Deep Learning for Computer Vision
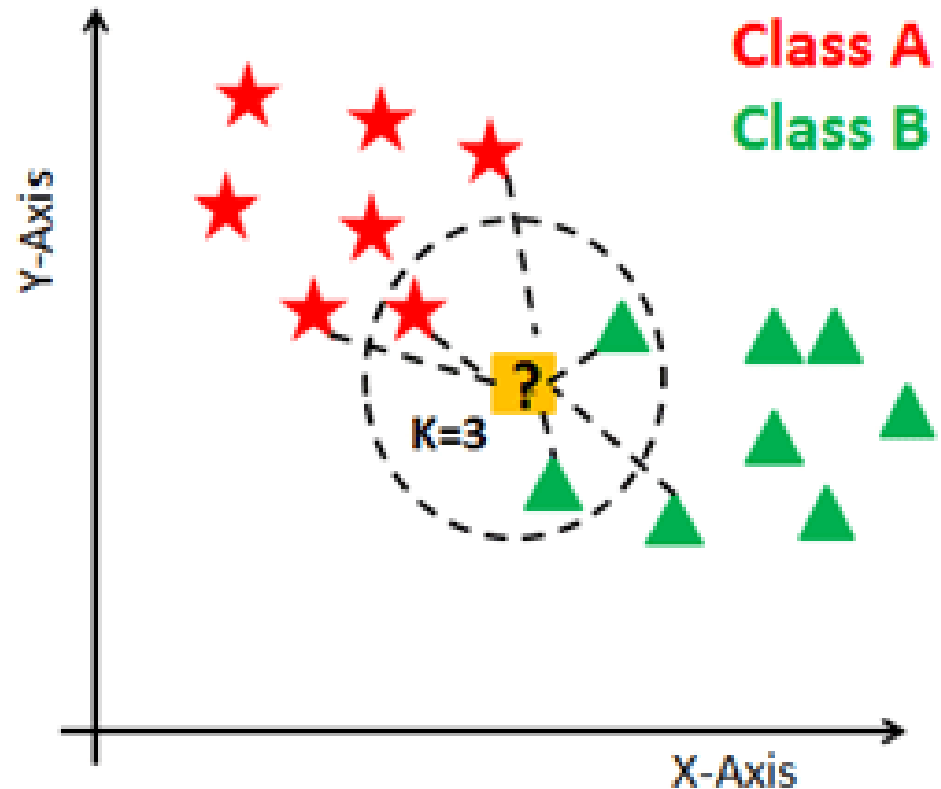
Assignment 2

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k-Nearest Neighbors Method

- Calculate distance
- Find k closest neighbors
- Vote for labels

Finding Neighbors & Voting for Labels

Implementing k-NN:
Step #1 - Gather Our Dataset

- Dataset for Training and Testing
  - 900 image per Cats, Dogs, and Panda Class from Animals dataset
- Dataset for Evaluation
  - 100 image per Cats, Dogs from Cifar-10 datasets
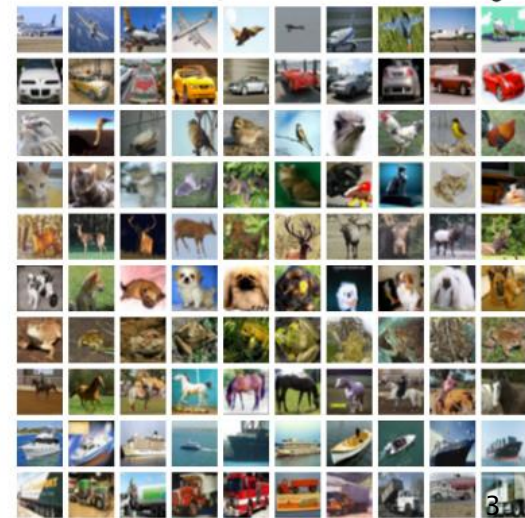 - 100 image per Panda Class from ImageNet datasets

Note: No image has
Been used twice.

Animals: Dogs, Cats, and Pandas

CIFAR-10

airplane
automobile
bird
cat
deer
dog
frog
horse
ship
truck

Implementing k-NN:
Step #2 - Split the Dataset

- Training dataset: 75% of 3x900 images
  - (675 image per class)

- Testing dataset: 25% of 3x900 images
  - (225 image per class)

- Evaluation dataset:100% of 3x100 images)
  - (100 image per class)

Implementing k-NN: Step #3 – Train the Classifier

▸ Dataset: Training dataset (75% of 3x900 images)

▸ Train the Classifier for Different Parameters:
  ◦ **Weights**: {'uniform', 'distance'}
  ◦ **Algorithm**: {'auto', 'ball_tree', 'kd_tree', 'brute'}
  ◦ **n_neighbors**: {1,2,3,4,5,6,7,8,9,10,12,14,16,18,20}

▸ => 2 x 4 x 15 = 120 combinations of parameters
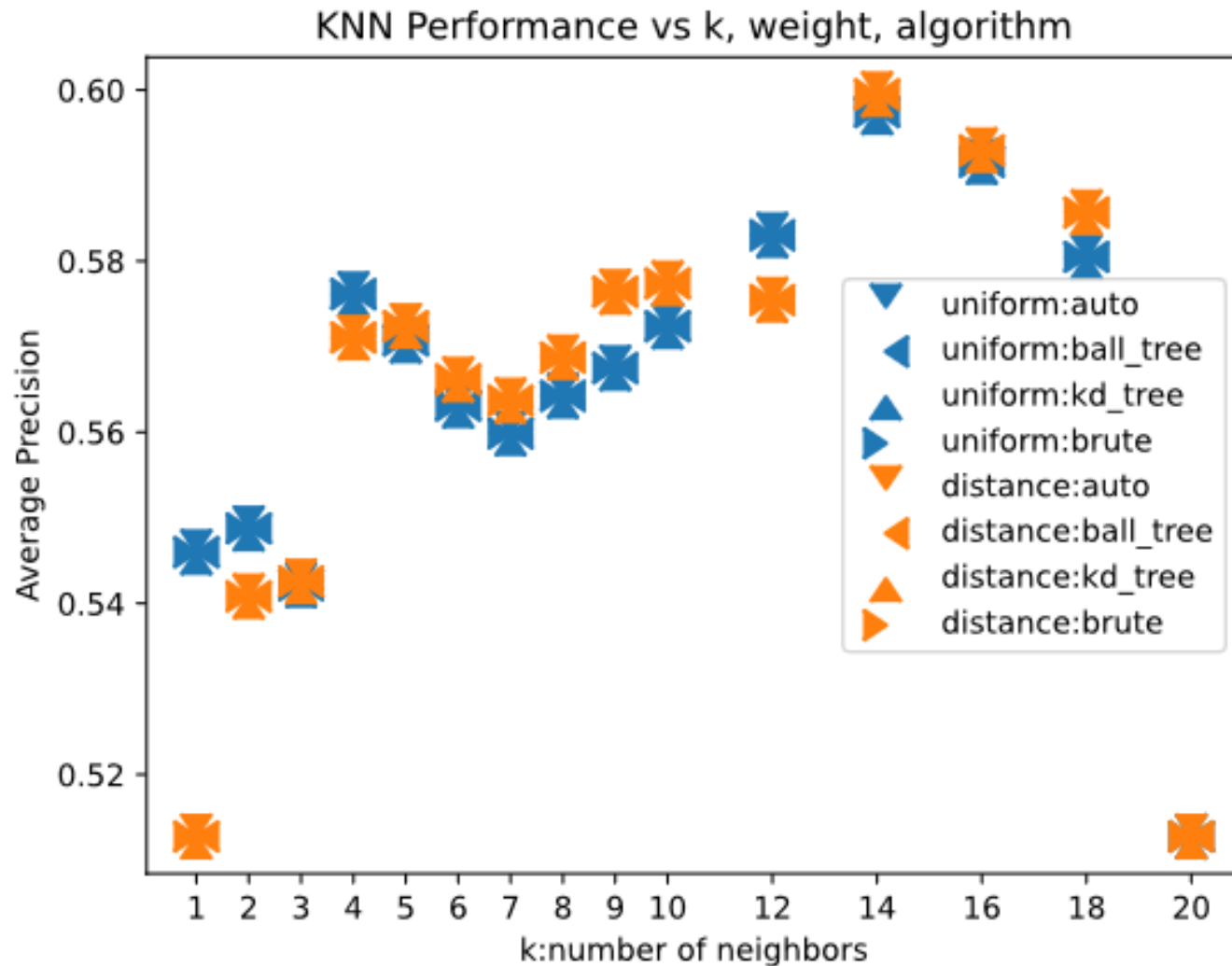
Implementing k-NN:
Step #4 – Test the Classifier

▸ Dataset: Testing dataset (25% of 3x900 images)

▸ => 2 x 4 x 15 = 120 combinations of parameters

▸ Compare average precision

▸ Choose best parameter values

Implementing k-NN: Step #5 – Evaluate Tuned Classifier

▸ Dataset: Evaluation dataset (100% of 3x100 images)

▸ Parameters: Optimal parameters from test results

k-NN Classifier Average Performance for Test Data
[Varied Parameters: n_neighbors, weights, algorithms]

KNN Performance vs k, weight, algorithm

Legend:
- ▼ uniform:auto
- ◄ uniform:ball_tree
- ▲ uniform:kd_tree
- ► uniform:brute
- ▼ distance:auto
- ◄ distance:ball_tree
- ▲ distance:kd_tree
- ► distance:brute

Average Precision vs k:number of neighbors

k-NN Classifier Average Performance for Test Data [Varied Parameters: n_neighbors, weights, algorithms]

- Average precision: 54% to 58%
- "distance" weight slightly higher than "uniform" weight;
- Equal average precision for all algorithms;
- "brute" was fastest algorithm;
- Highest average precision for n_neighbors = 14.

k-NN Classifier Class-wise Performance for Test Data [Varied Parameters: n_neighbors, weights, classes] algorithm = "brute"


KNN Performance vs k, weight, class
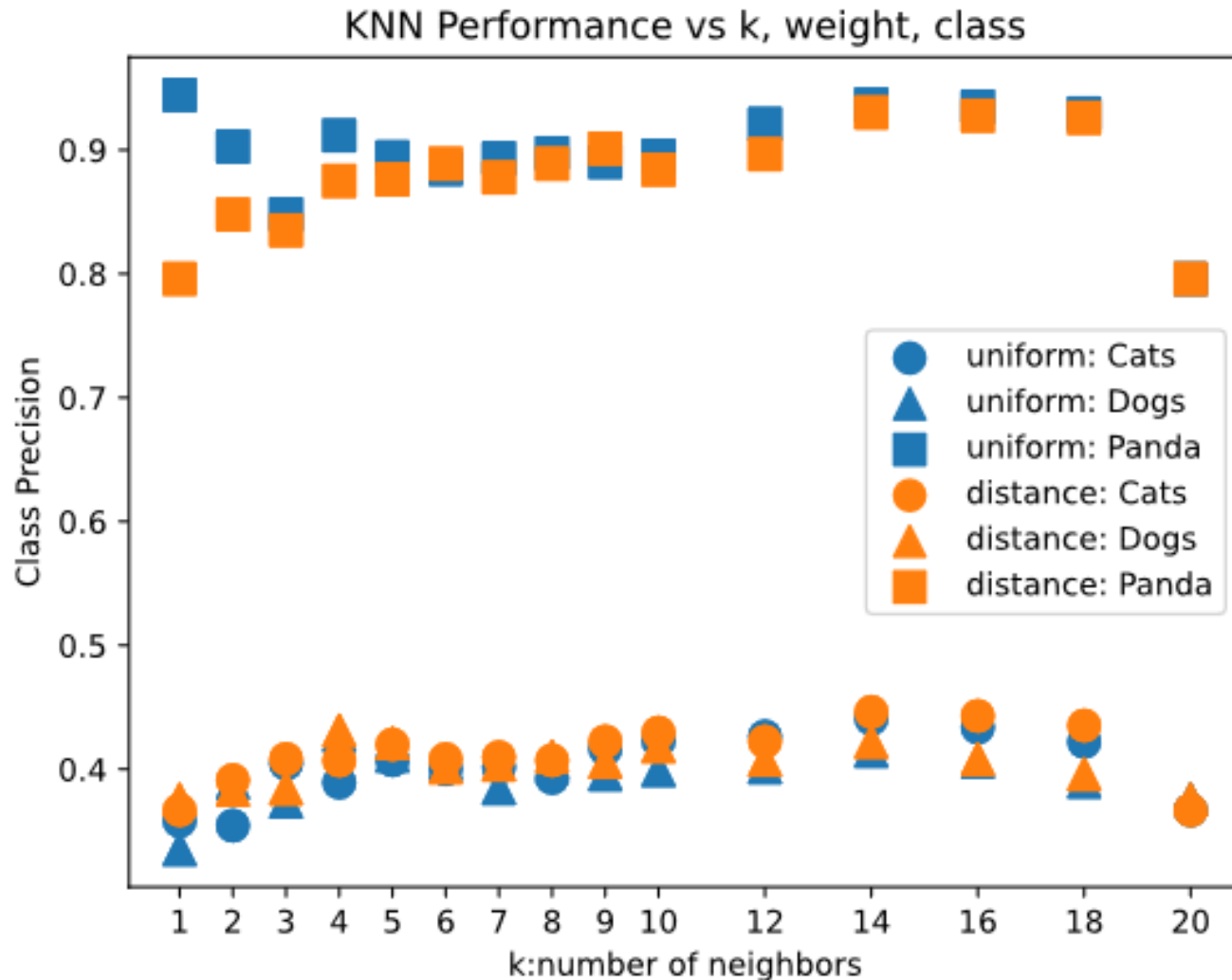
k-NN Classifier Class-wise Performance for Test Data [Varied Parameters: n_neighbors, weights, classes] algorithm = "brute"

- Average precision: 90% for Panda, 40% for Cats and Dogs.
- For Panda: "uniform" weight slightly more precise than "distance" weight.
- For Cats and Dogs, "distance" weight has higher precision.

k–NN Classifier Class–wise & Average Performance for Evaluation Data
[Varied Parameters: n_neighbors, classes]
weights="distance & "algorithm = "brute"

KNN Performance vs k & class
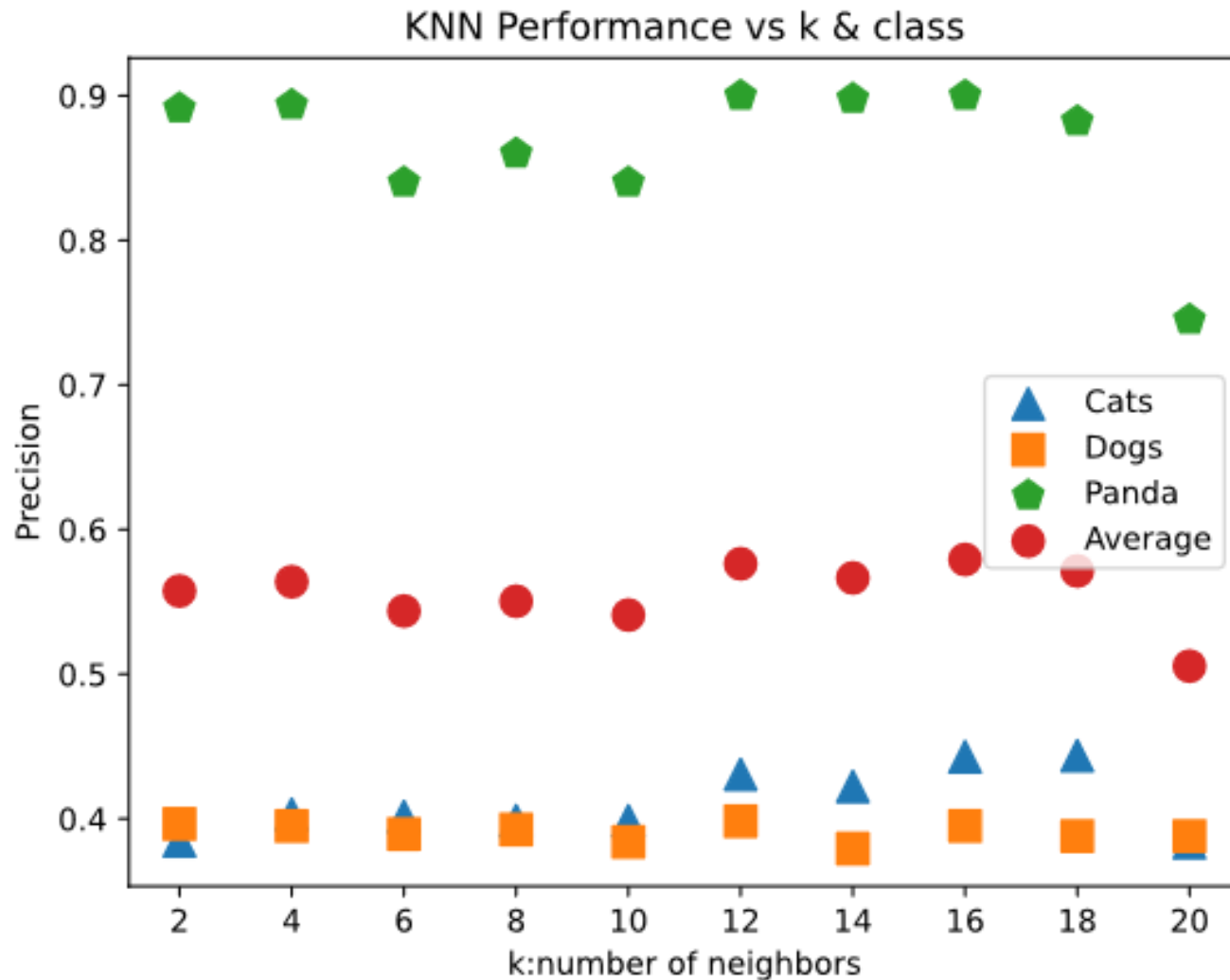
k-NN Classifier Class-wise & Average Performance for Evaluation Data
[Varied Parameters: n_neighbors, classes]
weights="distance & "algorithm = "brute"

- Overall average precision:56%
- Average class precision:
  - 41% for Cats,
  - 39% for Dogs,
  - 87% for Panda.
- Highest precision for n_neighbors = 2 & 12

References

- https://www.datacamp.com/community/tutorials/k-nearest-neighbor-classification-scikit-learn
- Rosebrock, A. (2017). Deep learning for computer vision with python: starter bundle. PyImageSearch.
- Cifar-10 Dataset: https://pjreddie.com/projects/cifar-10-dataset-mirror/
- ImageNet Dataset: https://www.image-net.org/index.php

Thanks for your attention

» Questions are welcome