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% gda02_01
%
% distribution and histogram
% supports Figure 2.1

clear all;

% axes
Dd = 0.1;
N = 101;
d = Dd*[0:N-1]';
dmin=0;
dmax=10;

sd = 1.0;
dbar = 5.0;
p = exp(-0.5*(d-dbar).^2/(sd^2))/(sqrt(2*pi)*sd);
norm = Dd*sum(p);
p = p/norm;

M=200;
r=random('Normal',dbar,sd,M,1);
Nb=26;
Db=(dmax-dmin)/(Nb-1);
bins=dmin+Db*[0:Nb-1]';
h = hist(r,bins)';
hmax=max(h);

figure(1);
clf;

% plot pdf
subplot(1,3,2);
set(gca,'LineWidth',3);
set(gca,'FontSize',14);
hold on;
axis( [dmin, dmax, 0, 0.5] );
plot(d,p,'r-','LineWidth',3);
xlabel('d');
ylabel('p(d)');

%plot histogram
subplot(1,3,1);
set(gca,'LineWidth',3);
set(gca,'FontSize',14);
hold on;
axis( [dmin, dmax, 0, hmax] );
%improvise bar chart
for i = [1:Nb]
    tb = [bins(i)-Db/2, bins(i)-Db/2, bins(i)+Db/2, bins(i)+Db/2]';
    th = [0, h(i), h(i), 0]';
    plot(tb,th,'b-','LineWidth',3);
end
xlabel('d');
ylabel('counts');

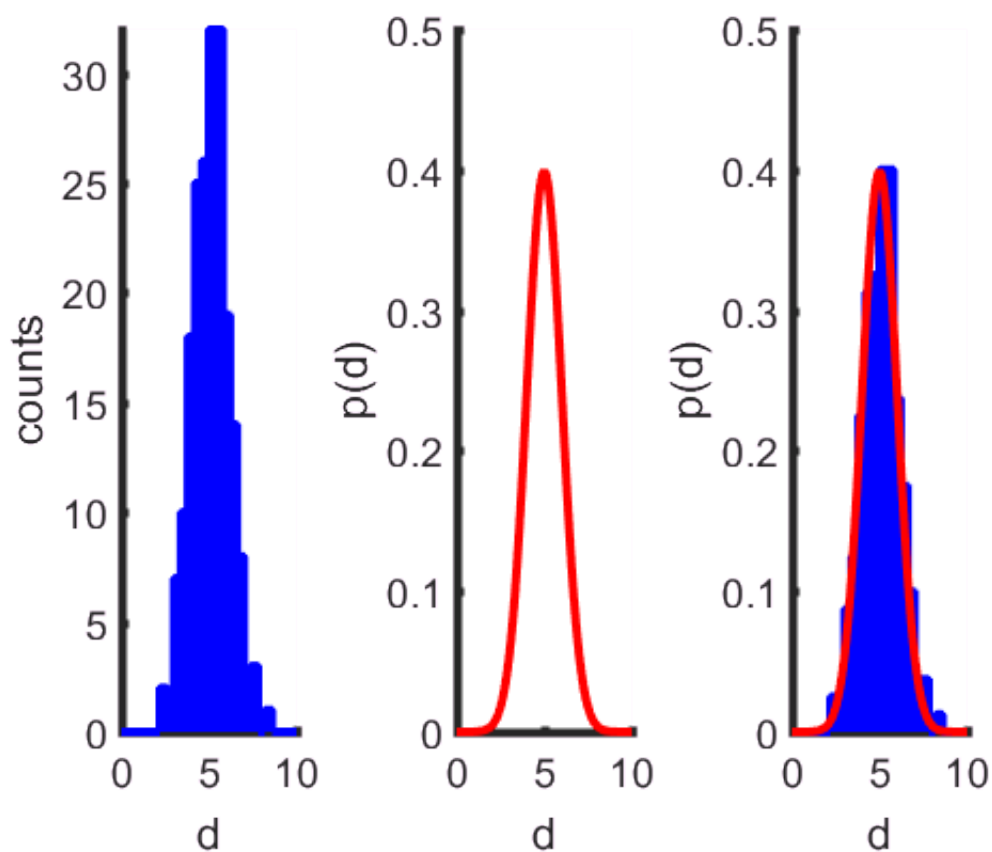
% convert histogram to an approximate pdf
norm = Db*sum(h);
h=h/norm;

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% plot dpf and histogram superimposed
subplot(1,3,3);
set(gca,'LineWidth',3);
set(gca,'FontSize',14);
hold on;
axis( [dmin, dmax, 0, 0.5 ] );
% improvise bar chart
for i = [1:Nb]
    tb = [bins(i)-Db/2, bins(i)-Db/2, bins(i)+Db/2, bins(i)+Db/2]';
    th = [0, h(i), h(i), 0]';
    plot(tb,th,'b-','LineWidth',3);
end
plot(d,p,'r-','LineWidth',3);
xlabel('d');
ylabel('p(d)');

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% Figure 2.1 (A) Histogram showing data from 200 repetitions of an experiment in which datum
 % d is measured. Noise causes observations to scatter about their mean value, $\langle d \rangle = 5$. (B) Prob
 % density function (p.d.f.), $p(d)$, of the data. (C) Histogram (blue) and p.d.f. (red) superimp
 % Note that the histogram has a shape similar to the p.d.f. MatLab script gda02_01.