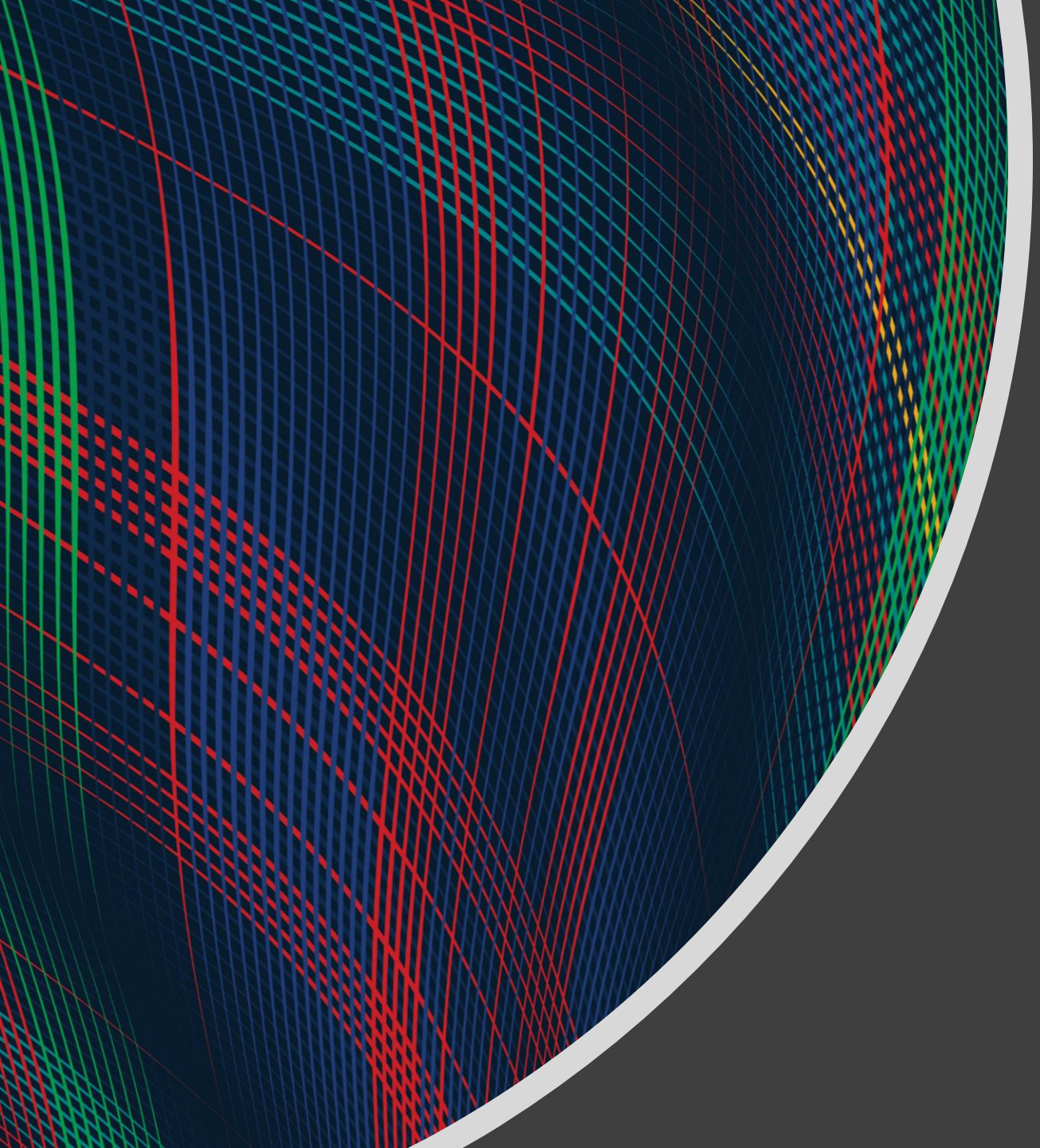
Announcements

Quiz

Homework

Exam



10-607 Computational Foundations for Machine Learning

Wrap-up Workshop

Instructor: Pat Virtue

Plan

Wrap up Bayes Nets and Variable Elimination

Nearest Neighbor Workshop

- Quick nearest neighbor intro
- Implement nearest neighbor in groups

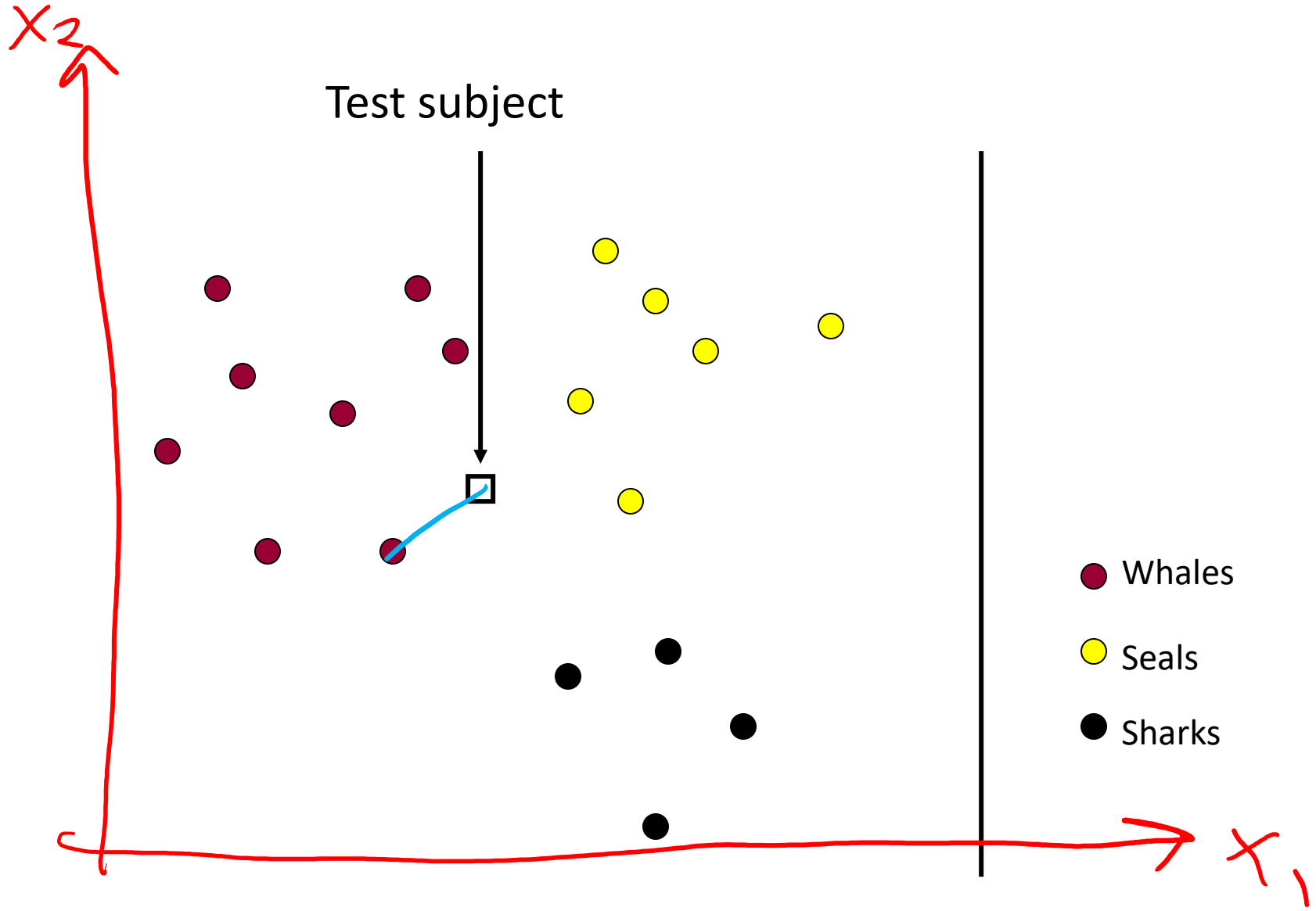
If time

- Pytorch tutorials

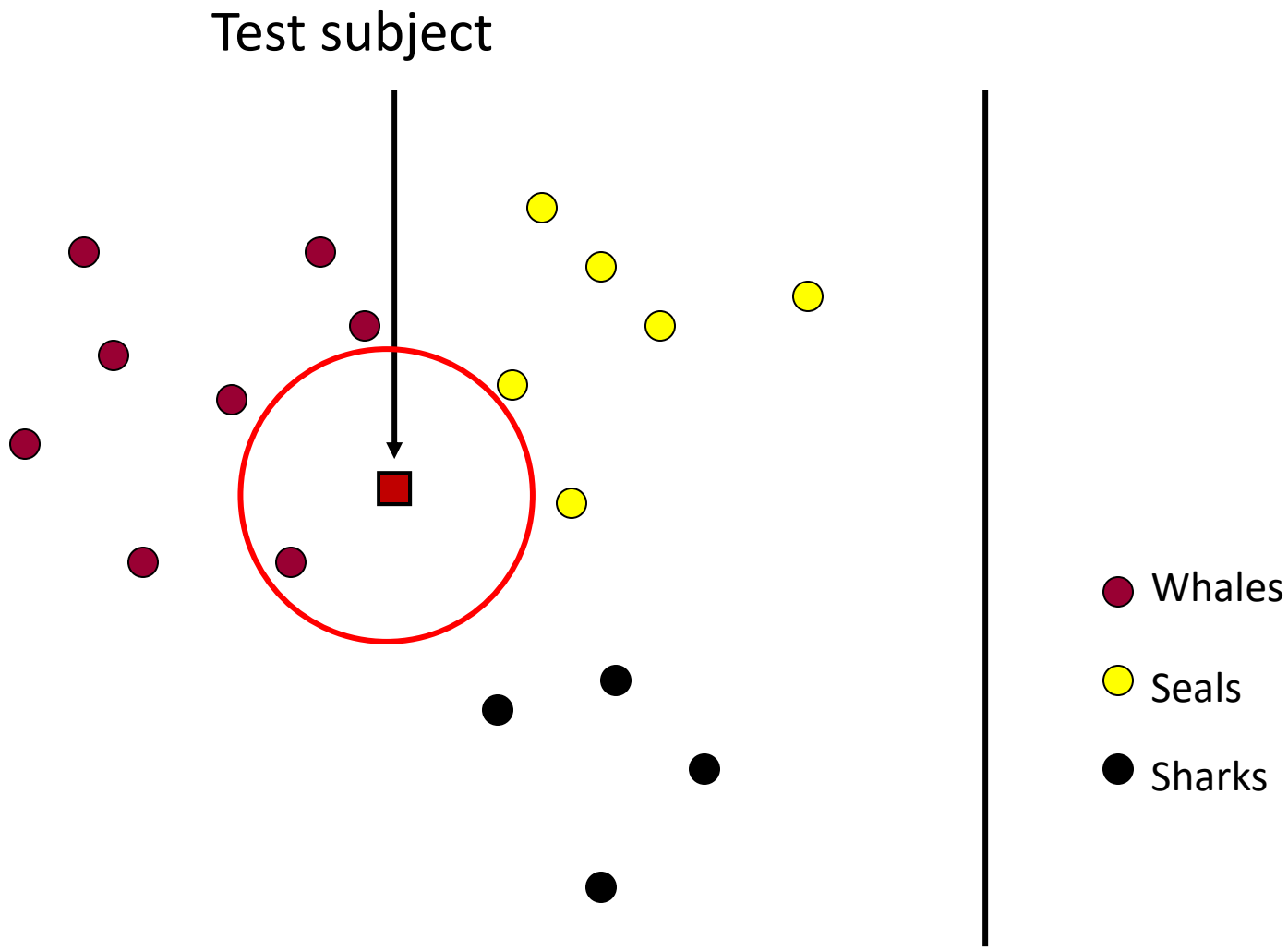
Bayes Nets

Previous lecture slides

Nearest Neighbor Classifier



Nearest Neighbor Classifier



Nearest Neighbor Classification

Given a training dataset $\mathcal{D} = \left\{y^{(n)}, \boldsymbol{x}^{(n)}\right\}_{n=1}^{N}$, $y \in \{1, \ldots, C\}$, $\boldsymbol{x} \in \mathbb{R}^M$

and a test input $\boldsymbol{x}_{test}$, predict the class label, $\hat{y}_{test}$:

1) Find the closest point in the training data to $\boldsymbol{x}_{test}$

$$n = \underset{n}{\operatorname{argmin}}\, d(\boldsymbol{x}_{test}, \boldsymbol{x}^{(n)})$$

2) Return the class label of that closest point

$$\hat{y}_{test} = y^{(n)}$$

Need distance function! What should $d(\vec{x}, \vec{z})$ be? ←

$$\sqrt{(x_1 - z_1)^2 + (x_2 - z_2)^2 + (x_3 - z_3)^2 \ldots + (x_M - z_M)^2}$$

Fisher Iris Dataset

Fisher (1936) used 150 measurements of flowers from 3 different species: Iris setosa (0), Iris virginica (1), Iris versicolor (2) collected by Anderson (1936)

Species	Sepal Length	Sepal Width	Petal Length	Petal Width
0	4.3	3.0	1.1	0.1
0	4.9	3.6	1.4	0.1
0	5.3	3.7	1.5	0.2
1	4.9	2.4	3.3	1.0
1	5.7	2.8	4.1	1.3
1	6.3	3.3	4.7	1.6
1	6.7	3.0	5.0	1.7

Full dataset: https://en.wikipedia.org/wiki/Iris_flower_data_set

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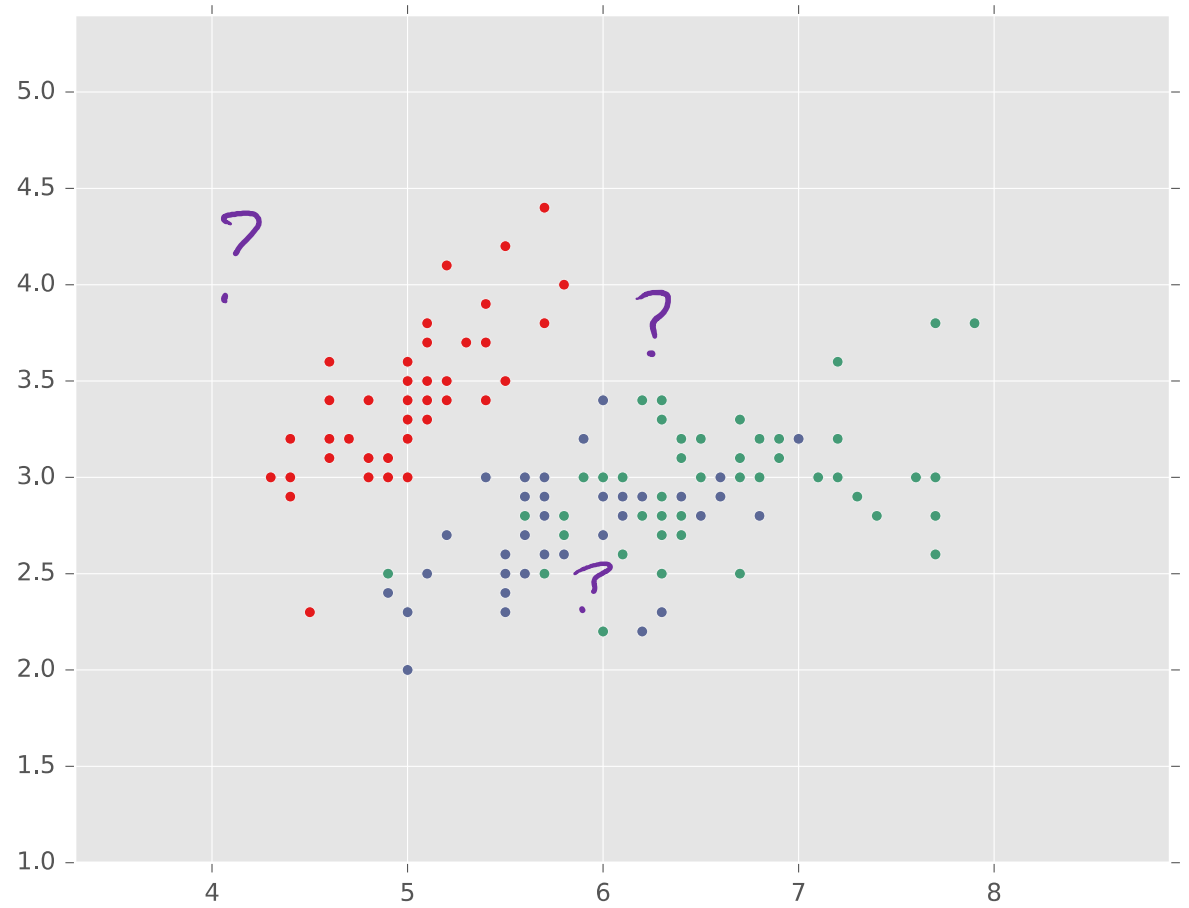
1	5.7	2.8
1	6.3	3.3
1	6.7	3.0

Deleted two of the four features, so that input space is 2D

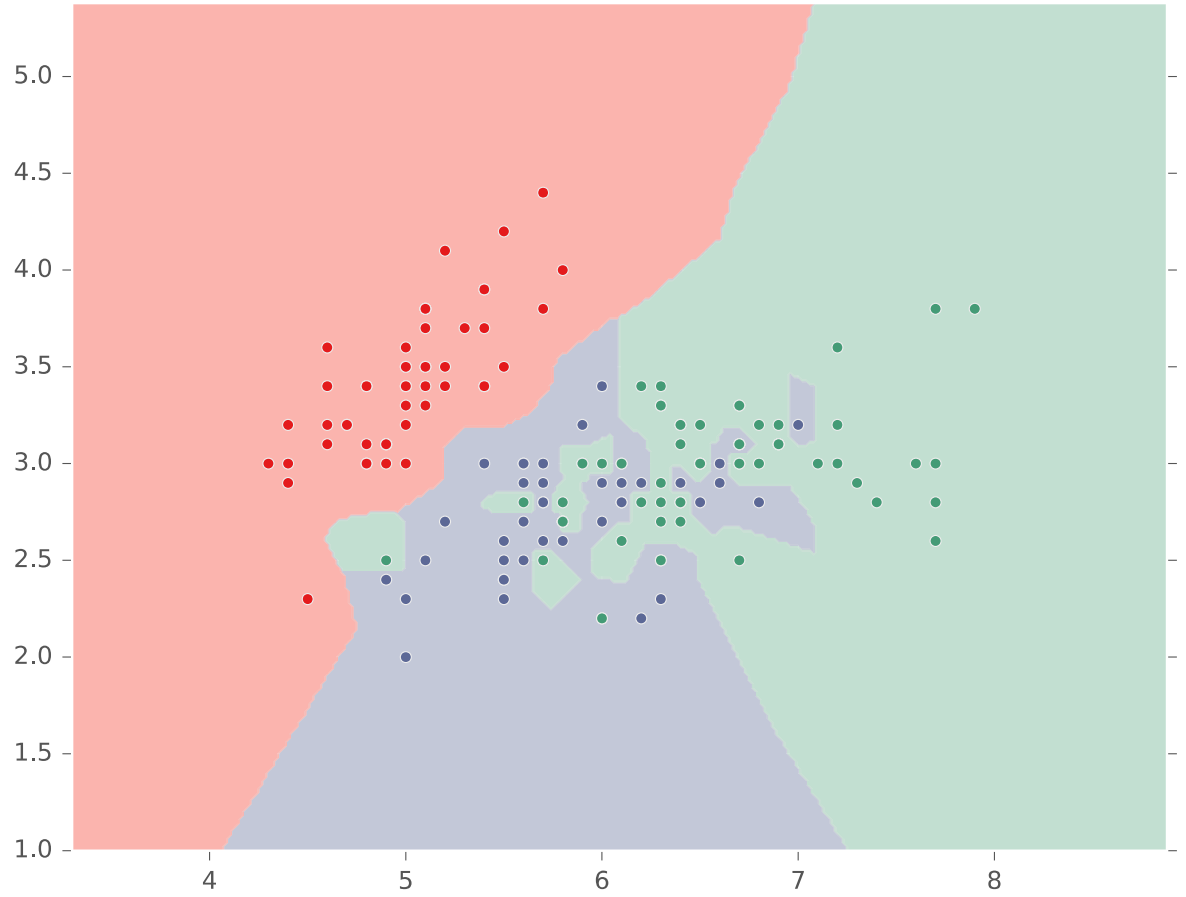
Full dataset: https://en.wikipedia.org/wiki/Iris_flower_data_set

Nearest Neighbor on Fisher Iris Data



Slide credit: CMU MLD Matt Gormley

Nearest Neighbor on Fisher Iris Data



Slide credit: CMU MLD Matt Gormley

Workshop: Nearest Neighbor

Task 1: Load into python and print contents

https://www.cs.cmu.edu/~10607/data/animals1.csv

Task 2: Plot animals1 data in 2D colored by label

Task 3: Implement nearest neighbor and predict label (y_hat) for
new_animal_body = 18.0
new_animal_brain = 8.5

Task 4: Run nearest neighbor with training data:
https://www.cs.cmu.edu/~10607/data/animalsND_train.csv

and measure the error rate on
https://www.cs.cmu.edu/~10607/data/animalsND_test.csv

Task 5: Calculate the confusion matrix for the animalsND_test dataset