COMPENG 3SK3 - Project 2

Newton's Method in Optimization

Instructor: Dr. Xiaolin Wu
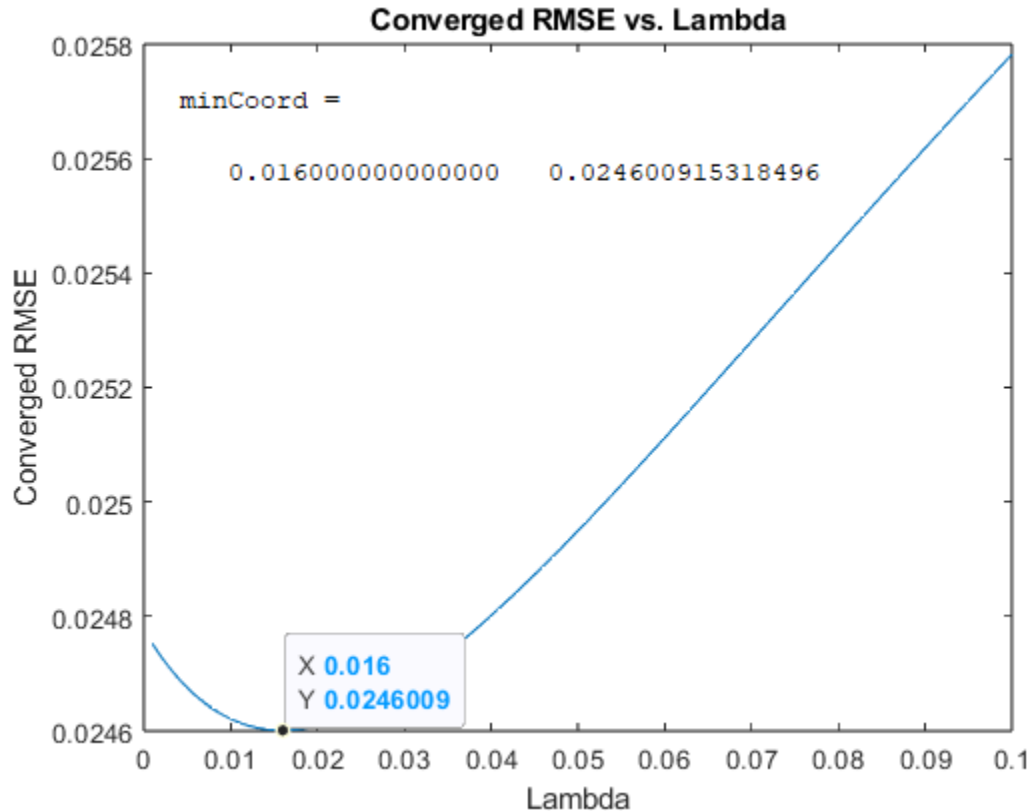
Glen Tsui – tsuig – 400201284
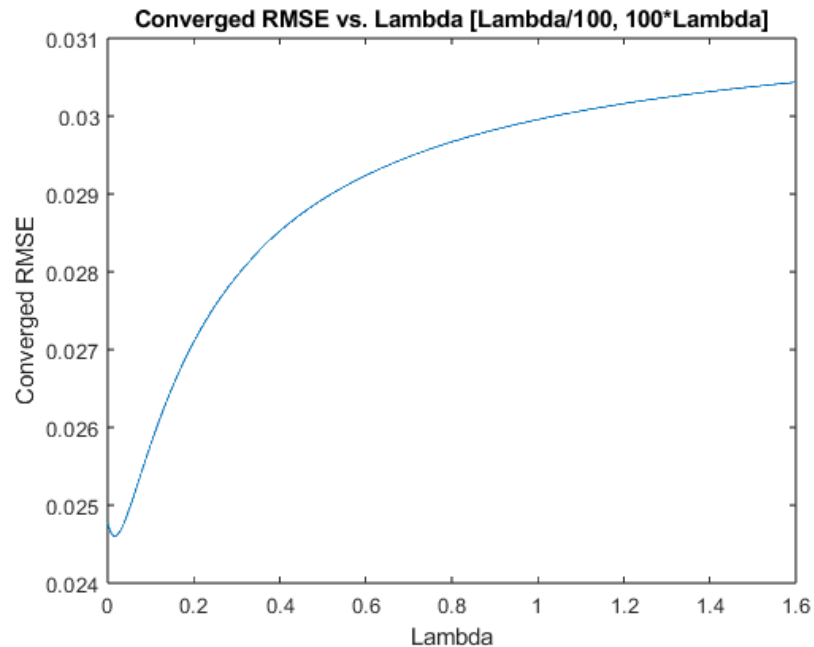
Pseudocode

Read in datasets
Initialize zeros of computation variables, loop ranges, vectors, etc.
For each marker out of 100 markers
    For every iteration
        For every observation point
            Calculate Jacobian matrix
            Calculate vector of residuals
            Calculate summation portion of gradient
        End
        Calculate gradient of the loss function
        Calculate Hessian Matrix of loss function
        Update coordinate value
    End
    Calculate summation portion of RMSE
End
Calculate RMSE value

Fine-tune Lambda

Converged RMSE vs. Lambda

minCoord =

0.016000000000000   0.024600915318496

X 0.016
Y 0.0246009

Converged RMSE vs. Lambda [Lambda/100, 100*Lambda]

The optimized lambda value is 0.016 and the converged RMSE value is 0.0246. The plot of the curve shows an initial dip in RMSE value near the optimized lambda value. Then the RMSE increases as lambda increases.

Fine-tune Initialization

Average the K measured coordinates

RMSE vs. Iterations [Average Method, Lambda = 0.016]

convIt =

28

X 28
Y 0.0245996
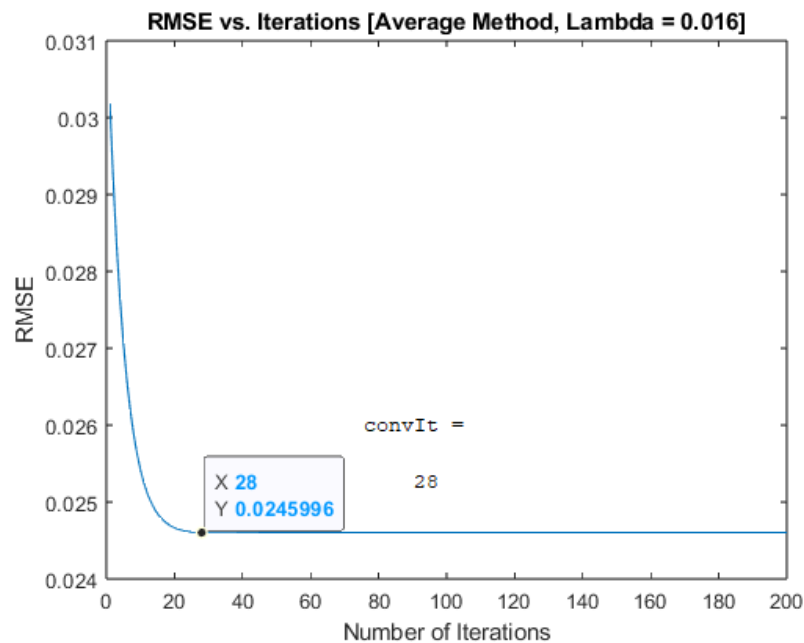
The 21 observations for each marker were averaged together to form the initialization vector. The average method needed around 28 iterations to converge. This method converges the fastest.

Choose one of the measured coordinates

RMSE vs. Iterations [Measured Method (Observation 10, Marker 64), Lambda = 0.016]
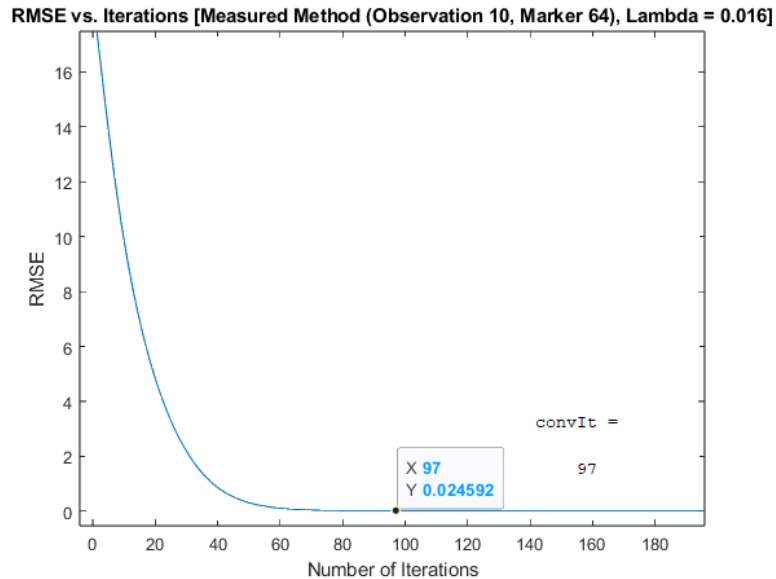
The measured coordinate from Observation Point 10, Marker 64 was chosen [4.745 4.393 1.403] as the measured coordinates for initialization. The measured coordinate method needed around 97 iterations to converge. This method converged slower than the average method, but faster than the random method.

Set it as a random vector

RMSE vs. Iterations [Random Method, Lambda = 0.016]
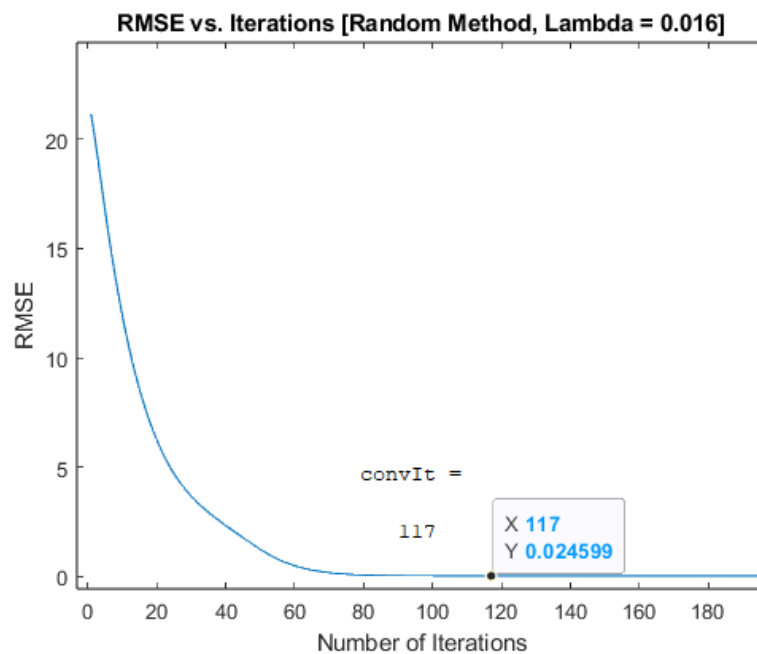
A random vector was computed for initialization. The random vector method needed around 117 iterations to converge. This method converged the slowest out of all the other methods.