EECS 16ML Quiz: Outlier Removal via OMP

Part 1. Use the following matrix equation setup to run OMP for two iterations. Please box the intermediate and final residuals as well as the two components identified to have non-zero entries.

$$\begin{bmatrix} \boldsymbol{A} & \boldsymbol{I} \end{bmatrix} \begin{bmatrix} \vec{x} \\ \vec{\epsilon} \end{bmatrix} = \vec{y} \Rightarrow \begin{bmatrix} 1 & 1 & 0 & 1 & 1 & 0 & 0 & 0 \\ 1 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\ 1 & 0 & 1 & 1 & 0 & 0 & 1 & 0 \\ 1 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} a \\ b \\ c \\ d \\ e \\ f \\ g \\ h \end{bmatrix} = \begin{bmatrix} 2 \\ 0 \\ 2 \\ 1 \end{bmatrix}$$

1. Iteration 1 Component:

2. Iteration 1 Residual:

3. Iteration 2 Component:

4. Iteration 2 Residual:

Part 2. Ignore the calculations done in the first problem. Suppose that a genie ran OMP for the problem above and told you the following about the sparse solution:

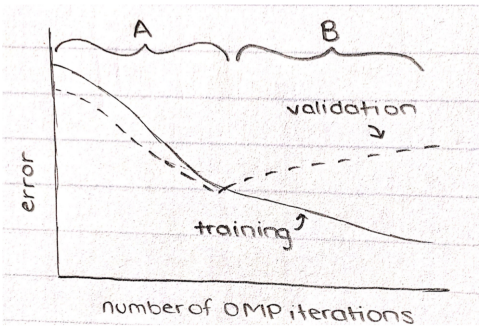
$$\vec{x} = \begin{bmatrix} \frac{1}{2} \\ 1 \\ -\frac{1}{2} \\ 1 \end{bmatrix}, \vec{\epsilon} = \begin{bmatrix} 0 \\ 10 \\ -\frac{1}{2} \\ 0 \end{bmatrix}$$

Interpret the results by identifying the outlier(s). Provide justification/explanation.

Part 3. In each of the three parts below, describe a potential stopping condition discussed in this course for OMP. In addition to naming the stopping condition, describe potential (dis)advantages and/or use cases. The order you list them in does not matter.

1. Stopping Condition 1:
   (a) Description:
   (b) Use Cases:
2. Stopping Condition 2:
   (a) Description:
   (b) Use Cases:
3. Stopping Condition 3:
   (a) Description:
   (b) Use Cases:

Part 4. Observe the graph below and describe what happens to the training and validation errors as the number of OMP iterations increases in the each of the two labeled regions.



1. Region A, Training Error

2. Region A, Validation Error

3. Region B, Training Error

4. Region B, Validation Error