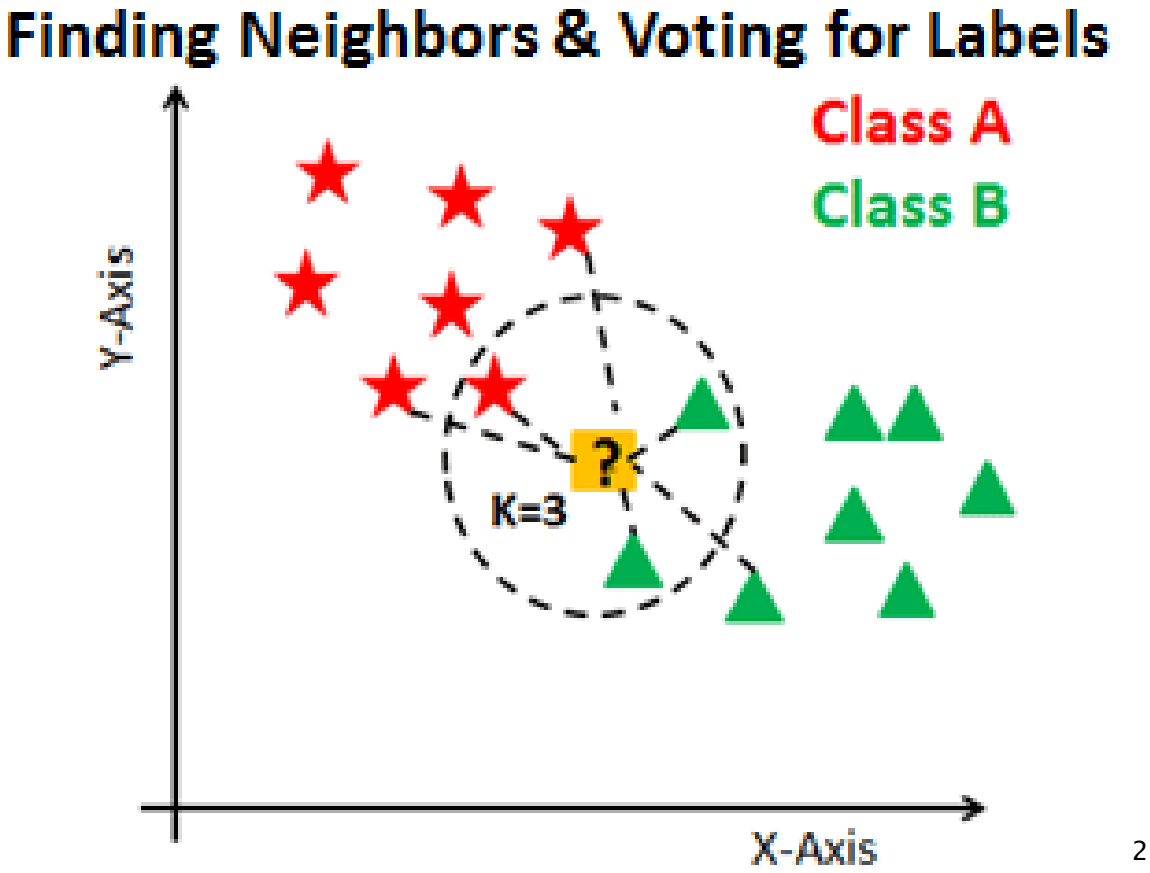
Deep Learning in Computer Vision

Image Classification Using k-NN

Instructor: Dr. Mehrandezh
Student: Marzieh Zamani

k-Nearest Neighbors Method

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



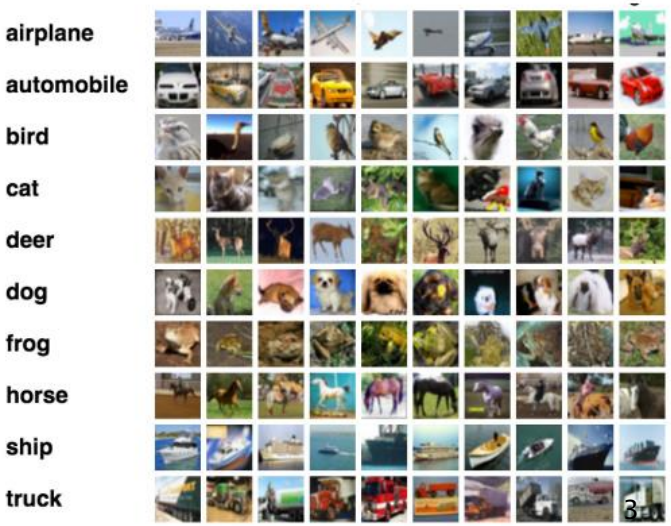
Implementing k-NN: Step #1 – Gather Our Dataset

- 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



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

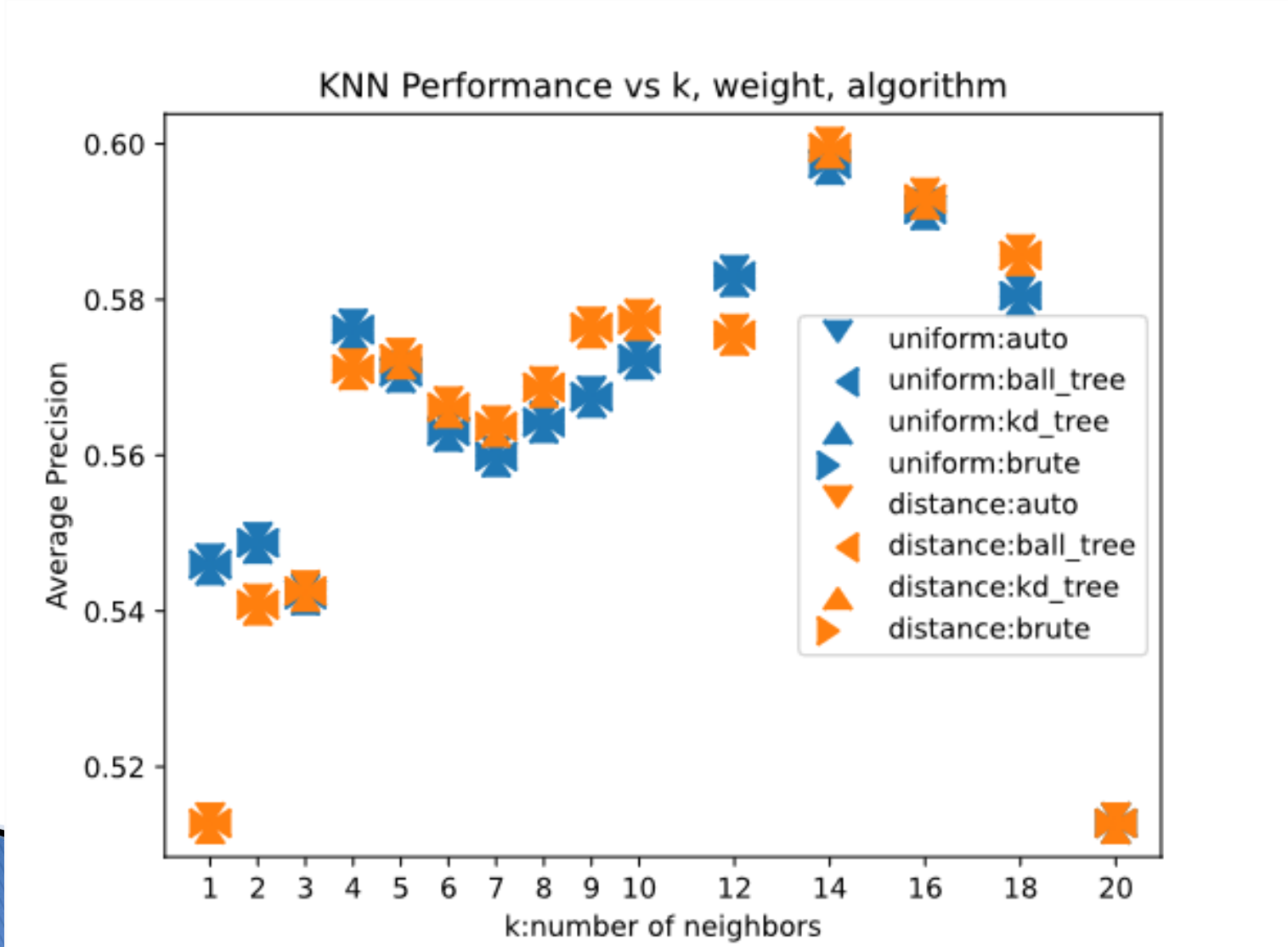
- Dataset: Testing dataset (25% of 3x900 images)
- => 2 x 4 x 15 = 120 combinations of parameters
- Compare average precision
- Choose best parameter values

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

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

- Parameters: Optimal parameters from test results

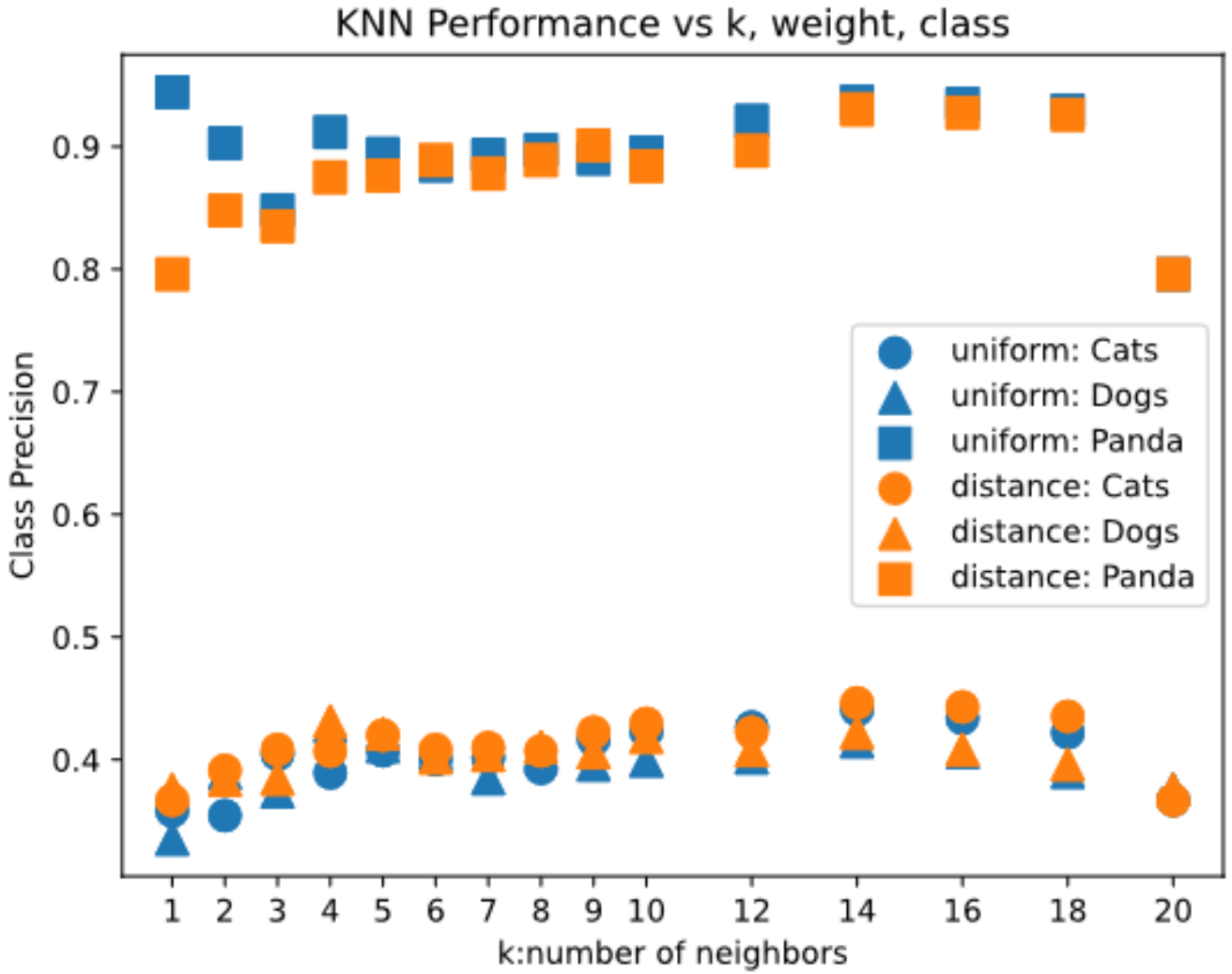
k-NN Classifier Average Performance for Test Data [Varied Parameters: n_neighbors, weights, algorithms]



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.

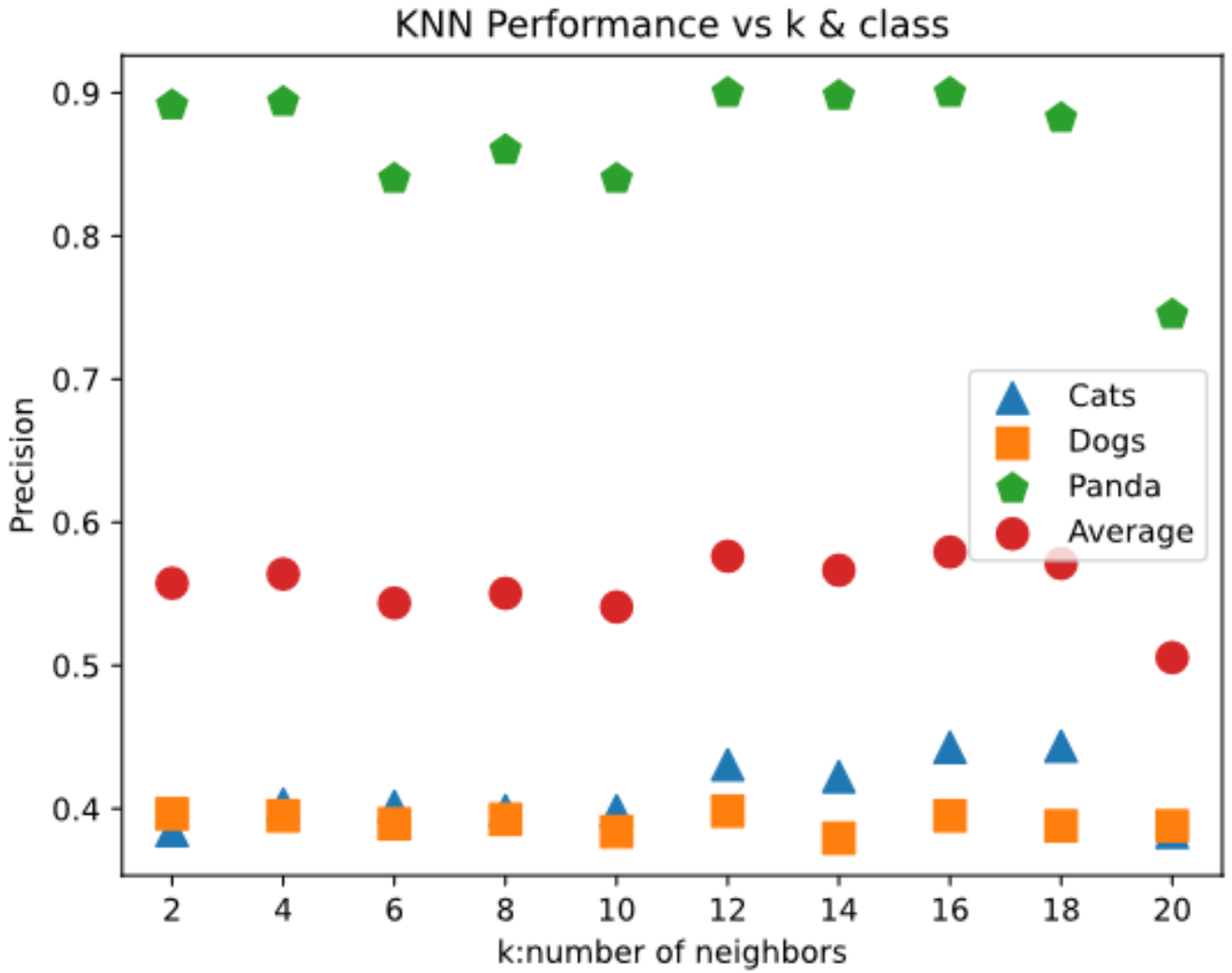
k-NN Classifier Class-wise Performance for Test Data [Varied Parameters: n_neighbors, weights, classes] algorithm = “brute”



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"



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