

Network Stability Through Training on New Populations

December 10, 2019

```
[ ]: #load the model
using Statistics
using HDF5
using PyPlot

include("sim.jl")
include("plot_functions.jl")
```

```
[ ]: trained_model = "trained.h5"
fid = h5open(trained_model,"r")
popmembers = read(fid["data"]["popmembers"])
weights = read(fid["data"]["weights"])
close(fid)

fid = h5open("popmembers_new_1.h5","r")
popmembers_new = read(fid["data"]["popmembers_new"])
close(fid)
```

```
[ ]: # we need to define a different set of stimulation pattern and save it
# can skip this section

"""
#populations
Npop = 20 #number of assemblies
pmembership = .05 #probability of belonging to any assembly
Nmaxmembers = 300 #maximum number of neurons in a population (to set size of
    ↪matrix)

#set up populations
popmembers_new = zeros{Int,Npop,Nmaxmembers}
for pp = 1:Npop
    members = findall(rand{Ne} .< pmembership)
    popmembers_new[pp,1:length(members)] = members
end

#then we save this set of
fid = h5open("popmembers_new_1.h5","w")
```

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g = g_create(fid,"data")
g["popmembers_new","chunk", size(popmembers),"compress",9] = popmembers_new
close(fid)
"""

```

```

[ ]: # stimulate for 1s b

stim_pop1 = zeros(1,4)
stim_pop1[1,1] = 1
stim_pop1[1,2] = 2e3
stim_pop1[1,3] = 7e3
stim_pop1[1,4] = 10

T = 10000
altd = 0.0008
altp = 0.0014
eta = 1
learn_rates = [altd altp eta]

weights_eta_1 = deepcopy(weights)

times_eta_1,ns_eta_1,Ne,Ncells,T,weights_time_eta_1, weights_time_track_eta_1 =
sim_track_rates(stim_pop1,weights_eta_1,popmembers_new,popmembers,T,learn_rates);

```

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[ ]: plot_raster(popmembers_new,times_eta_1,ns_eta_1)
title("New Clusters eta = 1")

plot_raster(popmembers,times_eta_1,ns_eta_1)
title("Old Clusters eta = 1")

```

```

[ ]: figure
plot(1:size(weights_time_track_eta_1,2),transpose(weights_time_track_eta_1[:,:]))
xlabel("Time (s)")
ylabel("Weights ")
title("Old Cluster weights eta = 1")

```

```

[ ]: figure
plot(1:size(weights_time_eta_1,2),transpose(weights_time_eta_1[:,:]))
xlabel("Time (s)")
ylabel("Weights eta = 1")
title("New Cluster Weights eta = 1")

```

```

[ ]: # stimulate for 1s b

stim_pop1 = zeros(1,4)
stim_pop1[1,1] = 1
stim_pop1[1,2] = 2e3

```

```

stim_pop1[1,3] = 7e3
stim_pop1[1,4] = 10

T = 10000
altd = 0.0008
altp = 0.0014
eta = 5
learn_rates = [altd altp eta]

weights_eta_5 = deepcopy(weights)

times_eta_5, ns_eta_5, Ne, Ncells, T, weights_time_eta_5, weights_time_track_eta_5 =
sim_track_rates(stim_pop1, weights_eta_5, popmembers_new, popmembers, T, learn_rates);

```

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[ ]: plot_raster(popmembers_new, times_eta_5, ns_eta_5)
title("New Clusters eta = 5")

plot_raster(popmembers, times_eta_5, ns_eta_5)
title("Old Clusters eta = 5")

```

```

[ ]: figure
plot(1:size(weights_time_track_eta_5,2), transpose(weights_time_track_eta_5[:, :]))
xlabel("Time (s)")
ylabel("Weights ")
title("Old Cluster weights eta = 5")

```

```

[ ]: figure
plot(1:size(weights_time_eta_5,2), transpose(weights_time_eta_5[:, :]))
ylim(2.5, 6.5)
xlabel("Time (s)")
ylabel("Weights eta")
title("New Cluster Weights eta = 5")

```

```

[ ]: # stimulate for 1s b

stim_pop1 = zeros(1,4)
stim_pop1[1,1] = 1
stim_pop1[1,2] = 2e3
stim_pop1[1,3] = 7e3
stim_pop1[1,4] = 10

T = 10000
altd = 0.0008
altp = 0.0014
eta = 10
learn_rates = [altd altp eta]

```

```

weights_eta_10 = deepcopy(weights)

times_eta_10,ns_eta_10,Ne,Ncells,T,weights_time_eta_10,
    ↳weights_time_track_eta_10 =
sim_track_rates(stim_pop1,weights_eta_10,popmembers_new,popmembers,T,learn_rates);
    ↳

```

```

[ ]: plot_raster(popmembers_new,times_eta_10,ns_eta_10)
    title("New Clusters eta = 10")

plot_raster(popmembers,times_eta_10,ns_eta_10)
    title("Old Clusters eta = 10")

```

```

[ ]: plot(1:size(weights_time_track_eta_10,2),transpose(weights_time_track_eta_10[:,
    ↳]))
    xlabel("Time (s)")
    ylabel("Weights ")
    title("Old Cluster weights eta = 10")

```

```

[ ]: figure()
    plot(1:size(weights_time_eta_10,2),transpose(weights_time_eta_10[:, :]))
    ylim(2.5,6.5)
    xlabel("Time (s)")
    ylabel("Weights")
    title("New Cluster Weights eta = 10")

```

```

[ ]: #investigate altd
stim_pop1 = zeros(1,4)
stim_pop1[1,1] = 1
stim_pop1[1,2] = 2e3
stim_pop1[1,3] = 7e3
stim_pop1[1,4] = 10

T = 10000

altd = 0.008
altp = 0.0014
eta = 1
learn_rates = [altd altp eta]

weights_altd_1_eta_10 = deepcopy(weights)
times_altd_1_eta_10,ns_altd_1_eta_10,Ne,Ncells,T,weights_time_altd_1_eta_10,
    ↳weights_time_track_altd_1_eta_10 =
sim_track_rates(stim_pop1,weights_altd_1_eta_10,popmembers_new,popmembers,T,learn_rates);
    ↳

```

```

altd = 0.08
altp = 0.0014
eta = 1
learn_rates = [altd altp eta]
weights_altd_2_eta_10 = deepcopy(weights)
times_altd_2_eta_10,ns_altd_2_eta_10,Ne,Ncells,T,weights_time_altd_2_eta_10,
    ↳weights_time_track_altd_2_eta_10 =
sim_track_rates(stim_pop1,weights_altd_2_eta_10,popmembers_new,popmembers,T,learn_rates);
    ↳

altd = 0.8
altp = 0.0014
eta = 1
learn_rates = [altd altp eta]
weights_altd_3_eta_10 = deepcopy(weights)
times_altd_3_eta_10,ns_altd_3_eta_10,Ne,Ncells,T,weights_time_altd_3_eta_10,
    ↳weights_time_track_altd_3_eta_10 =
sim_track_rates(stim_pop1,weights_altd_3_eta_10,popmembers_new,popmembers,T,learn_rates);
    ↳

```

```

[ ]: plot_raster(popmembers_new,times_altd_1_eta_10,ns_altd_1_eta_10)
title("New Clusters eta = 1 altd = 0.008")

plot_raster(popmembers,times_altd_1_eta_10,ns_altd_1_eta_10)
title("Old Clusters eta = 1 altd = 0.008")

plot_raster(popmembers_new,times_altd_2_eta_10,ns_altd_2_eta_10)
title("New Clusters eta = 1 altd = 0.08")

plot_raster(popmembers,times_altd_2_eta_10,ns_altd_2_eta_10)
title("Old Clusters eta = 1 altd = 0.08")

plot_raster(popmembers_new,times_altd_3_eta_10,ns_altd_3_eta_10)
title("New Clusters eta = 1 altd = 0.8")

plot_raster(popmembers,times_altd_3_eta_10,ns_altd_3_eta_10)
title("Old Clusters eta = 1 altd = 0.8")

```

```

[ ]: plot(1:
    ↳size(weights_time_track_altd_1_eta_10,2),transpose(weights_time_track_altd_1_eta_10[:
    ↳,:]))
xlabel("Time (s)")
ylabel("Weights ")
title("Old Cluster weights altd = 0.008 eta = 1")

```

```
[ ]: plot(1:
    ↳size(weights_time_track_altd_2_eta_10,2),transpose(weights_time_track_altd_2_eta_10[:
    ↳,:]))
xlabel("Time (s)")
ylabel("Weights ")
title("Old Cluster weights altd = 0.08 eta = 1")
```

```
[ ]: plot(1:
    ↳size(weights_time_track_altd_3_eta_10,2),transpose(weights_time_track_altd_3_eta_10[:
    ↳,:]))
xlabel("Time (s)")
ylabel("Weights ")
title("Old Cluster weights altd = 0.8 eta = 1")
```

```
[ ]: plot(1:size(weights_time_altd_1_eta_10,2),transpose(weights_time_altd_1_eta_10[:
    ↳,:]))
ylim(0,6.5)
xlabel("Time (s)")
ylabel("Weights")
title("New Cluster Weights altd = 0.008 eta = 1")
```

```
[ ]: plot(1:size(weights_time_altd_2_eta_10,2),transpose(weights_time_altd_2_eta_10[:
    ↳,:]))
ylim(0,6.5)
xlabel("Time (s)")
ylabel("Weights")
title("New Cluster Weights altd = 0.08 eta = 1")
```

```
[ ]: plot(1:size(weights_time_altd_3_eta_10,2),transpose(weights_time_altd_3_eta_10[:
    ↳,:]))
ylim(0,6.5)
xlabel("Time (s)")
ylabel("Weights")
title("New Cluster Weights altd = 0.8 eta = 1")
```

```
[ ]: altd = 0.0008
altp = 0.014
eta = 1
learn_rates = [altd altp eta]

weights_altp_1_eta_10 = deepcopy(weights)

times_altp_1_eta_10,ns_altp_1_eta_10,Ne,Ncells,T,weights_time_altp_1_eta_10,↳
    ↳weights_time_track_altp_1_eta_10 =
sim_track_rates(stim_pop1,weights_altp_1_eta_10,popmembers_new,popmembers,T,learn_rates);
↳
```

```

altd = 0.0008
altp = 0.14
eta = 1
learn_rates = [altd altp eta]
weights_altp_2_eta_10 = deepcopy(weights)

times_altp_2_eta_10,ns_altp_2_eta_10,Ne,Ncells,T,weights_time_altp_2_eta_10,
    ↳weights_time_track_altp_2_eta_10 =
sim_track_rates(stim_pop1,weights_altp_2_eta_10,popmembers_new,popmembers,T,learn_rates);
    ↳

altd = 0.0008
altp = 1.4
eta = 1
learn_rates = [altd altp eta]
weights_altp_3_eta_10 = deepcopy(weights)
times_altp_3_eta_10,ns_altp_3_eta_10,Ne,Ncells,T,weights_time_altp_3_eta_10,
    ↳weights_time_track_altp_3_eta_10 =
sim_track_rates(stim_pop1,weights_altp_3_eta_10,popmembers_new,popmembers,T,learn_rates);
    ↳

```

```

[ ]: plot_raster(popmembers_new,times_altp_1_eta_10,ns_altp_1_eta_10)
title("New Clusters eta = 1 altp = 0.014")

plot_raster(popmembers,times_altp_1_eta_10,ns_altp_1_eta_10)
title("Old Clusters eta = 1 altp = 0.014")

plot_raster(popmembers_new,times_altp_2_eta_10,ns_altp_2_eta_10)
title("New Clusters eta = 1 altp = 0.14")

plot_raster(popmembers,times_altp_2_eta_10,ns_altp_2_eta_10)
title("Old Clusters eta = 1 altp = 0.14")

plot_raster(popmembers_new,times_altp_3_eta_10,ns_altp_3_eta_10)
title("New Clusters eta = 1 altp = 1.4")

plot_raster(popmembers,times_altp_3_eta_10,ns_altp_3_eta_10)
title("Old Clusters eta = 1 altp = 1.4")

```

```

[ ]: plot(1:
    ↳size(weights_time_track_altp_1_eta_10,2),transpose(weights_time_track_altp_1_eta_10[:
    ↳,:]))
xlabel("Time (s)")
ylabel("Weights ")
title("Old Cluster Weights altp = 0.014 eta = 1")

```

```
[ ]: plot(1:
    →size(weights_time_track_altp_2_eta_10,2),transpose(weights_time_track_altp_2_eta_10[:
    →,:]))
xlabel("Time (s)")
ylabel("Weights ")
title("Old Cluster Weights altp = 0.14 eta = 1")
```

```
[ ]: plot(1:
    →size(weights_time_track_altp_3_eta_10,2),transpose(weights_time_track_altp_3_eta_10[:
    →,:]))
xlabel("Time (s)")
ylabel("Weights ")
title("Old Cluster Weights altp = 1.4 eta = 1")
```

```
[ ]: plot(1:size(weights_time_altp_1_eta_10,2),transpose(weights_time_altp_1_eta_10[:
    →,:]))
xlabel("Time (s)")
ylabel("Weights ")
title("New Cluster Weights altp = 0.014 eta = 1")
```

```
[ ]: plot(1:size(weights_time_altp_2_eta_10,2),transpose(weights_time_altp_2_eta_10[:
    →,:]))
xlabel("Time (s)")
ylabel("Weights ")
title("New Cluster Weights altp = 0.14 eta = 1")
```

```
[ ]: plot(1:size(weights_time_altp_3_eta_10,2),transpose(weights_time_altp_3_eta_10[:
    →,:]))
xlabel("Time (s)")
ylabel("Weights ")
title("New Cluster Weights altp = 1.4 eta = 1")
```