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CS 4342 D21
Assignment 2

Reported Accuracy Information:

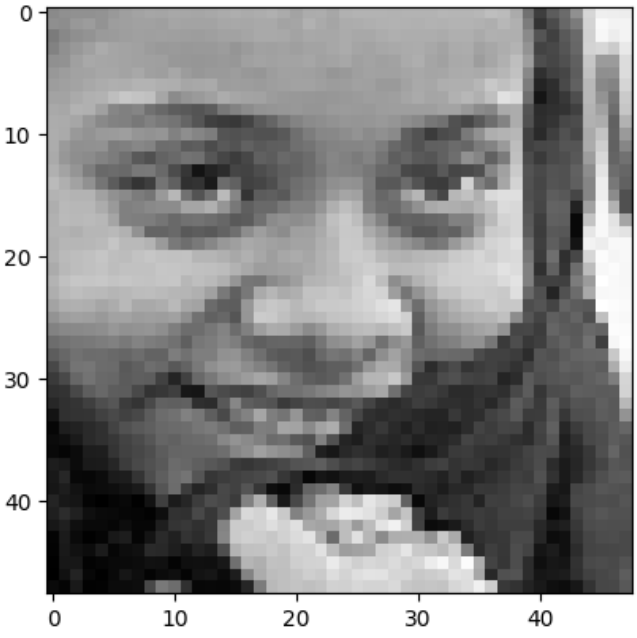
MSE cost for each procedure outlined in Homework 2:

Procedure	fMSE Training	fMSE Testing
Analytical	39.242962989290675	206.79647485400474
Gradient Descent	83.5482237824737	93.09897618322684
Gradient Descent with Regularization	83.55729781046894	93.11354728592632

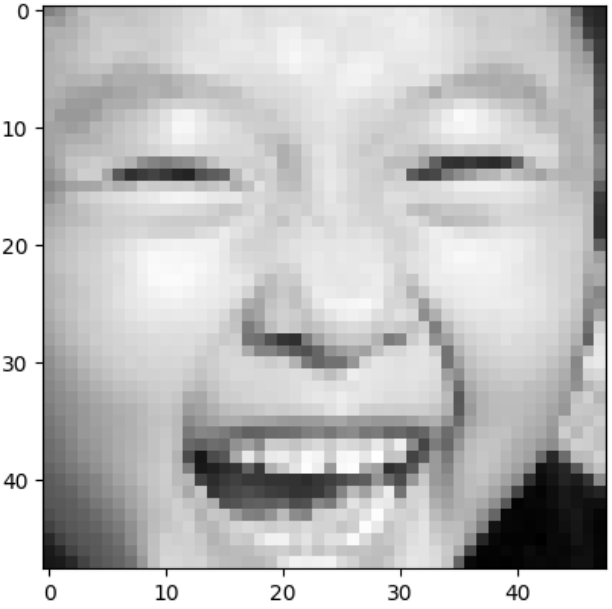
The rMSE ("true" rMSE was used) was 9.64953611765489 years for Gradient Descent with Regression as described in part c.

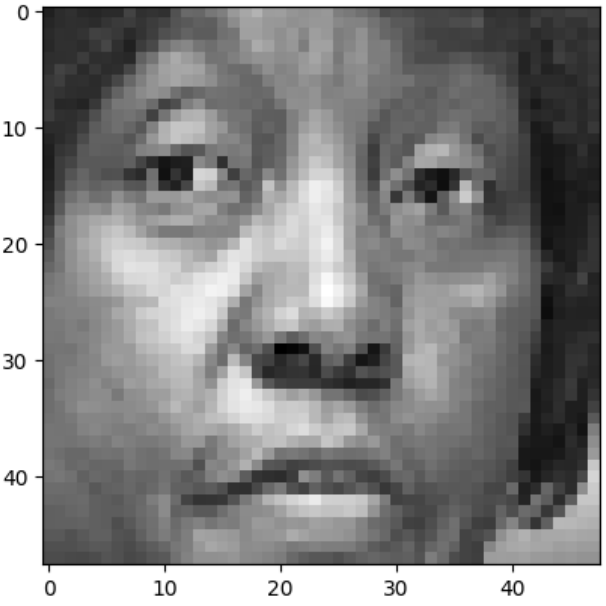
Error Analysis:

The images containing the "Top 5 Most Egregious Errors" are as follows

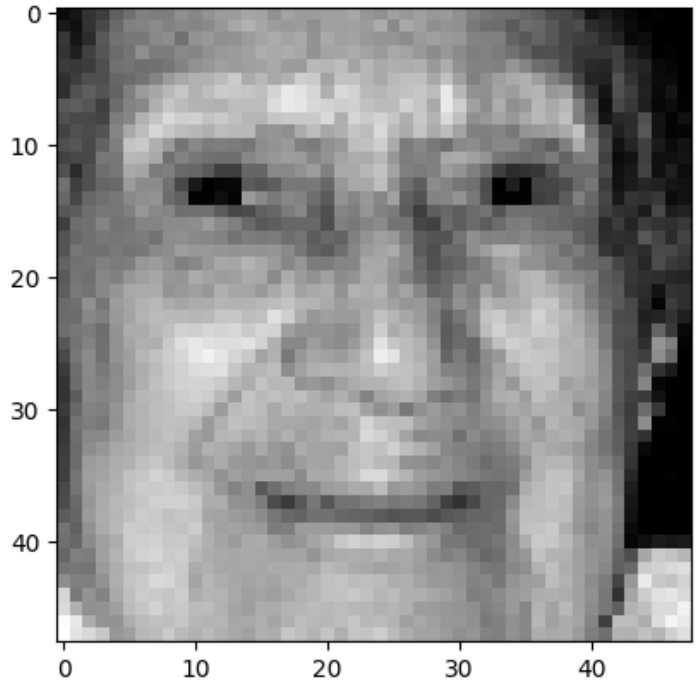
1. 

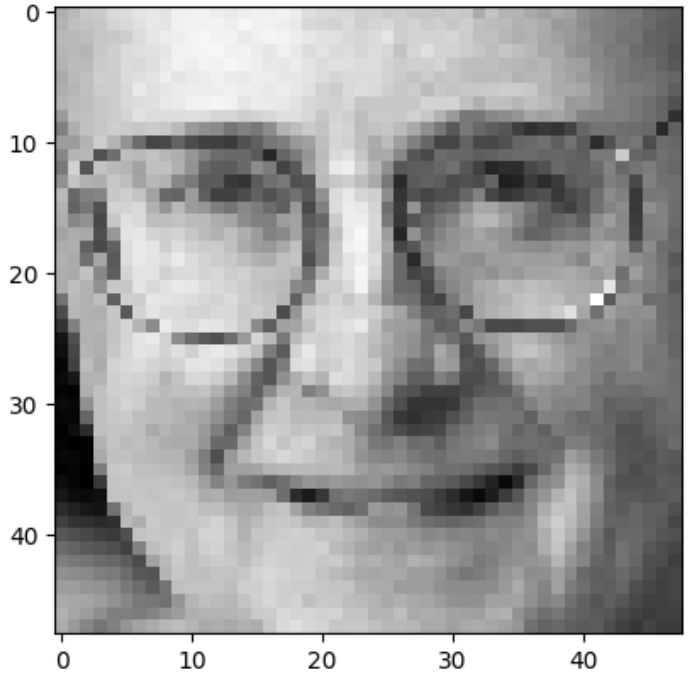
   a. Y: 10
   b. Ŷ: 59.99667

2. 

   a. Y: 4
   b. $\hat{Y}$: 52.38498
3. 

   a. Y: 89
   b. $\hat{Y}$: 41.64049

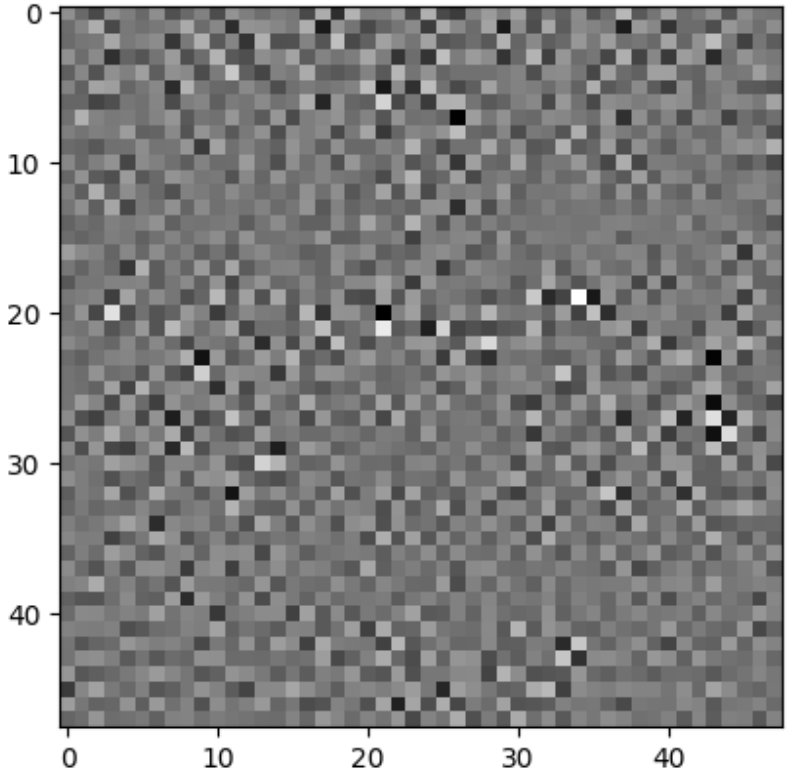
4. 

   a. Y: 80
   b. Ŷ: 33.38617
5. 

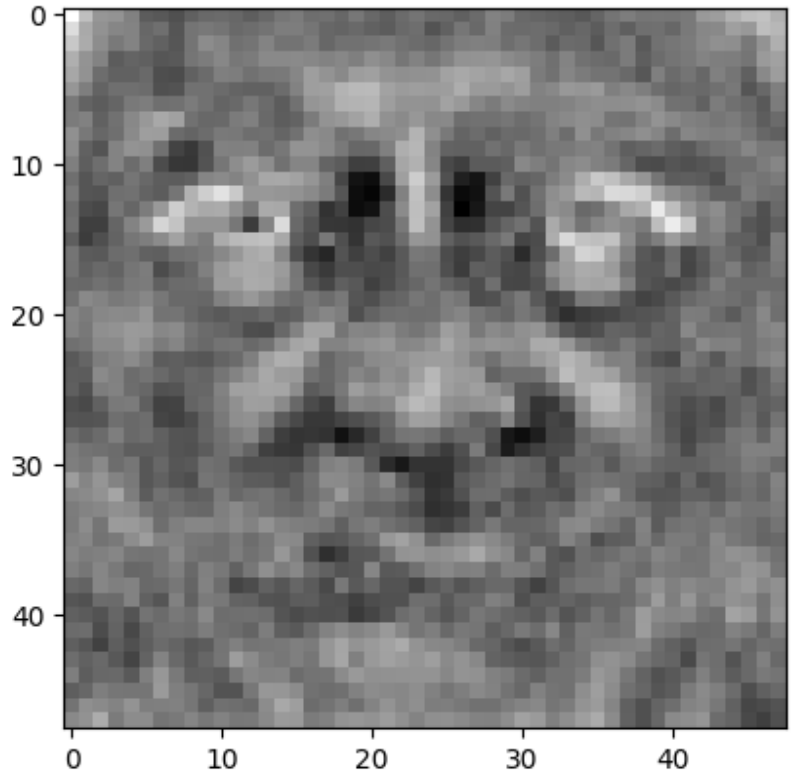
   a. Y: 8
   b. Ŷ: 53.53574

Visualizing the Machine's Behavior:

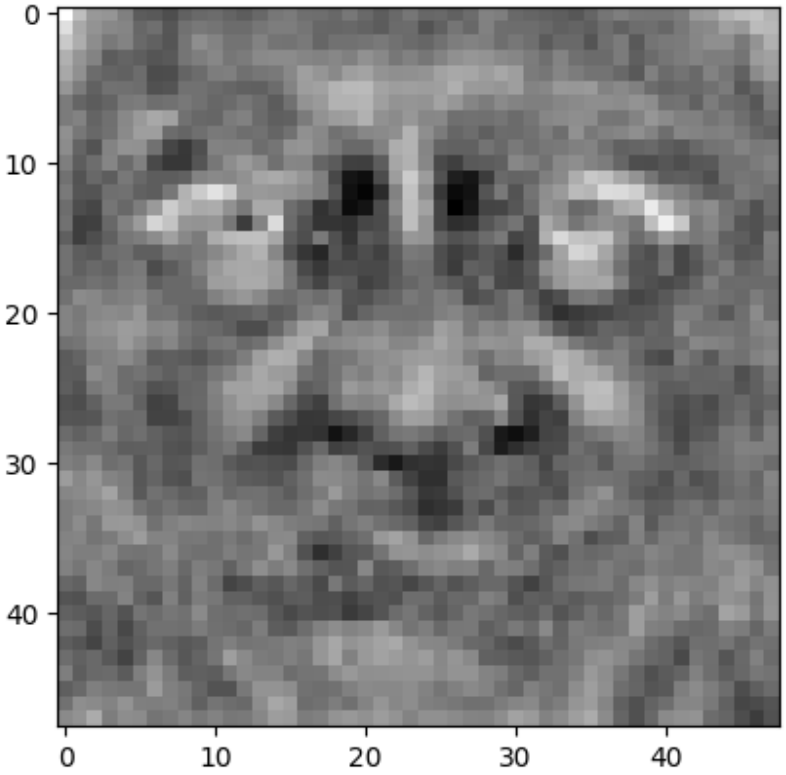
Analytical:



Gradient Descent:



Gradient Descent with Regularization:



It can be seen that the one-shot analytical weights found the lowest value or minimum value in the training set, yet suffers heavily when applied to the testing set, performing significantly worse than Gradient Descent and Gradient Descent with Regularization for the testing set. The Gradient Descent and Gradient Descent with Regularization methods have a higher cost in the training set but perform much better in the testing set. This may be due to the Gradient Descent and Gradient Descent with Regularization methods providing a more suitable fit, and the Analytical method tending to overfit the data.

Both Gradient Descent and Gradient Descent with Regularization yield discernable facial features. Gradient Descent is able to depict human facial features with some contours, though it can be difficult to discern at times between facial features and lighting. Gradient Descent with Regularization is able to depict weight and skin contours as a result of simulated lighting in the images as weight vectors based on the features on human faces.