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