Machine Learning

Lecture 13: Nearest Neighbor Classifiers

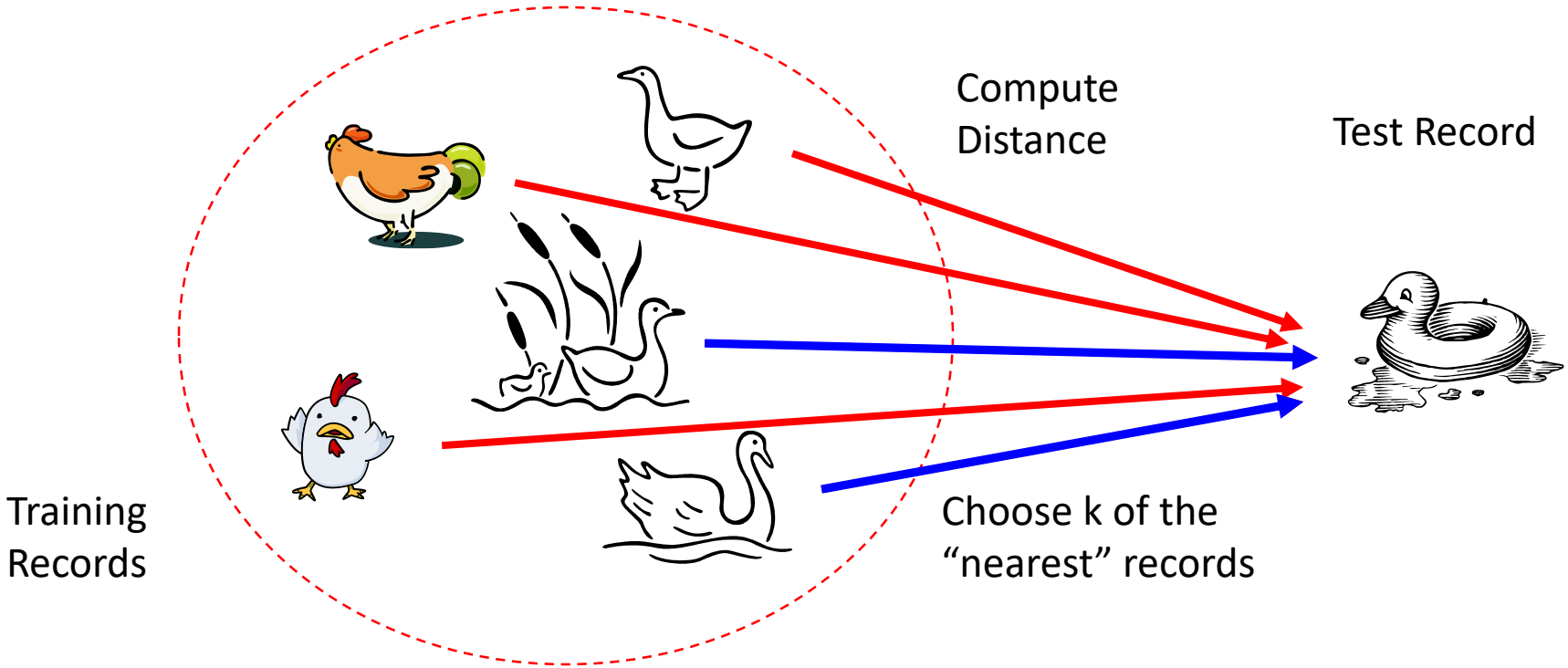
Sibei Yang

SIST

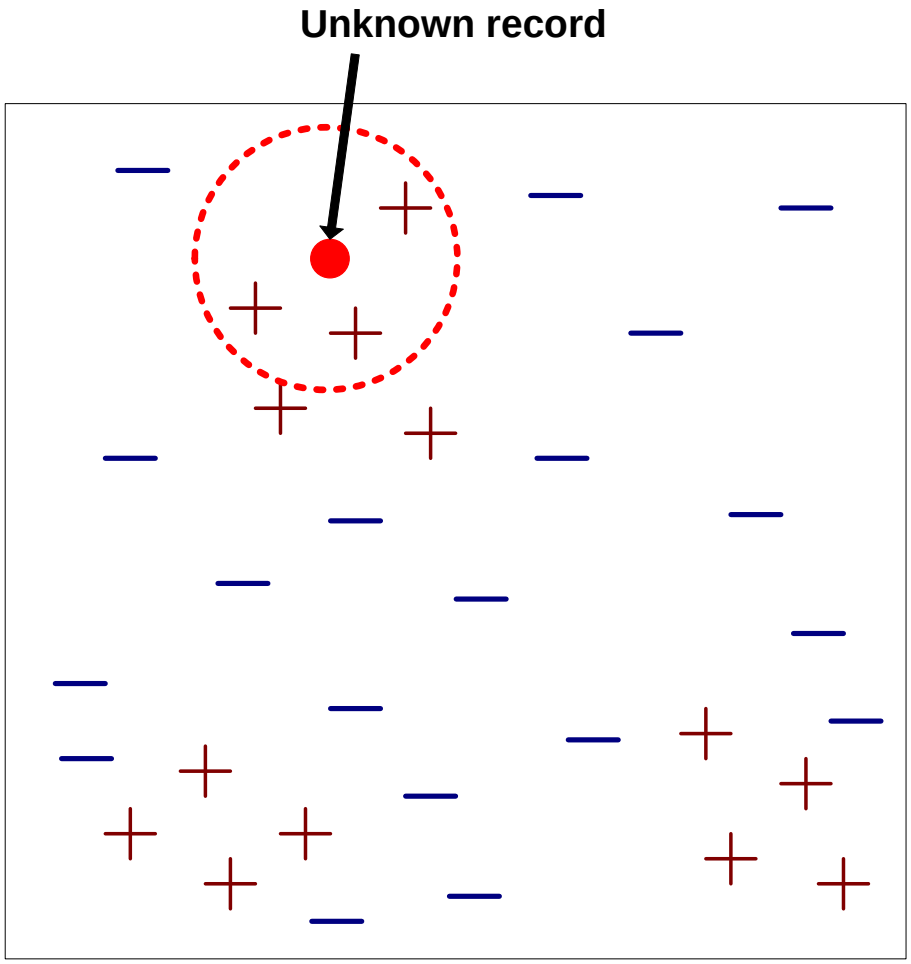
Email: yangsb@shanghaitech.edu.cn

Nearest Neighbor Classifiers

- Basic idea:
  - If it walks like a duck, quacks like a duck, then it's probably a duck



Nearest-Neighbor Classifiers



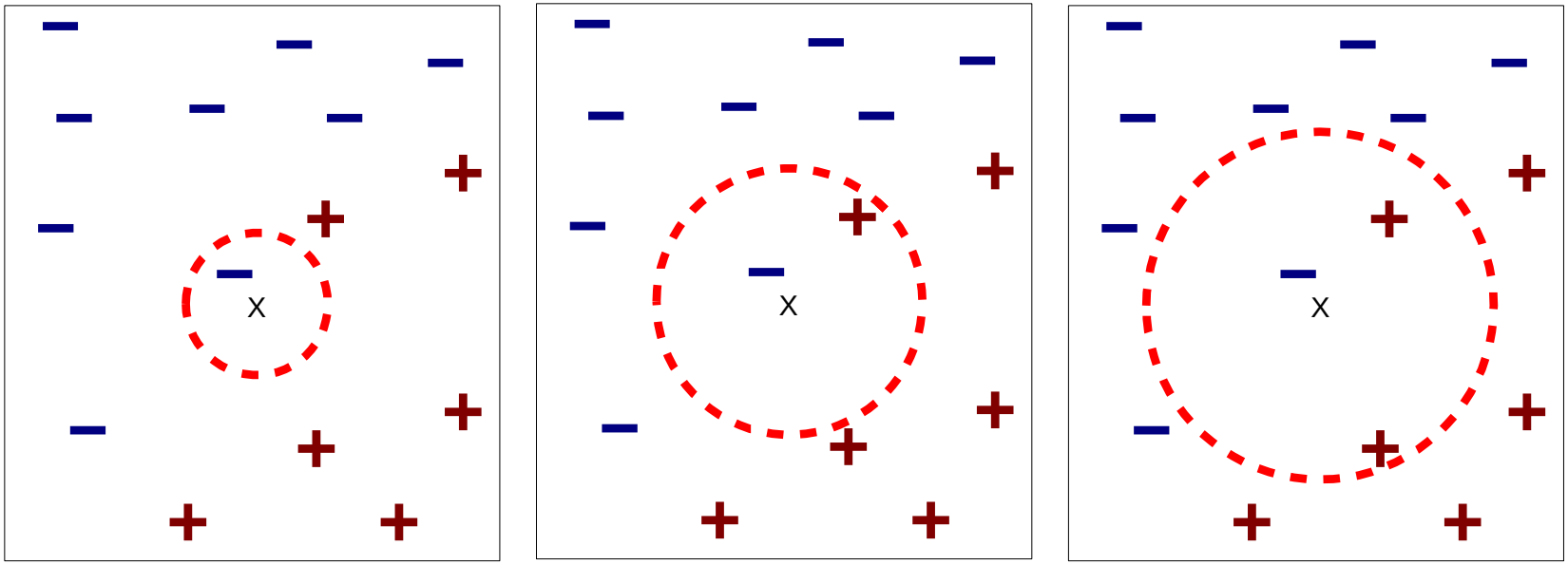
Requires three things

- The set of stored records
- Distance Metric to compute distance between records
- The value of *k*, the number of nearest neighbors to retrieve

To classify an unknown record:

- Compute distance to other training records
- Identify *k* nearest neighbors
- Use class labels of nearest neighbors to determine the class label of unknown record (e.g., by taking majority vote)

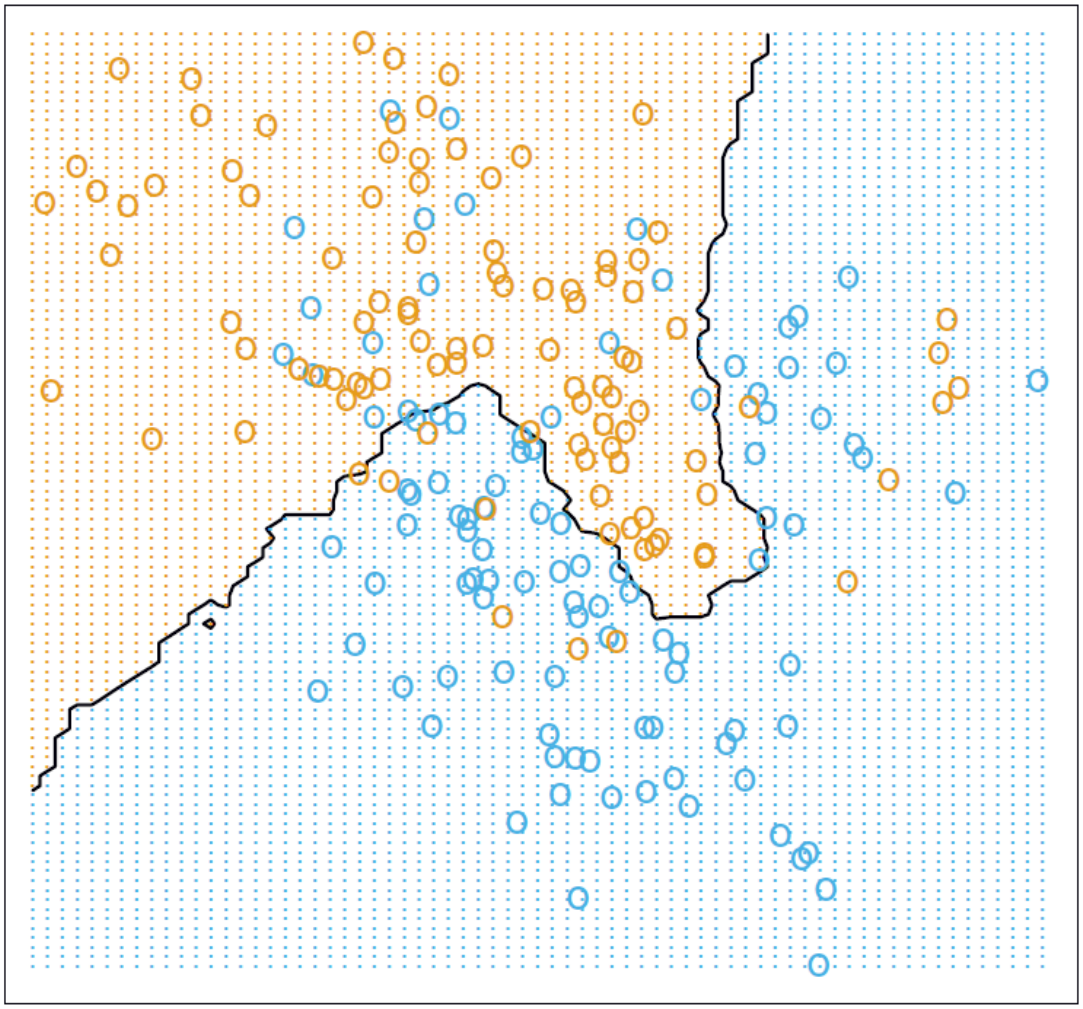
Definition of Nearest Neighbor



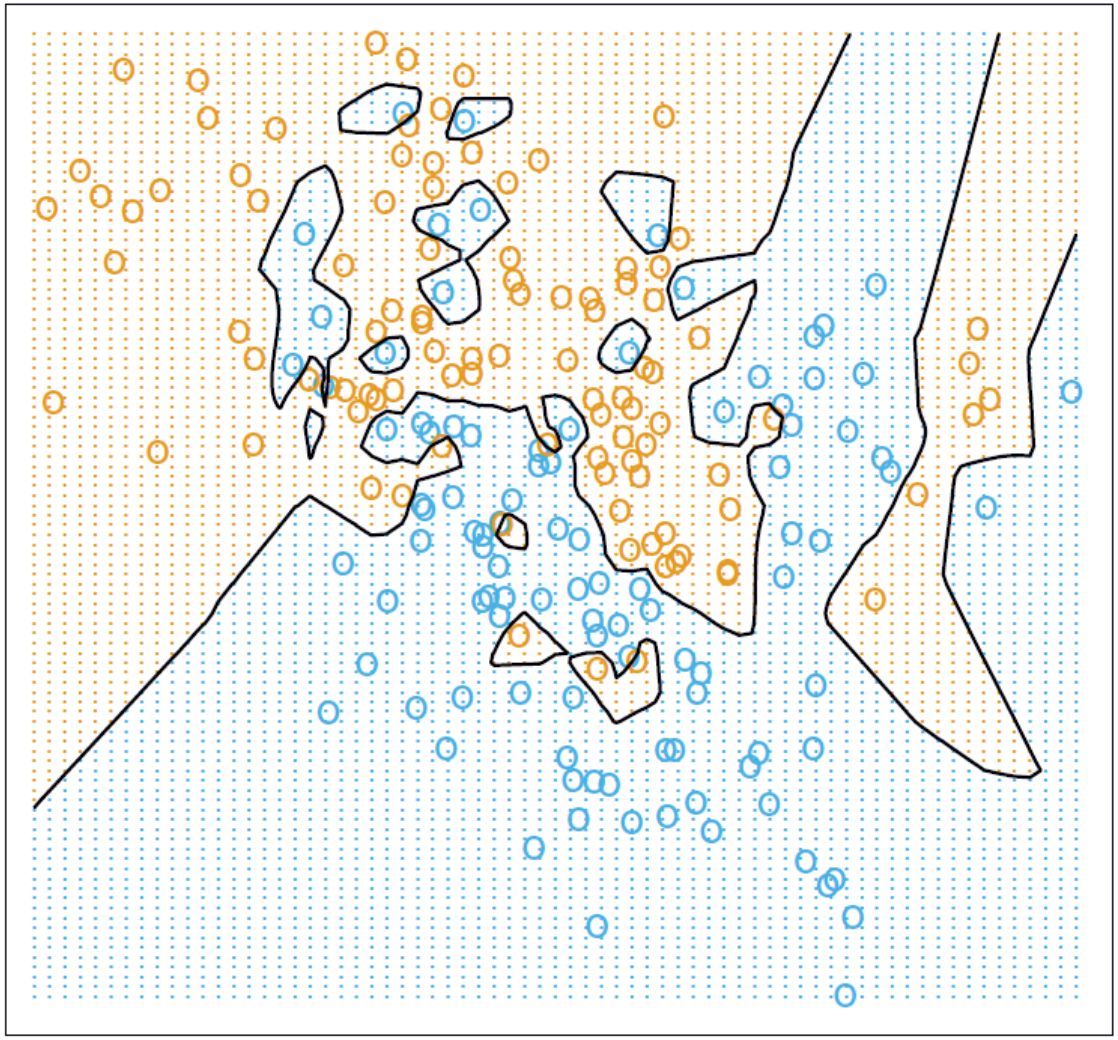
(a) 1-nearest neighbor (b) 2-nearest neighbor (c) 3-nearest neighbor

K-nearest neighbors of a record ***x*** are data points that have the *k* smallest distance to ***x***

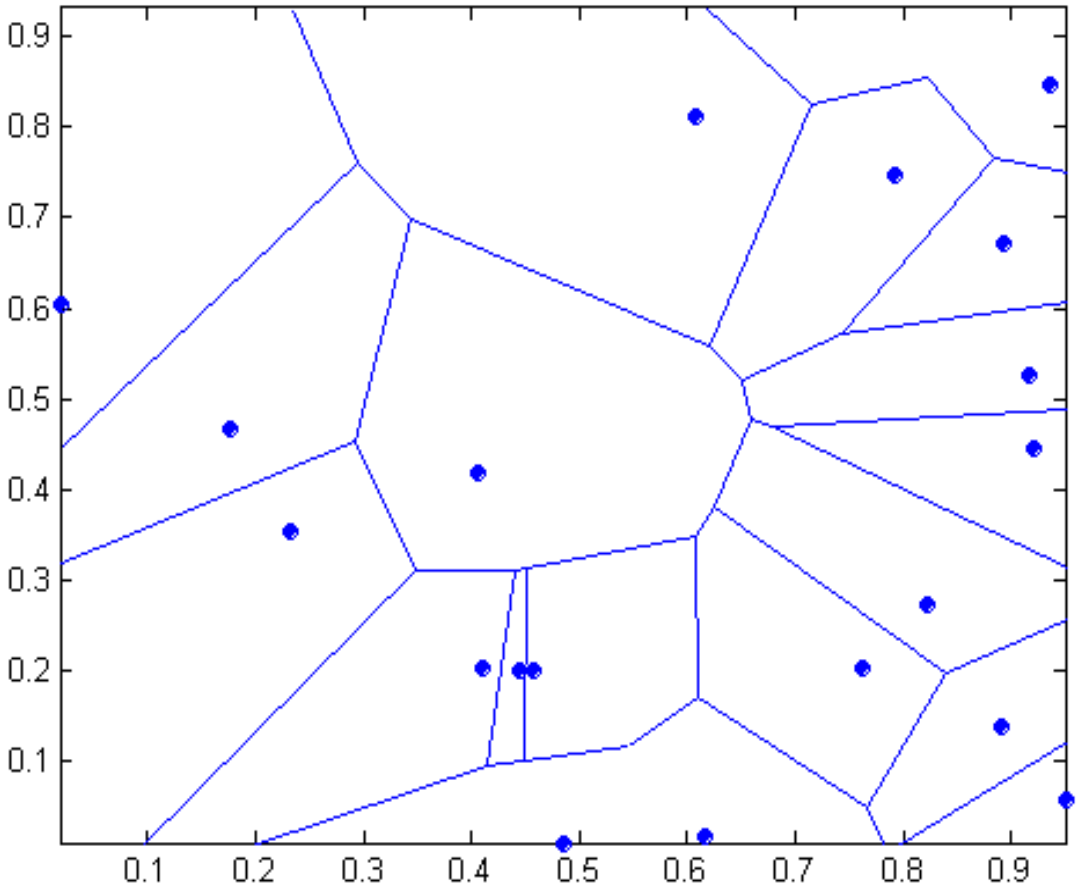
15-Nearest Neighbor Classifier



1-Nearest Neighbor Classifier

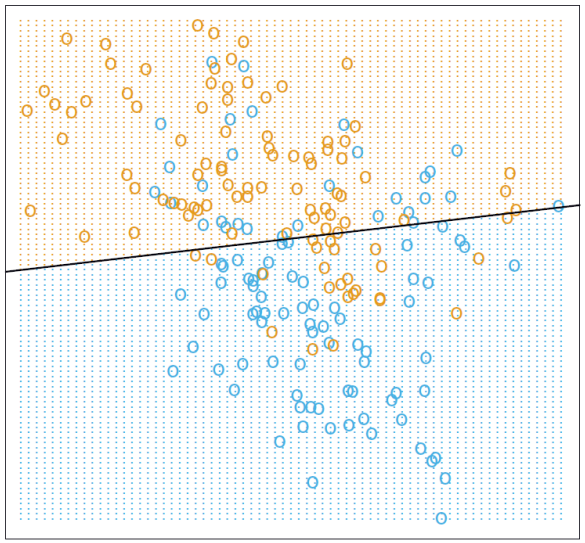
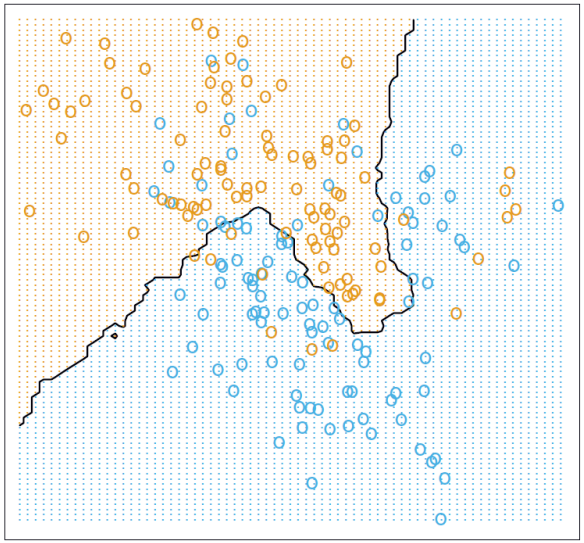
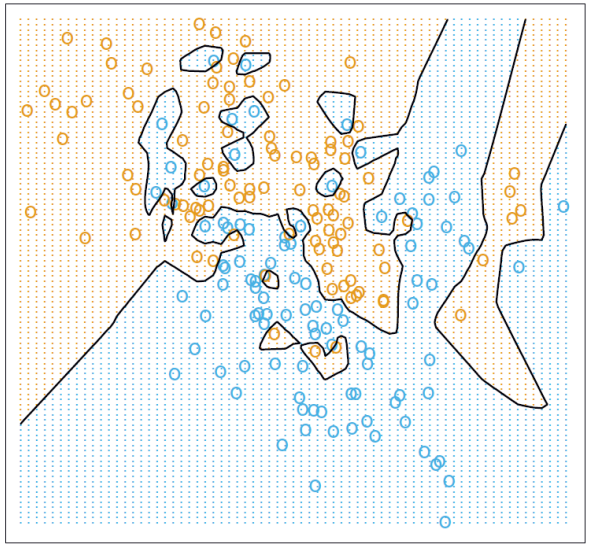


1 Nearest-Neighbor



Voronoi diagram (tessellation)

Linear Separator vs. K Nearest Neighbor

- Which one is better?
- How many parameters?
  - Effective number of parameters