

# Report

## Perceptron

### RICE DATASET

Optimal hyperparameters:	lr = 0.05, n_epochs = 15
Training accuracy:	99.761708
Validation accuracy:	99.670058
Test accuracy:	99.752543

Hyperparameter tuning strategy (RICE):

1. lr: {0.05, 0.5, 1, 1.5} + learning rate decay (\*0.95)
2. n\_epochs: {5, 15, 20}

### Fashion-MNIST DATASET

Optimal hyperparameters:	lr = 3.5, n_epochs = 40
Training accuracy:	83.282000
Validation accuracy:	82.380000
Test accuracy:	81.590000

Hyperparameter tuning strategy (Fashion-MNIST):

1. lr: {0.05, 0.5, 3, 3.5, 4, 5} + learning rate decay (\*0.95)
2. n\_epochs: {20, 30, 35, 40, 50, 100}

## SVM

### RICE DATASET

Optimal hyperparameters:	lr = 0.05, n_epochs = 5, reg_const = 0.05, batch_size = 256
Training accuracy:	99.972505
Validation accuracy:	99.890019
Test accuracy:	99.972505

Hyperparameter tuning strategy (RICE):

1. lr: {0.05, 0.5} + learning rate decay (\*0.95)
2. n\_epochs: {5, 15, 20}
3. reg\_constant: {0.05, 0.5}
4. batch\_size: {10, 100, 200, 256}

#### **Fashion-MNIST DATASET**

Optimal hyperparameters:	lr = 0.5, n_epochs = 40, reg_const = 0.05, batch_size = 256
Training accuracy:	85.424000
Validation accuracy:	81.690000
Test accuracy:	81.350000

Hyperparameter tuning strategy (Fashion-MNIST):

1. lr: {0.05, 0.5} + learning rate decay (\*0.95)
2. n\_epochs: {5, 15, 20}
3. reg\_constant: {0.05, 0.5}
4. batch\_size: {10, 100, 200, 256}

#### **Softmax**

#### **RICE DATASET**

Optimal hyperparameters:	lr = 0.4, n_epoch = 5, reg_const = 0.05, lr_decay = 1.2, batch_size = 256
Training accuracy:	100
Validation accuracy:	99.94
Test accuracy:	100

Hyperparameter tuning strategy for Rice:

- $lr = lr / (1 + lr\_decay * epoch)$
- lr: {0.1, 0.3, 0.4, 0.5, 1, 2, 3}
- reg\_constant: {0.01, 0.05, 0.1, 0.3}
- batch\_size: {256, 512}
- N\_epoch: {4, 5, 8, 9, 10, 14, 15, 20, 25}
- lr\_decay: {1, 1.1, 1.2}

### **Fashion-MNIST DATASET**

Optimal hyperparameters:	lr = 0.5, n_epoch =15, reg_const = 0.5, lr_decay = 1.2, batch_size = 256
Training accuracy:	85.51
Validation accuracy:	83.95
Test accuracy:	83.16

Hyperparameter tuning strategy for Fashion MNIST:

- $lr = lr / (1 + lr\_decay * epoch)$
- lr: {3e-4, 1e-3, 1e-2, 0.1, 0.5, 1, 2, 3}
- reg\_constant: {0.05, 0.1, 0.3, 0.4, 0.5, 0.6, 1, 3, 5}
- batch\_size: {10, 100, 200, 256, 512, 1000}
- N\_epoch: {5, 8, 9, 10, 14, 15, 20, 25}
- lr\_decay: {1, 1.1, 1.2}

Tried many other permutations and combinations, eventually landing at these sets of hyperparameters that resulted in the best generalization and accuracy.

### **Logistic**

### **RICE DATASET**

Optimal hyperparameters:	lr = 0.5, n_epoch =10, threshold = 0.5
Training accuracy:	100.00
Validation accuracy:	99.94
Test accuracy:	100.00

Hyperparameter tuning strategy for Rice:

- lr: {0.4, 0.5, 1}
- N\_epoch: {8, 10, 12}
- Threshold: {0.3, 0.5, 0.7}