

This report has four parts. The different of each part is from different form of our  $\text{cv}(\lambda)$ . There are ten simulations for each part. I used plots to illustrate the  $\text{cv}(\lambda)$  as a function of  $\lambda$ . The x-axis is the  $\lambda$  value and y-axis is the  $\text{cv}(\lambda)$ .

The section1 is all the setting in the correct form. The section2 is to show what I did wrong in our last meeting(Sorry about this.)

In section3, I changed the first term in the summation to use only one of k part of dataset. i.e, we divided our dataset into k parts, we used k-1 parts as training part, and use part which are not used as traing to do "testing". This idea is come from the definition of k-fold cross-validation. But usually people use original model to check MSE(mean squared error.), not the likelihood function.

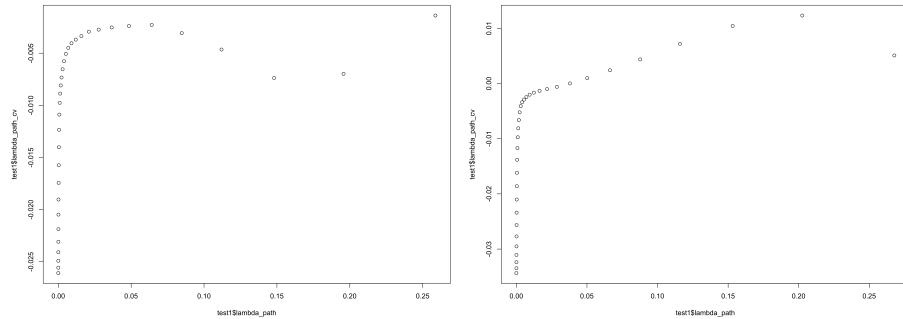
In section4, I just the squared the summation term to ignore the effect from sign.

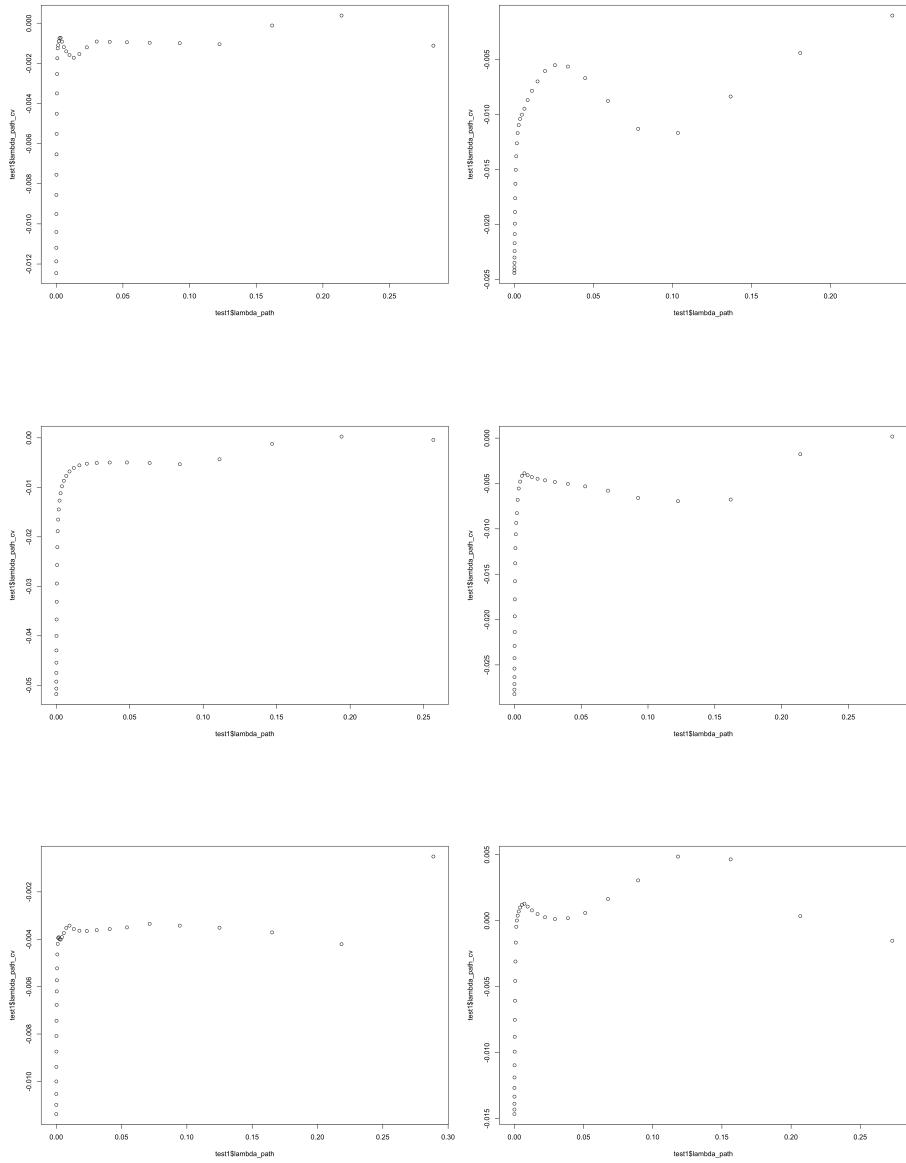
## 1 correct form

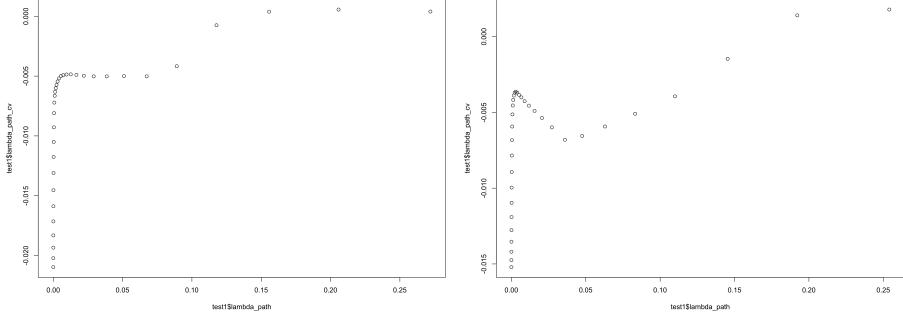
In this section, we define:

$$\arg \min_{\lambda} \text{cv}(\lambda) = \arg \min_{\lambda} \sum_{k=1}^5 \{l(\hat{\beta}_{\lambda}^{(-k)}) - l^{(-k)}(\hat{\beta}_{\lambda}^{(-k)})\}$$

It is the correct form. The plots we got are





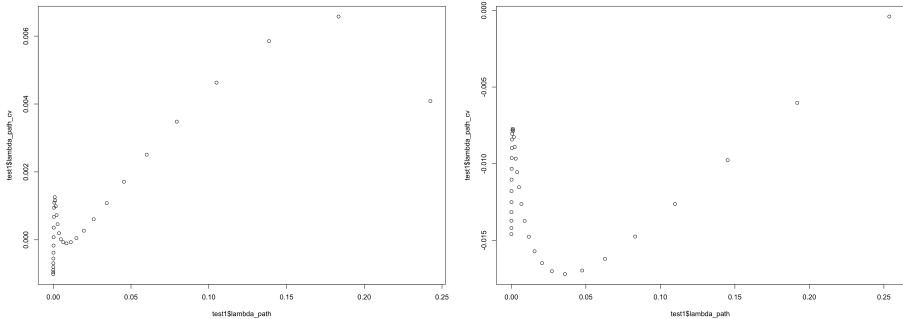
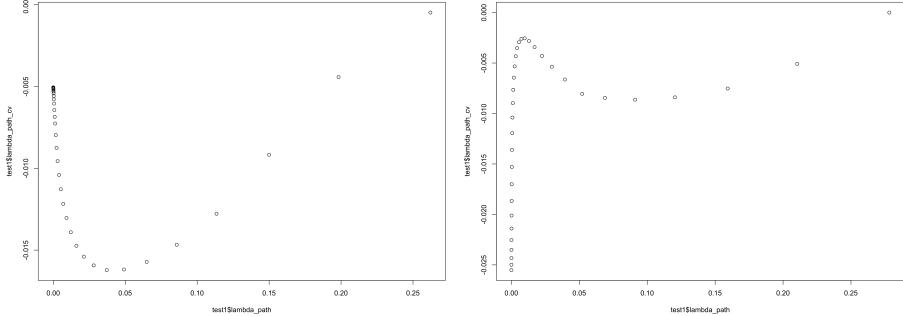


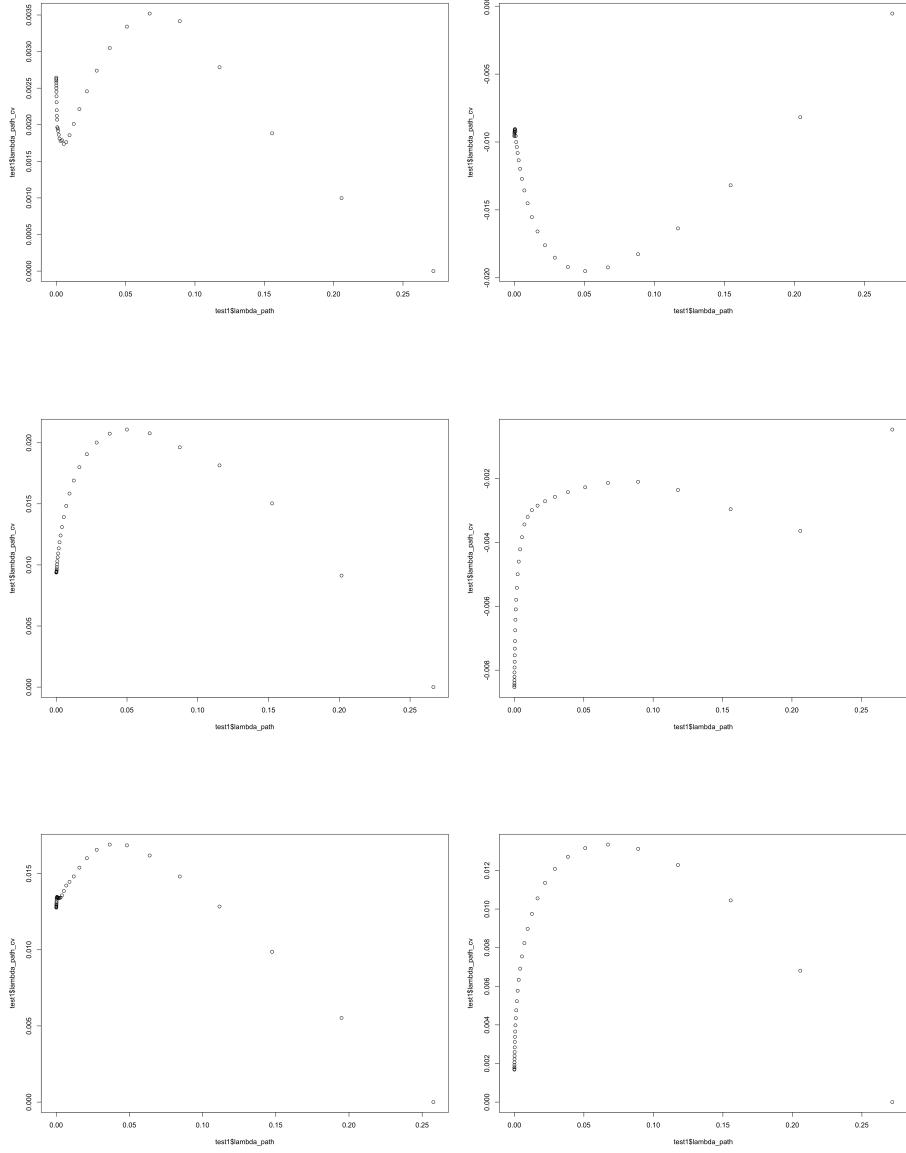
## 2 wrong index

This is the wrong thing I did in last time in our meeting. Only when  $k = 5$  has been counted to our  $\text{cv}(\lambda)$ . In this section, we define:

$$\arg \min_{\lambda} \text{cv}(\lambda) = \arg \min_{\lambda} \{l(\hat{\beta}_{\lambda}^{(-k)}) - l^{(-k)} \hat{\beta}_{\lambda}^{(-k)}\}$$

, where  $k = 5$  The plots we got are



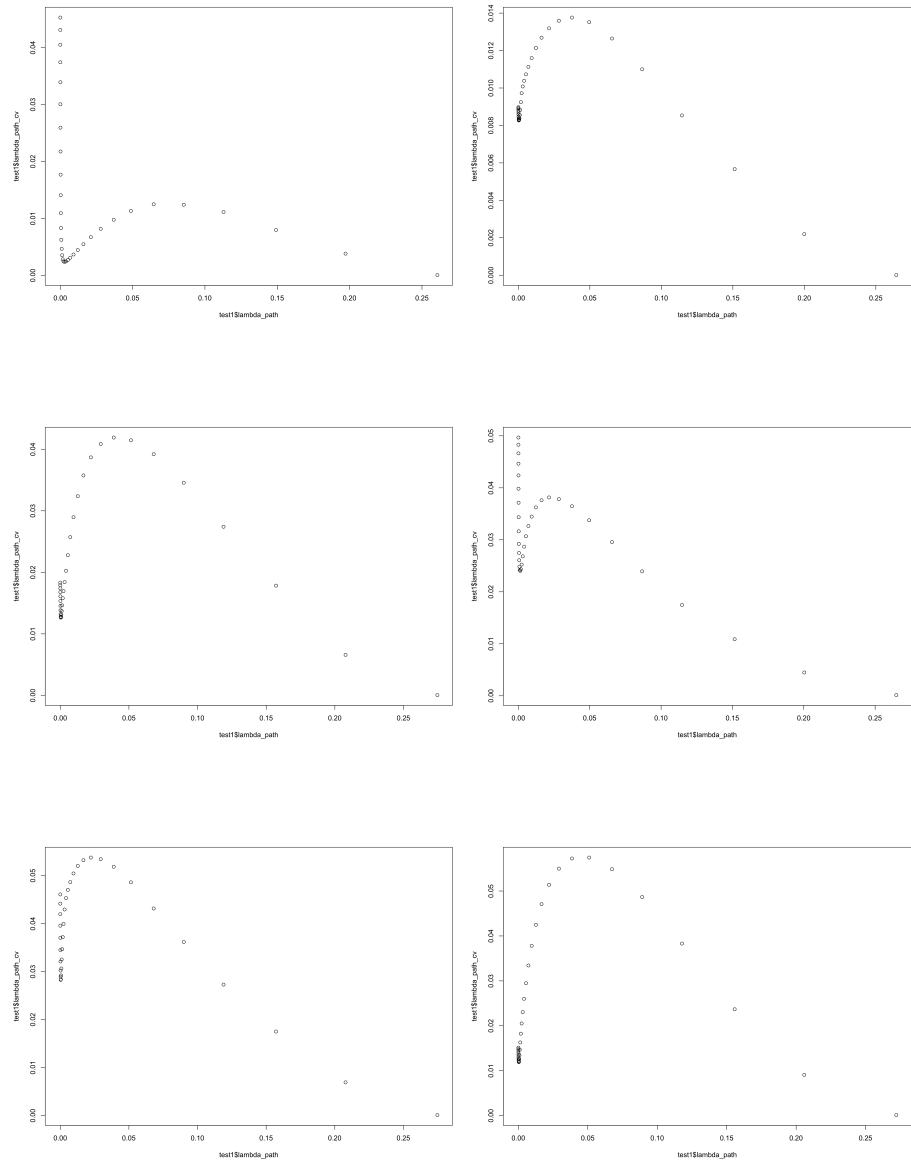


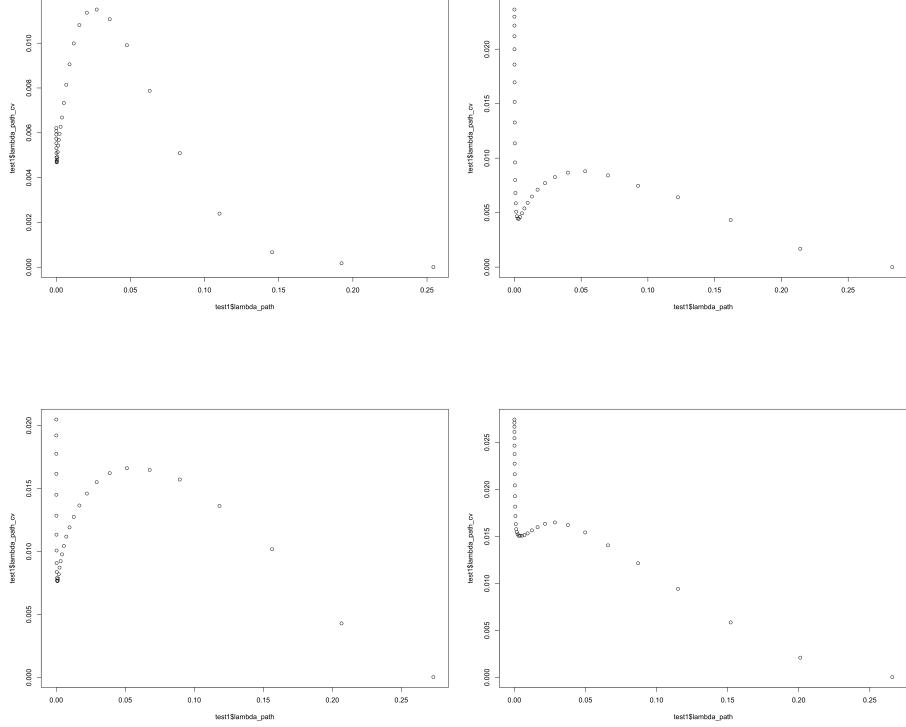
### 3 use only one part of k dataset in the first term

In this part, I used only the  $k^{\text{th}}$  part in our dataset for first term in the summation, and used another  $k-1$  dataset to generate the  $\hat{\beta}$ . In this section, we define:

$$\arg \min_{\lambda} \text{cv}(\lambda) = \arg \min_{\lambda} \sum_{k=1}^5 \{l^{(k)}(\hat{\beta}_{\lambda}^{(-k)}) - l^{(-k)}\hat{\beta}_{\lambda}^{(-k)}\}^2$$

The plots we got are





## 4 square sum term

In this part, I tried use the squared term in our sum formulation. In this section, we define:

$$\arg \min_{\lambda} \text{cv}(\lambda) = \arg \min_{\lambda} \sum_{k=1}^5 \{l(\hat{\beta}_{\lambda}^{(-k)}) - l^{(-k)} \hat{\beta}_{\lambda}^{(-k)}\}^2$$

The plots we got are

