

Machine Learning Homework 2

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Results

| Method | Training | | Testing | |
|----------------------------|----------|-------|---------|-------|
| | MSE | RMSE | MSE | RMSE |
| One Shot | 78.49 | 8.86 | 413.59 | 20.34 |
| Gradient Descent | 167.10 | 12.93 | 186.20 | 13.65 |
| Gradient w/ Regularization | 167.11 | 12.93 | 186.18 | 13.64 |

Table 1: Accuracy for each Algorithm

Table 1 shows the accuracies for each algorithm. Mean squared error was calculated using the equation shown below.

$$MSE = \frac{1}{n} \sum_{i=1}^n (y_i - \hat{y}_i)^2 \quad (1)$$

Weight Visualization

The following images show the weight matrix for each algorithm. Brighter colors (yellow being the brightest) represent a larger positive weight for that pixel, while darker colors represent a larger negative weight for that pixel (purple being the darkest). The weights for the one shot linear regression show no obvious pattern and do not resemble any image, likely due to overfitting the data set. However the weights for both versions of gradient descent resemble a face. The most important places to indicate age appear to be the eyes (especially the inside corners), cheeks, and mouth.

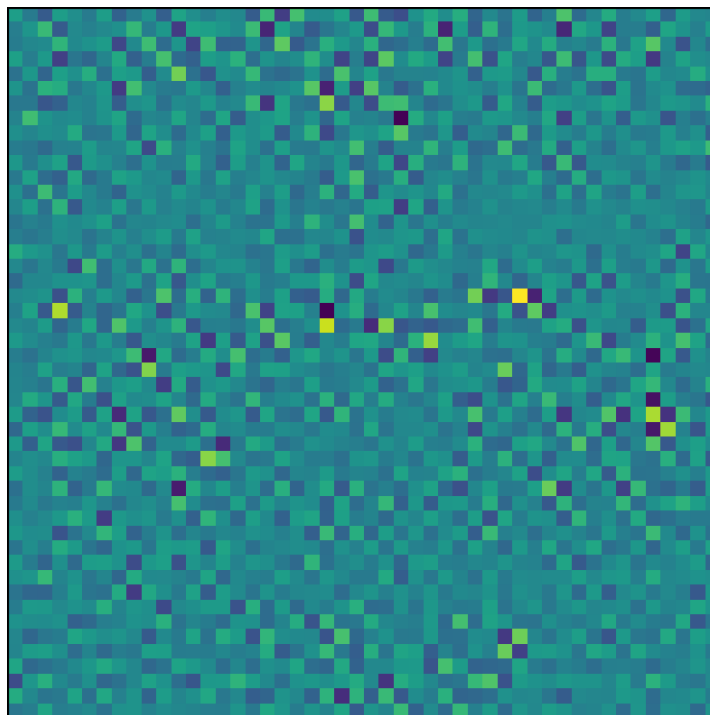


Figure 1: One Shot Linear Regression Weights

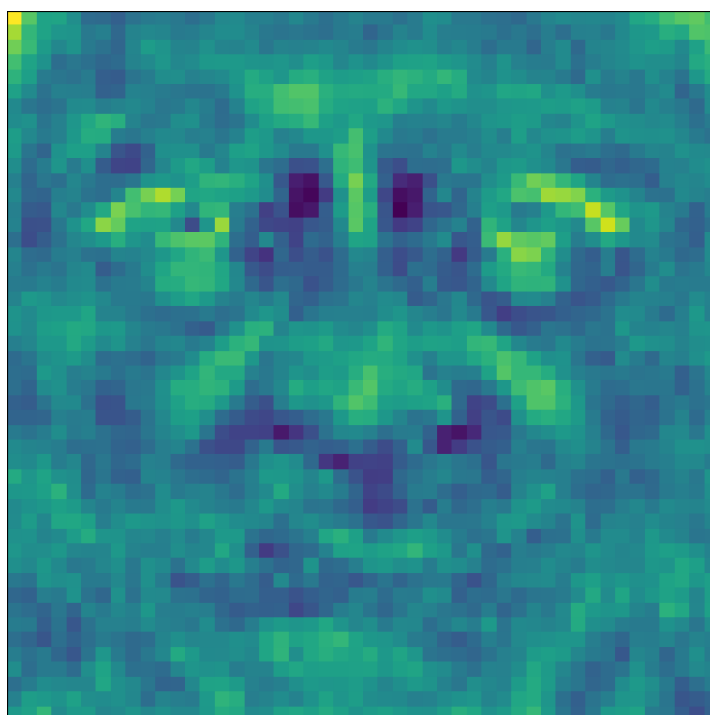


Figure 2: Gradient Descent Weights

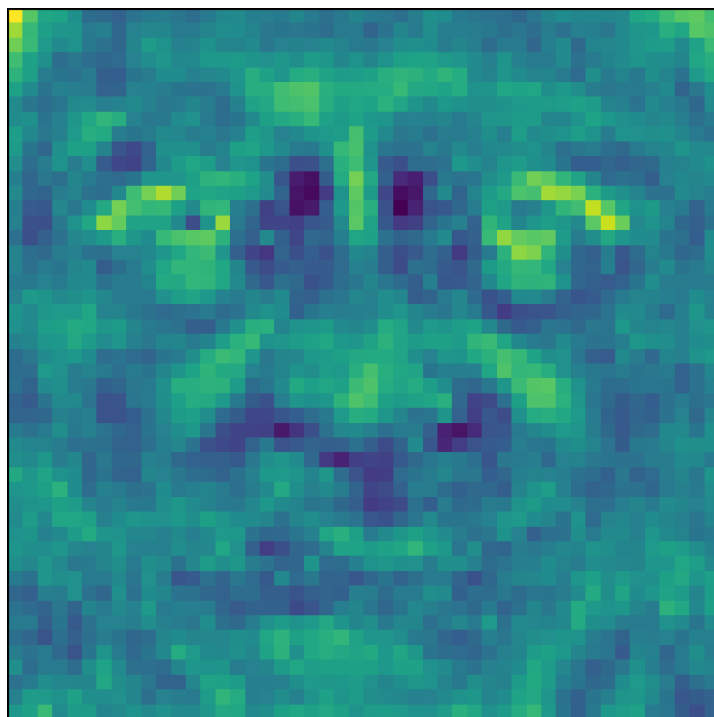


Figure 3: Gradient Descent with Regularization Weights

Errors

| Image Index | Predicted Age (yr) | Actual Age (yr) | Difference (yr) |
|-------------|--------------------|-----------------|-----------------|
| 884 | 59.99 | 10.0 | 49.99 |
| 1640 | 52.44 | 4.0 | 48.44 |
| 830 | 41.59 | 89.0 | 47.41 |
| 581 | 33.28 | 80.0 | 46.72 |
| 939 | 53.56 | 8.0 | 45.56 |

Table 2: Five Most Egregious Errors

Table 2 shows the size of the worst errors from the *Gradient Descent with Regularization* algorithm. In order, the following images are our 5 most egregious errors.



Figure 4: Image 884: Error of 49.99 Years



Figure 5: Image 1640: Error of 48.44 Years



Figure 6: Image 830: Error of 47.41 Years



Figure 7: Image 581: Error of 46.72 Years



Figure 8: Image 939: Error of 45.56 Years