CS383 Assignment 2

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Question 1

The third derivative just depicts the rate of change of the concavity. For the derivation of third derivative, I am using second derivative equation from the lecture slides and derivation of that would result in third order derivative.

$$W''(j) = \frac{W(j+2) - 2W(j) + W(j-2)}{4}$$

$$W'''(j) = \frac{W'(j+2) - 2W'(j) + W'(j-2)}{4}$$

$$W'''(j) = \frac{(\frac{W(j+3)-W(j+1)}{2}) - 2(\frac{W(j+1)-W(j-1)}{2}) + (\frac{W(j-1)-W(j-3)}{2})}{4}$$

$$W'''(j) = \frac{W(j+3) - W(j+1) - 2 \times (W(j+1) - W(j-1)) + W(j-1) - W(j-3)}{8}$$

$$W'''(j) = \frac{W(j+3) + 3W(j-1) - 3W(j+1) - W(j-3)}{8}$$

Question 2

Given the C1 = $\{1, 2, 3, 4\}$ and C2 = $\{5, 6, 7, 8\}$ output form the clustering algorithm. From the hand-labeled clustering C1 = $\{3, 4\}$ and C2 = $\{1, 2, 5, 6, 7, 8\}$, we can see that observations 3 and 4 are of same label, and 1,2,5,6,7,and 8 are of same label.

To calculate the average purity of our clusters, we have to sum the maximum instance of a label in each cluster and divide it by the total number of observations.

$$\text{Average Purity} = \frac{maxC_1(2,2) + maxC_2(4)}{8}$$

$$\text{Average Purity} = \frac{2+4}{8} = \frac{6}{8} = \frac{3}{4} = 75\%$$