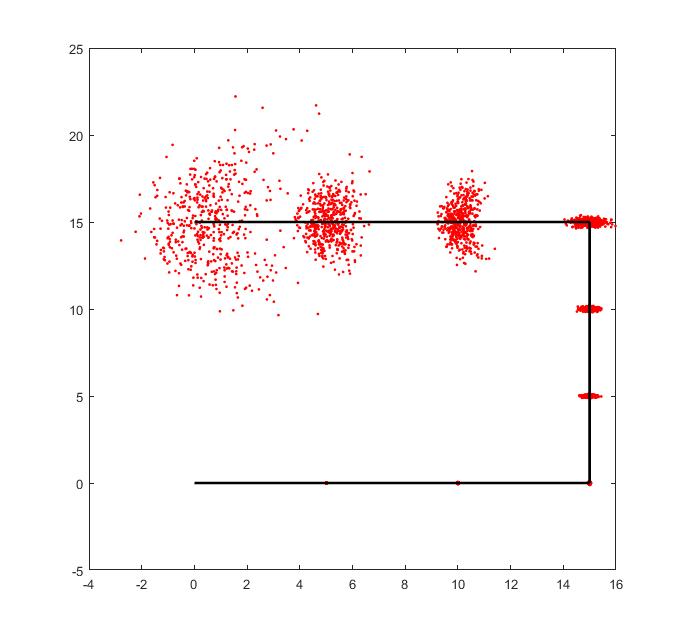
# Homework 4

**Task 1 Please generate samples of the odometry-based motion model (N=500)**

实现过程主要参照第五章的课件，sample产生的方法采用normal distribution，实现的工具是用matlab，下图是我生成的图：



**My code: (matlab)**

Sample 采用正态分布，代码如下：

function [ randVal ] = sample( variance )

maxVal = variance;

minVal = -maxVal;

randVal = ((1/2)\*sum(minVal + (maxVal-minVal).\*rand(12,1)));

end

Odometry Motion Model代码实现如下：

function [ newX,newY,newTheta] = sample\_motion\_model( xT,x2T,aT )

%Simple odometry-based motion model.

%Argumentts are xT=(x,y,theta),

O\_trans=sqrt((x2T(1)-xT(1)).^2+(x2T(2)-xT(2)).^2);

O\_rot1=atan2(x2T(2)-xT(2),x2T(1)-xT(1))-xT(3);

O\_rot2=x2T(3)-xT(3)-O\_rot1

varianceVal = aT(1)\*abs(O\_rot1)+aT(2)\*O\_trans;

newRot1 =O\_rot1+sample(varianceVal);

varianceVal = aT(3)\*O\_trans + aT(4)\*(abs(O\_rot1)+abs(O\_rot2));

newRot\_trans = O\_trans + sample(varianceVal);

varianceVal = (aT(1)\*abs(O\_rot2)+aT(2)\*O\_trans);

newRot2 = O\_rot2+sample(varianceVal);

newX = xT(1)+newRot\_trans\*cos(xT(3)+newRot1);

newY = xT(2)+newRot\_trans\*sin(xT(3)+newRot1);

newTheta = xT(3)+newRot1+newRot2;

end

主程序的code如下：

xs=zeros(500,1);

ys=zeros(500,1);

thetas = zeros(500,1);

xT\_array = [0,0,0;5,0,0;10,0,0;15,0,0;

15,5,pi/2;15,10,pi/2;15,15,pi/2;

10,15,pi;5,15,pi;0,15,pi];

aT = [.0004;.0002;.0004;.0004];

for j=1:size(xT\_array,1)-1

aT=aT\*2;

for i=1:500 [xs(i),ys(i),thetas(i)]=sample\_motion\_model(xT\_array(j,:),xT\_array(j+1,:),aT);

end

plot(xs,ys,'r.');

hold on;

end

plot([0;15],[0;0],'k','LineWidth',2)

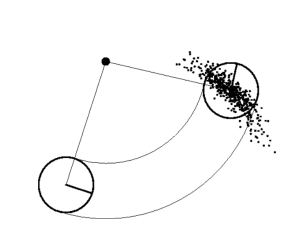
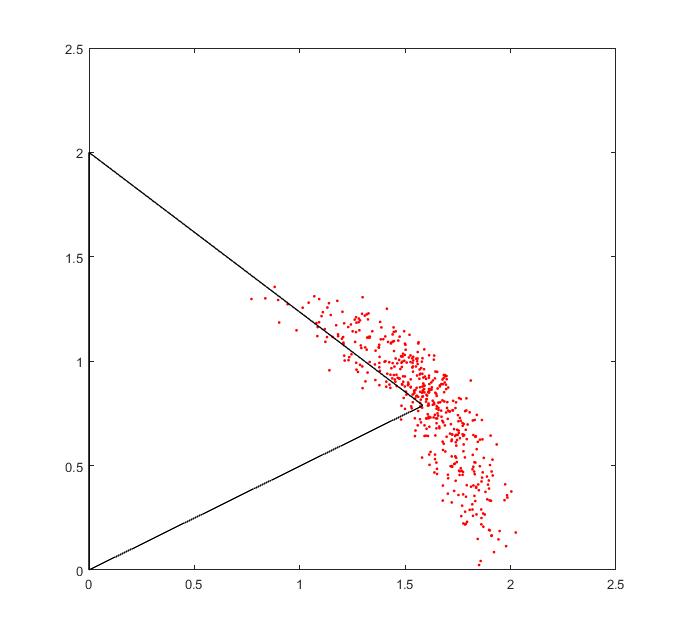
plot([15;15],[0;15],'k','LineWidth',2)

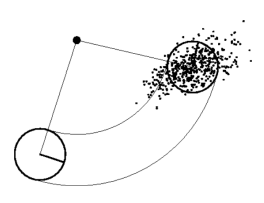
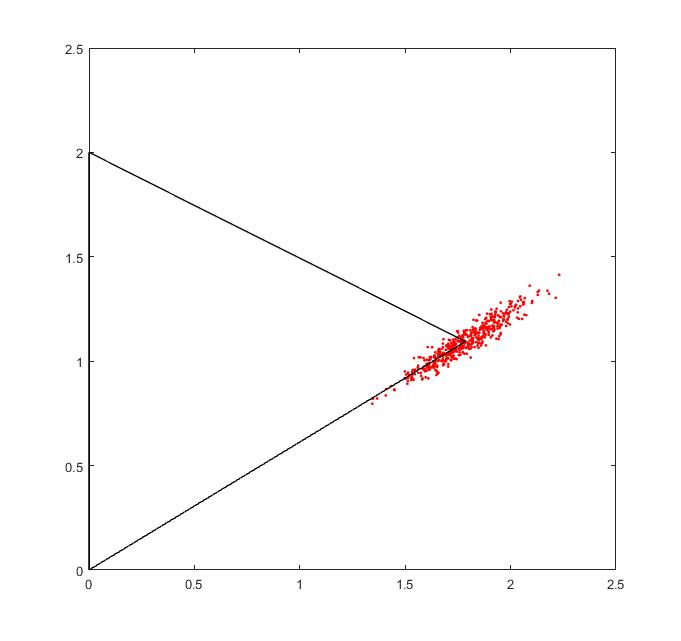
plot([15;0],[15;15],'k','LineWidth',2)

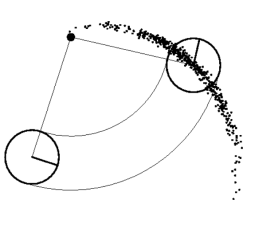
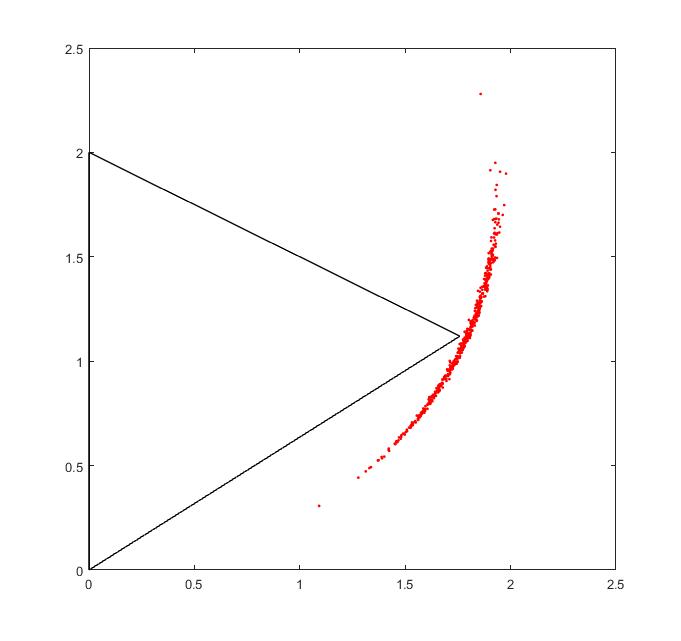
hold off;

**Task 2 Please generate samples of the velocity-based motion model for following cases (N=500).**

实验结果的截图如下：







**My code: (matlab)**

Velocity-based Motion Model代码实现如下：

function [ newX,newY,newTheta] = sample\_from\_Velocity\_Model( X,v,w,aT,t )

new\_v=v+sample(aT(1)\*abs(v)+aT(2)\*abs(w));

new\_w=w+sample(aT(3)\*abs(v)+aT(4)\*abs(w));

new\_yj=sample(aT(5)\*abs(v)+aT(6)\*abs(w));

newX=X(1)-(new\_v/new\_w)\*sin(X(3))+(new\_v/new\_w)\*sin(X(3)+new\_w\*t);

newY=X(2)+(new\_v/new\_w)\*cos(X(3))-(new\_v/new\_w)\*cos(X(3)+new\_w\*t);

newTheta=X(3)+new\_w\*t+new\_yj\*t;

end

主程序的code如下：

xs=zeros(500,1);

ys=zeros(500,1);

thetas = zeros(500,1);

xT = [0,0,0];

aT = [.04;.006;.006;.4;0.4;.2];

v=1;

w=0.5;%v=w\*r

t=0.6\*pi;%8.7

for i=1:500

[xs(i),ys(i),thetas(i)]=sample\_from\_Velocity\_Model(xT,v,w,aT,t);

end

plot(xs,ys,'r.');

axis([0 2.5 0 2.5])

hold on;

plot([0;0],[0;v/w],'k','LineWidth',1)

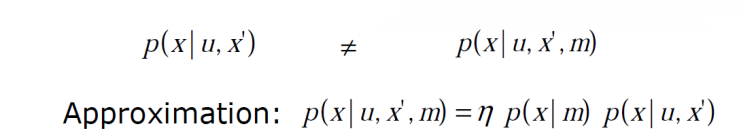
plot([0;mean(xs)],[v/w;mean(ys)],'k','LineWidth',1)

plot([0;mean(xs)],[0;mean(ys)],'k','LineWidth',1)

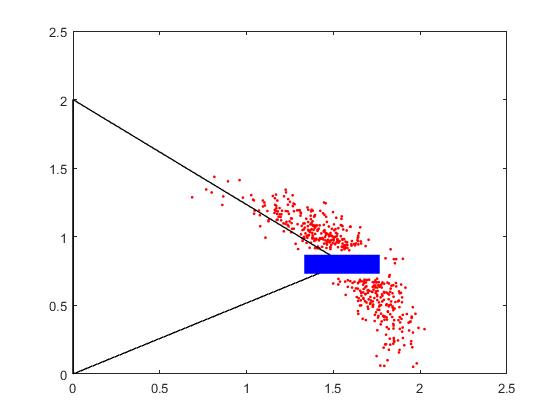
%line(xT\_array(1,1:3),xT\_array(4,1:3))

hold off;

**Task 3 Please generate the map-consistent probability model in the following situation.**



通过修改Task2的代码，得到如下的实验结果：



**My code: (matlab)**

Map-Consistent Motion Model代码实现如下：

function[ newX,newY,newTheta] = Map\_Consistent\_Motion\_Model( X,v,w,aT,t )

[ newX,newY,newTheta] =sample\_from\_Velocity\_Model(X,v,w,aT,t);

while (newX>=1.3&&newX<=1.8)&&(newY>=0.7&&newY<=0.9)

[ newX,newY,newTheta] =sample\_from\_Velocity\_Model(X,v,w,aT,t);

end

end

主程序的源码如下：

xs=zeros(500,1);

ys=zeros(500,1);

thetas = zeros(500,1);

xT = [0,0,0];

aT = [.04;.006;.006;.4;0.4;.2];

v=1;

w=0.5;

t=0.6\*pi;

for i=1:500

[xs(i),ys(i),thetas(i)]=Map\_Consistent\_Motion\_Model(xT,v,w,aT,t);

end

plot(xs,ys,'r.');

axis([0 2.5 0 2.5])

hold on;

plot([0;0],[0;v/w],'k','LineWidth',1)

plot([0;mean(xs)],[v/w;mean(ys)],'k','LineWidth',1)

plot([0;mean(xs)],[0;mean(ys)],'k','LineWidth',1)

rectangle('Position',[1.34,0.74,0.42,0.12],'FaceColor','b','EdgeColor','b','LineWidth',2,'LineStyle','-');

hold off;