line 301, in computeQV
    validation_set = valid_tuples)
  File "/home/ubuntu/simu_funs.py", line 60, in once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 99, in run
    self._target(*self._args, **self._kwargs)
  File "/home/ubuntu/simu_funs.py", line 60, in once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/simu_funs.py", line 212, in simu_once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/simu_funs.py", line 212, in simu_once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/main.py", line 301, in computeQV
    validation_set = valid_tuples)
  File "/home/ubuntu/main.py", line 463, in computeQV_basic
    SA_t1.append(arr([np.concatenate([a[5], a[6], [action], [Ta] ]) for a in validation_set])) # action
  File "/home/ubuntu/simu_funs.py", line 212, in simu_once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/_uti_basic.py", line 67, in fun
    q_out.put((i, f(x)))
  File "/home/ubuntu/simu_funs.py", line 212, in simu_once
    inner_parallel = inner_parallel)
```

```
  File "/home/ubuntu/main.py", line 156, in V_DR
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 156, in V_DR
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 443, in computeQV_basic
    SA_t = np.array([np.concatenate((a[0], a[3], [a[1]], [a[4]])) for a in validation_set]) # [S, Ts, A, Ta]
  File "/home/ubuntu/main.py", line 463, in <listcomp>
    SA_t1.append(arr([np.concatenate([a[5], a[6], [action], [Ta] ]) for a in validation_set])) # action
  File "/home/ubuntu/main.py", line 156, in V_DR
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/simu_funs.py", line 60, in once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/main.py", line 156, in V_DR
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 156, in <listcomp>
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 156, in <listcomp>
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    SA_t = np.array([np.concatenate((a[0], a[3], [a[1]], [a[4]])) for a in validation_set]) # [S, Ts, A, Ta]
  File "/home/ubuntu/main.py", line 156, in <listcomp>
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/simu_funs.py", line 212, in simu_once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/main.py", line 156, in <listcomp>
    r = arr([getOneRegionValue(i) for i in range(N)])
KeyboardInterrupt
  File "/home/ubuntu/main.py", line 79, in getOneRegionValue
    CV_QV = CV_QV, penalty_range = penalty, spatial = True)
  File "/home/ubuntu/main.py", line 79, in getOneRegionValue
    CV_QV = CV_QV, penalty_range = penalty, spatial = True)
  File "/home/ubuntu/main.py", line 79, in getOneRegionValue
    CV_QV = CV_QV, penalty_range = penalty, spatial = True)
  File "/home/ubuntu/main.py", line 156, in V_DR
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 301, in computeQV
    validation_set = valid_tuples)
  File "/home/ubuntu/main.py", line 79, in getOneRegionValue
    CV_QV = CV_QV, penalty_range = penalty, spatial = True)
KeyboardInterrupt
  File "/home/ubuntu/main.py", line 307, in computeQV
    spatial = spatial, mean_field = mean_field)
  File "/home/ubuntu/main.py", line 301, in computeQV
    validation_set = valid_tuples)
  File "/home/ubuntu/main.py", line 156, in <listcomp>
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 301, in computeQV
    validation_set = valid_tuples)
  File "/home/ubuntu/main.py", line 421, in computeQV_basic
    ECKQ1 = Kg.T.dot(solve(E_right_bef_inverse, CKQ_1)) # E[CK_Q,-1]
  File "/home/ubuntu/main.py", line 423, in computeQV_basic
    left = (ECKQ1.T.dot(ECKQ1) + np.vstack((np.hstack((T * lam * KQ, zeros((2 * T, 1)))), zeros((1, 2 * T + 1))))) # Left part of (\hat{
\alpha}, \hat{\eta})
  File "/home/ubuntu/main.py", line 423, in computeQV_basic
    left = (ECKQ1.T.dot(ECKQ1) + np.vstack((np.hstack((T * lam * KQ, zeros((2 * T, 1)))), zeros((1, 2 * T + 1))))) # Left part of (\hat{
\alpha}, \hat{\eta})
  File "/home/ubuntu/main.py", line 79, in getOneRegionValue
    CV_QV = CV_QV, penalty_range = penalty, spatial = True)
  File "/home/ubuntu/main.py", line 423, in computeQV_basic
    left = (ECKQ1.T.dot(ECKQ1) + np.vstack((np.hstack((T * lam * KQ, zeros((2 * T, 1)))), zeros((1, 2 * T + 1))))) # Left part of (\hat{
\alpha}, \hat{\eta})
  File "/home/ubuntu/main.py", line 301, in computeQV
    validation_set = valid_tuples)
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    ECKQ1 = Kg.T.dot(solve(E_right_bef_inverse, CKQ_1)) # E[CK_Q,-1]
KeyboardInterrupt
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KeyboardInterrupt
KeyboardInterrupt
Traceback (most recent call last):
Traceback (most recent call last):
Traceback (most recent call last):
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 297, in _bootstrap
    self.run()
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 297, in _bootstrap
    self.run()
Traceback (most recent call last):
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 99, in run
    self._target(*self._args, **self._kwargs)
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 99, in run
    self._target(*self._args, **self._kwargs)
  File "/home/ubuntu/_uti_basic.py", line 67, in fun
    q_out.put((i, f(x)))
  File "/home/ubuntu/_uti_basic.py", line 67, in fun
    q_out.put((i, f(x)))
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 297, in _bootstrap
    self.run()
  File "/home/ubuntu/simu_funs.py", line 60, in once
```

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    inner_parallel = inner_parallel)
  File "/home/ubuntu/simu_funs.py", line 60, in once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 99, in run
    self._target(*self._args, **self._kwargs)
  File "/home/ubuntu/simu_funs.py", line 212, in simu_once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/simu_funs.py", line 212, in simu_once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/_uti_basic.py", line 67, in fun
    q_out.put((i, f(x)))
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 297, in _bootstrap
    self.run()
  File "/home/ubuntu/main.py", line 156, in V_DR
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 156, in <listcomp>
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 156, in V_DR
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/simu_funs.py", line 60, in once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 99, in run
    self._target(*self._args, **self._kwargs)
  File "/home/ubuntu/main.py", line 79, in getOneRegionValue
    CV_QV = CV_QV, penalty_range = penalty, spatial = True)
  File "/home/ubuntu/simu_funs.py", line 212, in simu_once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/main.py", line 156, in <listcomp>
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/_uti_basic.py", line 67, in fun
    q_out.put((i, f(x)))
  File "/home/ubuntu/main.py", line 301, in computeQV
    validation_set = valid_tuples)
  File "/home/ubuntu/main.py", line 156, in V_DR
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 79, in getOneRegionValue
    CV_QV = CV_QV, penalty_range = penalty, spatial = True)
  File "/home/ubuntu/simu_funs.py", line 60, in once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/main.py", line 468, in computeQV_basic
    QSA1 = alpha.T.dot(SA_GRBF(Z = Z_tilde, gamma = gamma_q, Z2 = SA_t1)).T
  File "/home/ubuntu/main.py", line 156, in <listcomp>
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 301, in computeQV
    validation_set = valid_tuples)
  File "/home/ubuntu/simu_funs.py", line 212, in simu_once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/main.py", line 350, in SA_GRBF
    K = GRBF(Z[:,:(l - 2)], Z2[:,:(l - 2)], gamma) + nonsingular
  File "/home/ubuntu/main.py", line 79, in getOneRegionValue
    CV_QV = CV_QV, penalty_range = penalty, spatial = True)
  File "/home/ubuntu/main.py", line 412, in computeQV_basic
    KQ = SA_GRBF(Z_tilde, gamma_q)
  File "/home/ubuntu/main.py", line 156, in V_DR
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/anaconda3/lib/python3.7/site-packages/sklearn/metrics/pairwise.py", line 823, in rbf_kernel
    np.exp(K, K)    # exponentiate K in-place
  File "/home/ubuntu/main.py", line 301, in computeQV
    validation_set = valid_tuples)
  File "/home/ubuntu/main.py", line 350, in SA_GRBF
    K = GRBF(Z[:,:(l - 2)], Z2[:,:(l - 2)], gamma) + nonsingular
  File "/home/ubuntu/main.py", line 156, in <listcomp>
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 468, in computeQV_basic
    QSA1 = alpha.T.dot(SA_GRBF(Z = Z_tilde, gamma = gamma_q, Z2 = SA_t1)).T
  File "/home/ubuntu/main.py", line 350, in SA_GRBF
    K = GRBF(Z[:,:(l - 2)], Z2[:,:(l - 2)], gamma) + nonsingular
  File "/home/ubuntu/anaconda3/lib/python3.7/site-packages/sklearn/metrics/pairwise.py", line 823, in rbf_kernel
    np.exp(K, K)    # exponentiate K in-place
KeyboardInterrupt
  File "/home/ubuntu/main.py", line 79, in getOneRegionValue
    CV_QV = CV_QV, penalty_range = penalty, spatial = True)
  File "/home/ubuntu/anaconda3/lib/python3.7/site-packages/sklearn/metrics/pairwise.py", line 823, in rbf_kernel
    np.exp(K, K)    # exponentiate K in-place
  File "/home/ubuntu/main.py", line 301, in computeQV
    validation_set = valid_tuples)
  File "/home/ubuntu/main.py", line 412, in computeQV_basic
    KQ = SA_GRBF(Z_tilde, gamma_q)
KeyboardInterrupt
  File "/home/ubuntu/main.py", line 350, in SA_GRBF
    K = GRBF(Z[:,:(l - 2)], Z2[:,:(l - 2)], gamma) + nonsingular
KeyboardInterrupt
  File "/home/ubuntu/anaconda3/lib/python3.7/site-packages/sklearn/metrics/pairwise.py", line 821, in rbf_kernel
    K = euclidean_distances(X, Y, squared=True)
  File "/home/ubuntu/anaconda3/lib/python3.7/site-packages/sklearn/metrics/pairwise.py", line 249, in euclidean_distances
    distances += XX
KeyboardInterrupt
Traceback (most recent call last):
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 297, in _bootstrap
```

```
    self.run()
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 99, in run
    self._target(*self._args, **self._kwargs)
  File "/home/ubuntu/_uti_basic.py", line 67, in fun
    q_out.put((i, f(x)))
  File "/home/ubuntu/simu_funs.py", line 60, in once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/simu_funs.py", line 212, in simu_once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/main.py", line 156, in V_DR
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 156, in <listcomp>
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 79, in getOneRegionValue
    CV_QV = CV_QV, penalty_range = penalty, spatial = True)
  File "/home/ubuntu/main.py", line 301, in computeQV
    validation_set = valid_tuples)
  File "/home/ubuntu/main.py", line 468, in computeQV_basic
    QSA1 = alpha.T.dot(SA_GRBF(Z = Z_tilde, gamma = gamma_q, Z2 = SA_t1)).T
  File "/home/ubuntu/main.py", line 350, in SA_GRBF
    K = GRBF(Z[:,:(l - 2)], Z2[:,:(l - 2)], gamma) + nonsingular
  File "/home/ubuntu/anaconda3/lib/python3.7/site-packages/sklearn/metrics/pairwise.py", line 822, in rbf_kernel
    K *= -gamma
KeyboardInterrupt
Traceback (most recent call last):
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  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 297, in _bootstrap
    self.run()
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 99, in run
    self._target(*self._args, **self._kwargs)
  File "/home/ubuntu/_uti_basic.py", line 67, in fun
    q_out.put((i, f(x)))
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 297, in _bootstrap
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KeyboardInterrupt
KeyboardInterrupt
KeyboardInterrupt
KeyboardInterrupt
    if not self._sem.acquire(block, timeout):
KeyboardInterrupt
ubuntu@ip-172-31-9-59:~$ export openblas_num_threads=1; export OMP_NUM_THREADS=1; python EC2.py
23:12, 04/08; num of cores:36

final sd_R trend for[10] the same

Basic setting:[T, rep_times, sd_O, sd_D, sd_u_O, w_O, w_A, [M_in_R, mean_reversion, poisO, u_O_u_D], sd_R_range, t_func] = [None, 36, No
ne, None, 30, 0.5, 1, [True, False, True, 10], [10], None]


--------------------------------------
[pattern_seed, day, sd_R] = [2, 4, 10]

max(u_O) =  168.8
O_threshold = 80
number of reward locations:  15
O_threshold = 90
number of reward locations:  12
O_threshold = 100
```

```
number of reward locations:  9
O_threshold = 110
number of reward locations:  6
target 1 in 4 DONE!
target 2 in 4 DONE!
target 3 in 4 DONE!
target 4 in 4 DONE!

----------------------------------------
Value of Behaviour policy:57.65
O_threshold = 80
MC for this TARGET:[68.368, 0.175]
   [DR/QV/IS]; [DR_NO_MARL, DR_NO_MF, V_behav]
bias:[[-68.37, -1.78, -68.37]][[-68.37, -68.37, -10.72]]
std:[[0.0, 0.75, 0.0]][[0.0, 0.0, 0.29]]
MSE:[[68.37, 1.93, 68.37]][[68.37, 68.37, 10.72]]
MSE(-DR):[[0.0, -66.44, 0.0]][[0.0, 0.0, -57.65]]
***
==============
O_threshold = 90
MC for this TARGET:[66.727, 0.165]
   [DR/QV/IS]; [DR_NO_MARL, DR_NO_MF, V_behav]
bias:[[-66.73, -1.29, -66.73]][[-66.73, -66.73, -9.08]]
std:[[0.0, 0.56, 0.0]][[0.0, 0.0, 0.29]]
MSE:[[66.73, 1.41, 66.73]][[66.73, 66.73, 9.08]]
MSE(-DR):[[0.0, -65.32, 0.0]][[0.0, 0.0, -57.65]]
***
==============
O_threshold = 100
MC for this TARGET:[66.955, 0.162]
   [DR/QV/IS]; [DR_NO_MARL, DR_NO_MF, V_behav]
bias:[[-66.96, -3.72, -66.96]][[-66.96, -66.96, -9.3]]
std:[[0.0, 0.51, 0.0]][[0.0, 0.0, 0.29]]
MSE:[[66.96, 3.75, 66.96]][[66.96, 66.96, 9.3]]
MSE(-DR):[[0.0, -63.21, 0.0]][[0.0, 0.0, -57.66]]
***
==============
O_threshold = 110
MC for this TARGET:[65.971, 0.178]
   [DR/QV/IS]; [DR_NO_MARL, DR_NO_MF, V_behav]
bias:[[-65.97, -6.08, -65.97]][[-65.97, -65.97, -8.32]]
std:[[0.0, 0.94, 0.0]][[0.0, 0.0, 0.29]]
MSE:[[65.97, 6.15, 65.97]][[65.97, 65.97, 8.33]]
MSE(-DR):[[0.0, -59.82, 0.0]][[0.0, 0.0, -57.64]]
***
==============
******************** THIS SETTING IS GOOD ********************
[[68.37  1.93 68.37 68.37 68.37 10.72]
 [66.73  1.41 66.73 66.73 66.73  9.08]
 [66.96  3.75 66.96 66.96 66.96  9.3 ]
 [65.97  6.15 65.97 65.97 65.97  8.33]]


time spent until now: 5.1 mins

23:17, 04/08

----------------------------------------
[pattern_seed, day, sd_R] = [2, 8, 10]

max(u_O) =  168.8
O_threshold = 80
number of reward locations:  15
O_threshold = 90
number of reward locations:  12
O_threshold = 100
number of reward locations:  9
O_threshold = 110
number of reward locations:  6
^CProcess Process-68:
Process Process-70:
Process Process-69:
Process Process-56:
Process Process-67:
Process Process-60:
Process Process-47:
Traceback (most recent call last):
Process Process-72:
Process Process-48:
  File "EC2.py", line 100, in <module>
Process Process-71:
Process Process-43:
    with_MF = with_MF, with_NO_MARL = with_NO_MARL
  File "/home/ubuntu/simu_funs.py", line 62, in simu
Process Process-54:
Process Process-57:
Process Process-37:
    value_reps = parmap(once, range(OPE_rep_times), n_cores)
  File "/home/ubuntu/_uti_basic.py", line 80, in parmap
```

```
Process Process-44:
Process Process-45:
    [q_in.put((None, None)) for _ in range(nprocs)]
  File "/home/ubuntu/_uti_basic.py", line 80, in <listcomp>
Process Process-55:
    [q_in.put((None, None)) for _ in range(nprocs)]
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/queues.py", line 82, in put
Traceback (most recent call last):
Traceback (most recent call last):
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 297, in _bootstrap
    self.run()
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 99, in run
    self._target(*self._args, **self._kwargs)
  File "/home/ubuntu/_uti_basic.py", line 67, in fun
    q_out.put((i, f(x)))
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 297, in _bootstrap
    self.run()
  File "/home/ubuntu/simu_funs.py", line 60, in once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 99, in run
    self._target(*self._args, **self._kwargs)
    if not self._sem.acquire(block, timeout):
  File "/home/ubuntu/simu_funs.py", line 212, in simu_once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/main.py", line 156, in V_DR
    r = arr([getOneRegionValue(i) for i in range(N)])
KeyboardInterrupt
  File "/home/ubuntu/main.py", line 156, in <listcomp>
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 79, in getOneRegionValue
    CV_QV = CV_QV, penalty_range = penalty, spatial = True)
Process Process-46:
  File "/home/ubuntu/main.py", line 301, in computeQV
    validation_set = valid_tuples)
  File "/home/ubuntu/main.py", line 463, in computeQV_basic
    if not spatial:
  File "/home/ubuntu/main.py", line 463, in <listcomp>
    if not spatial:
KeyboardInterrupt
Traceback (most recent call last):
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 297, in _bootstrap
    self.run()
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 99, in run
    self._target(*self._args, **self._kwargs)
  File "/home/ubuntu/_uti_basic.py", line 67, in fun
    q_out.put((i, f(x)))
  File "/home/ubuntu/simu_funs.py", line 60, in once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/simu_funs.py", line 212, in simu_once
    inner_parallel = inner_parallel)
Process Process-59:
  File "/home/ubuntu/main.py", line 156, in V_DR
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 156, in <listcomp>
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 79, in getOneRegionValue
    CV_QV = CV_QV, penalty_range = penalty, spatial = True)
  File "/home/ubuntu/main.py", line 301, in computeQV
    validation_set = valid_tuples)
  File "/home/ubuntu/main.py", line 412, in computeQV_basic
  File "/home/ubuntu/main.py", line 350, in SA_GRBF
    K = GRBF(Z[:,:(l - 2)], Z2[:,:(l - 2)], gamma) + nonsingular
  File "/home/ubuntu/anaconda3/lib/python3.7/site-packages/sklearn/metrics/pairwise.py", line 821, in rbf_kernel
    K = euclidean_distances(X, Y, squared=True)
  File "/home/ubuntu/anaconda3/lib/python3.7/site-packages/sklearn/metrics/pairwise.py", line 248, in euclidean_distances
    distances *= -2
Traceback (most recent call last):
KeyboardInterrupt
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 297, in _bootstrap
    self.run()
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 99, in run
    self._target(*self._args, **self._kwargs)
  File "/home/ubuntu/_uti_basic.py", line 67, in fun
    q_out.put((i, f(x)))
  File "/home/ubuntu/simu_funs.py", line 60, in once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/simu_funs.py", line 212, in simu_once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/main.py", line 156, in V_DR
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 156, in <listcomp>
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 79, in getOneRegionValue
    CV_QV = CV_QV, penalty_range = penalty, spatial = True)
  File "/home/ubuntu/main.py", line 301, in computeQV
    validation_set = valid_tuples)
  File "/home/ubuntu/main.py", line 424, in computeQV_basic
    CKQ_1 = np.hstack((C.dot(KQ), -vec1))
  File "/home/ubuntu/anaconda3/lib/python3.7/site-packages/numpy/linalg/linalg.py", line 403, in solve
```

```
    r = gufunc(a, b, signature=signature, extobj=extobj)
KeyboardInterrupt
Traceback (most recent call last):
  File "/home/ubuntu/_uti_basic.py", line 67, in fun
    q_out.put((i, f(x)))
  File "/home/ubuntu/simu_funs.py", line 60, in once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/simu_funs.py", line 212, in simu_once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/main.py", line 156, in V_DR
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 297, in _bootstrap
    self.run()
  File "/home/ubuntu/main.py", line 156, in <listcomp>
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 99, in run
    self._target(*self._args, **self._kwargs)
  File "/home/ubuntu/main.py", line 79, in getOneRegionValue
    CV_QV = CV_QV, penalty_range = penalty, spatial = True)
  File "/home/ubuntu/_uti_basic.py", line 67, in fun
    q_out.put((i, f(x)))
  File "/home/ubuntu/main.py", line 301, in computeQV
    validation_set = valid_tuples)
  File "/home/ubuntu/simu_funs.py", line 60, in once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/main.py", line 463, in computeQV_basic
    if not spatial:
  File "/home/ubuntu/simu_funs.py", line 212, in simu_once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/main.py", line 463, in <listcomp>
    if not spatial:
  File "/home/ubuntu/main.py", line 156, in V_DR
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 156, in <listcomp>
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 79, in getOneRegionValue
    CV_QV = CV_QV, penalty_range = penalty, spatial = True)
  File "/home/ubuntu/main.py", line 301, in computeQV
    validation_set = valid_tuples)
  File "/home/ubuntu/main.py", line 426, in computeQV_basic
  File "/home/ubuntu/anaconda3/lib/python3.7/site-packages/numpy/linalg/linalg.py", line 2236, in lstsq
    x, resids, rank, s = gufunc(a, b, rcond, signature=signature, extobj=extobj)
KeyboardInterrupt
KeyboardInterrupt
Process Process-52:
Traceback (most recent call last):
ubuntu@ip-172-31-9-59:~$ export openblas_num_threads=1; export OMP_NUM_THREADS=1; python EC2.py
Traceback (most recent call last):
  File "EC2.py", line 5, in <module>
    from simu_funs import *
  File "/home/ubuntu/simu_funs.py", line 4, in <module>
    from main import *
  File "/home/ubuntu/main.py", line 445
    else: # used for Cross-validation
       ^
SyntaxError: invalid syntax
ubuntu@ip-172-31-9-59:~$ export openblas_num_threads=1; export OMP_NUM_THREADS=1; python EC2.py
23:20, 04/08; num of cores:36

final sd_R trend for[10] the same

Basic setting:[T, rep_times, sd_O, sd_D, sd_u_O, w_O, w_A, [M_in_R, mean_reversion, poisO, u_O_u_D], sd_R_range, t_func] = [None, 36, No
ne, None, 30, 0.5, 1, [True, False, True, 10], [10], None]


---------------------------------------
[pattern_seed, day, sd_R] = [2, 4, 10]

max(u_O) =  168.8
O_threshold = 80
number of reward locations:  15
O_threshold = 90
number of reward locations:  12
O_threshold = 100
number of reward locations:  9
O_threshold = 110
number of reward locations:  6
Process Process-10:
Traceback (most recent call last):
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 297, in _bootstrap
    self.run()
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 99, in run
    self._target(*self._args, **self._kwargs)
  File "/home/ubuntu/_uti_basic.py", line 67, in fun
    q_out.put((i, f(x)))
  File "/home/ubuntu/simu_funs.py", line 60, in once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/simu_funs.py", line 212, in simu_once
    inner_parallel = inner_parallel)
```

```
  File "/home/ubuntu/main.py", line 156, in V_DR
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 156, in <listcomp>
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 79, in getOneRegionValue
    CV_QV = CV_QV, penalty_range = penalty, spatial = True)
  File "/home/ubuntu/main.py", line 307, in computeQV
    spatial = spatial, mean_field = mean_field)
  File "/home/ubuntu/main.py", line 441, in computeQV_basic
    return Qi_diff, V
NameError: name 'V' is not defined
Process Process-15:
Process Process-14:
Traceback (most recent call last):
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 297, in _bootstrap
    self.run()
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 99, in run
    self._target(*self._args, **self._kwargs)
  File "/home/ubuntu/_uti_basic.py", line 67, in fun
    q_out.put((i, f(x)))
  File "/home/ubuntu/simu_funs.py", line 60, in once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/simu_funs.py", line 212, in simu_once
    inner_parallel = inner_parallel)
Traceback (most recent call last):
  File "/home/ubuntu/main.py", line 156, in V_DR
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 156, in <listcomp>
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 79, in getOneRegionValue
    CV_QV = CV_QV, penalty_range = penalty, spatial = True)
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 297, in _bootstrap
    self.run()
  File "/home/ubuntu/main.py", line 307, in computeQV
    spatial = spatial, mean_field = mean_field)
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 99, in run
    self._target(*self._args, **self._kwargs)
  File "/home/ubuntu/main.py", line 441, in computeQV_basic
    return Qi_diff, V
  File "/home/ubuntu/_uti_basic.py", line 67, in fun
    q_out.put((i, f(x)))
  File "/home/ubuntu/simu_funs.py", line 60, in once
    inner_parallel = inner_parallel)
NameError: name 'V' is not defined
  File "/home/ubuntu/simu_funs.py", line 212, in simu_once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/main.py", line 156, in V_DR
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 156, in <listcomp>
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 79, in getOneRegionValue
    CV_QV = CV_QV, penalty_range = penalty, spatial = True)
  File "/home/ubuntu/main.py", line 307, in computeQV
    spatial = spatial, mean_field = mean_field)
  File "/home/ubuntu/main.py", line 441, in computeQV_basic
    return Qi_diff, V
NameError: name 'V' is not defined
Process Process-7:
Traceback (most recent call last):
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 297, in _bootstrap
    self.run()
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 99, in run
    self._target(*self._args, **self._kwargs)
  File "/home/ubuntu/_uti_basic.py", line 67, in fun
    q_out.put((i, f(x)))
  File "/home/ubuntu/simu_funs.py", line 60, in once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/simu_funs.py", line 212, in simu_once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/main.py", line 156, in V_DR
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 156, in <listcomp>
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 79, in getOneRegionValue
    CV_QV = CV_QV, penalty_range = penalty, spatial = True)
  File "/home/ubuntu/main.py", line 307, in computeQV
    spatial = spatial, mean_field = mean_field)
  File "/home/ubuntu/main.py", line 441, in computeQV_basic
    return Qi_diff, V
NameError: name 'V' is not defined
Process Process-22:
Traceback (most recent call last):
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 297, in _bootstrap
    self.run()
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 99, in run
    self._target(*self._args, **self._kwargs)
  File "/home/ubuntu/_uti_basic.py", line 67, in fun
    q_out.put((i, f(x)))
  File "/home/ubuntu/simu_funs.py", line 60, in once
```

```
    inner_parallel = inner_parallel)
  File "/home/ubuntu/simu_funs.py", line 212, in simu_once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/main.py", line 156, in V_DR
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 156, in <listcomp>
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 79, in getOneRegionValue
    CV_QV = CV_QV, penalty_range = penalty, spatial = True)
  File "/home/ubuntu/main.py", line 307, in computeQV
    spatial = spatial, mean_field = mean_field)
  File "/home/ubuntu/main.py", line 441, in computeQV_basic
    return Qi_diff, V
NameError: name 'V' is not defined
Process Process-20:
Process Process-6:
Traceback (most recent call last):
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 297, in _bootstrap
    self.run()
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 99, in run
    self._target(*self._args, **self._kwargs)
  File "/home/ubuntu/_uti_basic.py", line 67, in fun
    q_out.put((i, f(x)))
  File "/home/ubuntu/simu_funs.py", line 60, in once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/simu_funs.py", line 212, in simu_once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/main.py", line 156, in V_DR
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 156, in <listcomp>
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 79, in getOneRegionValue
    CV_QV = CV_QV, penalty_range = penalty, spatial = True)
  File "/home/ubuntu/main.py", line 307, in computeQV
    spatial = spatial, mean_field = mean_field)
  File "/home/ubuntu/main.py", line 441, in computeQV_basic
    return Qi_diff, V
NameError: name 'V' is not defined
Process Process-23:
Traceback (most recent call last):
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 297, in _bootstrap
    self.run()
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 99, in run
    self._target(*self._args, **self._kwargs)
  File "/home/ubuntu/_uti_basic.py", line 67, in fun
    q_out.put((i, f(x)))
  File "/home/ubuntu/simu_funs.py", line 60, in once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/simu_funs.py", line 212, in simu_once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/main.py", line 156, in V_DR
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 156, in <listcomp>
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 79, in getOneRegionValue
    CV_QV = CV_QV, penalty_range = penalty, spatial = True)
  File "/home/ubuntu/main.py", line 307, in computeQV
    spatial = spatial, mean_field = mean_field)
  File "/home/ubuntu/main.py", line 441, in computeQV_basic
    return Qi_diff, V
NameError: name 'V' is not defined
Traceback (most recent call last):
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 297, in _bootstrap
    self.run()
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 99, in run
    self._target(*self._args, **self._kwargs)
  File "/home/ubuntu/_uti_basic.py", line 67, in fun
    q_out.put((i, f(x)))
  File "/home/ubuntu/simu_funs.py", line 60, in once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/simu_funs.py", line 212, in simu_once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/main.py", line 156, in V_DR
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 156, in <listcomp>
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 79, in getOneRegionValue
    CV_QV = CV_QV, penalty_range = penalty, spatial = True)
  File "/home/ubuntu/main.py", line 307, in computeQV
    spatial = spatial, mean_field = mean_field)
  File "/home/ubuntu/main.py", line 441, in computeQV_basic
    return Qi_diff, V
NameError: name 'V' is not defined
Process Process-30:
Traceback (most recent call last):
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 297, in _bootstrap
    self.run()
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 99, in run
    self._target(*self._args, **self._kwargs)
```

```
  File "/home/ubuntu/_uti_basic.py", line 67, in fun
    q_out.put((i, f(x)))
  File "/home/ubuntu/simu_funs.py", line 60, in once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/simu_funs.py", line 212, in simu_once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/main.py", line 156, in V_DR
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 156, in <listcomp>
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 79, in getOneRegionValue
    CV_QV = CV_QV, penalty_range = penalty, spatial = True)
  File "/home/ubuntu/main.py", line 307, in computeQV
    spatial = spatial, mean_field = mean_field)
  File "/home/ubuntu/main.py", line 441, in computeQV_basic
    return Qi_diff, V
NameError: name 'V' is not defined
Process Process-28:
Traceback (most recent call last):
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 297, in _bootstrap
    self.run()
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 99, in run
    self._target(*self._args, **self._kwargs)
  File "/home/ubuntu/_uti_basic.py", line 67, in fun
    q_out.put((i, f(x)))
  File "/home/ubuntu/simu_funs.py", line 60, in once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/simu_funs.py", line 212, in simu_once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/main.py", line 156, in V_DR
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 156, in <listcomp>
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 79, in getOneRegionValue
    CV_QV = CV_QV, penalty_range = penalty, spatial = True)
  File "/home/ubuntu/main.py", line 307, in computeQV
    spatial = spatial, mean_field = mean_field)
  File "/home/ubuntu/main.py", line 441, in computeQV_basic
    return Qi_diff, V
NameError: name 'V' is not defined
Process Process-13:
Traceback (most recent call last):
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 297, in _bootstrap
    self.run()
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 99, in run
    self._target(*self._args, **self._kwargs)
  File "/home/ubuntu/_uti_basic.py", line 67, in fun
    q_out.put((i, f(x)))
  File "/home/ubuntu/simu_funs.py", line 60, in once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/simu_funs.py", line 212, in simu_once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/main.py", line 156, in V_DR
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 156, in <listcomp>
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 79, in getOneRegionValue
    CV_QV = CV_QV, penalty_range = penalty, spatial = True)
  File "/home/ubuntu/main.py", line 307, in computeQV
    spatial = spatial, mean_field = mean_field)
  File "/home/ubuntu/main.py", line 441, in computeQV_basic
    return Qi_diff, V
NameError: name 'V' is not defined
Process Process-17:
Traceback (most recent call last):
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 297, in _bootstrap
    self.run()
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 99, in run
    self._target(*self._args, **self._kwargs)
  File "/home/ubuntu/_uti_basic.py", line 67, in fun
    q_out.put((i, f(x)))
  File "/home/ubuntu/simu_funs.py", line 60, in once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/simu_funs.py", line 212, in simu_once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/main.py", line 156, in V_DR
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 156, in <listcomp>
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 79, in getOneRegionValue
    CV_QV = CV_QV, penalty_range = penalty, spatial = True)
  File "/home/ubuntu/main.py", line 307, in computeQV
    spatial = spatial, mean_field = mean_field)
  File "/home/ubuntu/main.py", line 441, in computeQV_basic
    return Qi_diff, V
NameError: name 'V' is not defined
Process Process-34:
Process Process-3:
Traceback (most recent call last):
```

```
Process Process-24:
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 297, in _bootstrap
    self.run()
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 99, in run
    self._target(*self._args, **self._kwargs)
  File "/home/ubuntu/_uti_basic.py", line 67, in fun
    q_out.put((i, f(x)))
  File "/home/ubuntu/simu_funs.py", line 60, in once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/simu_funs.py", line 212, in simu_once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/main.py", line 156, in V_DR
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 156, in <listcomp>
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 79, in getOneRegionValue
    CV_QV = CV_QV, penalty_range = penalty, spatial = True)
  File "/home/ubuntu/main.py", line 307, in computeQV
    spatial = spatial, mean_field = mean_field)
  File "/home/ubuntu/main.py", line 441, in computeQV_basic
    return Qi_diff, V
NameError: name 'V' is not defined
Traceback (most recent call last):
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 297, in _bootstrap
    self.run()
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 99, in run
    self._target(*self._args, **self._kwargs)
  File "/home/ubuntu/_uti_basic.py", line 67, in fun
    q_out.put((i, f(x)))
  File "/home/ubuntu/simu_funs.py", line 60, in once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/simu_funs.py", line 212, in simu_once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/main.py", line 156, in V_DR
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 156, in <listcomp>
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 79, in getOneRegionValue
    CV_QV = CV_QV, penalty_range = penalty, spatial = True)
  File "/home/ubuntu/main.py", line 307, in computeQV
    spatial = spatial, mean_field = mean_field)
  File "/home/ubuntu/main.py", line 441, in computeQV_basic
    return Qi_diff, V
Traceback (most recent call last):
NameError: name 'V' is not defined
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 297, in _bootstrap
    self.run()
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 99, in run
    self._target(*self._args, **self._kwargs)
  File "/home/ubuntu/_uti_basic.py", line 67, in fun
    q_out.put((i, f(x)))
  File "/home/ubuntu/simu_funs.py", line 60, in once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/simu_funs.py", line 212, in simu_once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/main.py", line 156, in V_DR
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 156, in <listcomp>
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 79, in getOneRegionValue
    CV_QV = CV_QV, penalty_range = penalty, spatial = True)
  File "/home/ubuntu/main.py", line 307, in computeQV
    spatial = spatial, mean_field = mean_field)
  File "/home/ubuntu/main.py", line 441, in computeQV_basic
    return Qi_diff, V
NameError: name 'V' is not defined
Process Process-9:
Traceback (most recent call last):
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 297, in _bootstrap
    self.run()
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 99, in run
    self._target(*self._args, **self._kwargs)
  File "/home/ubuntu/_uti_basic.py", line 67, in fun
    q_out.put((i, f(x)))
  File "/home/ubuntu/simu_funs.py", line 60, in once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/simu_funs.py", line 212, in simu_once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/main.py", line 156, in V_DR
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 156, in <listcomp>
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 79, in getOneRegionValue
    CV_QV = CV_QV, penalty_range = penalty, spatial = True)
  File "/home/ubuntu/main.py", line 307, in computeQV
    spatial = spatial, mean_field = mean_field)
  File "/home/ubuntu/main.py", line 441, in computeQV_basic
    return Qi_diff, V
NameError: name 'V' is not defined
```

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Process Process-19:
Traceback (most recent call last):
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 297, in _bootstrap
    self.run()
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 99, in run
    self._target(*self._args, **self._kwargs)
  File "/home/ubuntu/_uti_basic.py", line 67, in fun
    q_out.put((i, f(x)))
  File "/home/ubuntu/simu_funs.py", line 60, in once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/simu_funs.py", line 212, in simu_once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/main.py", line 156, in V_DR
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 156, in <listcomp>
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 79, in getOneRegionValue
    CV_QV = CV_QV, penalty_range = penalty, spatial = True)
  File "/home/ubuntu/main.py", line 307, in computeQV
    spatial = spatial, mean_field = mean_field)
  File "/home/ubuntu/main.py", line 441, in computeQV_basic
    return Qi_diff, V
NameError: name 'V' is not defined
Process Process-36:
Traceback (most recent call last):
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 297, in _bootstrap
    self.run()
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 99, in run
    self._target(*self._args, **self._kwargs)
  File "/home/ubuntu/_uti_basic.py", line 67, in fun
    q_out.put((i, f(x)))
  File "/home/ubuntu/simu_funs.py", line 60, in once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/simu_funs.py", line 212, in simu_once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/main.py", line 156, in V_DR
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 156, in <listcomp>
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 79, in getOneRegionValue
    CV_QV = CV_QV, penalty_range = penalty, spatial = True)
  File "/home/ubuntu/main.py", line 307, in computeQV
    spatial = spatial, mean_field = mean_field)
  File "/home/ubuntu/main.py", line 441, in computeQV_basic
    return Qi_diff, V
NameError: name 'V' is not defined
Process Process-18:
Traceback (most recent call last):
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 297, in _bootstrap
    self.run()
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 99, in run
    self._target(*self._args, **self._kwargs)
  File "/home/ubuntu/_uti_basic.py", line 67, in fun
    q_out.put((i, f(x)))
  File "/home/ubuntu/simu_funs.py", line 60, in once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/simu_funs.py", line 212, in simu_once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/main.py", line 156, in V_DR
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 156, in <listcomp>
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 79, in getOneRegionValue
    CV_QV = CV_QV, penalty_range = penalty, spatial = True)
  File "/home/ubuntu/main.py", line 307, in computeQV
    spatial = spatial, mean_field = mean_field)
  File "/home/ubuntu/main.py", line 441, in computeQV_basic
    return Qi_diff, V
NameError: name 'V' is not defined
Process Process-27:
Process Process-32:
Process Process-35:
Traceback (most recent call last):
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 297, in _bootstrap
    self.run()
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 99, in run
    self._target(*self._args, **self._kwargs)
  File "/home/ubuntu/_uti_basic.py", line 67, in fun
    q_out.put((i, f(x)))
  File "/home/ubuntu/simu_funs.py", line 60, in once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/simu_funs.py", line 212, in simu_once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/main.py", line 156, in V_DR
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 156, in <listcomp>
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 79, in getOneRegionValue
    CV_QV = CV_QV, penalty_range = penalty, spatial = True)
```

```
  File "/home/ubuntu/main.py", line 307, in computeQV
    spatial = spatial, mean_field = mean_field)
  File "/home/ubuntu/main.py", line 441, in computeQV_basic
    return Qi_diff, V
NameError: name 'V' is not defined
Traceback (most recent call last):
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 297, in _bootstrap
    self.run()
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 99, in run
    self._target(*self._args, **self._kwargs)
  File "/home/ubuntu/_uti_basic.py", line 67, in fun
    q_out.put((i, f(x)))
  File "/home/ubuntu/simu_funs.py", line 60, in once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/simu_funs.py", line 212, in simu_once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/main.py", line 156, in V_DR
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 156, in <listcomp>
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 79, in getOneRegionValue
    CV_QV = CV_QV, penalty_range = penalty, spatial = True)
  File "/home/ubuntu/main.py", line 307, in computeQV
    spatial = spatial, mean_field = mean_field)
  File "/home/ubuntu/main.py", line 441, in computeQV_basic
    return Qi_diff, V
NameError: name 'V' is not defined
Traceback (most recent call last):
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 297, in _bootstrap
    self.run()
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 99, in run
    self._target(*self._args, **self._kwargs)
  File "/home/ubuntu/_uti_basic.py", line 67, in fun
    q_out.put((i, f(x)))
  File "/home/ubuntu/simu_funs.py", line 60, in once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/simu_funs.py", line 212, in simu_once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/main.py", line 156, in V_DR
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 156, in <listcomp>
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 79, in getOneRegionValue
    CV_QV = CV_QV, penalty_range = penalty, spatial = True)
  File "/home/ubuntu/main.py", line 307, in computeQV
    spatial = spatial, mean_field = mean_field)
  File "/home/ubuntu/main.py", line 441, in computeQV_basic
    return Qi_diff, V
NameError: name 'V' is not defined
Process Process-29:
Traceback (most recent call last):
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 297, in _bootstrap
    self.run()
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 99, in run
    self._target(*self._args, **self._kwargs)
  File "/home/ubuntu/_uti_basic.py", line 67, in fun
    q_out.put((i, f(x)))
  File "/home/ubuntu/simu_funs.py", line 60, in once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/simu_funs.py", line 212, in simu_once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/main.py", line 156, in V_DR
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 156, in <listcomp>
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 79, in getOneRegionValue
    CV_QV = CV_QV, penalty_range = penalty, spatial = True)
  File "/home/ubuntu/main.py", line 307, in computeQV
    spatial = spatial, mean_field = mean_field)
  File "/home/ubuntu/main.py", line 441, in computeQV_basic
    return Qi_diff, V
NameError: name 'V' is not defined
Process Process-25:
Traceback (most recent call last):
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 297, in _bootstrap
    self.run()
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 99, in run
    self._target(*self._args, **self._kwargs)
  File "/home/ubuntu/_uti_basic.py", line 67, in fun
    q_out.put((i, f(x)))
  File "/home/ubuntu/simu_funs.py", line 60, in once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/simu_funs.py", line 212, in simu_once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/main.py", line 156, in V_DR
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 156, in <listcomp>
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 79, in getOneRegionValue
```

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    CV_QV = CV_QV, penalty_range = penalty, spatial = True)
  File "/home/ubuntu/main.py", line 307, in computeQV
    spatial = spatial, mean_field = mean_field)
  File "/home/ubuntu/main.py", line 441, in computeQV_basic
    return Qi_diff, V
NameError: name 'V' is not defined
Process Process-33:
Traceback (most recent call last):
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 297, in _bootstrap
    self.run()
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 99, in run
    self._target(*self._args, **self._kwargs)
  File "/home/ubuntu/_uti_basic.py", line 67, in fun
    q_out.put((i, f(x)))
  File "/home/ubuntu/simu_funs.py", line 60, in once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/simu_funs.py", line 212, in simu_once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/main.py", line 156, in V_DR
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 156, in <listcomp>
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 79, in getOneRegionValue
    CV_QV = CV_QV, penalty_range = penalty, spatial = True)
  File "/home/ubuntu/main.py", line 307, in computeQV
    spatial = spatial, mean_field = mean_field)
  File "/home/ubuntu/main.py", line 441, in computeQV_basic
    return Qi_diff, V
NameError: name 'V' is not defined
Process Process-11:
Traceback (most recent call last):
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 297, in _bootstrap
    self.run()
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 99, in run
    self._target(*self._args, **self._kwargs)
  File "/home/ubuntu/_uti_basic.py", line 67, in fun
    q_out.put((i, f(x)))
  File "/home/ubuntu/simu_funs.py", line 60, in once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/simu_funs.py", line 212, in simu_once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/main.py", line 156, in V_DR
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 156, in <listcomp>
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 79, in getOneRegionValue
    CV_QV = CV_QV, penalty_range = penalty, spatial = True)
  File "/home/ubuntu/main.py", line 307, in computeQV
    spatial = spatial, mean_field = mean_field)
  File "/home/ubuntu/main.py", line 441, in computeQV_basic
    return Qi_diff, V
NameError: name 'V' is not defined
Process Process-12:
Traceback (most recent call last):
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 297, in _bootstrap
    self.run()
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 99, in run
    self._target(*self._args, **self._kwargs)
  File "/home/ubuntu/_uti_basic.py", line 67, in fun
    q_out.put((i, f(x)))
  File "/home/ubuntu/simu_funs.py", line 60, in once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/simu_funs.py", line 212, in simu_once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/main.py", line 156, in V_DR
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 156, in <listcomp>
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 79, in getOneRegionValue
    CV_QV = CV_QV, penalty_range = penalty, spatial = True)
  File "/home/ubuntu/main.py", line 307, in computeQV
    spatial = spatial, mean_field = mean_field)
  File "/home/ubuntu/main.py", line 441, in computeQV_basic
    return Qi_diff, V
NameError: name 'V' is not defined
Process Process-16:
Traceback (most recent call last):
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 297, in _bootstrap
    self.run()
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 99, in run
    self._target(*self._args, **self._kwargs)
  File "/home/ubuntu/_uti_basic.py", line 67, in fun
    q_out.put((i, f(x)))
  File "/home/ubuntu/simu_funs.py", line 60, in once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/simu_funs.py", line 212, in simu_once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/main.py", line 156, in V_DR
    r = arr([getOneRegionValue(i) for i in range(N)])
```

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  File "/home/ubuntu/main.py", line 156, in <listcomp>
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 79, in getOneRegionValue
    CV_QV = CV_QV, penalty_range = penalty, spatial = True)
  File "/home/ubuntu/main.py", line 307, in computeQV
    spatial = spatial, mean_field = mean_field)
  File "/home/ubuntu/main.py", line 441, in computeQV_basic
    return Qi_diff, V
NameError: name 'V' is not defined
Process Process-1:
Traceback (most recent call last):
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 297, in _bootstrap
    self.run()
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 99, in run
    self._target(*self._args, **self._kwargs)
  File "/home/ubuntu/_uti_basic.py", line 67, in fun
    q_out.put((i, f(x)))
  File "/home/ubuntu/simu_funs.py", line 60, in once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/simu_funs.py", line 212, in simu_once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/main.py", line 156, in V_DR
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 156, in <listcomp>
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 79, in getOneRegionValue
    CV_QV = CV_QV, penalty_range = penalty, spatial = True)
  File "/home/ubuntu/main.py", line 307, in computeQV
    spatial = spatial, mean_field = mean_field)
  File "/home/ubuntu/main.py", line 441, in computeQV_basic
    return Qi_diff, V
NameError: name 'V' is not defined
Process Process-4:
Traceback (most recent call last):
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 297, in _bootstrap
    self.run()
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 99, in run
    self._target(*self._args, **self._kwargs)
  File "/home/ubuntu/_uti_basic.py", line 67, in fun
    q_out.put((i, f(x)))
  File "/home/ubuntu/simu_funs.py", line 60, in once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/simu_funs.py", line 212, in simu_once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/main.py", line 156, in V_DR
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 156, in <listcomp>
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 79, in getOneRegionValue
    CV_QV = CV_QV, penalty_range = penalty, spatial = True)
  File "/home/ubuntu/main.py", line 307, in computeQV
    spatial = spatial, mean_field = mean_field)
  File "/home/ubuntu/main.py", line 441, in computeQV_basic
    return Qi_diff, V
NameError: name 'V' is not defined
Process Process-31:
Traceback (most recent call last):
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 297, in _bootstrap
    self.run()
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 99, in run
    self._target(*self._args, **self._kwargs)
  File "/home/ubuntu/_uti_basic.py", line 67, in fun
    q_out.put((i, f(x)))
  File "/home/ubuntu/simu_funs.py", line 60, in once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/simu_funs.py", line 212, in simu_once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/main.py", line 156, in V_DR
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 156, in <listcomp>
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 79, in getOneRegionValue
    CV_QV = CV_QV, penalty_range = penalty, spatial = True)
  File "/home/ubuntu/main.py", line 307, in computeQV
    spatial = spatial, mean_field = mean_field)
  File "/home/ubuntu/main.py", line 441, in computeQV_basic
    return Qi_diff, V
NameError: name 'V' is not defined
Process Process-8:
Traceback (most recent call last):
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 297, in _bootstrap
    self.run()
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 99, in run
    self._target(*self._args, **self._kwargs)
  File "/home/ubuntu/_uti_basic.py", line 67, in fun
    q_out.put((i, f(x)))
  File "/home/ubuntu/simu_funs.py", line 60, in once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/simu_funs.py", line 212, in simu_once
```

```
    inner_parallel = inner_parallel)
  File "/home/ubuntu/main.py", line 156, in V_DR
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 156, in <listcomp>
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 79, in getOneRegionValue
    CV_QV = CV_QV, penalty_range = penalty, spatial = True)
  File "/home/ubuntu/main.py", line 307, in computeQV
    spatial = spatial, mean_field = mean_field)
  File "/home/ubuntu/main.py", line 441, in computeQV_basic
    return Qi_diff, V
NameError: name 'V' is not defined
Process Process-2:
Traceback (most recent call last):
Process Process-5:
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 297, in _bootstrap
    self.run()
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 99, in run
    self._target(*self._args, **self._kwargs)
  File "/home/ubuntu/_uti_basic.py", line 67, in fun
    q_out.put((i, f(x)))
  File "/home/ubuntu/simu_funs.py", line 60, in once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/simu_funs.py", line 212, in simu_once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/main.py", line 156, in V_DR
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 156, in <listcomp>
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 79, in getOneRegionValue
    CV_QV = CV_QV, penalty_range = penalty, spatial = True)
  File "/home/ubuntu/main.py", line 307, in computeQV
    spatial = spatial, mean_field = mean_field)
  File "/home/ubuntu/main.py", line 441, in computeQV_basic
    return Qi_diff, V
NameError: name 'V' is not defined
Traceback (most recent call last):
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 297, in _bootstrap
    self.run()
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 99, in run
    self._target(*self._args, **self._kwargs)
  File "/home/ubuntu/_uti_basic.py", line 67, in fun
    q_out.put((i, f(x)))
  File "/home/ubuntu/simu_funs.py", line 60, in once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/simu_funs.py", line 212, in simu_once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/main.py", line 156, in V_DR
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 156, in <listcomp>
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 79, in getOneRegionValue
    CV_QV = CV_QV, penalty_range = penalty, spatial = True)
  File "/home/ubuntu/main.py", line 307, in computeQV
    spatial = spatial, mean_field = mean_field)
  File "/home/ubuntu/main.py", line 441, in computeQV_basic
    return Qi_diff, V
NameError: name 'V' is not defined
Process Process-21:
Traceback (most recent call last):
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 297, in _bootstrap
    self.run()
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 99, in run
    self._target(*self._args, **self._kwargs)
  File "/home/ubuntu/_uti_basic.py", line 67, in fun
    q_out.put((i, f(x)))
  File "/home/ubuntu/simu_funs.py", line 60, in once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/simu_funs.py", line 212, in simu_once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/main.py", line 156, in V_DR
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 156, in <listcomp>
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 79, in getOneRegionValue
    CV_QV = CV_QV, penalty_range = penalty, spatial = True)
  File "/home/ubuntu/main.py", line 307, in computeQV
    spatial = spatial, mean_field = mean_field)
  File "/home/ubuntu/main.py", line 441, in computeQV_basic
    return Qi_diff, V
NameError: name 'V' is not defined
Process Process-26:
Traceback (most recent call last):
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 297, in _bootstrap
    self.run()
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 99, in run
    self._target(*self._args, **self._kwargs)
  File "/home/ubuntu/_uti_basic.py", line 67, in fun
    q_out.put((i, f(x)))
```

```
  File "/home/ubuntu/simu_funs.py", line 60, in once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/simu_funs.py", line 212, in simu_once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/main.py", line 156, in V_DR
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 156, in <listcomp>
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 79, in getOneRegionValue
    CV_QV = CV_QV, penalty_range = penalty, spatial = True)
  File "/home/ubuntu/main.py", line 307, in computeQV
    spatial = spatial, mean_field = mean_field)
  File "/home/ubuntu/main.py", line 441, in computeQV_basic
    return Qi_diff, V
NameError: name 'V' is not defined
^[[A
^CTraceback (most recent call last):
  File "EC2.py", line 100, in <module>
    with_MF = with_MF, with_NO_MARL = with_NO_MARL
  File "/home/ubuntu/simu_funs.py", line 62, in simu
    value_reps = parmap(once, range(OPE_rep_times), n_cores)
  File "/home/ubuntu/_uti_basic.py", line 80, in parmap
    [q_in.put((None, None)) for _ in range(nprocs)]
  File "/home/ubuntu/_uti_basic.py", line 80, in <listcomp>
    [q_in.put((None, None)) for _ in range(nprocs)]
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/queues.py", line 82, in put
    if not self._sem.acquire(block, timeout):
KeyboardInterrupt
ubuntu@ip-172-31-9-59:~$ export openblas_num_threads=1; export OMP_NUM_THREADS=1; python EC2.py

23:20, 04/08; num of cores:36

final sd_R trend for[10] the same

Basic setting:[T, rep_times, sd_O, sd_D, sd_u_O, w_O, w_A, [M_in_R, mean_reversion, pois0, u_O_u_D], sd_R_range, t_func] = [None, 36, No
ne, None, 30, 0.5, 1, [True, False, True, 10], [10], None]


--------------------------------------
[pattern_seed, day, sd_R] = [2, 4, 10]

max(u_O) =  168.8
O_threshold = 80
number of reward locations:  15
O_threshold = 90
number of reward locations:  12
O_threshold = 100
number of reward locations:  9
O_threshold = 110
number of reward locations:  6
target 1 in 4 DONE!
target 2 in 4 DONE!
target 3 in 4 DONE!
target 4 in 4 DONE!

----------------------------------------
Value of Behaviour policy:57.65
O_threshold = 80
MC for this TARGET:[68.368, 0.175]
   [DR/QV/IS]; [DR_NO_MARL, DR_NO_MF, V_behav]
bias:[[-68.37, -10.72, -68.37]][[-68.37, -68.37, -10.72]]
std:[[0.0, 0.3, 0.0]][[0.0, 0.0, 0.29]]
MSE:[[68.37, 10.72, 68.37]][[68.37, 68.37, 10.72]]
MSE(-DR):[[0.0, -57.65, 0.0]][[0.0, 0.0, -57.65]]
***
==============
O_threshold = 90
MC for this TARGET:[66.727, 0.165]
   [DR/QV/IS]; [DR_NO_MARL, DR_NO_MF, V_behav]
bias:[[-66.73, -9.08, -66.73]][[-66.73, -66.73, -9.08]]
std:[[0.0, 0.3, 0.0]][[0.0, 0.0, 0.29]]
MSE:[[66.73, 9.08, 66.73]][[66.73, 66.73, 9.08]]
MSE(-DR):[[0.0, -57.65, 0.0]][[0.0, 0.0, -57.65]]
***
==============
O_threshold = 100
MC for this TARGET:[66.955, 0.162]
   [DR/QV/IS]; [DR_NO_MARL, DR_NO_MF, V_behav]
bias:[[-66.96, -9.31, -66.96]][[-66.96, -66.96, -9.3]]
std:[[0.0, 0.3, 0.0]][[0.0, 0.0, 0.29]]
MSE:[[66.96, 9.31, 66.96]][[66.96, 66.96, 9.3]]
MSE(-DR):[[0.0, -57.65, 0.0]][[0.0, 0.0, -57.66]]
***
==============
O_threshold = 110
MC for this TARGET:[65.971, 0.178]
   [DR/QV/IS]; [DR_NO_MARL, DR_NO_MF, V_behav]
bias:[[-65.97, -8.32, -65.97]][[-65.97, -65.97, -8.32]]
std:[[0.0, 0.3, 0.0]][[0.0, 0.0, 0.29]]
```

```
MSE:[[65.97, 8.33, 65.97]][[65.97, 65.97, 8.33]]
MSE(-DR):[[0.0, -57.64, 0.0]][[0.0, 0.0, -57.64]]
***
==============
******************** THIS SETTING IS GOOD ********************
[[68.37 10.72 68.37 68.37 68.37 10.72]
 [66.73  9.08 66.73 66.73 66.73  9.08]
 [66.96  9.31 66.96 66.96 66.96  9.3 ]
 [65.97  8.33 65.97 65.97 65.97  8.33]]


time spent until now: 1.4 mins

23:22, 04/08

---------------------------------------
[pattern_seed, day, sd_R] = [2, 8, 10]

max(u_O) =  168.8
O_threshold = 80
number of reward locations:  15
O_threshold = 90
number of reward locations:  12
O_threshold = 100
number of reward locations:  9
O_threshold = 110
number of reward locations:  6
^CProcess Process-67:
Process Process-69:
Process Process-59:
Process Process-47:
Process Process-52:
Process Process-51:
Process Process-49:
Process Process-50:
Process Process-48:
Process Process-46:
Process Process-53:
Process Process-70:
Process Process-37:
Process Process-57:
Traceback (most recent call last):
  File "EC2.py", line 100, in <module>
Process Process-41:
Process Process-63:
Process Process-55:
Process Process-60:
Process Process-42:
    with_MF = with_MF, with_NO_MARL = with_NO_MARL
Process Process-44:
  File "/home/ubuntu/simu_funs.py", line 62, in simu
    value_reps = parmap(once, range(OPE_rep_times), n_cores)
  File "/home/ubuntu/_uti_basic.py", line 80, in parmap
    [q_in.put((None, None)) for _ in range(nprocs)]
  File "/home/ubuntu/_uti_basic.py", line 80, in <listcomp>
Process Process-56:
    [q_in.put((None, None)) for _ in range(nprocs)]
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/queues.py", line 82, in put
Process Process-72:
    if not self._sem.acquire(block, timeout):
KeyboardInterrupt
Traceback (most recent call last):
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 297, in _bootstrap
    self.run()
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 99, in run
    self._target(*self._args, **self._kwargs)
  File "/home/ubuntu/_uti_basic.py", line 67, in fun
    q_out.put((i, f(x)))
  File "/home/ubuntu/simu_funs.py", line 60, in once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/simu_funs.py", line 212, in simu_once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/main.py", line 156, in V_DR
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 156, in <listcomp>
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 79, in getOneRegionValue
    CV_QV = CV_QV, penalty_range = penalty, spatial = True)
  File "/home/ubuntu/main.py", line 301, in computeQV
    validation_set = valid_tuples)
  File "/home/ubuntu/main.py", line 427, in computeQV_basic
    left = (ECKQ1.T.dot(ECKQ1) + np.vstack((np.hstack((T * lam * KQ, zeros((2 * T, 1)))), zeros((1, 2 * T + 1))))) # Left part of (\hat{
\alpha}, \hat{\eta})
Traceback (most recent call last):
KeyboardInterrupt
Traceback (most recent call last):
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 297, in _bootstrap
    self.run()
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 297, in _bootstrap
```

```
    self.run()
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 99, in run
    self._target(*self._args, **self._kwargs)
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 99, in run
    self._target(*self._args, **self._kwargs)
  File "/home/ubuntu/_uti_basic.py", line 67, in fun
    q_out.put((i, f(x)))
  File "/home/ubuntu/_uti_basic.py", line 67, in fun
    q_out.put((i, f(x)))
  File "/home/ubuntu/simu_funs.py", line 60, in once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/simu_funs.py", line 60, in once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/simu_funs.py", line 212, in simu_once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/simu_funs.py", line 212, in simu_once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/main.py", line 156, in V_DR
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 156, in V_DR
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 156, in <listcomp>
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 156, in <listcomp>
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 79, in getOneRegionValue
    CV_QV = CV_QV, penalty_range = penalty, spatial = True)
  File "/home/ubuntu/main.py", line 79, in getOneRegionValue
    CV_QV = CV_QV, penalty_range = penalty, spatial = True)
  File "/home/ubuntu/main.py", line 301, in computeQV
    validation_set = valid_tuples)
  File "/home/ubuntu/main.py", line 301, in computeQV
    validation_set = valid_tuples)
  File "/home/ubuntu/main.py", line 416, in computeQV_basic
    KQ = SA_GRBF(Z_tilde, gamma_q)
  File "/home/ubuntu/main.py", line 473, in computeQV_basic
    SA_t1.append(arr([np.concatenate([a[5], a[6], [action], [Ta] ]) for a in validation_set])) # action
  File "/home/ubuntu/main.py", line 343, in SA_GRBF
    nonsingular = identity(T) * 1e-8
  File "/home/ubuntu/main.py", line 473, in <listcomp>
    SA_t1.append(arr([np.concatenate([a[5], a[6], [action], [Ta] ]) for a in validation_set])) # action
KeyboardInterrupt
KeyboardInterrupt
Traceback (most recent call last):
Traceback (most recent call last):
Traceback (most recent call last):
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 297, in _bootstrap
    self.run()
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 297, in _bootstrap
    self.run()
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 99, in run
    self._target(*self._args, **self._kwargs)
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 99, in run
    self._target(*self._args, **self._kwargs)
  File "/home/ubuntu/_uti_basic.py", line 67, in fun
    q_out.put((i, f(x)))
  File "/home/ubuntu/simu_funs.py", line 60, in once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/_uti_basic.py", line 67, in fun
    q_out.put((i, f(x)))
  File "/home/ubuntu/simu_funs.py", line 212, in simu_once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/simu_funs.py", line 60, in once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/main.py", line 156, in V_DR
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/simu_funs.py", line 212, in simu_once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/main.py", line 156, in <listcomp>
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 156, in V_DR
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 79, in getOneRegionValue
    CV_QV = CV_QV, penalty_range = penalty, spatial = True)
  File "/home/ubuntu/main.py", line 156, in <listcomp>
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 79, in getOneRegionValue
    CV_QV = CV_QV, penalty_range = penalty, spatial = True)
  File "/home/ubuntu/main.py", line 301, in computeQV
    validation_set = valid_tuples)
  File "/home/ubuntu/main.py", line 425, in computeQV_basic
    ECKQ1 = Kg.T.dot(solve(E_right_bef_inverse, CKQ_1)) # E[CK_Q,-1]
ubuntu@ip-172-31-9-59:~$ export openblas_num_threads=1; export OMP_NUM_THREADS=1; python EC2.py
23:23, 04/08; num of cores:36

final sd_R trend for[10] the same

Basic setting:[T, rep_times, sd_O, sd_D, sd_u_O, w_O, w_A, [M_in_R, mean_reversion, poisO, u_O_u_D], sd_R_range, t_func] = [None, 36, No
ne, None, 30, 0.5, 1, [True, False, True, 10], [10], None]
```

```
--------------------------------------
[pattern_seed, day, sd_R] = [2, 4, 10]

max(u_O) =  168.8
O_threshold = 80
number of reward locations:  15
O_threshold = 90
number of reward locations:  12
O_threshold = 100
number of reward locations:  9
O_threshold = 110
number of reward locations:  6
target 1 in 4 DONE!
target 2 in 4 DONE!
target 3 in 4 DONE!
target 4 in 4 DONE!

--------------------------------------
Value of Behaviour policy:57.65
O_threshold = 80
MC for this TARGET:[68.368, 0.175]
   [DR/QV/IS]; [DR_NO_MARL, DR_NO_MF, V_behav]
bias:[[-68.37, -9.11, -68.37]][[-68.37, -68.37, -10.72]]
std:[[0.0, 0.43, 0.0]][[0.0, 0.0, 0.29]]
MSE:[[68.37, 9.12, 68.37]][[68.37, 68.37, 10.72]]
MSE(-DR):[[0.0, -59.25, 0.0]][[0.0, 0.0, -57.65]]
***
==============
O_threshold = 90
MC for this TARGET:[66.727, 0.165]
   [DR/QV/IS]; [DR_NO_MARL, DR_NO_MF, V_behav]
bias:[[-66.73, -8.25, -66.73]][[-66.73, -66.73, -9.08]]
std:[[0.0, 0.37, 0.0]][[0.0, 0.0, 0.29]]
MSE:[[66.73, 8.26, 66.73]][[66.73, 66.73, 9.08]]
MSE(-DR):[[0.0, -58.47, 0.0]][[0.0, 0.0, -57.65]]
***
==============
O_threshold = 100
MC for this TARGET:[66.955, 0.162]
   [DR/QV/IS]; [DR_NO_MARL, DR_NO_MF, V_behav]
bias:[[-66.96, -8.98, -66.96]][[-66.96, -66.96, -9.3]]
std:[[0.0, 0.37, 0.0]][[0.0, 0.0, 0.29]]
MSE:[[66.96, 8.99, 66.96]][[66.96, 66.96, 9.3]]
MSE(-DR):[[0.0, -57.97, 0.0]][[0.0, 0.0, -57.66]]
***
==============
O_threshold = 110
MC for this TARGET:[65.971, 0.178]
   [DR/QV/IS]; [DR_NO_MARL, DR_NO_MF, V_behav]
bias:[[-65.97, -8.53, -65.97]][[-65.97, -65.97, -8.32]]
std:[[0.0, 0.41, 0.0]][[0.0, 0.0, 0.29]]
MSE:[[65.97, 8.54, 65.97]][[65.97, 65.97, 8.33]]
MSE(-DR):[[0.0, -57.43, 0.0]][[0.0, 0.0, -57.64]]
***
==============
******************** THIS SETTING IS GOOD ********************
[[68.37  9.12 68.37 68.37 68.37 10.72]
 [66.73  8.26 66.73 66.73 66.73  9.08]
 [66.96  8.99 66.96 66.96 66.96  9.3 ]
 [65.97  8.54 65.97 65.97 65.97  8.33]]


time spent until now: 1.5 mins

23:25, 04/08

--------------------------------------
[pattern_seed, day, sd_R] = [2, 8, 10]

max(u_O) =  168.8
O_threshold = 80
number of reward locations:  15
O_threshold = 90
number of reward locations:  12
O_threshold = 100
number of reward locations:  9
O_threshold = 110
number of reward locations:  6
^CProcess Process-70:
Process Process-62:
Process Process-60:
Traceback (most recent call last):
Process Process-40:
  File "EC2.py", line 100, in <module>
Process Process-41:
Process Process-61:
    with_MF = with_MF, with_NO_MARL = with_NO_MARL
```

```
Process Process-68:
Process Process-44:
  File "/home/ubuntu/simu_funs.py", line 62, in simu
Process Process-63:
Process Process-55:
    value_reps = parmap(once, range(OPE_rep_times), n_cores)
  File "/home/ubuntu/_uti_basic.py", line 80, in parmap
Process Process-50:
    [q_in.put((None, None)) for _ in range(nprocs)]
  File "/home/ubuntu/_uti_basic.py", line 80, in <listcomp>
    [q_in.put((None, None)) for _ in range(nprocs)]
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/queues.py", line 82, in put
    if not self._sem.acquire(block, timeout):
KeyboardInterrupt
Process Process-71:
Traceback (most recent call last):
Traceback (most recent call last):
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 297, in _bootstrap
    self.run()
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 297, in _bootstrap
    self.run()
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 99, in run
    self._target(*self._args, **self._kwargs)
  File "/home/ubuntu/_uti_basic.py", line 67, in fun
    q_out.put((i, f(x)))
Process Process-37:
  File "/home/ubuntu/simu_funs.py", line 60, in once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/simu_funs.py", line 212, in simu_once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/main.py", line 156, in V_DR
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 156, in <listcomp>
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 79, in getOneRegionValue
    CV_QV = CV_QV, penalty_range = penalty, spatial = True)
  File "/home/ubuntu/main.py", line 301, in computeQV
    validation_set = valid_tuples)
  File "/home/ubuntu/main.py", line 417, in computeQV_basic
    KQ = SA_GRBF(Z_tilde, gamma_q)
  File "/home/ubuntu/main.py", line 343, in SA_GRBF
    nonsingular = identity(T) * 1e-8
KeyboardInterrupt
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 99, in run
    self._target(*self._args, **self._kwargs)
  File "/home/ubuntu/_uti_basic.py", line 67, in fun
    q_out.put((i, f(x)))
  File "/home/ubuntu/simu_funs.py", line 60, in once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/simu_funs.py", line 212, in simu_once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/main.py", line 156, in V_DR
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 156, in <listcomp>
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 79, in getOneRegionValue
    CV_QV = CV_QV, penalty_range = penalty, spatial = True)
  File "/home/ubuntu/main.py", line 307, in computeQV
    spatial = spatial, mean_field = mean_field)
  File "/home/ubuntu/main.py", line 417, in computeQV_basic
    KQ = SA_GRBF(Z_tilde, gamma_q)
  File "/home/ubuntu/main.py", line 352, in SA_GRBF
    K = GRBF(Z, Z2, gamma) + nonsingular
KeyboardInterrupt
Traceback (most recent call last):
ubuntu@ip-172-31-9-59:~$ export openblas_num_threads=1; export OMP_NUM_THREADS=1; python EC2.py
23:25, 04/08; num of cores:36

final sd_R trend for[10] the same

Basic setting:[T, rep_times, sd_O, sd_D, sd_u_O, w_O, w_A, [M_in_R, mean_reversion, poisO, u_O_u_D], sd_R_range, t_func] = [None, 36, No
ne, None, 30, 0.5, 1, [True, False, True, 10], [10], None]


--------------------------------------
[pattern_seed, day, sd_R] = [2, 4, 10]

max(u_O) =  168.8
O_threshold = 80
number of reward locations:  15
O_threshold = 90
number of reward locations:  12
O_threshold = 100
number of reward locations:  9
O_threshold = 110
number of reward locations:  6
target 1 in 4 DONE!
target 2 in 4 DONE!
target 3 in 4 DONE!
```

```
target 4 in 4 DONE!

---------------------------------------
Value of Behaviour policy:57.65
O_threshold = 80
MC for this TARGET:[68.368, 0.175]
   [DR/QV/IS]; [DR_NO_MARL, DR_NO_MF, V_behav]
bias:[[-68.37, -0.65, -68.37]][[-68.37, -68.37, -10.72]]
std:[[0.0, 0.72, 0.0]][[0.0, 0.0, 0.29]]
MSE:[[68.37, 0.97, 68.37]][[68.37, 68.37, 10.72]]
MSE(-DR):[[0.0, -67.4, 0.0]][[0.0, 0.0, -57.65]]
***
==============
O_threshold = 90
MC for this TARGET:[66.727, 0.165]
   [DR/QV/IS]; [DR_NO_MARL, DR_NO_MF, V_behav]
bias:[[-66.73, -0.38, -66.73]][[-66.73, -66.73, -9.08]]
std:[[0.0, 0.52, 0.0]][[0.0, 0.0, 0.29]]
MSE:[[66.73, 0.64, 66.73]][[66.73, 66.73, 9.08]]
MSE(-DR):[[0.0, -66.09, 0.0]][[0.0, 0.0, -57.65]]
***
==============
O_threshold = 100
MC for this TARGET:[66.955, 0.162]
   [DR/QV/IS]; [DR_NO_MARL, DR_NO_MF, V_behav]
bias:[[-66.96, -2.92, -66.96]][[-66.96, -66.96, -9.3]]
std:[[0.0, 0.55, 0.0]][[0.0, 0.0, 0.29]]
MSE:[[66.96, 2.97, 66.96]][[66.96, 66.96, 9.3]]
MSE(-DR):[[0.0, -63.99, 0.0]][[0.0, 0.0, -57.66]]
***
==============
O_threshold = 110
MC for this TARGET:[65.971, 0.178]
   [DR/QV/IS]; [DR_NO_MARL, DR_NO_MF, V_behav]
bias:[[-65.97, -5.34, -65.97]][[-65.97, -65.97, -8.32]]
std:[[0.0, 0.94, 0.0]][[0.0, 0.0, 0.29]]
MSE:[[65.97, 5.42, 65.97]][[65.97, 65.97, 8.33]]
MSE(-DR):[[0.0, -60.55, 0.0]][[0.0, 0.0, -57.64]]
***
==============
******************** THIS SETTING IS GOOD ********************
[[68.37  0.97 68.37 68.37 68.37 10.72]
 [66.73  0.64 66.73 66.73 66.73  9.08]
 [66.96  2.97 66.96 66.96 66.96  9.3 ]
 [65.97  5.42 65.97 65.97 65.97  8.33]]


time spent until now: 1.5 mins

23:27, 04/08

---------------------------------------
[pattern_seed, day, sd_R] = [2, 8, 10]

max(u_O) =  168.8
O_threshold = 80
number of reward locations:  15
O_threshold = 90
number of reward locations:  12
O_threshold = 100
number of reward locations:  9
O_threshold = 110
number of reward locations:  6
target 1 in 4 DONE!
target 2 in 4 DONE!
^CProcess Process-59:
Process Process-56:
Process Process-64:
Process Process-55:
Process Process-61:
Process Process-58:
Process Process-44:
Traceback (most recent call last):
  File "EC2.py", line 100, in <module>
Process Process-51:
Process Process-40:
    with_MF = with_MF, with_NO_MARL = with_NO_MARL
  File "/home/ubuntu/simu_funs.py", line 62, in simu
Process Process-49:
    value_reps = parmap(once, range(OPE_rep_times), n_cores)
  File "/home/ubuntu/_uti_basic.py", line 80, in parmap
    [q_in.put((None, None)) for _ in range(nprocs)]
  File "/home/ubuntu/_uti_basic.py", line 80, in <listcomp>
Process Process-71:
    [q_in.put((None, None)) for _ in range(nprocs)]
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/queues.py", line 82, in put
Process Process-45:
    if not self._sem.acquire(block, timeout):
KeyboardInterrupt
```

```
Process Process-69:
Traceback (most recent call last):
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 297, in _bootstrap
    self.run()
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 99, in run
    self._target(*self._args, **self._kwargs)
  File "/home/ubuntu/_uti_basic.py", line 67, in fun
    q_out.put((i, f(x)))
  File "/home/ubuntu/simu_funs.py", line 60, in once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/simu_funs.py", line 212, in simu_once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/main.py", line 156, in V_DR
    r = arr([getOneRegionValue(i) for i in range(N)])
Process Process-43:
  File "/home/ubuntu/main.py", line 156, in <listcomp>
    r = arr([getOneRegionValue(i) for i in range(N)])
ubuntu@ip-172-31-9-59:~$ export openblas_num_threads=1; export OMP_NUM_THREADS=1; python EC2.py
23:31, 04/08; num of cores:36

final sd_R trend for[10] the same

Basic setting:[T, rep_times, sd_O, sd_D, sd_u_O, w_O, w_A, [M_in_R, mean_reversion, poisO, u_O_u_D], sd_R_range, t_func] = [None, 36, No
ne, None, 30, 0.5, 1, [True, False, True, 10], [10], None]


--------------------------------------
[pattern_seed, day, sd_R] = [2, 6, 10]

max(u_O) =  168.8
O_threshold = 80
number of reward locations:  15
O_threshold = 90
number of reward locations:  12
O_threshold = 100
number of reward locations:  9
O_threshold = 110
number of reward locations:  6
target 1 in 4 DONE!
target 2 in 4 DONE!
target 3 in 4 DONE!
target 4 in 4 DONE!

----------------------------------------
Value of Behaviour policy:57.748
O_threshold = 80
MC for this TARGET:[68.351, 0.135]
   [DR/QV/IS]; [DR_NO_MARL, DR_NO_MF, V_behav]
bias:[[-68.35, -0.38, -68.35]][[-68.35, -68.35, -10.6]]
std:[[0.0, 0.73, 0.0]][[0.0, 0.0, 0.26]]
MSE:[[68.35, 0.82, 68.35]][[68.35, 68.35, 10.6]]
MSE(-DR):[[0.0, -67.53, 0.0]][[0.0, 0.0, -57.75]]
***
==============
O_threshold = 90
MC for this TARGET:[66.713, 0.14]
   [DR/QV/IS]; [DR_NO_MARL, DR_NO_MF, V_behav]
bias:[[-66.71, -0.15, -66.71]][[-66.71, -66.71, -8.97]]
std:[[0.0, 0.58, 0.0]][[0.0, 0.0, 0.26]]
MSE:[[66.71, 0.6, 66.71]][[66.71, 66.71, 8.97]]
MSE(-DR):[[0.0, -66.11, 0.0]][[0.0, 0.0, -57.74]]
***
==============
O_threshold = 100
MC for this TARGET:[66.955, 0.145]
   [DR/QV/IS]; [DR_NO_MARL, DR_NO_MF, V_behav]
bias:[[-66.96, -2.65, -66.96]][[-66.96, -66.96, -9.21]]
std:[[0.0, 0.63, 0.0]][[0.0, 0.0, 0.26]]
MSE:[[66.96, 2.72, 66.96]][[66.96, 66.96, 9.21]]
MSE(-DR):[[0.0, -64.24, 0.0]][[0.0, 0.0, -57.75]]
***
==============
O_threshold = 110
MC for this TARGET:[65.975, 0.144]
   [DR/QV/IS]; [DR_NO_MARL, DR_NO_MF, V_behav]
bias:[[-65.97, -4.73, -65.97]][[-65.97, -65.97, -8.23]]
std:[[0.0, 0.93, 0.0]][[0.0, 0.0, 0.26]]
MSE:[[65.97, 4.82, 65.97]][[65.97, 65.97, 8.23]]
MSE(-DR):[[0.0, -61.15, 0.0]][[0.0, 0.0, -57.74]]
***
==============
******************** THIS SETTING IS GOOD ********************
[[68.35  0.82 68.35 68.35 68.35 10.6 ]
 [66.71  0.6  66.71 66.71 66.71  8.97]
 [66.96  2.72 66.96 66.96 66.96  9.21]
 [65.97  4.82 65.97 65.97 65.97  8.23]]


time spent until now: 2.9 mins
```

```
23:34, 04/08

--------------------------------------
[pattern_seed, day, sd_R] = [2, 10, 10]

max(u_O) =  168.8
O_threshold = 80
number of reward locations:  15
O_threshold = 90
number of reward locations:  12
O_threshold = 100
number of reward locations:  9
O_threshold = 110
number of reward locations:  6
^CProcess Process-69:
Process Process-64:
Process Process-43:
Process Process-66:
Process Process-62:
Process Process-40:
Process Process-49:
Traceback (most recent call last):
Process Process-60:
  File "EC2.py", line 100, in <module>
Process Process-57:
Process Process-70:
Process Process-67:
Process Process-55:
Process Process-72:
Process Process-56:
Process Process-50:
    with_MF = with_MF, with_NO_MARL = with_NO_MARL
  File "/home/ubuntu/simu_funs.py", line 62, in simu
Process Process-45:
    value_reps = parmap(once, range(OPE_rep_times), n_cores)
  File "/home/ubuntu/_uti_basic.py", line 80, in parmap
    [q_in.put((None, None)) for _ in range(nprocs)]
  File "/home/ubuntu/_uti_basic.py", line 80, in <listcomp>
    [q_in.put((None, None)) for _ in range(nprocs)]
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/queues.py", line 82, in put
    if not self._sem.acquire(block, timeout):
Process Process-39:
KeyboardInterrupt
Process Process-47:
Traceback (most recent call last):
Process Process-48:
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 297, in _bootstrap
    self.run()
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 99, in run
    self._target(*self._args, **self._kwargs)
  File "/home/ubuntu/_uti_basic.py", line 67, in fun
    q_out.put((i, f(x)))
  File "/home/ubuntu/simu_funs.py", line 60, in once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/simu_funs.py", line 212, in simu_once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/main.py", line 156, in V_DR
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 156, in <listcomp>
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 79, in getOneRegionValue
    CV_QV = CV_QV, penalty_range = penalty, spatial = True)
  File "/home/ubuntu/main.py", line 301, in computeQV
    validation_set = valid_tuples)
  File "/home/ubuntu/main.py", line 417, in computeQV_basic
    KQ = SA_GRBF(Z_tilde, gamma_q)
  File "/home/ubuntu/main.py", line 348, in SA_GRBF
    I_Ta = (Z[:, dim * 2 + 1].reshape(-1,1) == Z2[:, dim * 2 + 1].reshape(1,-1))
Traceback (most recent call last):
KeyboardInterrupt
Traceback (most recent call last):
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 297, in _bootstrap
    self.run()
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 99, in run
    self._target(*self._args, **self._kwargs)
  File "/home/ubuntu/_uti_basic.py", line 67, in fun
    q_out.put((i, f(x)))
  File "/home/ubuntu/simu_funs.py", line 60, in once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/simu_funs.py", line 212, in simu_once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 297, in _bootstrap
    self.run()
  File "/home/ubuntu/main.py", line 156, in V_DR
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 99, in run
    self._target(*self._args, **self._kwargs)
  File "/home/ubuntu/main.py", line 156, in <listcomp>
```

```
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/_uti_basic.py", line 67, in fun
    q_out.put((i, f(x)))
  File "/home/ubuntu/main.py", line 79, in getOneRegionValue
    CV_QV = CV_QV, penalty_range = penalty, spatial = True)
  File "/home/ubuntu/simu_funs.py", line 60, in once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/main.py", line 301, in computeQV
    validation_set = valid_tuples)
  File "/home/ubuntu/simu_funs.py", line 212, in simu_once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/main.py", line 417, in computeQV_basic
    KQ = SA_GRBF(Z_tilde, gamma_q)
  File "/home/ubuntu/main.py", line 347, in SA_GRBF
    I_A = (Z[:, dim * 2].reshape(-1,1) == Z2[:, dim * 2].reshape(1,-1))
KeyboardInterrupt
Traceback (most recent call last):
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 297, in _bootstrap
    self.run()
ubuntu@ip-172-31-9-59:~$ export openblas_num_threads=1; export OMP_NUM_THREADS=1; python EC2.py
23:35, 04/08; num of cores:36

final sd_R trend for[10] the same

Basic setting:[T, rep_times, sd_O, sd_D, sd_u_O, w_O, w_A, [M_in_R, mean_reversion, poisO, u_O_u_D], sd_R_range, t_func] = [None, 96, No
ne, None, 30, 0.5, 1, [True, False, True, 10], [10], None]


----------------------------------------
[pattern_seed, day, sd_R] = [2, 6, 10]

max(u_O) =  168.8
O_threshold = 80
number of reward locations:  15
O_threshold = 90
number of reward locations:  12
O_threshold = 100
number of reward locations:  9
O_threshold = 110
number of reward locations:  6
target 1 in 4 DONE!
target 2 in 4 DONE!
target 3 in 4 DONE!
target 4 in 4 DONE!

----------------------------------------
Value of Behaviour policy:57.75
O_threshold = 80
MC for this TARGET:[68.351, 0.135]
   [DR/QV/IS]; [DR_NO_MARL, DR_NO_MF, V_behav]
bias:[[-68.35, -0.55, -68.35]][[-68.35, -68.35, -10.6]]
std:[[0.0, 0.76, 0.0]][[0.0, 0.0, 0.25]]
MSE:[[68.35, 0.94, 68.35]][[68.35, 68.35, 10.6]]
MSE(-DR):[[0.0, -67.41, 0.0]][[0.0, 0.0, -57.75]]
***
==============
O_threshold = 90
MC for this TARGET:[66.713, 0.14]
   [DR/QV/IS]; [DR_NO_MARL, DR_NO_MF, V_behav]
bias:[[-66.71, -0.33, -66.71]][[-66.71, -66.71, -8.96]]
std:[[0.0, 0.73, 0.0]][[0.0, 0.0, 0.25]]
MSE:[[66.71, 0.8, 66.71]][[66.71, 66.71, 8.96]]
MSE(-DR):[[0.0, -65.91, 0.0]][[0.0, 0.0, -57.75]]
***
==============
O_threshold = 100
MC for this TARGET:[66.955, 0.145]
   [DR/QV/IS]; [DR_NO_MARL, DR_NO_MF, V_behav]
bias:[[-66.96, -2.89, -66.96]][[-66.96, -66.96, -9.21]]
std:[[0.0, 0.7, 0.0]][[0.0, 0.0, 0.25]]
MSE:[[66.96, 2.97, 66.96]][[66.96, 66.96, 9.21]]
MSE(-DR):[[0.0, -63.99, 0.0]][[0.0, 0.0, -57.75]]
***
==============
O_threshold = 110
MC for this TARGET:[65.975, 0.144]
   [DR/QV/IS]; [DR_NO_MARL, DR_NO_MF, V_behav]
bias:[[-65.97, -5.13, -65.97]][[-65.97, -65.97, -8.23]]
std:[[0.0, 0.93, 0.0]][[0.0, 0.0, 0.25]]
MSE:[[65.97, 5.21, 65.97]][[65.97, 65.97, 8.23]]
MSE(-DR):[[0.0, -60.76, 0.0]][[0.0, 0.0, -57.74]]
***
==============
******************** THIS SETTING IS GOOD ********************
[[68.35  0.94 68.35 68.35 68.35 10.6 ]
 [66.71  0.8  66.71 66.71 66.71  8.96]
 [66.96  2.97 66.96 66.96 66.96  9.21]
 [65.97  5.21 65.97 65.97 65.97  8.23]]
```

```
time spent until now: 7.7 mins

23:42, 04/08

--------------------------------------
[pattern_seed, day, sd_R] = [2, 10, 10]

max(u_O) =  168.8
O_threshold = 80
number of reward locations:  15
O_threshold = 90
number of reward locations:  12
O_threshold = 100
number of reward locations:  9
O_threshold = 110
number of reward locations:  6
^CTraceback (most recent call last):
  File "EC2.py", line 100, in <module>
Process Process-56:
    with_MF = with_MF, with_NO_MARL = with_NO_MARL
  File "/home/ubuntu/simu_funs.py", line 62, in simu
Process Process-68:
Process Process-69:
Process Process-37:
    value_reps = parmap(once, range(OPE_rep_times), n_cores)
Process Process-52:
  File "/home/ubuntu/_uti_basic.py", line 79, in parmap
Process Process-59:
    sent = [q_in.put((i, x)) for i, x in enumerate(X)]
  File "/home/ubuntu/_uti_basic.py", line 79, in <listcomp>
Process Process-72:
    sent = [q_in.put((i, x)) for i, x in enumerate(X)]
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/queues.py", line 82, in put
    if not self._sem.acquire(block, timeout):
KeyboardInterrupt
Traceback (most recent call last):
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 297, in _bootstrap
    self.run()
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 99, in run
    self._target(*self._args, **self._kwargs)
  File "/home/ubuntu/_uti_basic.py", line 67, in fun
    q_out.put((i, f(x)))
  File "/home/ubuntu/simu_funs.py", line 60, in once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/simu_funs.py", line 212, in simu_once
    inner_parallel = inner_parallel)
  File "/home/ubuntu/main.py", line 156, in V_DR
    r = arr([getOneRegionValue(i) for i in range(N)])
  File "/home/ubuntu/main.py", line 156, in <listcomp>
    r = arr([getOneRegionValue(i) for i in range(N)])
Traceback (most recent call last):
  File "/home/ubuntu/anaconda3/lib/python3.7/multiprocessing/process.py", line 297, in _bootstrap
    self.run()
  File "/home/ubuntu/main.py", line 79, in getOneRegionValue
    CV_QV = CV_QV, penalty_range = penalty, spatial = True)
  File "/home/ubuntu/main.py", line 301, in computeQV
    validation_set = valid_tuples)
ubuntu@ip-172-31-9-59:~$ export openblas_num_threads=1; export OMP_NUM_THREADS=1; python EC2.py
23:43, 04/08; num of cores:36

final sd_R trend for[10] the same

Basic setting:[T, rep_times, sd_O, sd_D, sd_u_O, w_O, w_A, [M_in_R, mean_reversion, poisO, u_O_u_D], sd_R_range, t_func] = [None, 96, No
ne, None, 30, 0.5, 1, [True, False, True, 10], [10], None]


--------------------------------------
[pattern_seed, day, sd_R] = [2, 6, 10]

max(u_O) =  168.8
O_threshold = 80
number of reward locations:  15
O_threshold = 90
number of reward locations:  12
O_threshold = 100
number of reward locations:  9
O_threshold = 110
number of reward locations:  6
target 1 in 4 DONE!
target 2 in 4 DONE!
target 3 in 4 DONE!
target 4 in 4 DONE!

--------------------------------------
Value of Behaviour policy:57.75
O_threshold = 80
MC for this TARGET:[68.351, 0.135]
   [DR/QV/IS]; [DR_NO_MARL, DR_NO_MF, V_behav]
```

```
bias:[[-68.35, -1.51, -68.35]][[-68.35, -68.35, -10.6]]
std:[[0.0, 0.66, 0.0]][[0.0, 0.0, 0.25]]
MSE:[[68.35, 1.65, 68.35]][[68.35, 68.35, 10.6]]
MSE(-DR):[[0.0, -66.7, 0.0]][[0.0, 0.0, -57.75]]
***
==============
O_threshold = 90
MC for this TARGET:[66.713, 0.14]
   [DR/QV/IS]; [DR_NO_MARL, DR_NO_MF, V_behav]
bias:[[-66.71, -1.11, -66.71]][[-66.71, -66.71, -8.96]]
std:[[0.0, 0.64, 0.0]][[0.0, 0.0, 0.25]]
MSE:[[66.71, 1.28, 66.71]][[66.71, 66.71, 8.96]]
MSE(-DR):[[0.0, -65.43, 0.0]][[0.0, 0.0, -57.75]]
***
==============
O_threshold = 100
MC for this TARGET:[66.955, 0.145]
   [DR/QV/IS]; [DR_NO_MARL, DR_NO_MF, V_behav]
bias:[[-66.96, -3.61, -66.96]][[-66.96, -66.96, -9.21]]
std:[[0.0, 0.61, 0.0]][[0.0, 0.0, 0.25]]
MSE:[[66.96, 3.66, 66.96]][[66.96, 66.96, 9.21]]
MSE(-DR):[[0.0, -63.3, 0.0]][[0.0, 0.0, -57.75]]
***
==============
O_threshold = 110
MC for this TARGET:[65.975, 0.144]
   [DR/QV/IS]; [DR_NO_MARL, DR_NO_MF, V_behav]
bias:[[-65.97, -5.98, -65.97]][[-65.97, -65.97, -8.23]]
std:[[0.0, 0.76, 0.0]][[0.0, 0.0, 0.25]]
MSE:[[65.97, 6.03, 65.97]][[65.97, 65.97, 8.23]]
MSE(-DR):[[0.0, -59.94, 0.0]][[0.0, 0.0, -57.74]]
***
==============
******************** THIS SETTING IS GOOD ********************
[[68.35  1.65 68.35 68.35 68.35 10.6 ]
 [66.71  1.28 66.71 66.71 66.71  8.96]
 [66.96  3.66 66.96 66.96 66.96  9.21]
 [65.97  6.03 65.97 65.97 65.97  8.23]]


time spent until now: 28.4 mins

00:12, 04/09

--------------------------------------
[pattern_seed, day, sd_R] = [2, 10, 10]

max(u_O) =  168.8
O_threshold = 80
number of reward locations:  15
O_threshold = 90
number of reward locations:  12
O_threshold = 100
number of reward locations:  9
O_threshold = 110
number of reward locations:  6
```