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| --- | --- | --- |
| Full names | Students id | Contributions |
| Daniel Correa Tucunduva | 002228689 | complete scikit-learn implementation of all 5 algorithms |
| Siqian Liu | 002240226 | complete Logistic Regression implementation and parameter tuning. |
| Weina Zhu | 002242570 | complete Linear Regression implementation and parameter tuning. |
| Yan Jiang | 002271130 | complete Linear and Logistic Regression implementation and parameter tuning. |

For each of the sections below, report the obtained accuracy on your test.

**KNN**

*Report the different k values you tried and the k value that you found to be best in the table below. In addition, report the validation and testing accuracy for your implementation with this best k value:*

The validation accuracy for k = 1.000000 is given by : 35.700000

(…) for k = 2.000000 is given by : 30.900000

(…) for k = 3.000000 is given by : 32.700000

(...) for k = 4.000000 is given by : 32.300000

(...) for k = 5.000000 is given by : 32.600000

(...) for k = 6.000000 is given by : 31.700000

(...) for k = 7.000000 is given by : 32.300000

(...) for k = 8.000000 is given by : 31.700000

(...) for k = 9.000000 is given by : 30.800000

(...) for k = 10.000000 is given by : 31.600000

(...) for k = 12.000000 is given by : 31.300000

(...) for k = 14.000000 is given by : 30.600000

(...) for k = 16.000000 is given by : 30.700000

(...) for k = 18.000000 is given by : 31.300000

(...) for k = 20.000000 is given by : 30.500000

(...) for k = 22.000000 is given by : 29.800000

(...) for k = 24.000000 is given by : 30.000000

(...) for k = 26.000000 is given by : 30.400000

(...) for k = 28.000000 is given by : 29.400000

(...) for k = 30.000000 is given by : 29.100000

(...) for k = 32.000000 is given by : 29.000000

(...) for k = 34.000000 is given by : 29.500000

(...) for k = 36.000000 is given by : 29.300000

(...) for k = 38.000000 is given by : 29.600000

(...) for k = 40.000000 is given by : 29.900000

|  |  |
| --- | --- |
| k values tried: | 1 to 10, and 12, 14, 16…to 40 |
| Best k value: | 1 |
| Validation accuracy: | 35.700000% |
| Test accuracy: | 35.000000% |

**Linear regression**

*Briefly describe the hyperparameter settings you tried. In particular, you should list the different values for learning rate and number of epochs you tried. You should also mention whether adding a learning rate decay helped and how you implemented this decay. Report the optimal hyperparameter setting you found in the table below. Report your training, validation, and testing accuracy with your optimal hyperparameter setting.*

Parameters tried

|  |  |  |
| --- | --- | --- |
| Epochs | Learning Rate | Learning Rate Decay |
| 1 | 0.001 | 0 |

The train accuracy is given by : 10.026531

The validation accuracy is given by : 8.700000

The test accuracy is given by : 9.760000

|  |  |  |
| --- | --- | --- |
| Epochs | Learning Rate | Learning Rate Decay |
| 500 | 0.001 | 0 |

The train accuracy is given by : 8.685714

The validation accuracy is given by : 8.500000

The test accuracy is given by : 8.480000

|  |  |  |
| --- | --- | --- |
| Epochs | Learning Rate | Learning Rate Decay |
| 500 | 0.001 | 0.5 |

The train accuracy is given by : 9.510204

The validation accuracy is given by : 8.400000

The test accuracy is given by : 9.140000

|  |  |  |
| --- | --- | --- |
| Epochs | Learning Rate | Learning Rate Decay |
| 1000 | 0.001 | 0.5 |

The train accuracy is given by : 9.595918

The validation accuracy is given by : 8.300000

The test accuracy is given by : 9.300000

|  |  |  |
| --- | --- | --- |
| Epochs | Learning Rate | Learning Rate Decay |
| 500 | 0.1 | 0 |

The train accuracy is given by : 10.377551

The validation accuracy is given by : 9.400000

The test accuracy is given by : 10.140000

|  |  |  |
| --- | --- | --- |
| Epochs | Learning Rate | Learning Rate Decay |
| 1000 | 0.00001 | 0.5 |

The train accuracy is given by : 10.026531

The validation accuracy is given by : 8.700000

The test accuracy is given by : 9.760000

|  |  |  |
| --- | --- | --- |
| Epochs | Learning Rate | Learning Rate Decay |
| 5000 | 0.00001 | 0.5 |

The train accuracy is given by : 10.026531

The validation accuracy is given by : 8.700000

The test accuracy is given by : 9.760000

|  |  |
| --- | --- |
| Optimal hyperparameters: | Learning Rate = 0.1  epochs = 500  decay\_rate: 0 |
| Training accuracy: | 10.377551 |
| Validation accuracy: | 9.400000 |
| Test accuracy: | 10.140000 |

**Perceptron**

*Briefly describe the hyperparameter settings you tried. In particular, you should list the different values for learning rate and number of epochs you tried. You should also mention whether adding a learning rate decay helped and how you implemented this decay. Report the optimal hyperparameter setting you found in the table below. Report your training, validation, and testing accuracy with your optimal hyperparameter setting.*

Parameters tried

alpha: 0.001, 0.01, 0.1, 0.2, 0.3, 0.4 and 0.5

epochs: 100, 300, 500 (500 is sufficient to achieve convergence)

reg\_const: 0.5, 0.25, 0.1, 0.01

decay\_rate: 0.9, 0.95, 0.99 (as simple multiplier coefficients), divide learning rate by 5 each time 5 epochs pass without loss reduction

|  |  |
| --- | --- |
| Optimal hyperparameters: | alpha = 0.01  epochs = 500  decay\_rate: divide learning rate by 5 each time 5 epochs pass without loss reduction |
| Training accuracy: | 23.775510 |
| Validation accuracy: | 22.700000 |
| Test accuracy: | 22.020000 |

**SVM**

*Describe the hyperparameter tuning you tried for learning rate, number of epochs, and regularization constant. Report the optimal hyperparameter setting you found in the table below. Also report your training, validation, and testing accuracy with your optimal hyperparameter setting.*

Parameters tried

alpha: 0.001, 0.01, 0.1, 0.2, 0.3, 0.4 and 0.5

epochs: 100, 300, 500 (500 is sufficient to achieve convergence)

reg\_const: 0.5, 0.25, 0.1, 0.01

decay\_rate: divide learning rate by 5 each time 5 epochs pass without loss reduction

|  |  |
| --- | --- |
| Optimal hyperparameters: | alpha = 0.01  epochs = 500  reg\_const = 0.01  decay\_rate: divide learning rate by 5 each time 5 epochs pass without loss reduction |
| Training accuracy: | 42.426531 |
| Validation accuracy: | 37.900000 |
| Test accuracy: | 39.860000 |

**Logistic Regression**

*Once again, describe the hyperparameter tuning you tried for learning rate, number of epochs, and regularization constant. Report the optimal hyperparameter setting you found in the table below. Also report your training, validation, and testing accuracy with your optimal hyperparameter setting.*

|  |  |  |
| --- | --- | --- |
| Epochs | Learning Rate | Learning Rate Decay |
| 1 | 0.001 | 0 |

The train accuracy is given by : 38.000000

The validation accuracy is given by : 39.000000

The test accuracy is given by : 38.000000

|  |  |  |
| --- | --- | --- |
| Epochs | Learning Rate | Learning Rate Decay |
| 6 | 0.001 | 0 |

The train accuracy is given by : 40.000000

The validation accuracy is given by : 40.000000

The test accuracy is given by : 39.000000

|  |  |  |
| --- | --- | --- |
| Epochs | Learning Rate | Learning Rate Decay |
| 6 | 0.001 | 0.5 |

The train accuracy is given by : 15.000000

The validation accuracy is given by : 15.000000

The test accuracy is given by : 15.000000

|  |  |  |
| --- | --- | --- |
| Epochs | Learning Rate | Learning Rate Decay |
| 20 | 0.001 | 0 |

The train accuracy is given by : 42.000000

The validation accuracy is given by : 40.000000

The test accuracy is given by : 40.000000

|  |  |  |
| --- | --- | --- |
| Epochs | Learning Rate | Learning Rate Decay |
| 6 | 0.1 | 0 |

The train accuracy is given by : 40.000000

The validation accuracy is given by : 36.000000

The test accuracy is given by : 35.000000

|  |  |
| --- | --- |
| Optimal hyperparameters: | Epochs= 6  Learning Rate=0.001  Decay= 0 |
| Training accuracy: | 40 |
| Validation accuracy: | 40 |
| Test accuracy: | 39 |