power_simulation.m

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Simulation to at minimum effect size to achieve 80 percent power, given alpha of 0.05, and n=16 and n=55 across the two groups. Population size to sample from is set to n=10,000,000 and this simulation runs 100,000 experiments repeatedly sample n=16 and n=55 from the population of 10 million. The minimum effect size to achieve 80 percent of simulated experiments with a significant effect at alpha < 0.05 is an effect of 0.80751 standard deviations of difference.

Initial parameters to set

```
% set seed for reproducibility
rng(1);

% population effect size
popES = 0.80751;

% sample sizes
sample_sizes = [55, 16];

% actual effect size
actualES = 1.28;

% population size
pop_size = 10000000;

% number of experiments to simulate
n_exp = 100000;

% set to 1 to plot rejected h0 in histogram
PLOTREJECTEDH0 = 1;

% plot options to set
% number of bins for histogram
nbins = 100;
% xlimits to plot
XLIM = [-0.5 2.5];
% line width
lineWidth = 1;
% colors
pop_es_lineColor = [0 1 0];
rejected_h0_color = [1 0 0];
```

```
% alpha transparency
faceAlpha = 1;
% CI limits
ci_lim = [2.5 97.5];
```

Population

```
% population parameters
pop_mean1 = popES;
pop_sd1 = 1;
pop_mean2 = 0;
pop_sd2 = 1;

% generate population data
pop1_data = normrnd(pop_mean1, pop_sd1, pop_size,1);
pop2_data = normrnd(pop_mean2, pop_sd2, pop_size,1);

% calculate effect size
D = cohens_d(pop1_data, pop2_data, 1, 0);
```

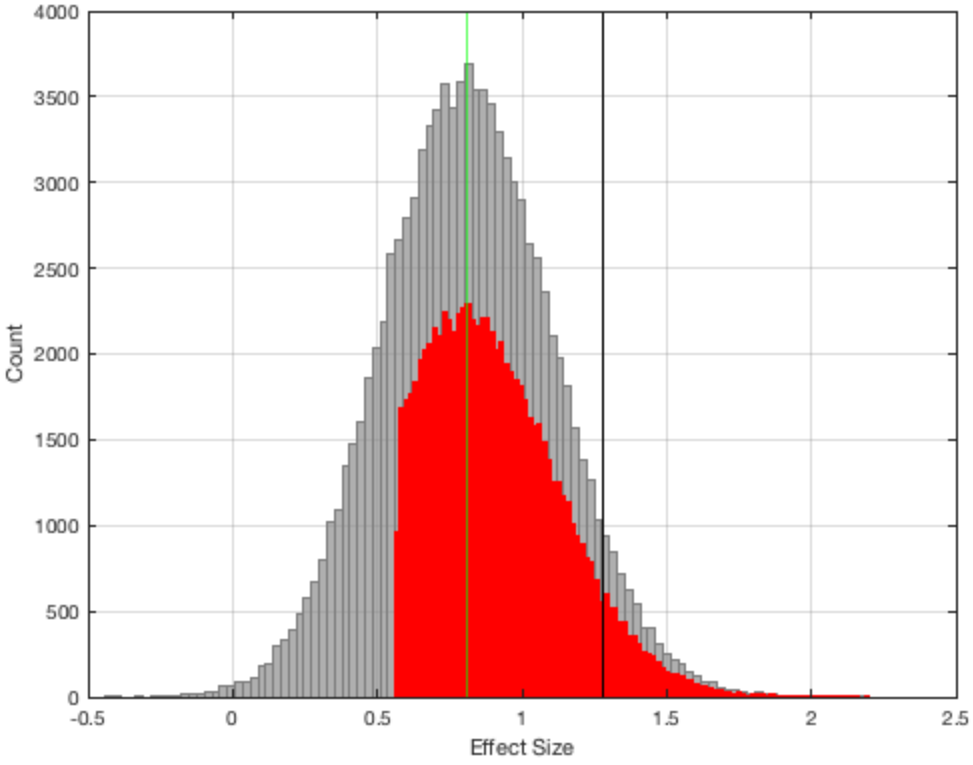
Simulate experiments with varying sample sizes and estimate effect size

```
% pre-allocate sample effect size estimate variable
d = zeros(n_exp,1);
t = zeros(size(d));
p = zeros(size(d));
reject_h0 = zeros(size(d));

% run 100,000 simulated experiments
for i = 1:n_exp

    % sample data from group 1
    samp1_data = datasample(pop1_data,sample_sizes(1), 'Replace',
 false);

    % sample data from group 2
    samp2_data = datasample(pop2_data,sample_sizes(2), 'Replace',
 false);

    % compute effect size
    d(i,1) = cohens_d(samp1_data, samp2_data, 1, 0);

    % run hypothesis test
    [H,P,CI,STATS] = ttest2(samp1_data,samp2_data);
    t(i,1) = STATS.tstat;
    p(i,1) = P;
    reject_h0(i,1) = H;

end % for i
```

```
% get binary mask of whether experiments rejected null hypothesis or
 not
reject_h0 = logical(reject_h0);
```

Plot results

```
figure; set(gcf,'color','white');

% plot histogram of sample effect sizes
h = histogram(d,nbins);
h.FaceColor = ones(1,3)./2;
h.EdgeColor = h.FaceColor; %axis square;

if PLOTREJECTEDH0
    % plot histogram of effect sizes for experiments with rejected H0
    hold on;
    h = histogram(d(reject_h0),nbins);
    h.FaceColor = rejected_h0_color;
    h.EdgeColor = h.FaceColor;
    h.FaceAlpha = faceAlpha; %axis square;
end

% plot line for population effect
hold on; l = line([D D],ylim); l.Color = pop_es_lineColor; l.LineWidth
 = lineWidth;

% plot line for actual effect size in current study
hold on; l = line([actualES actualES],ylim); l.Color = [0 0 0];
 l.LineWidth = lineWidth;

grid on;
xlabel('Effect Size');
ylabel('Count');
xlim(XLIM);
```



print power to screen

```
disp(sprintf('Effect Size = %f',popES));
disp(sprintf('TD n = %d',sample_sizes(1)));
disp(sprintf('GeoPrefASD n = %d',sample_sizes(2)));
disp(sprintf('Power = %f',sum(reject_h0)/n_exp));
```

```
Effect Size = 0.807510
TD n = 55
GeoPrefASD n = 16
Power = 0.800000
```

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