

Parameter distributions and clustering

IKtof

Parameter density estimation

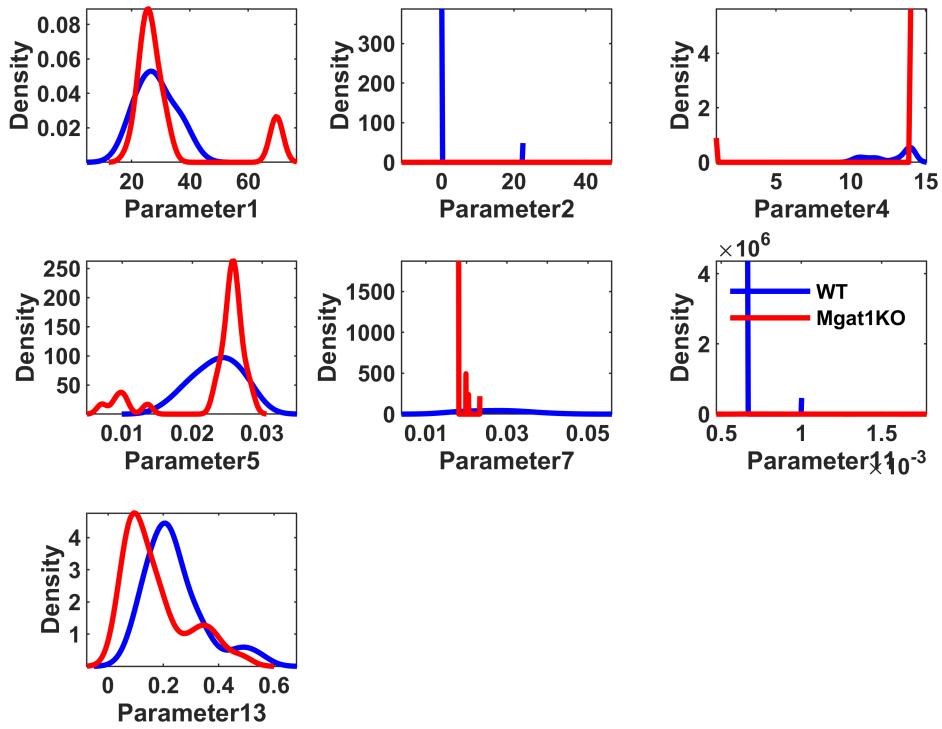
```
pktof = readtable("exp42_pktof.csv");
pidx = unique(pktof.param);

figure
for i=1:length(pidx)
    psub = pktof(pktof.param==pidx(i),:);
    psub_wt = psub(string(psub.Group)=="WT",:);
    psub_ko = psub(string(psub.Group)=="Mgat1KO",:);

    [f1,xi1] = ksdensity(psub_wt.value);
    [f2,xi2] = ksdensity(psub_ko.value);

    subplot(3,3,i)
    plot(xi1,f1, 'Color','blue', 'LineWidth',2)
    hold on
    plot(xi2,f2, 'Color','red', 'LineWidth',2)
    hold off
    axis tight
    xlabel(strcat('Parameter', num2str(pidx(i))))
    ylabel('Density')
    set(gca, 'FontName','Arial','FontWeight','bold')

    if i==6
        legend(["WT","Mgat1KO"])
        legend box off
    end
end
```



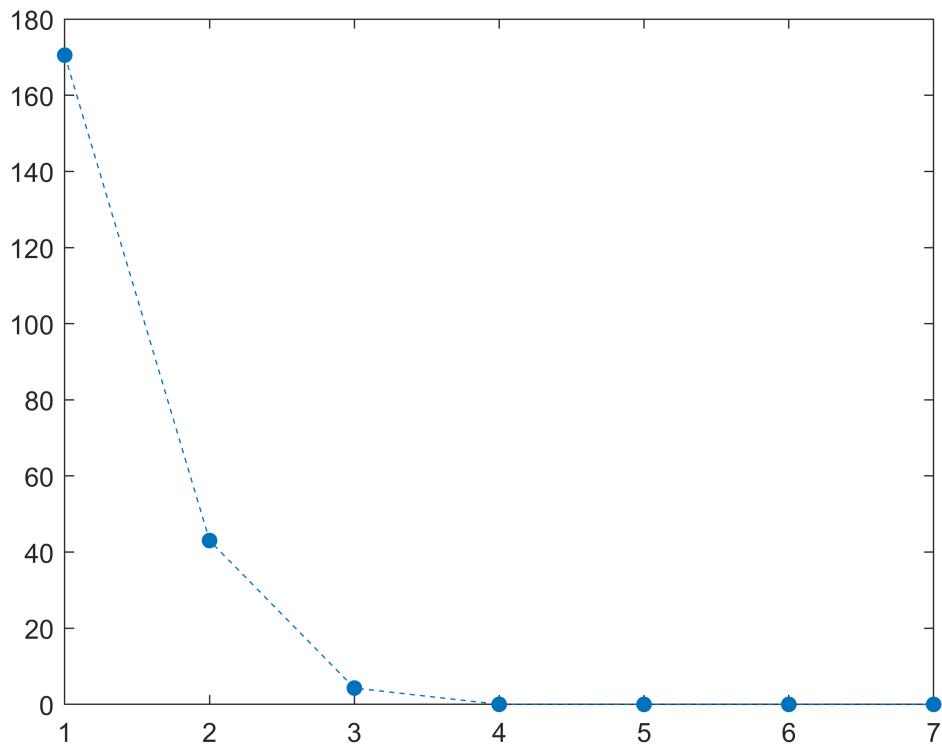
Clustering

```
% data modification
nrow = size(pktof,1)/length(pidx);
pktof2 = array2table(NaN(nrow,length(pidx)+1));
pktof2.Properties.VariableNames(1) = {'Group'};
pktof2.Group = pktof(pktof.param==pidx(1),:).Group;

for i=1:length(pidx)
    pktof2.Properties.VariableNames(i+1) = {strcat('P',num2str(pidx(i)))};
    pktof2(:,i+1)= pktof(pktof.param==pidx(i), 'value');
end

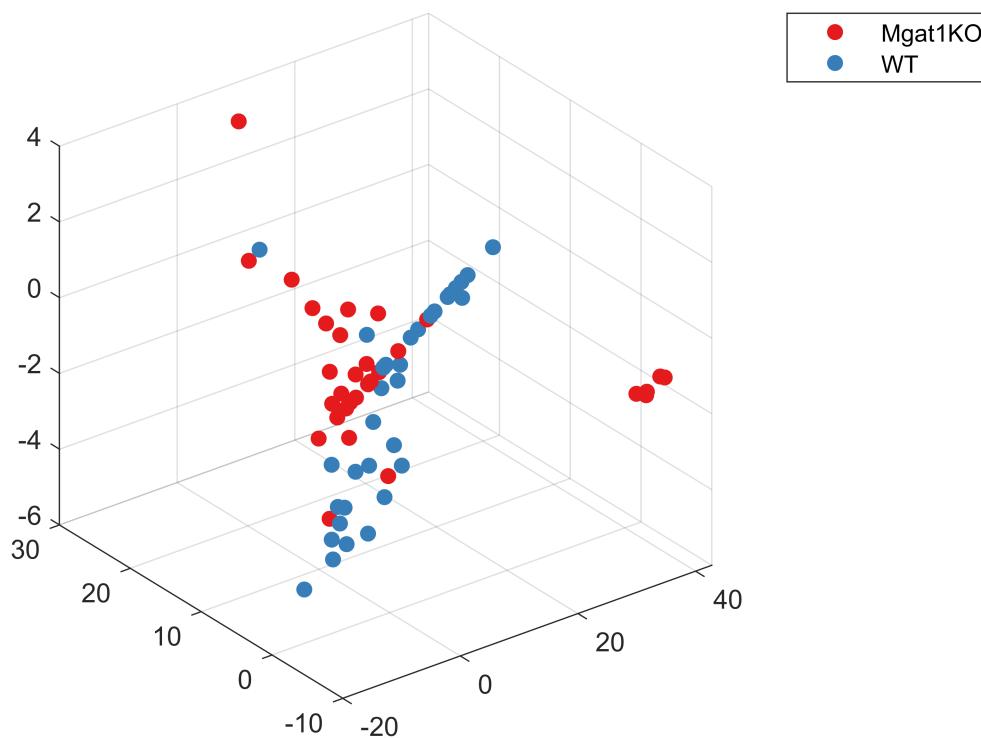
[~,score,latent] = pca(table2array(pktof2(:,2:end)));

figure
plot(latent, '--.', 'MarkerSize', 20)
```

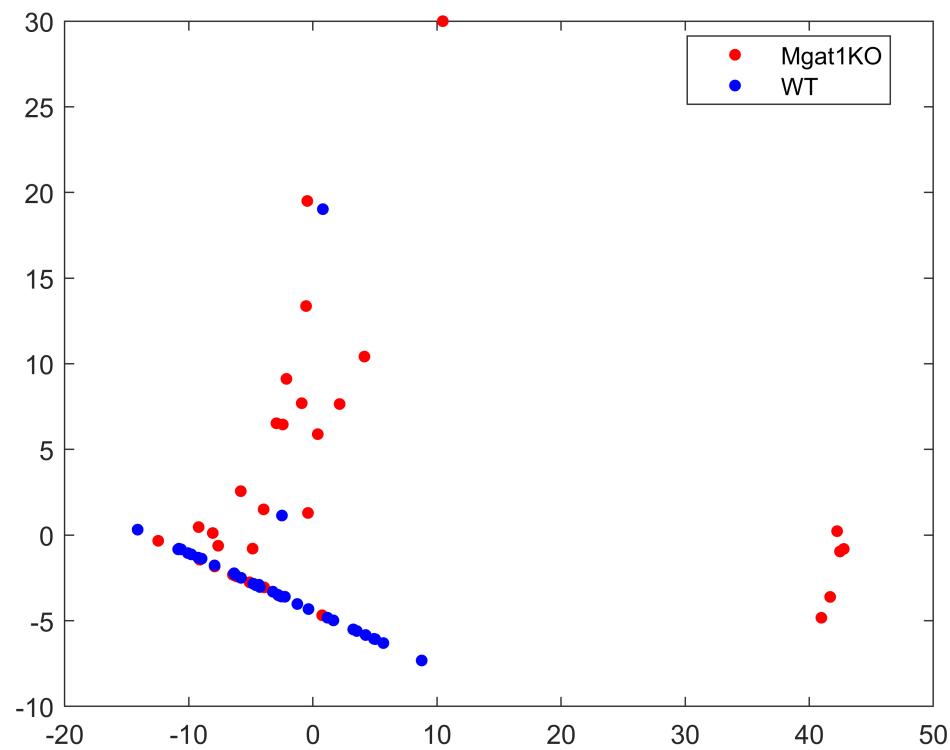


```
g = NaN(nrow,1);
g(pktof2.Group == "Mgat1KO") = 1;
g(pktof2.Group == "WT") = 2;
c = brewermap(length(unique(g)), 'Set1');
tlabels = string(1:nrow);

scatter3(score(g==1,1),score(g==1,2),score(g==1,3), 'filled', 'CData',c(g==1,:))
hold on
scatter3(score(g==2,1),score(g==2,2),score(g==2,3), 'filled', 'CData',c(g==2,:))
hold off
legend(["Mgat1KO","WT"])
```



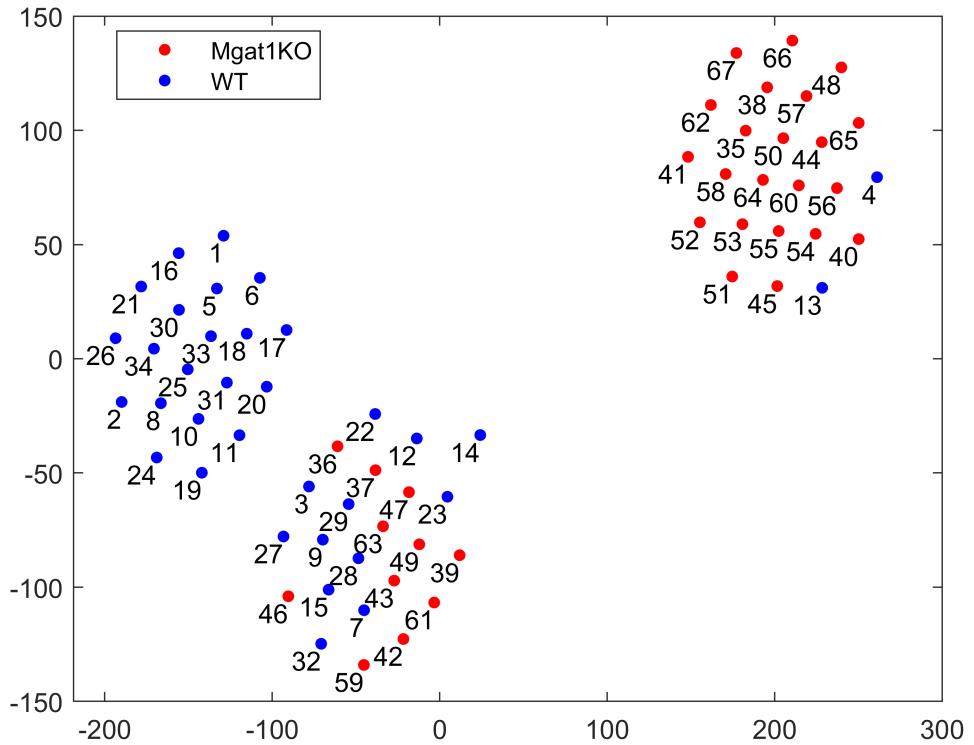
```
g2 = categorical(pktof2.Group);
gscatter(score(:,1),score(:,2),g2, 'rb');
```



```

embd = tsne(table2array(pktf2(:,2:end)), 'Algorithm', 'exact', 'Distance', 'spearman');
gscatter(embd(:,1), embd(:,2), g2, 'rb')
text(embd(:,1), embd(:,2), tlabels, 'VerticalAlignment', 'top', 'HorizontalAlignment', 'right')

```



IKslow1

Parameter density estimation

```

pkslow1 = readtable("exp42_pkslow1.csv");
pidx = unique(pkslow1.param);

figure
for i=1:length(pidx)
    psub = pkslow1(pkslow1.param==pidx(i),:);
    psub_wt = psub(string(psub.Group)== "WT",:);
    psub_ko = psub(string(psub.Group)== "Mgat1KO",:);

    [f1,xi1] = ksdensity(psub_wt.value);
    [f2,xi2] = ksdensity(psub_ko.value);

    subplot(3,3,i)
    plot(xi1,f1, 'Color', 'blue', 'LineWidth',2)
    hold on
    plot(xi2,f2, 'Color', 'red', 'LineWidth',2)
    hold off
    axis tight

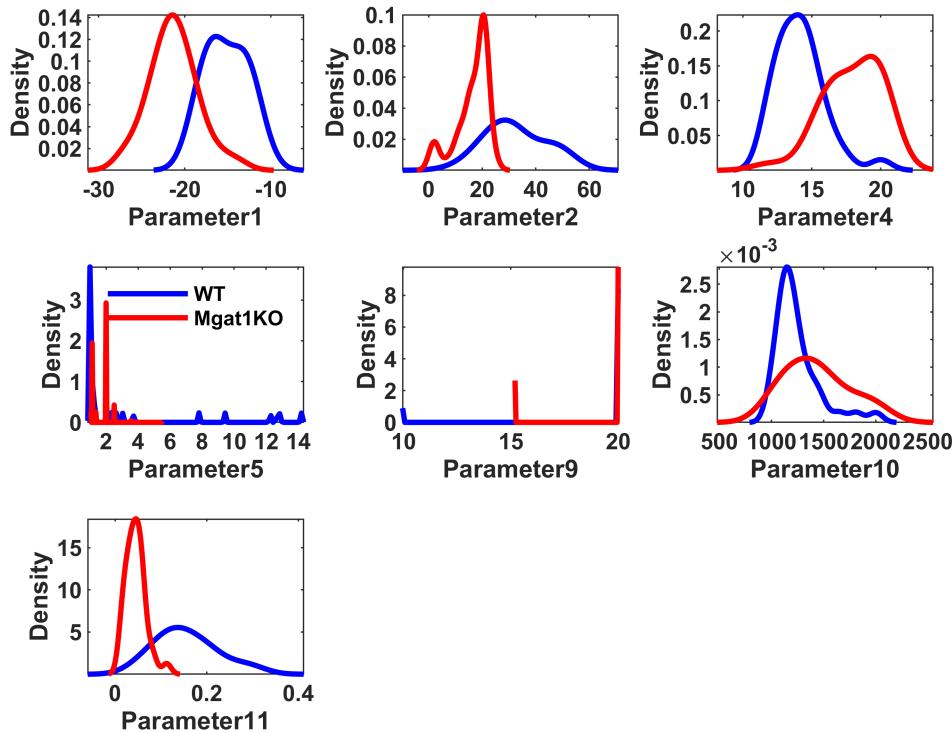
```

```

xlabel(strcat('Parameter', num2str(pidx(i))))
ylabel('Density')
set(gca, 'FontName','Arial','FontSize',12,'FontWeight','bold')

if i==4
    legend('WT','Mgat1KO', 'Location','best')
    legend box off
end
end

```



Clustering

```

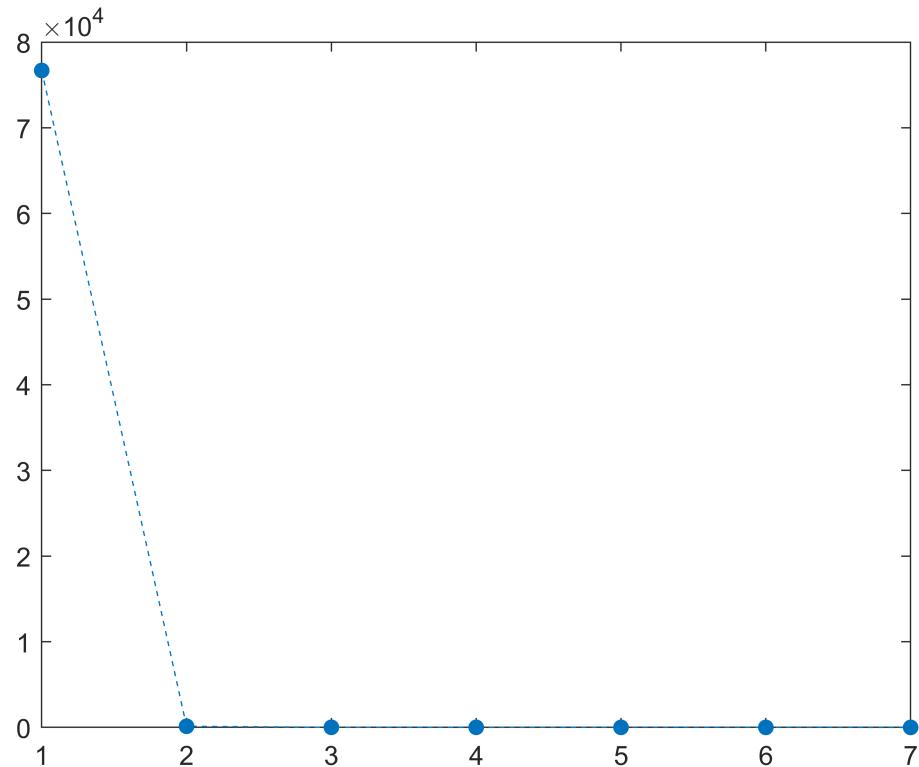
pkslow12 = array2table(NaN(nrow,length(pidx)+1));
pkslow12.Properties.VariableNames(1) = {'Group'};
pkslow12.Group = pkslow1(pkslow1.param==pidx(1),:).Group;

for i=1:length(pidx)
    pkslow12.Properties.VariableNames(i+1) = {strcat('P',num2str(pidx(i)))};
    pkslow12(:,i+1)= pkslow1(pkslow1.param==pidx(i),'value');
end

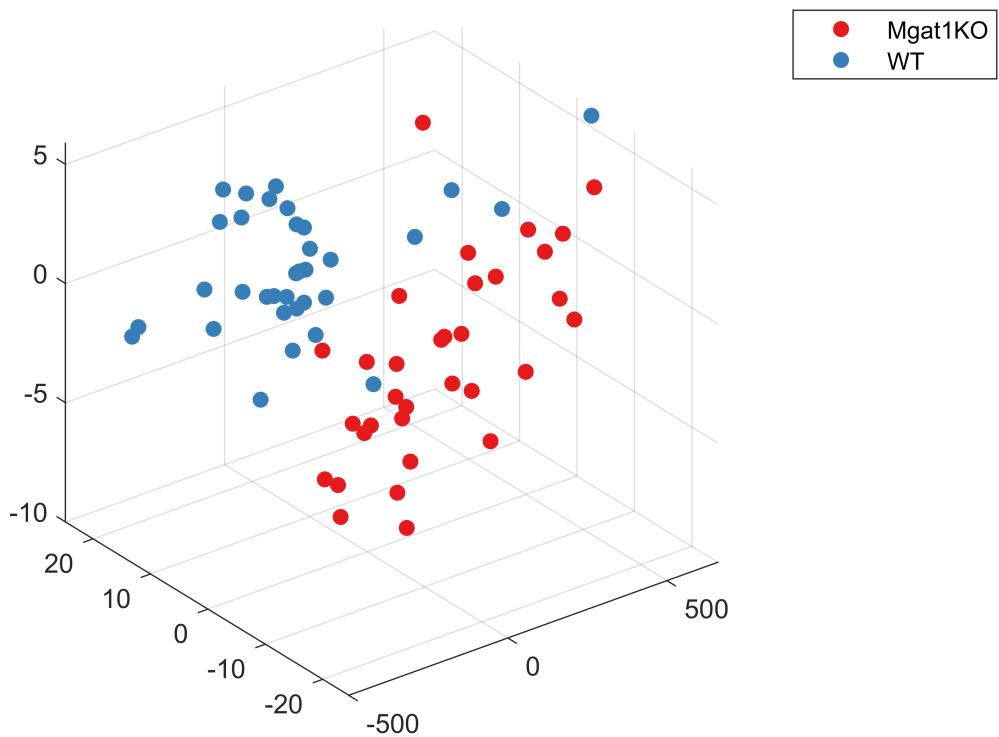
[~,score,latent] = pca(table2array(pkslow12(:,2:end)));

figure
plot(latent,'--.', 'MarkerSize',20)

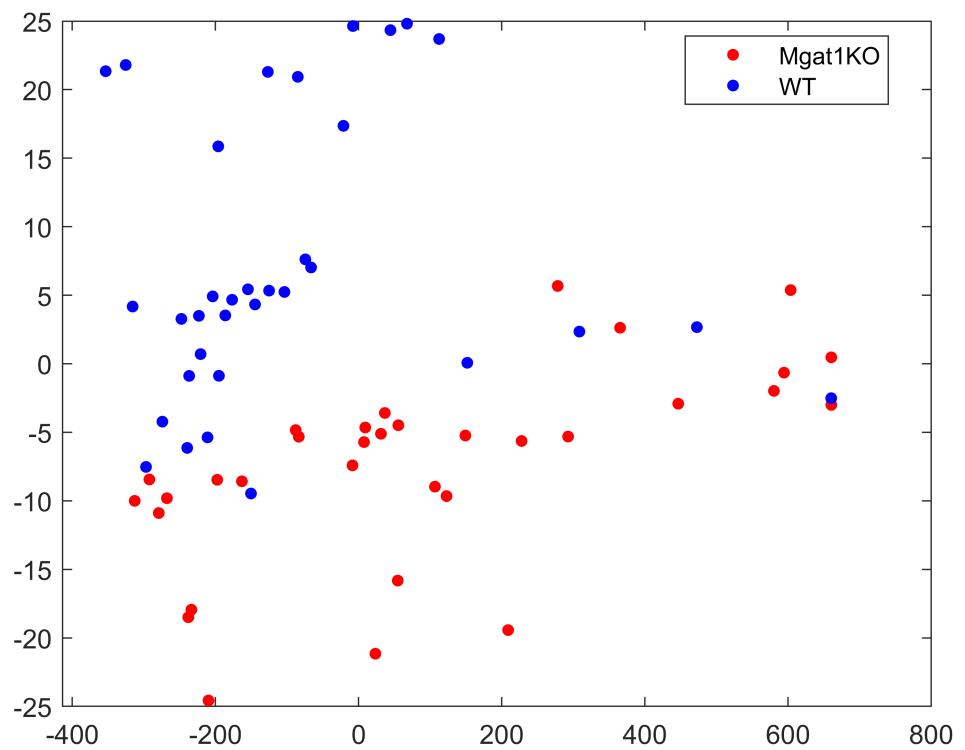
```



```
scatter3(score(g==1,1),score(g==1,2),score(g==1,3), 'filled', 'CData',c(g(g==1),:))
hold on
scatter3(score(g==2,1),score(g==2,2),score(g==2,3), 'filled', 'CData',c(g(g==2),:))
hold off
legend(["Mgat1KO","WT"])
```



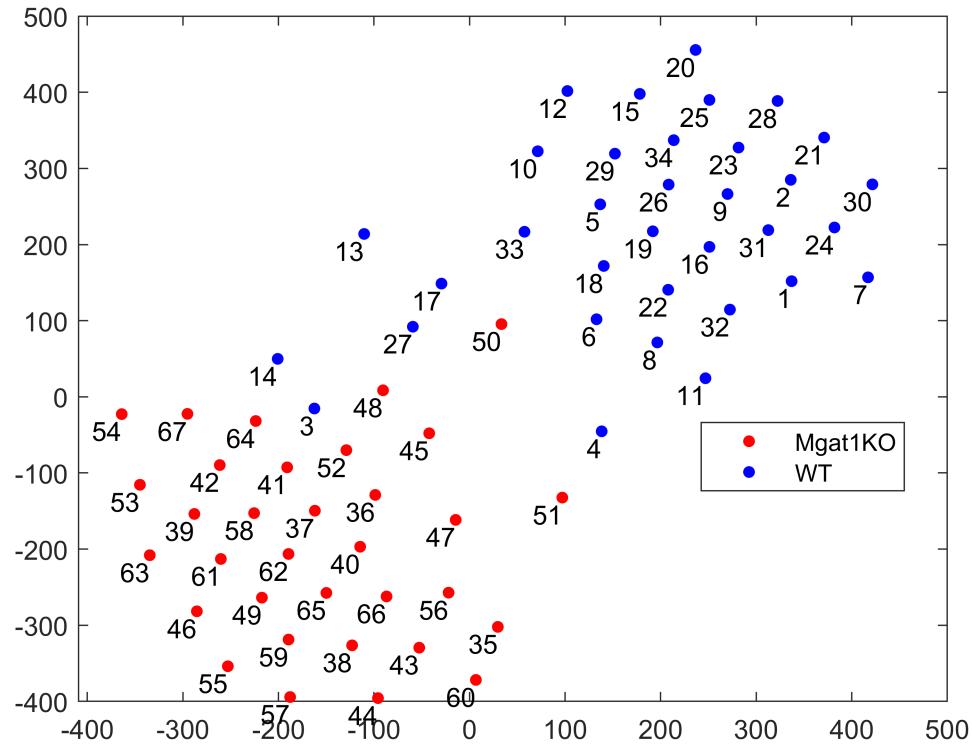
```
gscatter(score(:,1),score(:,2),g2,'rb')
```



```

embd = tsne(normalize(table2array(pkslow12(:,2:end))), 'Algorithm', 'exact', 'Distance', 'spearman')
gscatter(embd(:,1),embd(:,2),g2, 'rb')
text(embd(:,1),embd(:,2),tlabels, 'VerticalAlignment', 'top', 'HorizontalAlignment', 'right')

```



IKss

Parameter density estimation

```

pkss = readtable("exp42_pkss.csv");
pidx = unique(pkss.param);

figure
for i=1:length(pidx)
    psub = pkss(pkss.param==pidx(i),:);
    psub_wt = psub(string(psub.Group)== "WT",:);
    psub_ko = psub(string(psub.Group)== "Mgat1KO",:);

    [f1,xi1] = ksdensity(psub_wt.value);
    [f2,xi2] = ksdensity(psub_ko.value);

    subplot(2,2,i)
    plot(xi1,f1, 'Color', 'blue', 'LineWidth',2)
    hold on
    plot(xi2,f2, 'Color', 'red', 'LineWidth',2)
    hold off
    axis tight

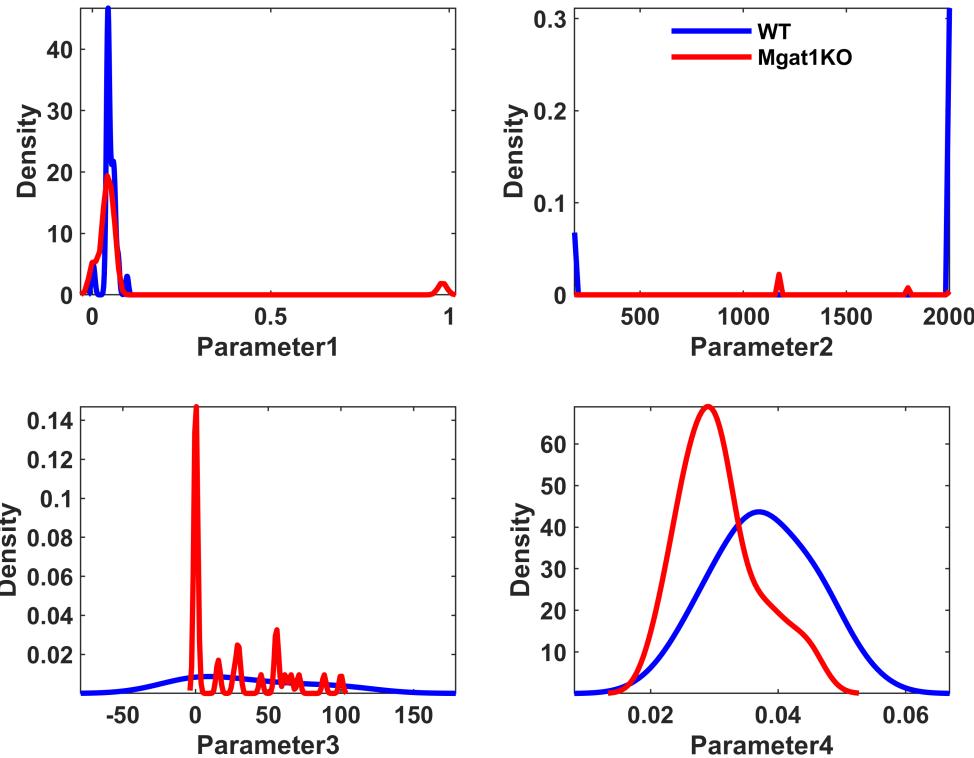
```

```

xlabel(strcat('Parameter', num2str(pidx(i))))
ylabel('Density')
set(gca, 'FontName','Arial','FontSize',12,'FontWeight','bold')

if i==2
    legend('WT','Mgat1KO', 'Location','best')
    legend box off
end
end

```



Clustering

```

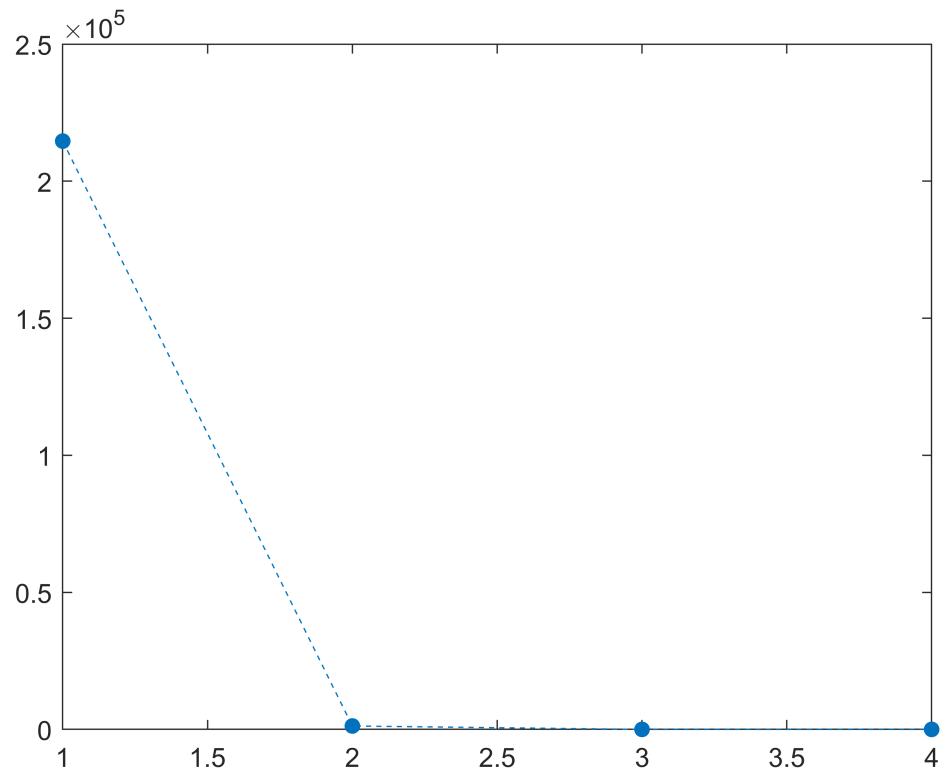
pkss2 = array2table(NaN(nrow,length(pidx)+1));
pkss2.Properties.VariableNames(1) = {'Group'};
pkss2.Group = pkss(pkss.param==pidx(1),:).Group;

for i=1:length(pidx)
    pkss2.Properties.VariableNames(i+1) = {strcat('P',num2str(pidx(i)))};
    pkss2(:,i+1)= pkss(pkss.param==pidx(i),'value');
end

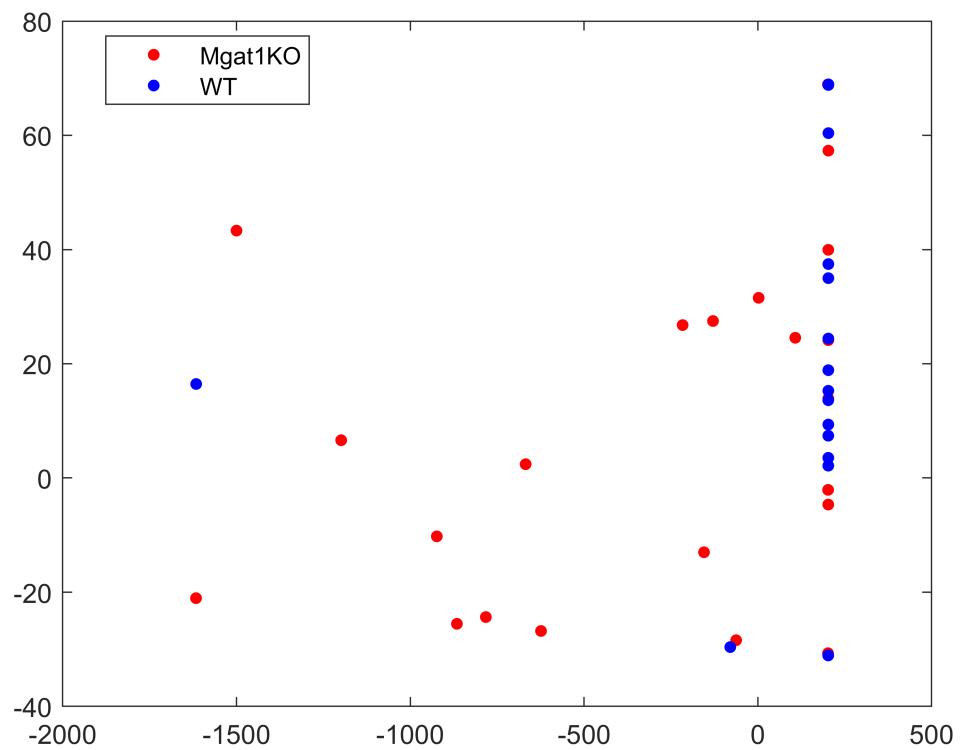
[~,score,latent] = pca(table2array(pkss2(:,2:end)));

figure
plot(latent,'--.', 'MarkerSize',20)

```



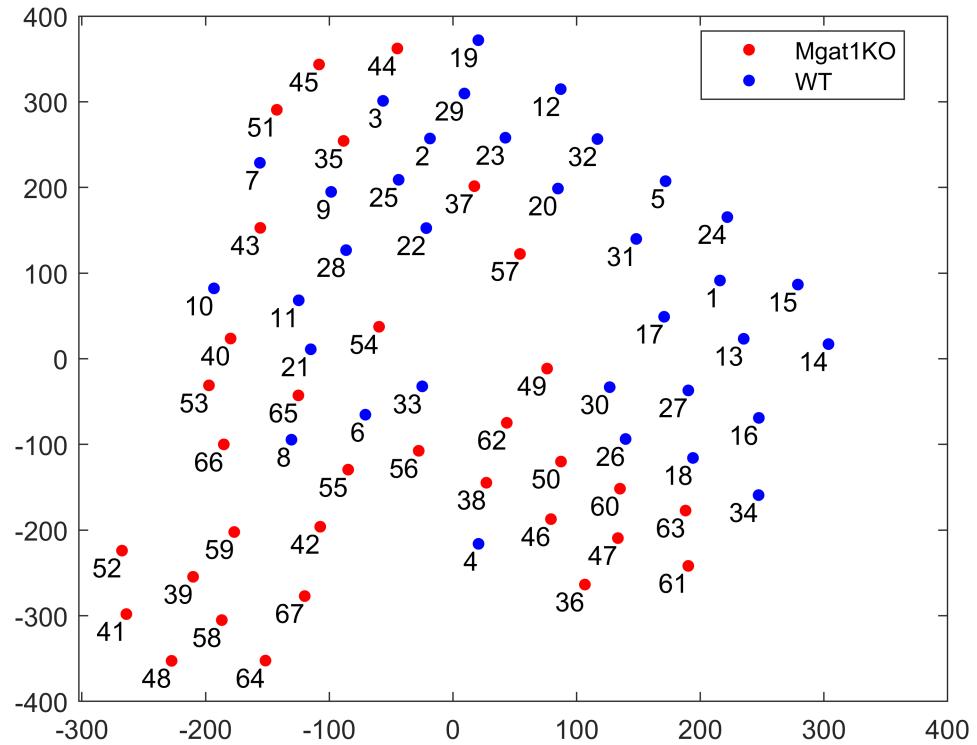
```
gscatter(score(:,1),score(:,2),g2,'rb')
```



```

embd = tsne(normalize(table2array(pkss2(:,2:end))), 'Algorithm', 'exact', 'Distance', 'spearman');
gscatter(embd(:,1), embd(:,2), g2, 'rb')
text(embd(:,1), embd(:,2), tlabels, 'VerticalAlignment', 'top', 'HorizontalAlignment', 'right')

```



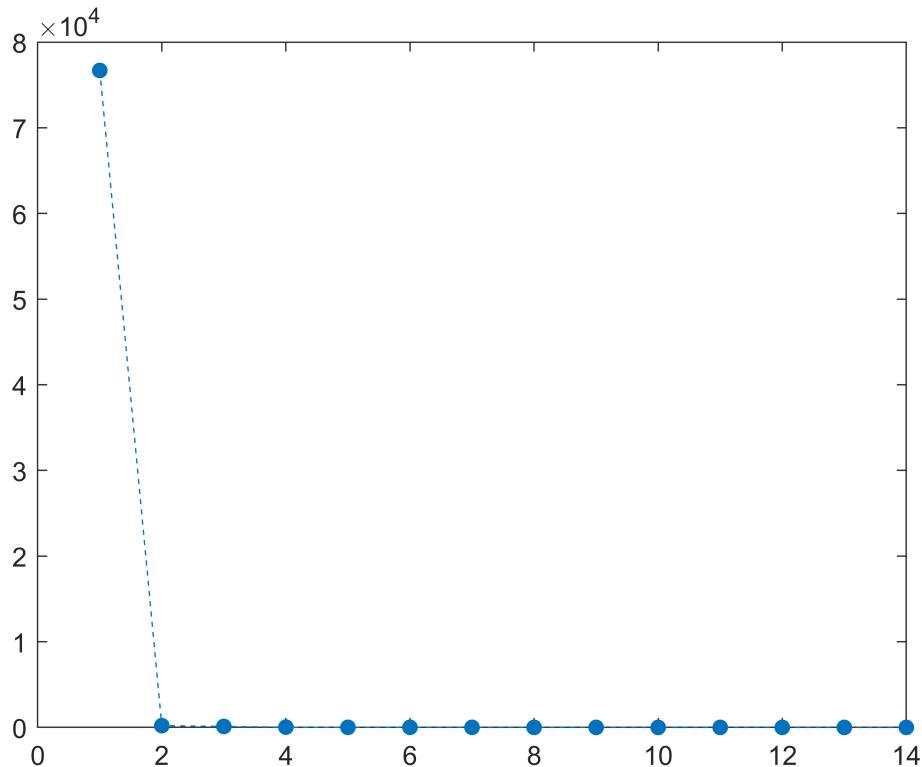
Clustering with the three K⁺ current models combined

PCA

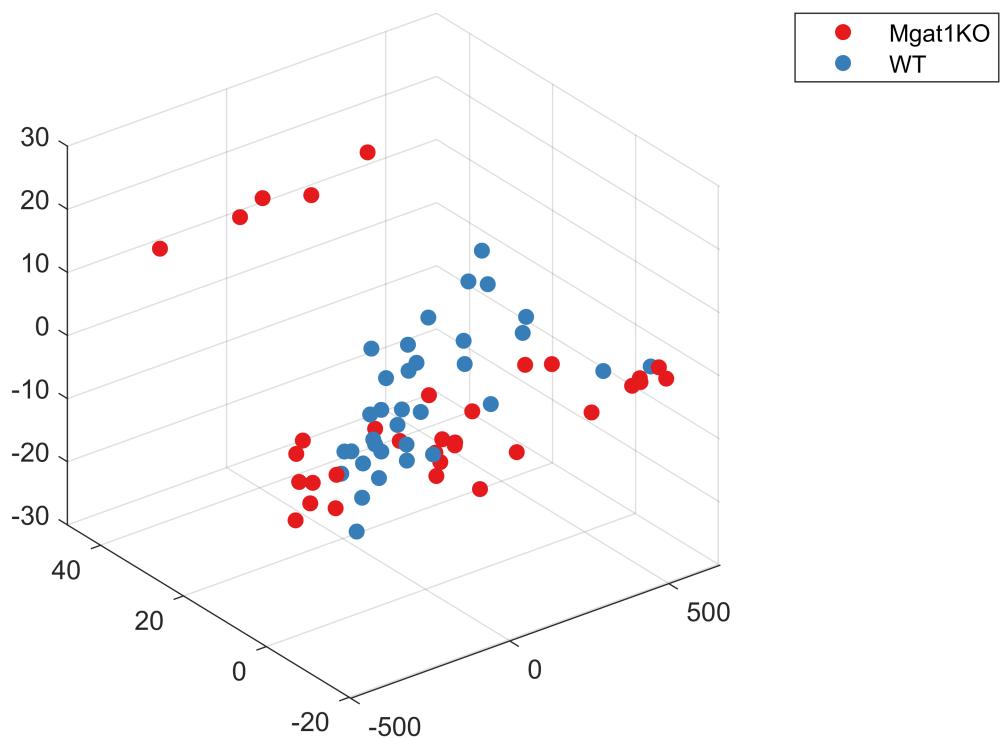
```

pmx = [table2array(pktof2(:,2:end)), table2array(pkslow12(:,2:end))];
[~,score,latent] = pca(pmx);
plot(latent,'--.', 'MarkerSize',20)

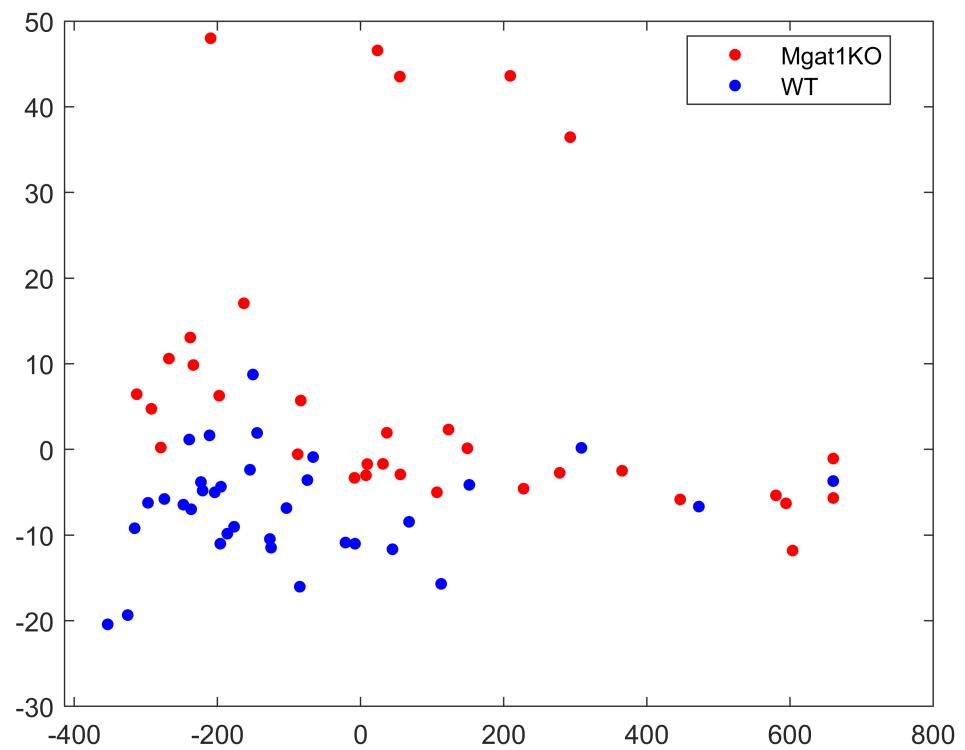
```



```
scatter3(score(g==1,1),score(g==1,2),score(g==1,3), 'filled', 'CData',c(g(g==1),:))
hold on
scatter3(score(g==2,1),score(g==2,2),score(g==2,3), 'filled', 'CData',c(g(g==2),:))
hold off
legend(["Mgat1KO","WT"])
```



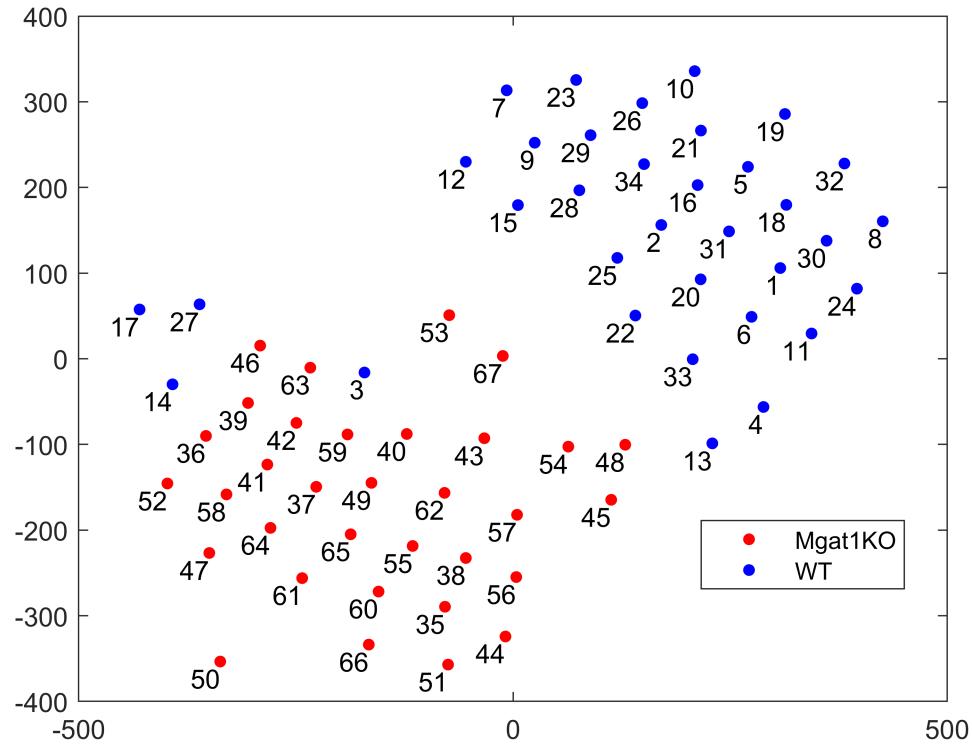
```
gscatter(score(:,1),score(:,2),g2,'rb')
```



```

embd = tsne(normalize(pmx), 'Algorithm', 'exact', 'Distance', 'spearman');
gscatter(embd(:,1),embd(:,2),g2,'rb')
text(embd(:,1),embd(:,2),tlabels,'VerticalAlignment','top','HorizontalAlignment','right')

```



Repeat the same routine for Experiment 45

IKtof

```

pktof = readtable("exp45_pktof.csv");
pidx = unique(pktof.param);

figure
for i=1:length(pidx)
    psub = pktof(pktof.param==pidx(i),:);
    psub_wt = psub(string(psub.Group)== "WT",:);
    psub_ko = psub(string(psub.Group)== "Mgat1KO",:);

    [f1,xi1] = ksdensity(psub_wt.value);
    [f2,xi2] = ksdensity(psub_ko.value);

    subplot(3,3,i)
    plot(xi1,f1, 'Color','blue', 'LineWidth',2)
    hold on
    plot(xi2,f2, 'Color','red', 'LineWidth',2)
    hold off

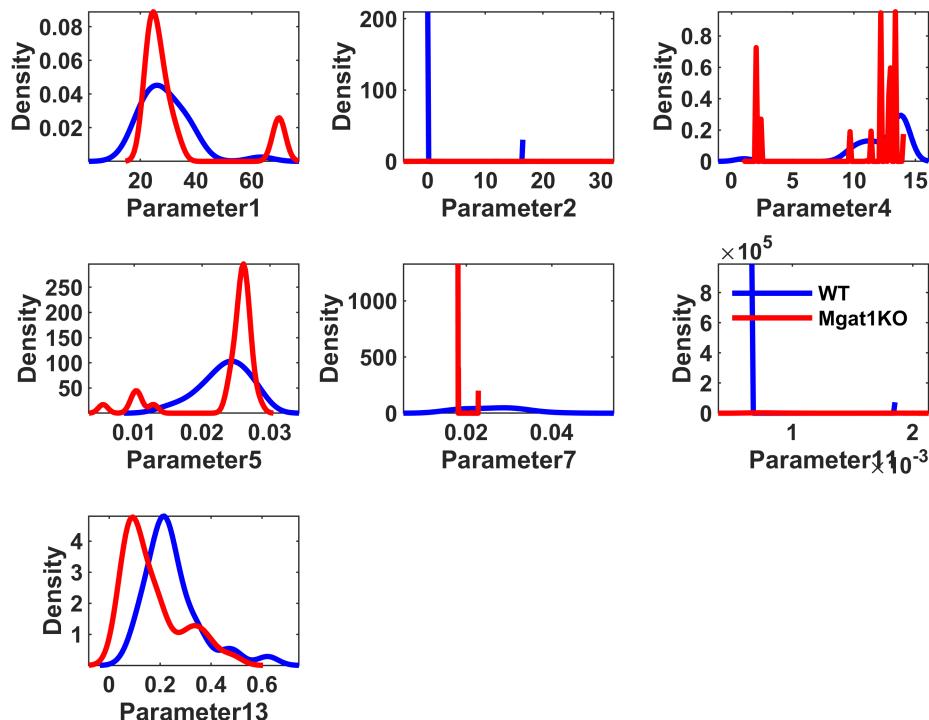
```

```

axis tight
xlabel(strcat('Parameter', num2str(pidx(i))))
ylabel('Density')
set(gca, 'FontName','Arial', 'FontWeight','bold')

if i==6
    legend(["WT", "Mgat1KO"])
    legend box off
end
end

```



```

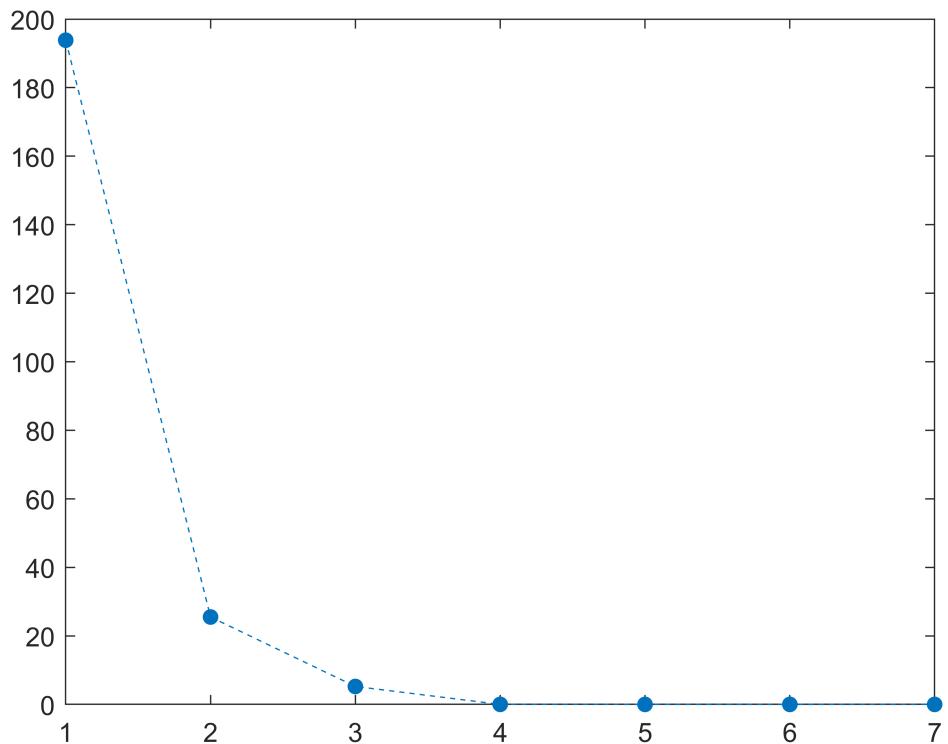
nrow = size(pktof,1)/length(pidx);
pktof2 = array2table(NaN(nrow,length(pidx)+1));
pktof2.Properties.VariableNames(1) = {'Group'};
pktof2.Group = pktof(pktof.param==pidx(1),:).Group;

for i=1:length(pidx)
    pktof2.Properties.VariableNames(i+1) = {strcat('P',num2str(pidx(i)))};
    pktof2(:,i+1)= pktof(pktof.param==pidx(i),'value');
end

[~,score,latent] = pca(table2array(pktof2(:,2:end)));

figure
plot(latent,'--.', 'MarkerSize',20)

```

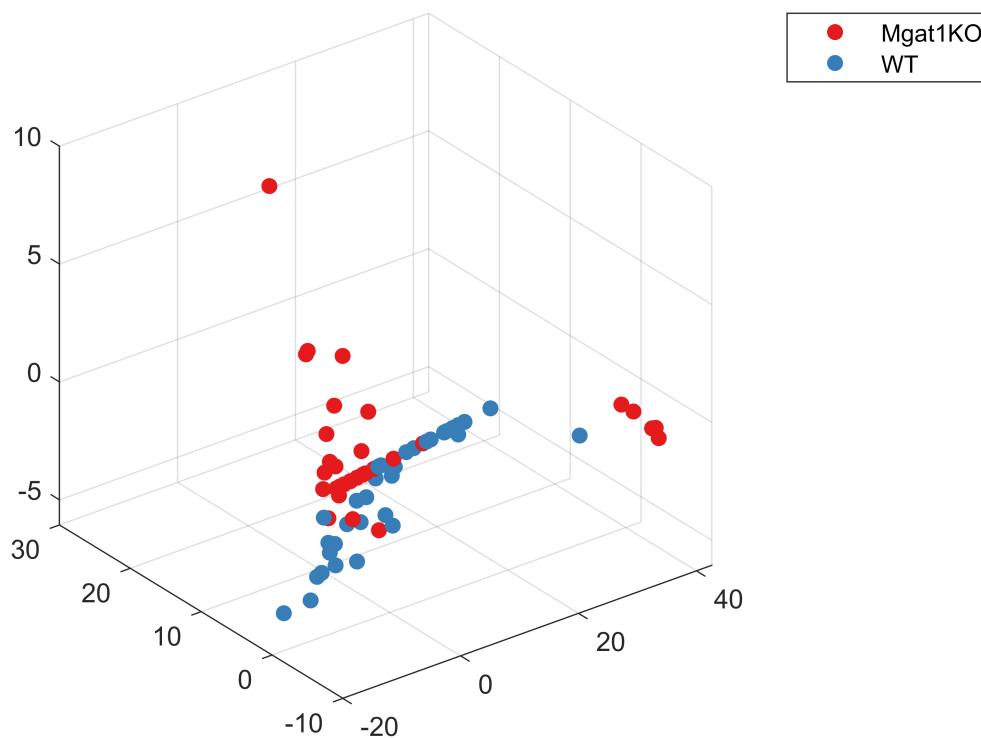


```

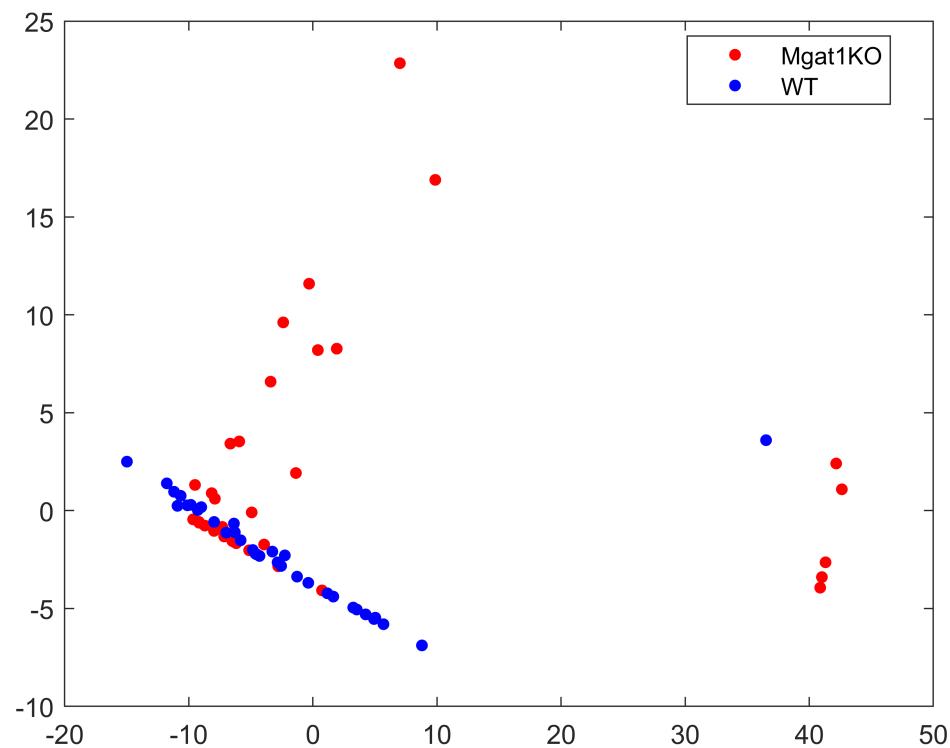
g = NaN(nrow,1);
g(pktof2.Group == "Mgat1KO") = 1;
g(pktof2.Group == "WT") = 2;
c = brewermap(length(unique(g)), 'Set1');
tlabels = string(1:nrow);

scatter3(score(g==1,1),score(g==1,2),score(g==1,3), 'filled', 'CData',c(g==1,:))
hold on
scatter3(score(g==2,1),score(g==2,2),score(g==2,3), 'filled', 'CData',c(g==2,:))
hold off
legend(["Mgat1KO","WT"])

```



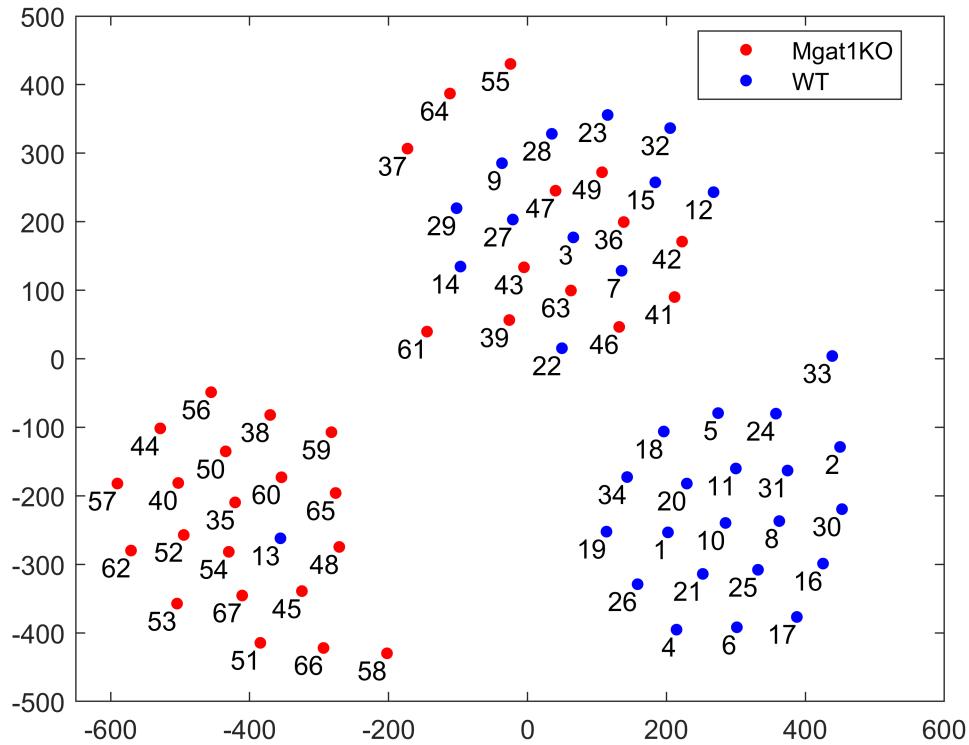
```
g2 = categorical(pktof2$Group);
gscatter(score(:,1),score(:,2),g2, 'rb');
```



```

embd = tsne(table2array(pktot2(:,2:end)), 'Algorithm', 'exact', 'Distance', 'spearman');
gscatter(embd(:,1), embd(:,2), g2, 'rb')
text(embd(:,1), embd(:,2), tlabels, 'VerticalAlignment', 'top', 'HorizontalAlignment', 'right')

```



IKslow1

```

pkslow1 = readtable("exp45_pkslow1.csv");
pidx = unique(pkslow1.param);

figure
for i=1:length(pidx)
    psub = pkslow1(pkslow1.param==pidx(i),:);
    psub_wt = psub(string(psub.Group)== "WT",:);
    psub_ko = psub(string(psub.Group)== "Mgat1KO",:);

    [f1,xi1] = ksdensity(psub_wt.value);
    [f2,xi2] = ksdensity(psub_ko.value);

    subplot(3,3,i)
    plot(xi1,f1, 'Color', 'blue', 'LineWidth',2)
    hold on
    plot(xi2,f2, 'Color', 'red', 'LineWidth',2)
    hold off
    axis tight
    xlabel(strcat('Parameter', num2str(pidx(i))))
    ylabel('Density')

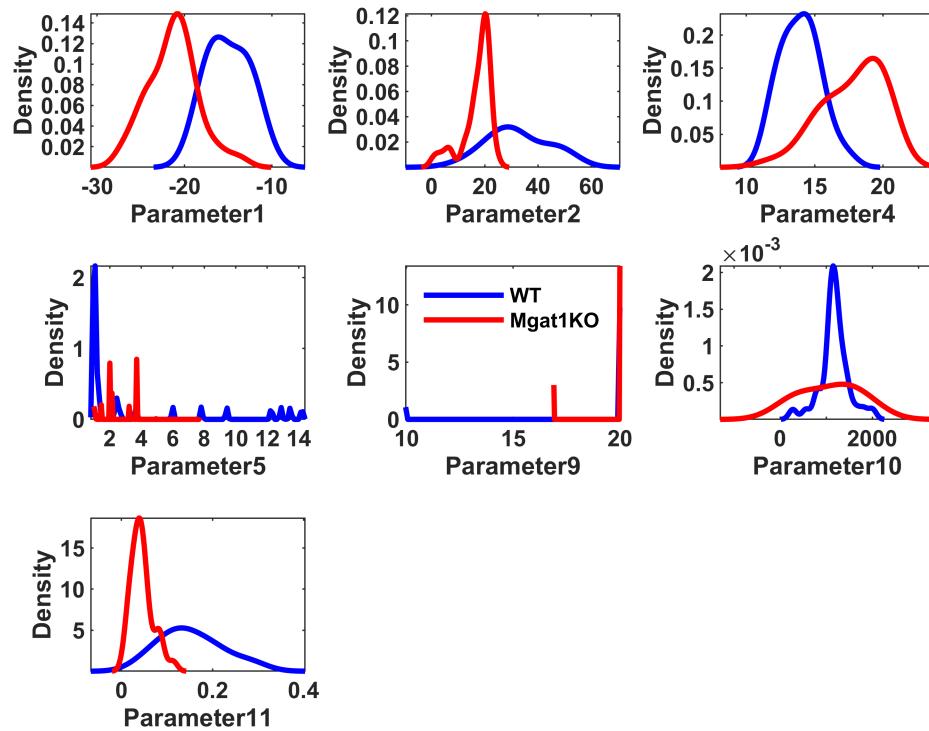
```

```

set(gca, 'FontName','Arial', 'FontSize',12, 'FontWeight','bold')

if i==5
    legend(["WT", "Mgat1KO"])
    legend box off
end
end

```



```

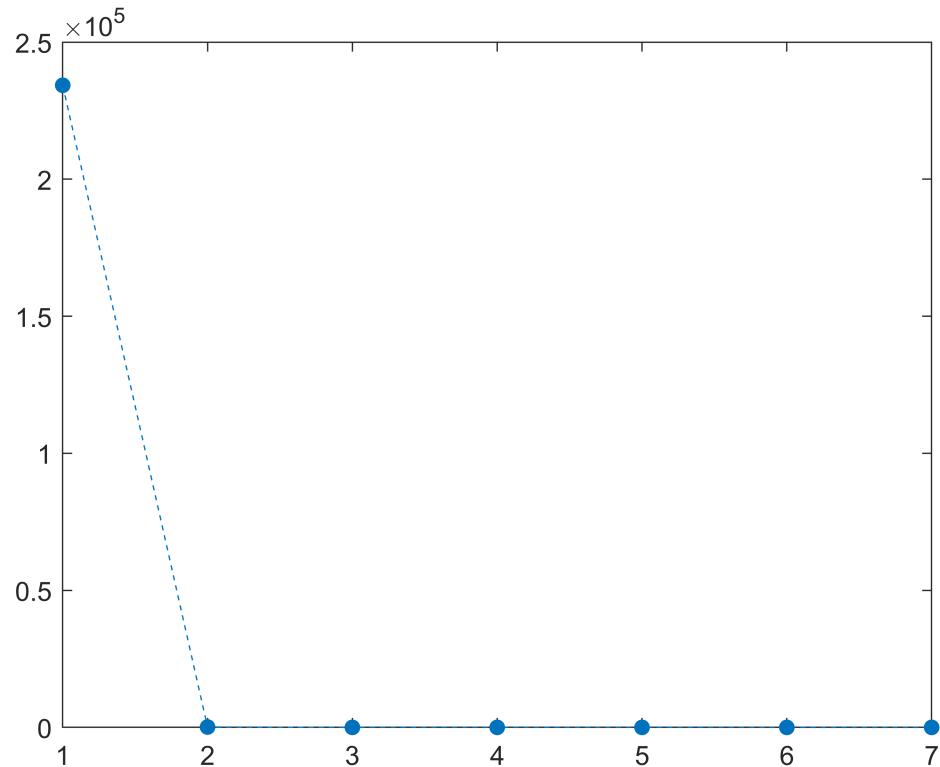
nrow = size(pkslow1,1)/length(pidx);
pkslow12 = array2table(NaN(nrow,length(pidx)+1));
pkslow12.Properties.VariableNames(1) = {'Group'};
pkslow12.Group = pkslow1(pkslow1.param==pidx(1),:).Group;

for i=1:length(pidx)
    pkslow12.Properties.VariableNames(i+1) = {strcat('P',num2str(pidx(i)))};
    pkslow12(:,i+1)= pkslow1(pkslow1.param==pidx(i), 'value');
end

[~,score,latent] = pca(table2array(pkslow12(:,2:end)));

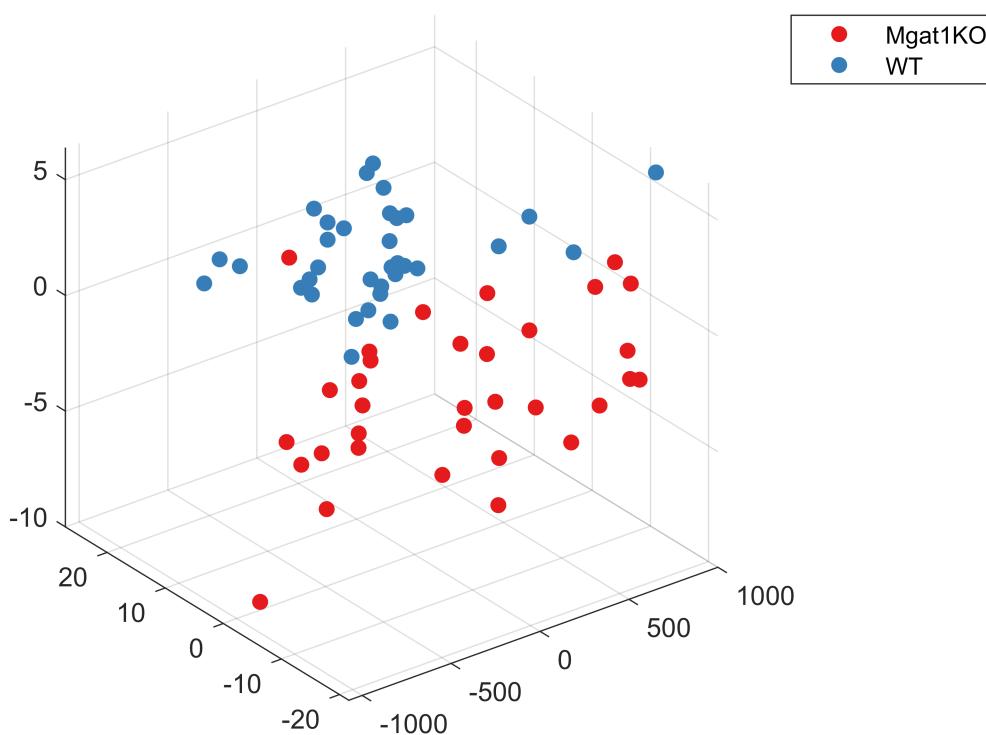
figure
plot(latent,'--.', 'MarkerSize',20)

```

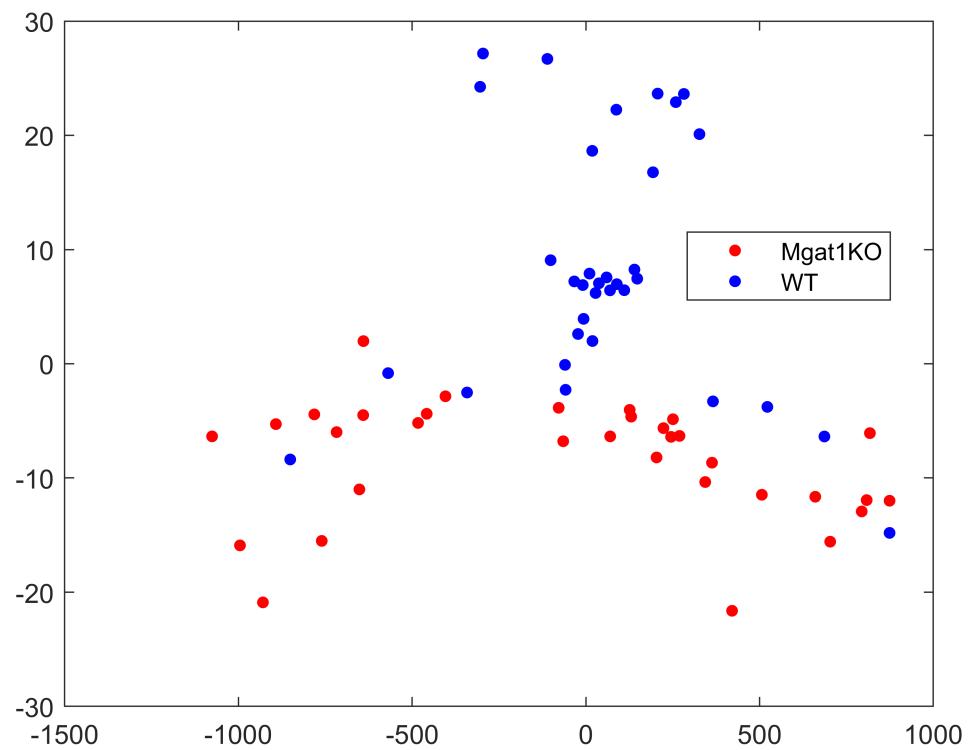


```
g = NaN(nrow,1);
g(pkslow12.Group == "Mgat1KO") = 1;
g(pkslow12.Group == "WT") = 2;
c = brewermap(length(unique(g)), 'Set1');

scatter3(score(g==1,1),score(g==1,2),score(g==1,3), 'filled', 'CData',c(g==1,:))
hold on
scatter3(score(g==2,1),score(g==2,2),score(g==2,3), 'filled', 'CData',c(g==2,:))
hold off
legend(["Mgat1KO", "WT"])
```



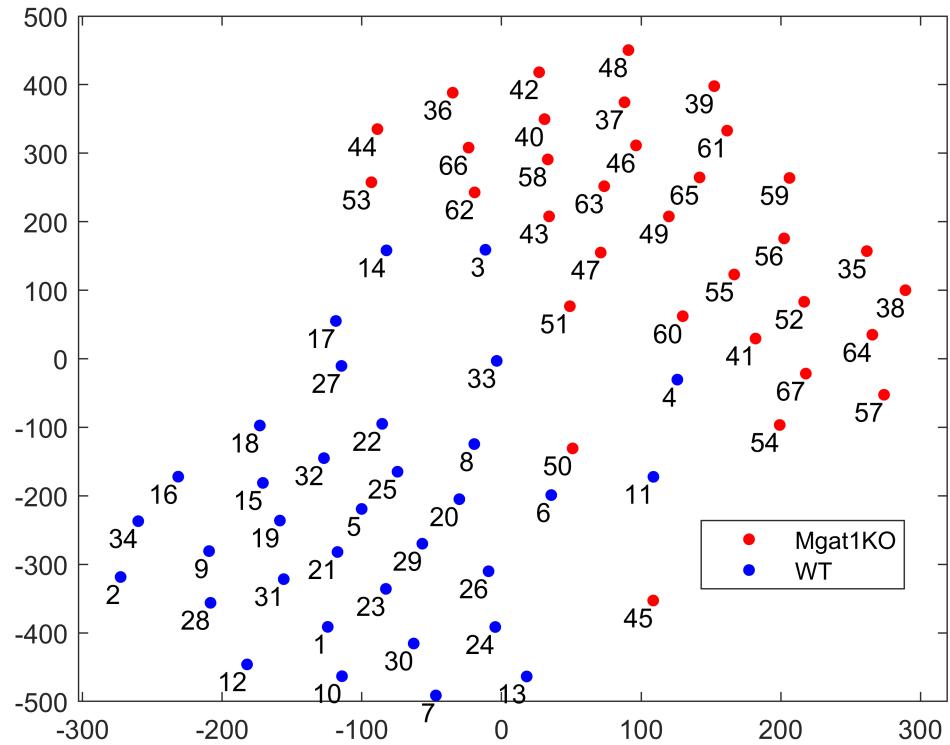
```
g2 = categorical(pkslow12.Group);
gscatter(score(:,1),score(:,2),g2,'rb')
```



```

embd = tsne(normalize(table2array(pkslow12(:,2:end))), 'Algorithm', 'exact', 'Distance', 'spearman')
gscatter(embd(:,1),embd(:,2),g2, 'rb')
text(embd(:,1),embd(:,2),tlabels, 'VerticalAlignment', 'top', 'HorizontalAlignment', 'right')

```



IKslow2

```

pkslow2 = readtable("exp45_pkslow2.csv");
pidx = unique(pkslow2.param);

for i=1:length(pidx)
    psub = pkslow2(pkslow2.param==pidx(i),:);
    psub_wt = psub(string(psub.Group)=='WT',:);
    psub_ko = psub(string(psub.Group)=='Mgat1KO',:);

    [f1,xi1] = ksdensity(psub_wt.value);
    [f2,xi2] = ksdensity(psub_ko.value);

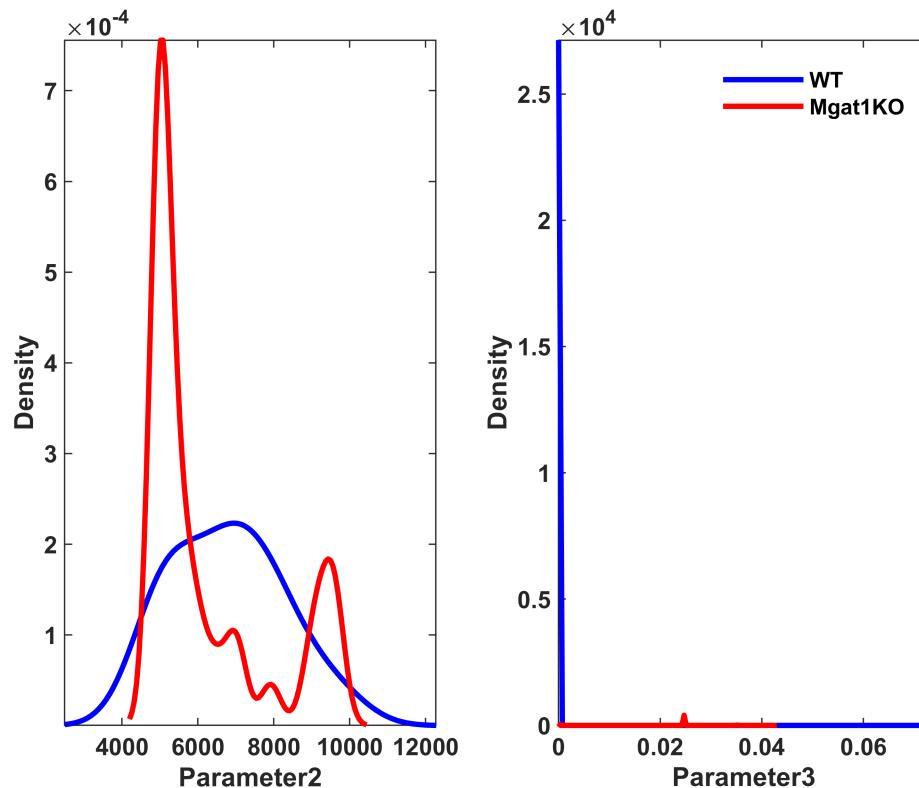
    subplot(1,2,i)
    plot(xi1,f1, 'Color','blue', 'LineWidth',2)
    hold on
    plot(xi2,f2, 'Color','red', 'LineWidth',2)
    hold off
    axis tight
    xlabel(strcat('Parameter', num2str(pidx(i))))
    ylabel('Density')
    set(gca, 'FontName','Arial', 'FontWeight','bold')

```

```

if i==2
    legend(["WT","Mgat1KO"])
    legend box off
end
end

```

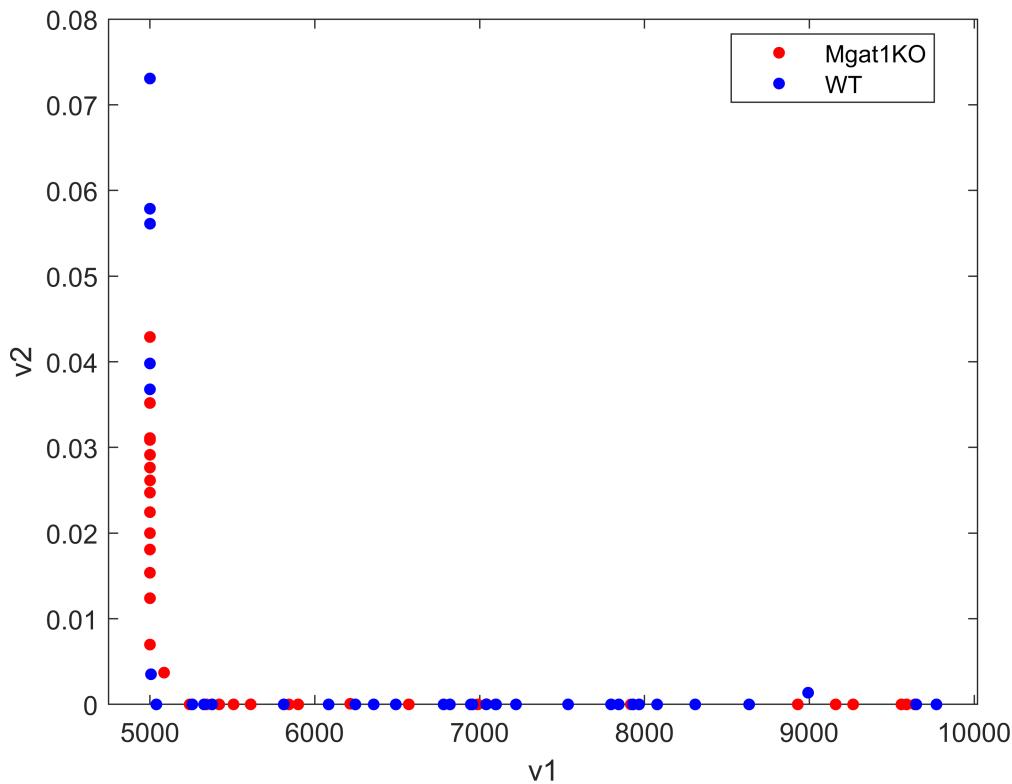


```

nrow = size(pkslow2,1)/length(pidx);
g = categorical(pkslow2(pkslow2.param==pidx(1),:).Group);
v1 = pkslow2(pkslow2.param==pidx(1),:).value;
v2 = pkslow2(pkslow2.param==pidx(2),:).value;
pkslow22 = table(g,v1,v2);

figure
gscatter(v1,v2,g,'rb')

```



IKss

```

pkss = readtable("exp45_pkss.csv");
pidx = unique(pkss.param);

figure
for i=1:length(pidx)
    psub = pkss(pkss.param==pidx(i),:);
    psub_wt = psub(string(psub.Group)=="WT",:);
    psub_ko = psub(string(psub.Group)=="Mgat1KO",:);

    [f1,xi1] = ksdensity(psub_wt.value);
    [f2,xi2] = ksdensity(psub_ko.value);

    subplot(2,2,i)
    plot(xi1,f1, 'Color','blue', 'LineWidth',2)
    hold on
    plot(xi2,f2, 'Color','red', 'LineWidth',2)
    hold off
    axis tight
    xlabel(strcat('Parameter', num2str(pidx(i))))
    ylabel('Density')
    set(gca, 'FontName','Arial','FontWeight','bold')

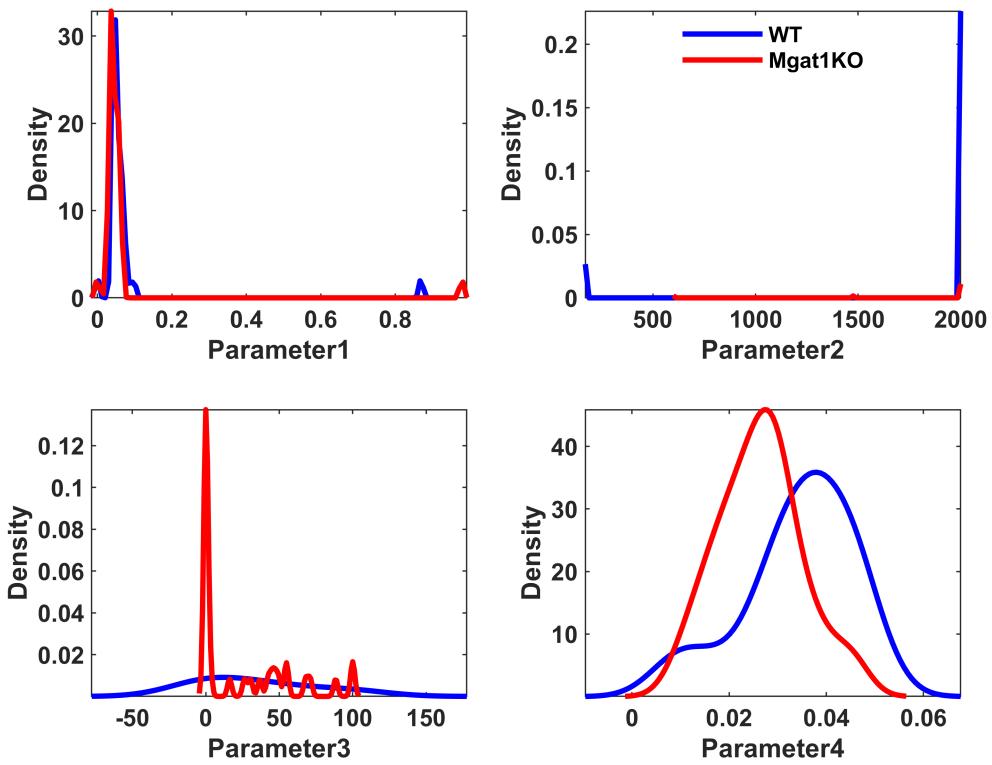
if i==2

```

```

        legend('WT','Mgat1KO', 'Location','best')
        legend box off
    end
end

```



```

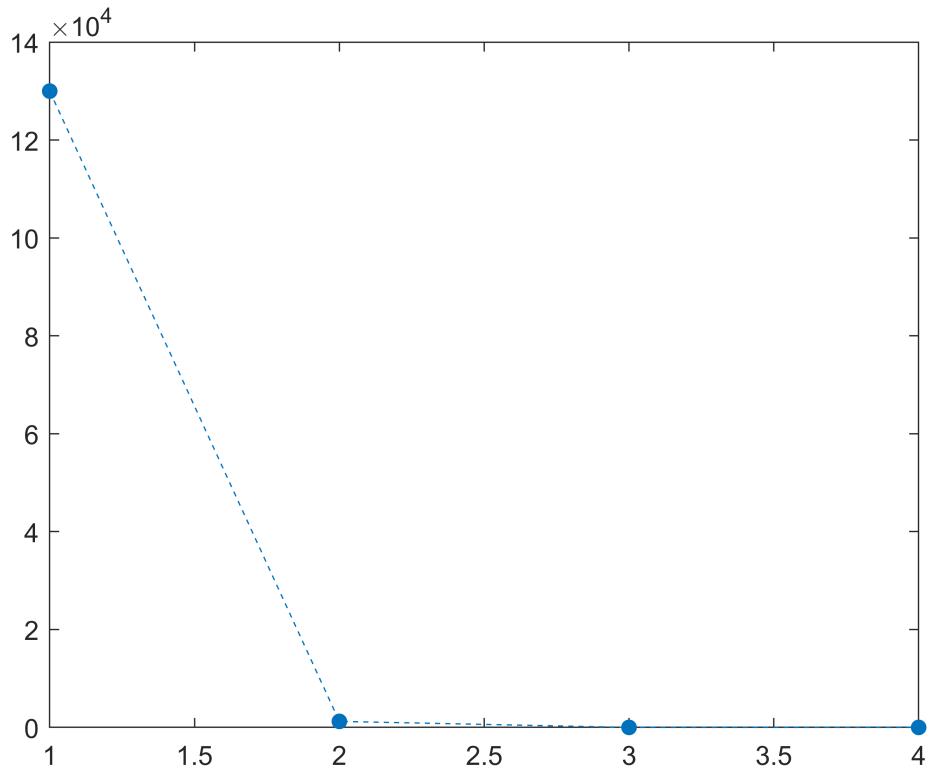
pkss2 = array2table(NaN(nrow,length(pidx)+1));
pkss2.Properties.VariableNames(1) = {'Group'};
pkss2.Group = pkss(pkss.param==pidx(1),:).Group;

for i=1:length(pidx)
    pkss2.Properties.VariableNames(i+1) = {strcat('P',num2str(pidx(i)))};
    pkss2(:,i+1)= pkss(pkss.param==pidx(i),'value');
end

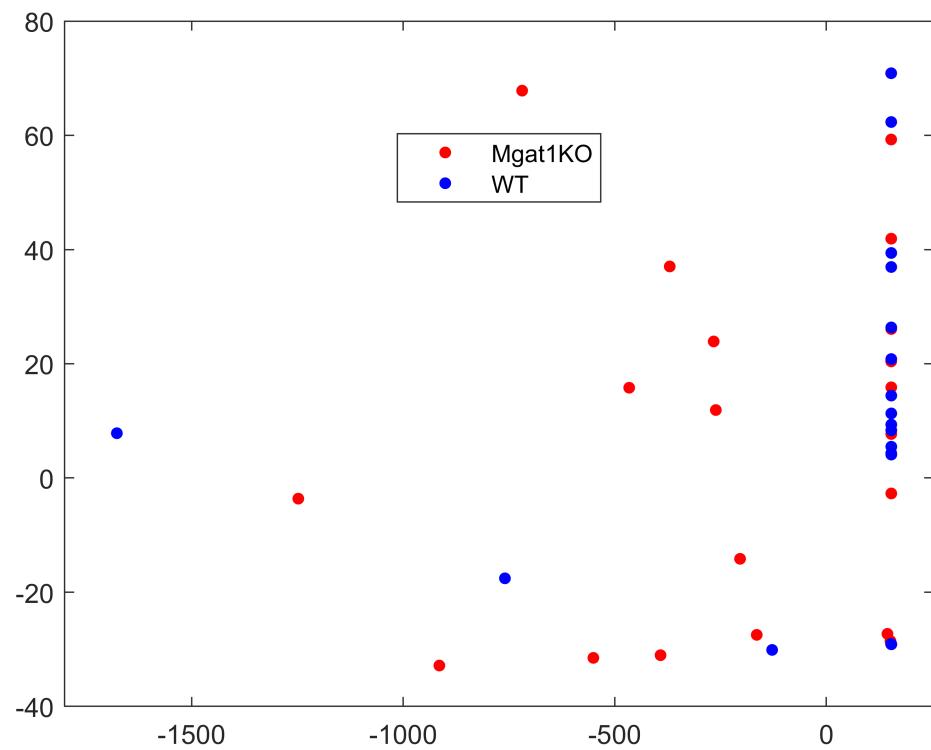
[~,score,latent] = pca(table2array(pkss2(:,2:end)));

figure
plot(latent,'--.', 'MarkerSize',20)

```



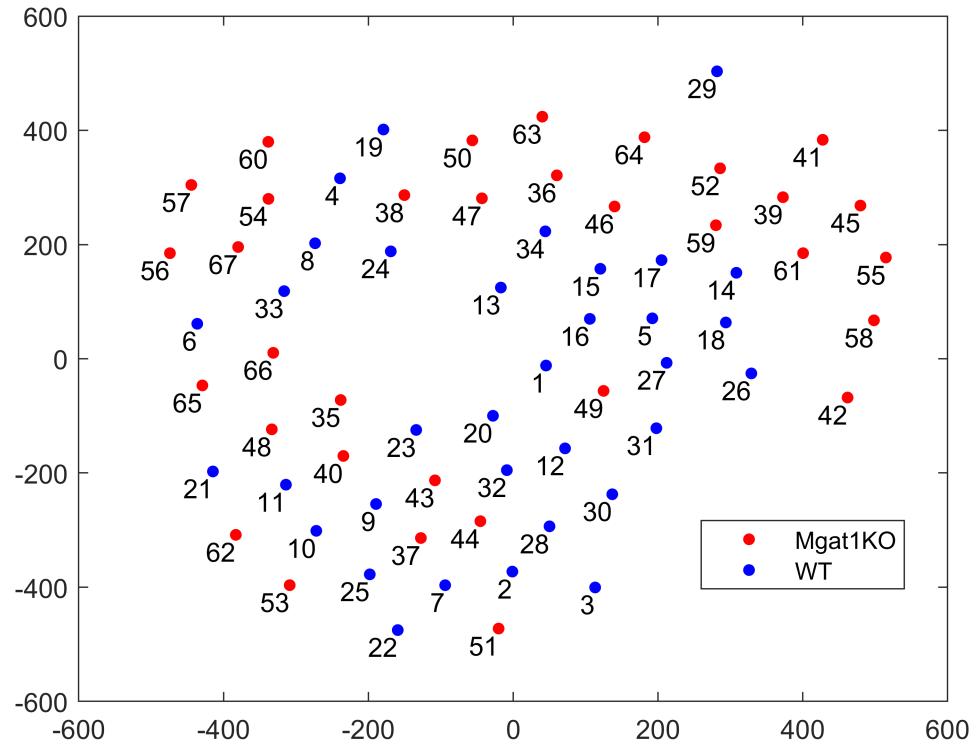
```
gscatter(score(:,1),score(:,2),g2,'rb')
```



```

embd = tsne(normalize(table2array(pkss2(:,2:end))), 'Algorithm', 'exact', 'Distance', 'spearman');
gscatter(embd(:,1), embd(:,2), g2, 'rb')
text(embd(:,1), embd(:,2), tlabels, 'VerticalAlignment', 'top', 'HorizontalAlignment', 'right')

```



Combine the four K⁺ current models

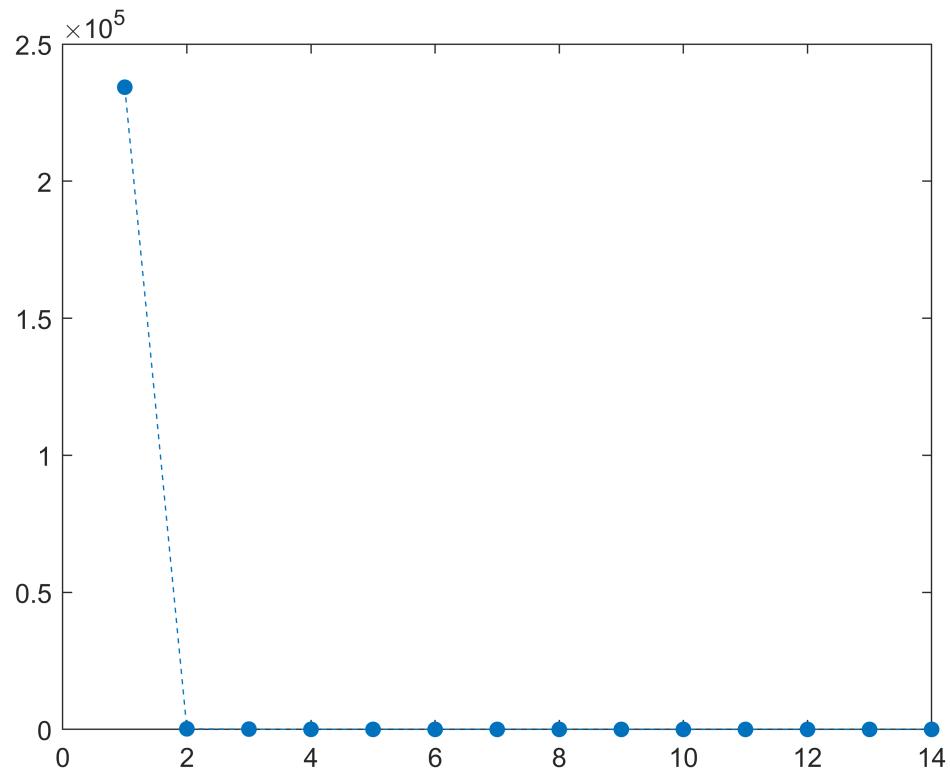
```

pmx = [table2array(pktof2(:,2:end)), table2array(pkslow12(:,2:end)), table2array(pkslow22(:,2:end))];

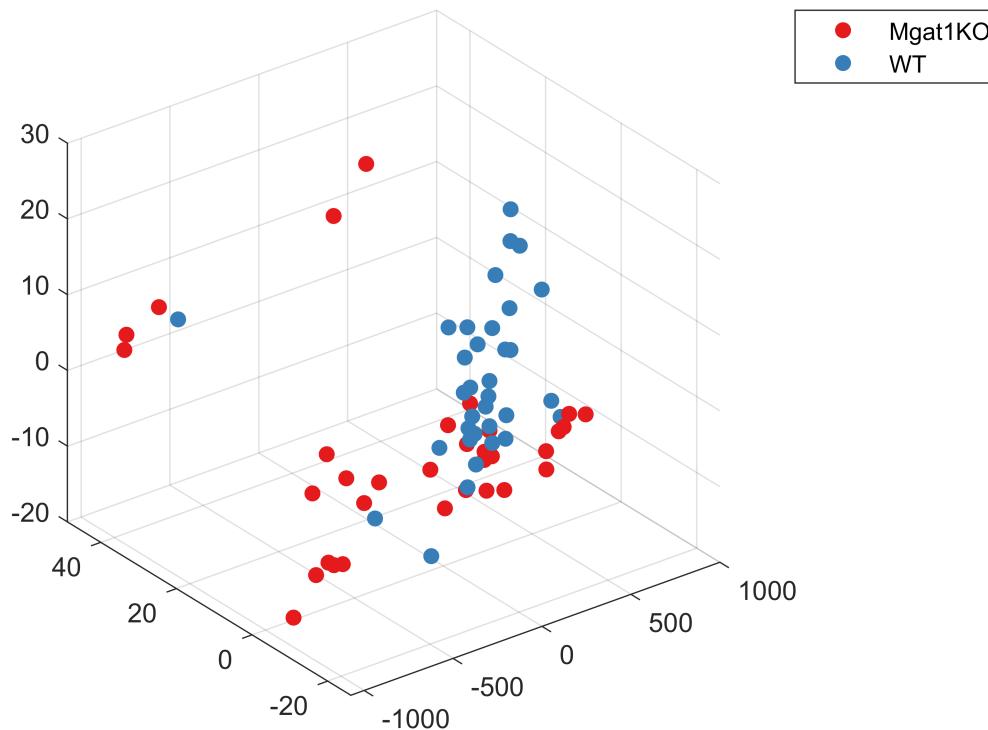
g = NaN(nrow,1);
g(pktof2.Group == "Mgat1KO") = 1;
g(pktof2.Group == "WT") = 2;

[~,score,latent] = pca(pmx);
plot(latent,'--.', 'MarkerSize',20)

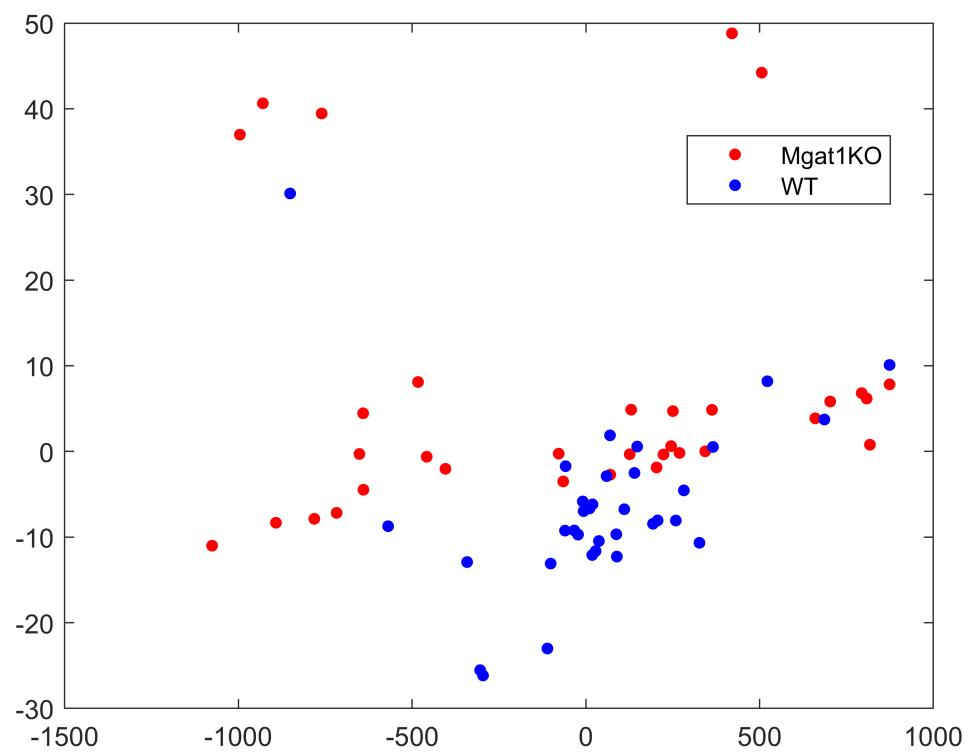
```



```
scatter3(score(g==1,1),score(g==1,2),score(g==1,3), 'filled', 'CData',c(g(g==1),:))
hold on
scatter3(score(g==2,1),score(g==2,2),score(g==2,3), 'filled', 'CData',c(g(g==2),:))
hold off
legend(["Mgat1KO","WT"])
```



```
gscatter(score(:,1),score(:,2),g2,'rb');
```



```

embd = tsne(normalize(pmx), 'Algorithm', 'exact', 'Distance', 'spearman');
gscatter(embd(:,1),embd(:,2),g2,'rb')
text(embd(:,1),embd(:,2),tlabels,'VerticalAlignment','top','HorizontalAlignment','right')

```

