Ch2: L1 parameter estimates, individual activity

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Question 1

The parameter estimated from L1 algorithm is t0 = 2.1786 and s2 = 0.2079. The

data and the fitted model are plotted at figure below. Comparison between the estimation from L1 and L2, we can find that L1 estimation is closer to the general trend and away from the outliers (e.g., the rightest point in the figure).



Question 2

I use *q* = 5000 in this problem and the qq plot for the two parameters are shown in figure below. We can find the variables are almost fit in a straight line, which means they are close to normal distribution.



Question 3

1. From the sort operation, I found the 95% confidence interval for t0 is 0.2506 and for s2 is the 0.0138. The range is t0 = 2.1786 and

s2 = 0.2079

1. The covariance matrix from L1 estimation is

The confidence interval = 1.96\*sqrt(diag(cov)) = 0.2477 and 0.0138

The range is t0 = 2.1786 and

s2 = 0.2079

The confidence interval from L2 estimation is 0.2017 and 0.0113 respectively. We can find that the uncertainty from sort and covariance are almost the same but uncertainty from L2 is smaller.

Codes

clear

clear

t = [3.4935;4.2853;5.1374;5.8181;6.8632;8.1841];

x = [6;10.1333;14.2667;18.4;22.5333;26.6667];

% organize G

G = [ones(6,1),x];

% L1 estimate

s\_l1 = irls(G, t, 1e-3, 1e-3, 1, 20)

t\_pred = G\*s\_l1;

% least square estimate s2

s2 = inv(G'\*G)\*G'\*t;

t\_pred2 = G\*s2;

% plot the data and the fitted model, and the residuals.

figure(1)

plot(x,t,'o','MarkerSize',8)

hold on

errorbar(x,t\_pred,0.1\*ones(size(t\_pred)),'LineWidth',1.2)

hold on

errorbar(x,t\_pred2,0.1\*ones(size(t\_pred)),'LineWidth',1.2)

xlabel('Distance (m)')

legend('Observed','Predicted from L1','Predicted from L2')

ylabel('Time (s)')

xlim([5,30])

set(gca,'fontsize',14)

title('Data')

%% question 2

q = 5000;

for i =1:q

M (:,i)= irls(G, t\_pred + 0.1\*randn(size(t\_pred)), 1e-3, 1e-3, 1, 50);

end

std(t\_pred2-t)

figure

subplot(1,2,1)

qqplot(M(1,:))

title('qqplot for t\_0')

set(gca,'fontsize',14)

subplot(1,2,2)

qqplot(M(2,:))

title('qqplot for s\_2')

set(gca,'fontsize',14)

%% question 3

%(a)

t0sort = sort(abs(s\_l1(1)-M(1,:)));

t0\_in = t0sort(q\*0.95)

s2sort = sort(abs(s\_l1(2)-M(2,:)));

s2\_in = s2sort(q\*0.95)

%(b)

A = M - s\_l1;

cov = A\*A'/q

1.96\*sqrt(diag(cov))

CI = [s\_l1-1.96\*sqrt(diag(cov)), s\_l1 + 1.96\*sqrt(diag(cov))]