```
clear all, close all, clc
```

```
load('data/2017-08-31-ks_analysis.mat')
whos
```

```
  Name              Size              Bytes  Class     Attributes

  epm               1x1              841024  struct
  exptAges          2x1                 244  cell
  exptRegions       4x1                 512  cell
  gr                1x1              422265  struct
  kstable         336x9             53448809  table
  sc                1x1              998745  struct
  timestamp         1x20                 40  char
  ym                1x1             1731200  struct
```

```
B = ym.CrusI.Adult
```

```
B = struct with fields:
          behavior: [51×14 table]
          dataPath: 'data/BehavioralDataMatrix.April14_clean_8_17_2017.xlsx'
            isCtrl: [51×1 logical]
        metafields: {'Age'  'Region'  'Condition'}
      metricLabels: {'YM_AcqInitialLR'  'YM_AcqSecondaryLR'  'YM_AcqAbility'  'YM_EarlyRevInitialLR'  'YM_EarlyRe
            params: [1×1 struct]
              mice: {51×1 cell}
           metrics: [51×10 double]
          isMetric: [0 0 0 0 1 1 1 1 1 1 1 1 1 1]
      descriptions: {1×10 cell}
             units: {'% correct'  'change in % correct'  'average % correct'  '% correct'  'change in % correct'
               pcs: [1×1 struct]
        assay_name: 'Ymaze'
      assay_abbrev: 'YM'
               raw: [51×10 table]
                 X: [51×10 table]
               pca: [51×10 table]
               all: [51×20 table]
              expt: [10×20 table]
              ctrl: [41×20 table]
         allLabels: {1×20 cell}
    allDescriptions: {1×20 cell}
          allUnits: {1×20 cell}
           rawUnit: [1×1 struct]
              desc: [1×1 struct]
              unit: [1×1 struct]
                ks: [1×1 struct]
       region_name: 'CrusI'
       region_desc: 'Crus I'
          age_name: 'Adult'
```

```
% already normalized/projected:
allmice_amps = B.pca{:,:};
untreat_amps = B.pca{B.isCtrl,:}; % controls
treated_amps = B.pca{~B.isCtrl,:}; % experimentals
```

```
num_untreat = size(untreat_amps,1)
```

```
num_untreat =
    41
```

```
num_treated = size(treated_amps,1)
```

```
num_treated =
    10
```

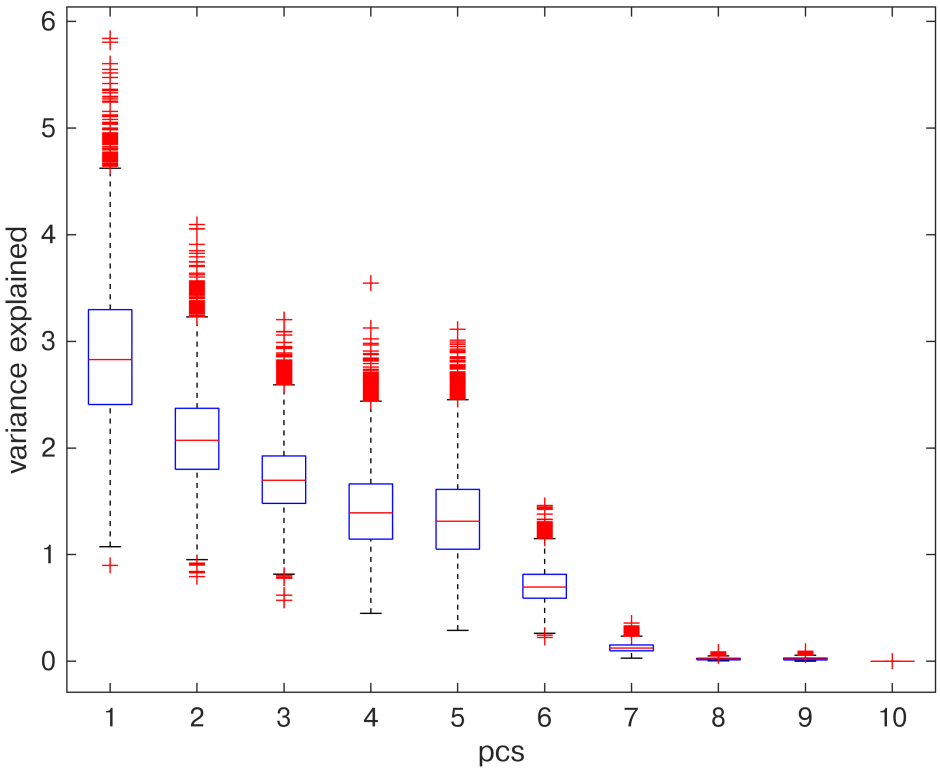
```
d = size(allmice_amps,2) % number of pcs
```

```
d =
    10
```

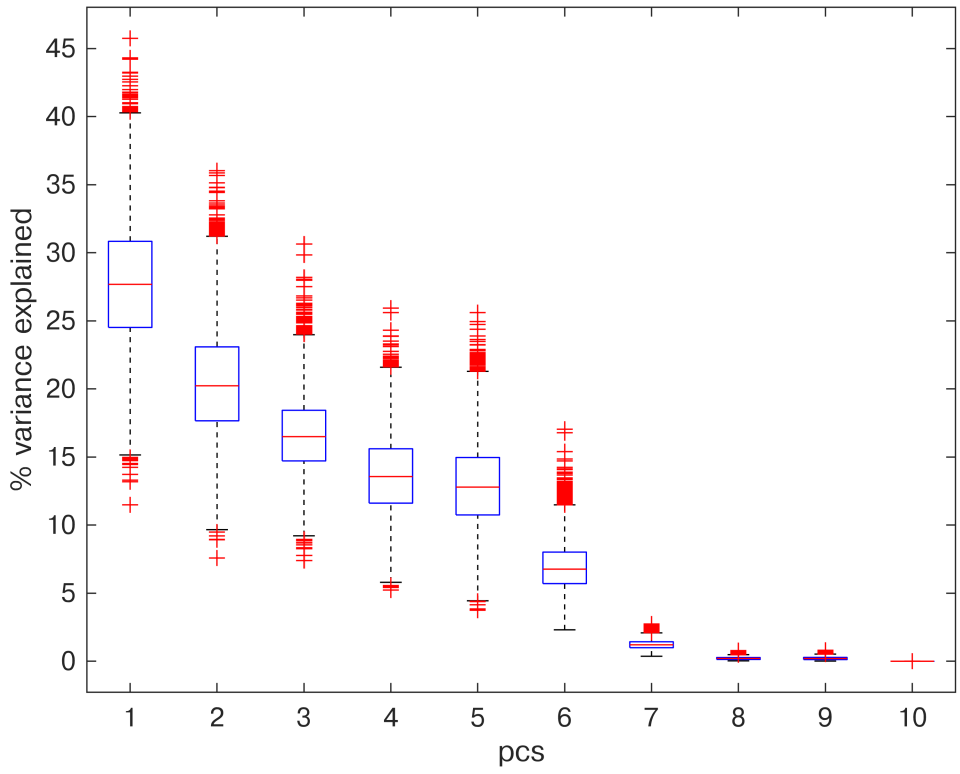
```
N = 10000; % number of bootstrap samples
k = size(untreat_amps,1); % number of mice per sampling
% k = size(treated_amps,1); % number of mice per sampling
alpha = 0.05; % significance level

tic;
sample_pval = NaN(N,d);
sample_var = NaN(N,d);
sample_sig_var = NaN(N,1);
sample_num_sig = NaN(N,1);
for i = 1:N
    sample_amps = datasample(allmice_amps,k); % random subsample
    sample_latent = sum(sample_amps .^ 2) ./ size(sample_amps,1); % compute latents (eigenvalu

    [~,sample_pval(i,:)] = ttest2(untreat_amps,sample_amps); % significance test
    is_sig = sample_pval(i,:) < alpha;

    sample_var(i,:) = sample_latent; % variance per pc
    sample_sig_var(i) = sum(sample_latent(is_sig)); % sum of variance for significant pcs
    sample_num_sig(i) = sum(is_sig); % count of significant pcs
end
toc
```

```
Elapsed time is 2.213994 seconds.
```

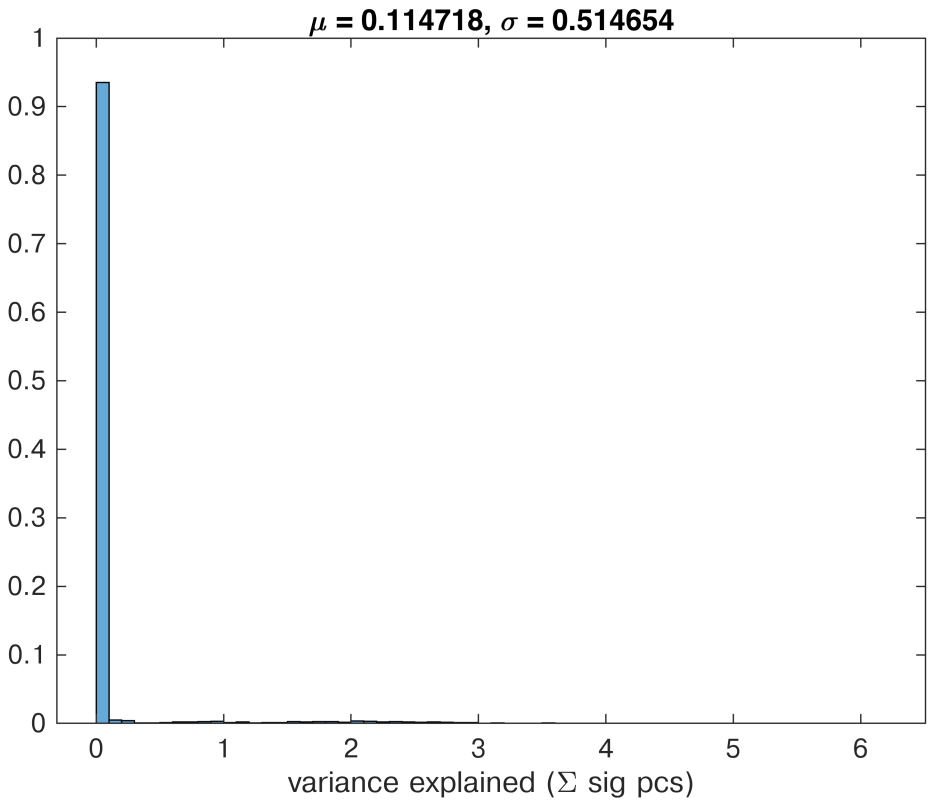
```
figure,boxplot(sample_var)
xlabel('pcs'),ylabel('variance explained')
```



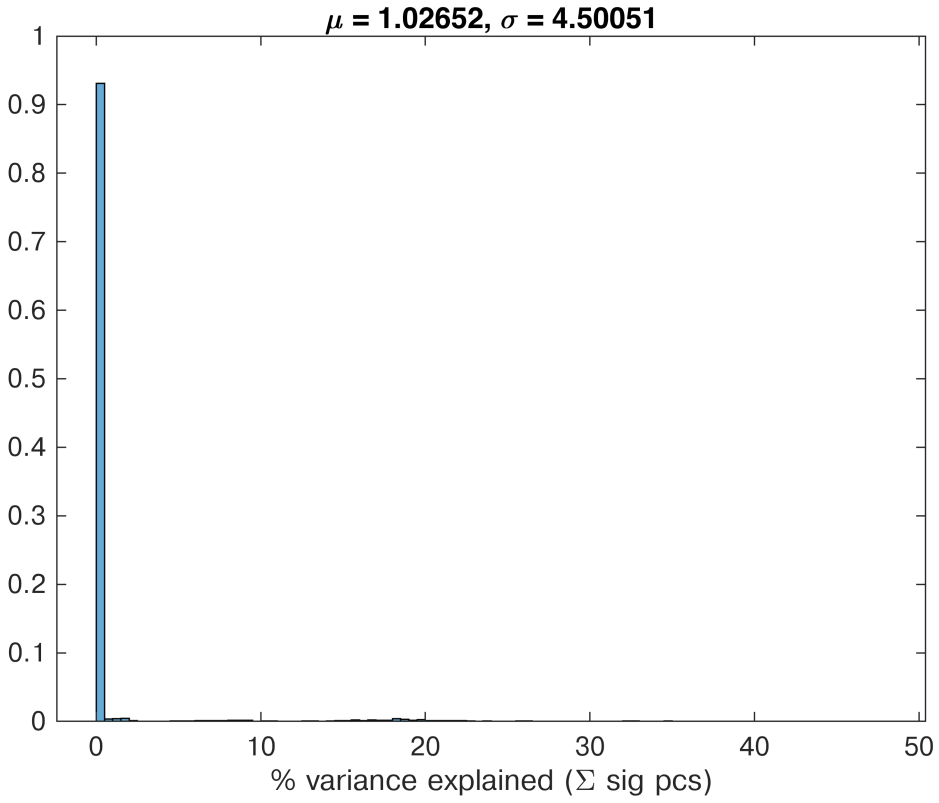

```
figure,boxplot(sample_var ./ sum(sample_var,2) * 100)
xlabel('pcs'),ylabel('% variance explained')
```



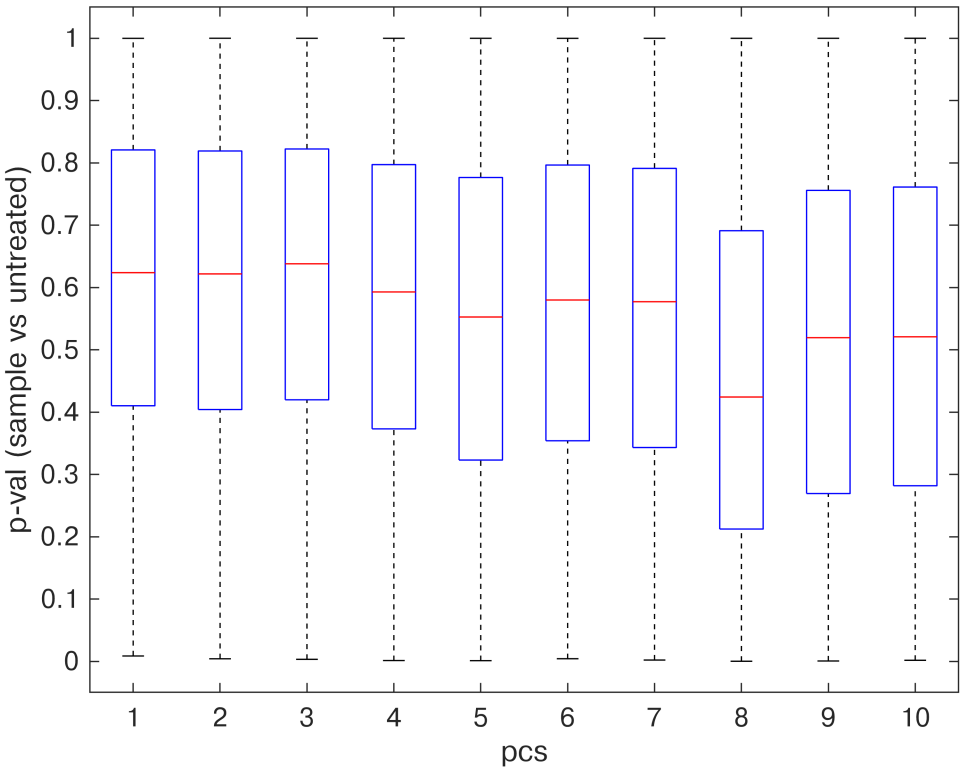

```
figure,histogram(sample_sig_var, 'Normalization','probability'),xlabel('variance explained (\%
title(sprintf('\\mu = %g, \\sigma = %g', mean(sample_sig_var), std(sample_sig_var)))
```



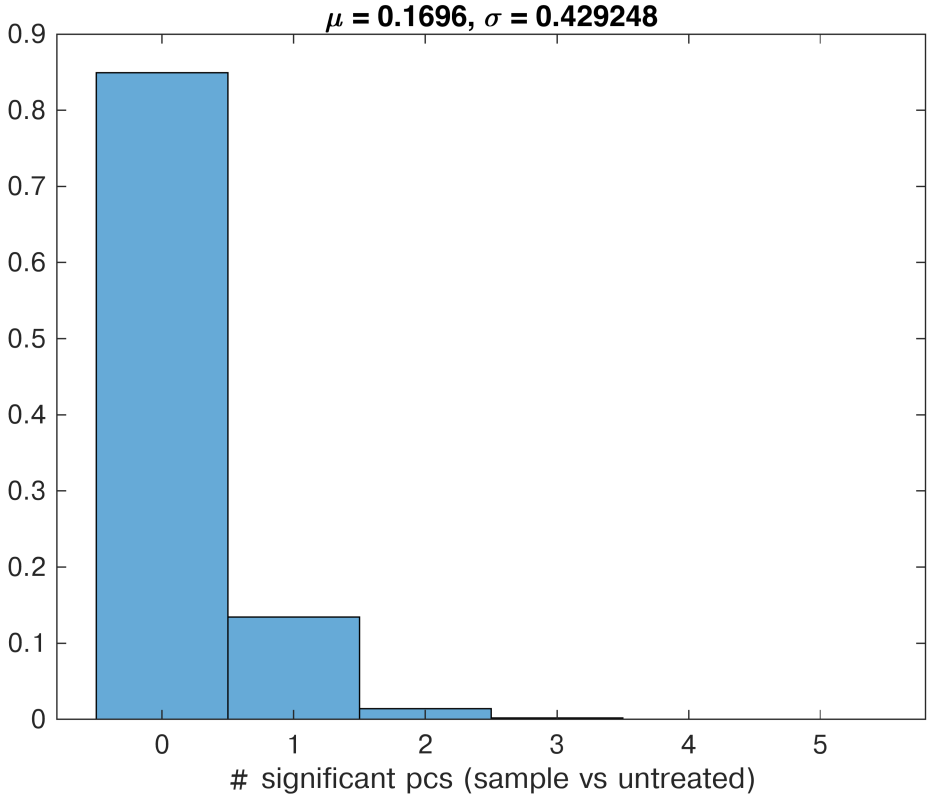

```
sample_sig_var_perc = sample_sig_var ./ sum(sample_var,2) * 100;
figure,histogram(sample_sig_var_perc, 'Normalization','probability'),xlabel('% variance expla
title(sprintf('\\mu = %g, \\sigma = %g', mean(sample_sig_var_perc), std(sample_sig_var_perc))
```




```
figure,boxplot(sample_pval),ylabel('p-val (sample vs untreated)'),xlabel('pcs')
```




```
figure,histogram(sample_num_sig,'Normalization','probability'),xlabel('# significant pcs (samp
title(sprintf('\\mu = %g, \\sigma = %g', mean(sample_num_sig), std(sample_num_sig)))
```


μ = 0.1696, σ = 0.429248
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
1
2
3
4
5
significant pcs (sample vs untreated)