CSE 471
Machine Learning

K Nearest Neighbor

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k-Nearest Neighbor

- Also known as kNN/KNN
- KNN can be used for both classification and regression predictive problems.
- Non-parametric approach: Don't assume any strong/fixed model or functional form

- For each test input point,
  - ➢ considers the class/output of its nearest k number of train (available) data points and
  - ➢ Determine its class by voting of the k data points
    - ✓ May use different distance calculation measure (e.g., Euclidean, Manhattan)
    - ✓ Voting system can be equal/weighted

k-Nearest Neighbor

- Calculate Distance from ***point p*** to all the training points
- If k=1, nearest point = {A}

Predicted Class= Green

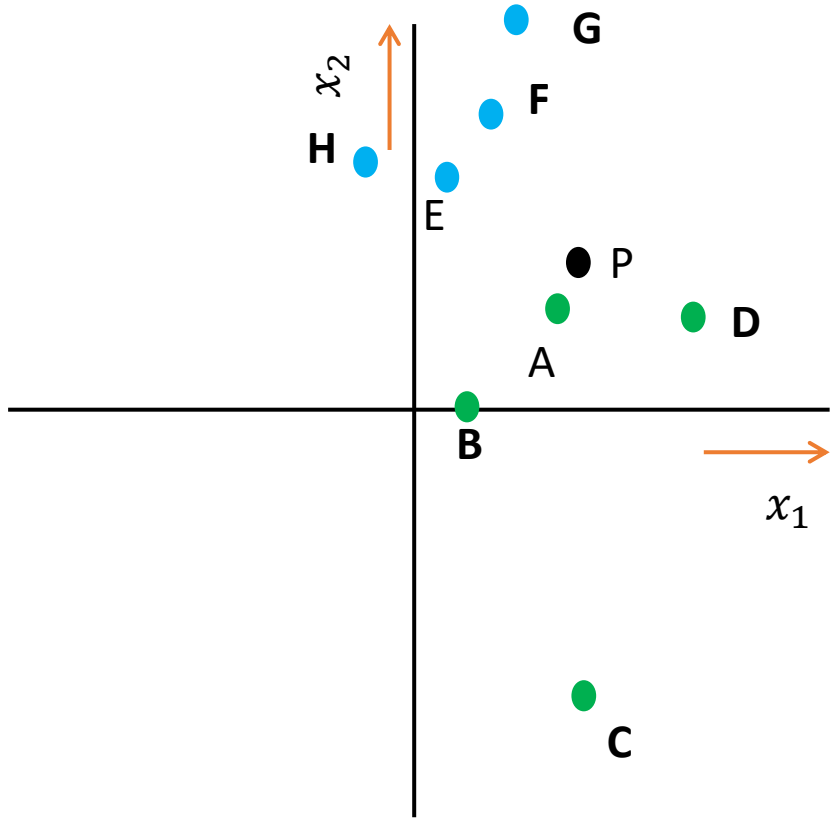
- If k=2, nearest points = {A, D}

Predicted Class= Green

- If k=3, nearest points = {A, D, E}

Predicted Class= Green

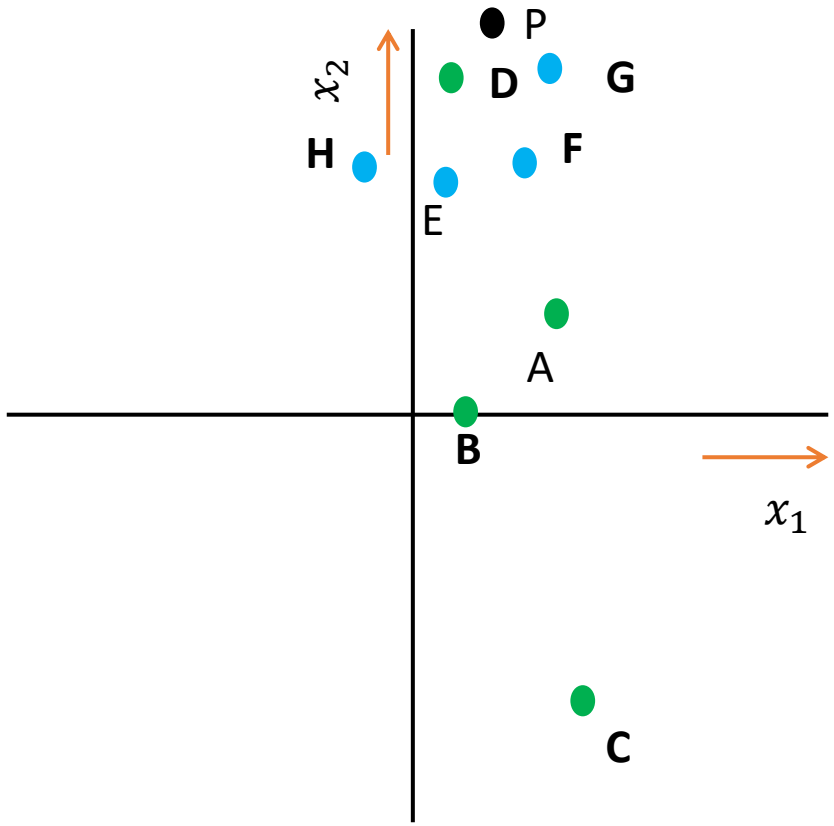
- What if k=7?



k-Nearest Neighbor Issues

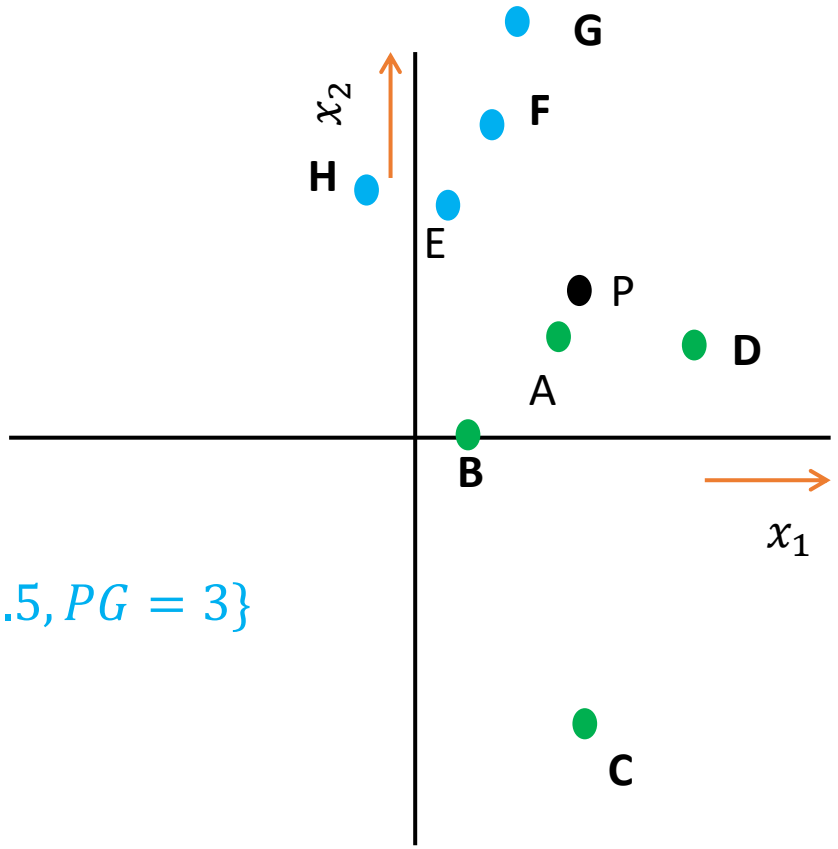
- Tuning the k (hyperparameter) value
  - ➢Too small k: sensitive to outliers (as indicated by the figure)
  - ➢Too large k: too many points from other classes

  (As the case in the previous slide)



k-Nearest Neighbor Issues

- Weight of nearest neighbors
  - Equal weight
  - Different weights



- If k=7, Nearest points = {A, D, E, B, F, H, G}
- If equal weighted, predicted class = Blue
- If weighted voting and $weight = \frac{1}{Distance}$
- Distances ={$PA = 0.5, PD = 1.2, PE = 1.5, PB = 1.7, PF = 2, PH = 2.5, PG = 3$}
- Vote for Green =2*1+0.8*1+0.6*1 = 3.4
- Vote for Blue =0.7*1 + 0.5*1+0.4*1+0.3*1 = 1.9
- Predicted class = Green

References

Code Implementation Reference:

https://machinelearningmastery.com/tutorial-to-implement-k-nearest-neighbors-in-python-from-scratch/

Lecture References:

https://machinelearningmastery.com/parametric-and-nonparametric-machine-learning-algorithms/

https://www.analyticsvidhya.com/blog/2018/03/introduction-k-neighbours-algorithm-clustering/

https://www.geeksforgeeks.org/weighted-k-nn/

Lecture Note by Madhusudan Basak