Assignment #1 - Supervised Learning

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1. 테스트 환경

Test OS: Windows 11 23H Education edition, Google colab

• python version: 3.12.2

2. 실험 진행

a. Dataset

MNIST dataset

• 클래스: 0 ~ 9까지 숫자의 총 10개 클래스

training images / labels: 60000

test images / labels : 10000

• input image resolution: 28 × 28 with depth 1

• label type : class

CIFAR 10 dataset

 classes: airplane / automobile / bird / cat / deer / dog / frog / horse / ship / truck

• train images / labels: 50000

test images / labels : 10000

• input image resolution: 32 × 32 with depth 3

• label type : class

```
MNIST original dataset
Train images: torch.Size([60000, 28, 28])
Train labels: (60000,)
Test images: torch.Size([10000, 28, 28])
Test labels: (10000,)
CIFAR-10 original dataset
Train images: (50000, 32, 32, 3)
Train labels: (50000,)
Test images: (10000, 32, 32, 3)
Test labels: (10000,)
MNIST dataset
Train images: (60000, 784)
Train labels: (60000,)
Test images: (10000, 784)
Test labels: (10000,)
CIFAR-10 dataset
Train images: (50000, 3072)
Train labels: (50000,)
Test images: (10000, 3072)
Test labels: (10000,)
```

b. Experimental setup

Decision tree classifier

• classifier 구현체 : scikit learn 라이브러에서 제공하는 DecisionTreeClassifier

tree depth: 3 / 6 / 9 / 12

Grid search parameter :

min samples split : 2 / 5 / 10

min samples leaf: 1/2/4

max leaf nodes: 5 / 10 / None

cross validation: 5

• Decision Tree Algorithm for MNIST

Algorithm 1 MNIST Decision Tree with Hyperparameters

Input: MNIST train and test data

Output: Accuracy scores for decision tree on MNIST dataset Data Loading and Preprocessing:

- 1: Load MNIST train and test datasets
- Preprocess images and labels Algorithm Configuration:
- 3: Initialize decision tree classifiers with different depths
- 4: Set hyperparameters grid for grid search MNIST Dataset Training and Evaluation:
- 5: **for** *i* in tree_depth **do**
- 6: Train decision tree classifier (tree_depth = i)
- 7: end for
- 8: Print accuracy scores for each decision tree classifier
- Decision Tree Algorithm for CIFAR

Algorithm 1 CIFAR Decision Tree with Hyperparameters

Input: CIFAR-10 train and test data

Output: Accuracy scores for decision tree on CIFAR-10 dataset

Data Loading and Preprocessing:

- 1: Load CIFAR-10 train and test datasets
- 2: Preprocess images and labels Algorithm Configuration:
- 3: Initialize decision tree classifiers with different depths
- 4: Set hyperparameters grid for grid search CIFAR-10 Dataset Training and Evaluation:
- 5: **for** *i* in tree_depth **do**
- 6: Train decision tree classifier (tree_depth = i)
- 7: end for
- 8: Print accuracy scores for each decision tree classifier

SVM classifier

- classifier 구현체 : scikit learn 라이브러에서 제공하는 svm 모듈의 SVC사용.
- kernel type: linear / radial basis function
- SVM Train Algorithm for MNIST

Algorithm 1 MNIST SVM with Hyperparameters

Input: MNIST train and test data

Output: Accuracy scores for SVM on MNIST dataset

Data Loading and Preprocessing:

- Load MNIST train and test datasets
- 2: Preprocess images and labels Algorithm Configuration:
- 3: Initialize SVM classifiers with different kernels MNIST Dataset Training and Evaluation:
- 4: Train SVM classifier (kernel = 'linear')
- 5: Train SVM classifier (kernel = 'rbf')
- 6: Print accuracy scores for linear and RBF SVM classifiers
- SVM Train Algorithm for CIFAR

Algorithm 1 CIFAR SVM with Hyperparameters

Input: CIFAR-10 train and test data

Output: Accuracy scores for SVM on CIFAR-10 dataset Data Loading and Preprocessing:

- Load CIFAR-10 train and test datasets
- 2: Preprocess images and labels Algorithm Configuration:
- 3: Initialize SVM classifiers with different kernels CIFAR-10 Dataset Training and Evaluation:
- 4: Train SVM classifier (kernel = 'linear')
- 5: Train SVM classifier (kernel = 'rbf')
- 6: Print accuracy scores for linear and RBF SVM classifiers

MNIST dataset에 대해서 local machine에서 decision tree, svm의 학습 동시에 진행 CIFAR dataset에 대해서 local machine(decision tree학습)과 colab(svm 학습)에서 병렬적으로 진행.

c. Results

MNIST

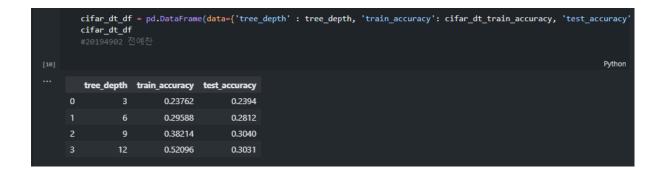
train / test accuracy on decision tree with depth of 3/6/9/12



• train / test accuracy on svm with linear and rbf kernel

CIFAR 10

• train / test accuracy on decision tree with depth of 3/6/9/12



• train / test accuracy on svm with linear and rbf kernel