



190F Foundations of Data Science

Spring 2020

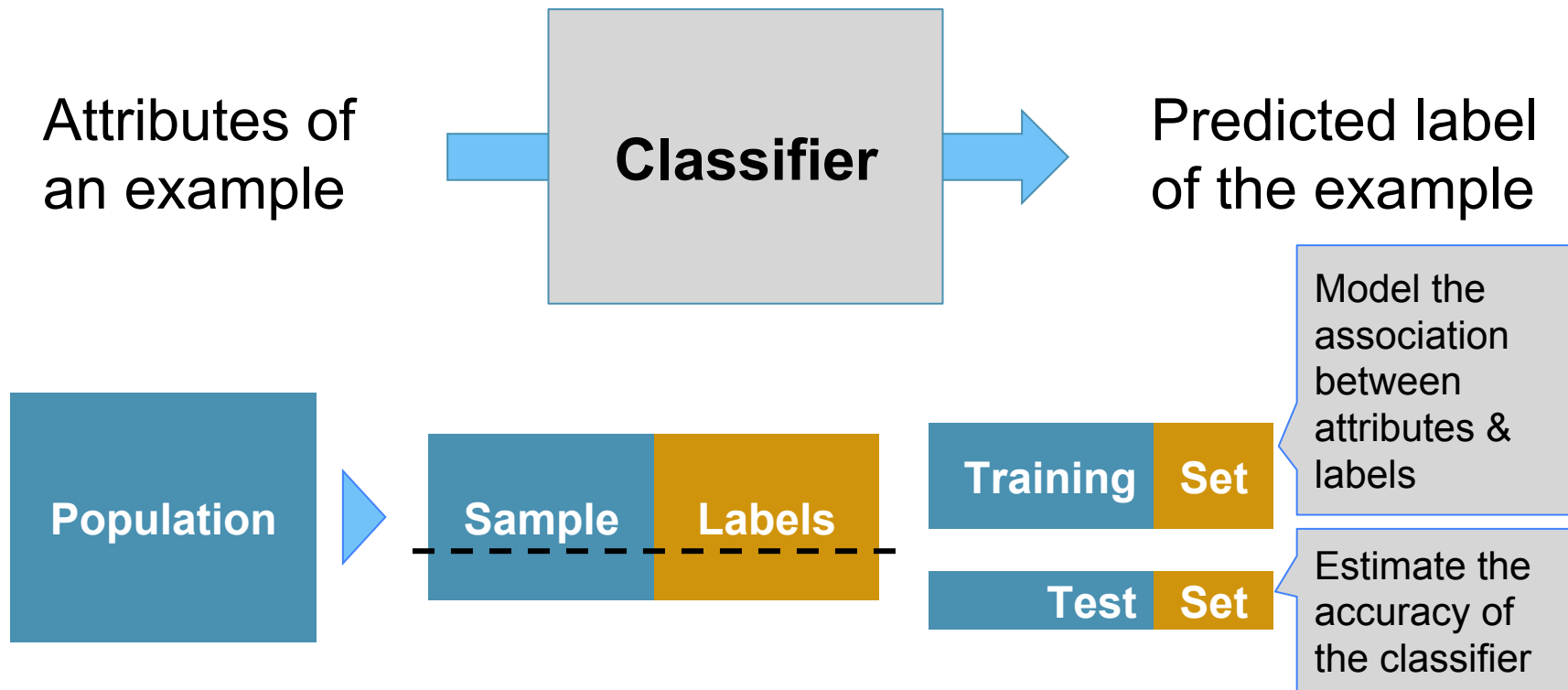
Lecture 22

Classifiers

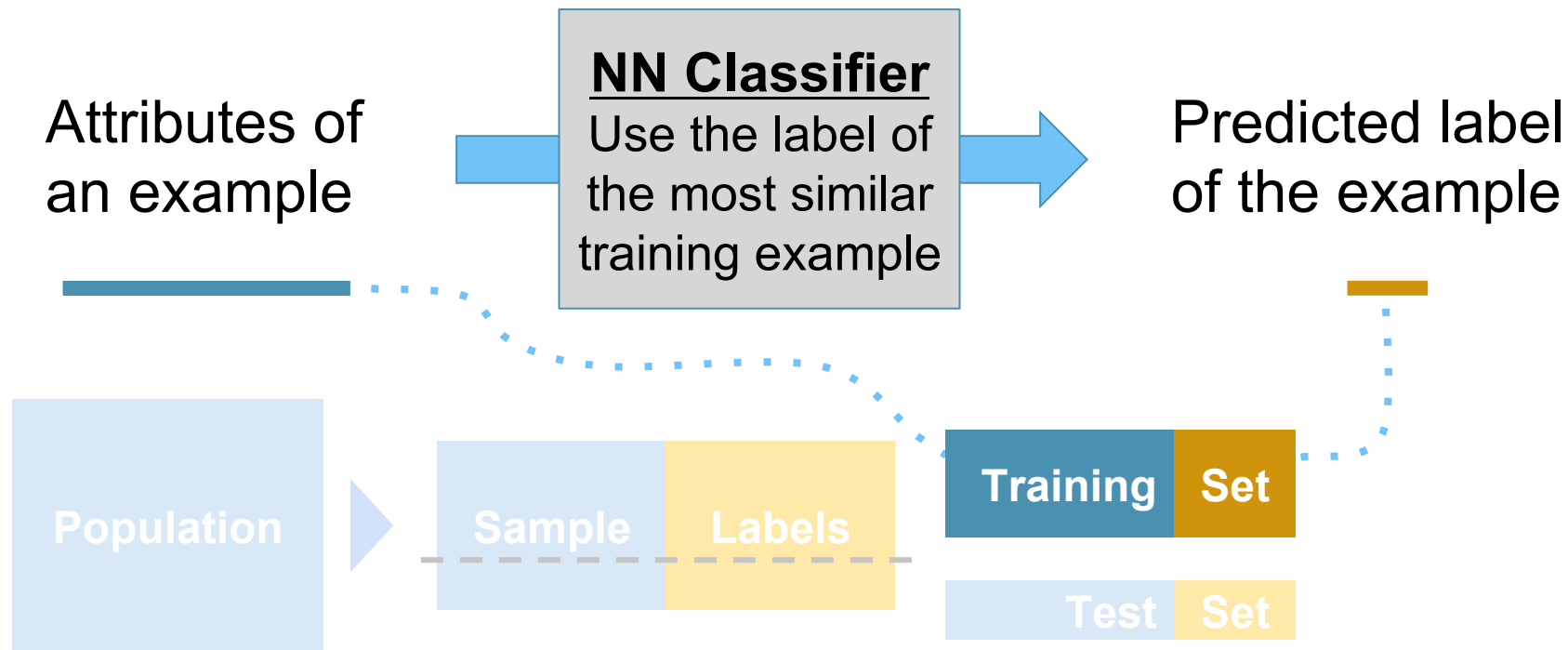
Announcements

Classifiers

Training a Classifier

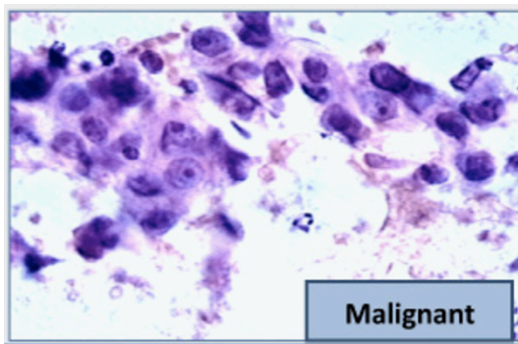
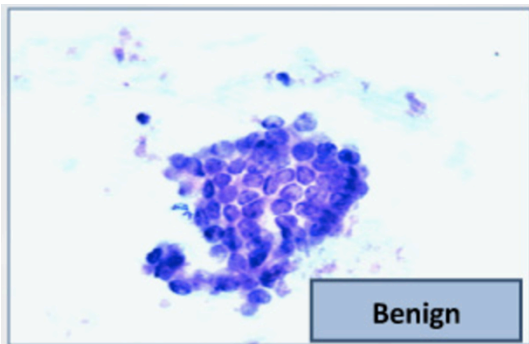


Nearest Neighbor Classifier



The Google Science Fair

- Brittany Wenger, a 17-year-old high school student in 2012
- Won by building a breast cancer classifier with 99% accuracy



(Demo)

Distance

Rows of Tables

Each row contains all the data for one individual

- `t.row(i)` evaluates to *i*th row of table *t*
- `t.row(i).item(j)` is the value of column *j* in row *i*
- If all values are numbers, then `np.array(t.row(i))` evaluates to an array of all the numbers in the row.
- To consider each row individually, use

```
for row in t.rows:
    ... row.item(j) ...
```


Distance Between Two Points

- Two attributes x and y :

$$D = \sqrt{(x_0 - x_1)^2 + (y_0 - y_1)^2}.$$

- Three attributes x , y , and z :

$$D = \sqrt{(x_0 - x_1)^2 + (y_0 - y_1)^2 + (z_0 - z_1)^2}$$

- and so on ...

(Demo)

Nearest Neighbors

Finding the k Nearest Neighbors

To find the k nearest neighbors of an example:

- Find the distance between the example and each example in the training set
 - Augment the training data table with a column containing all the distances
 - Sort the augmented table in increasing order of the distances
 - Take the top k rows of the sorted table (Demo)
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The Classifier

To classify a point:

- Find its k nearest neighbors
- Take a majority vote of the k nearest neighbors to see which of the two classes appears more often
- Assign the point the class that wins the majority vote

(Demo)

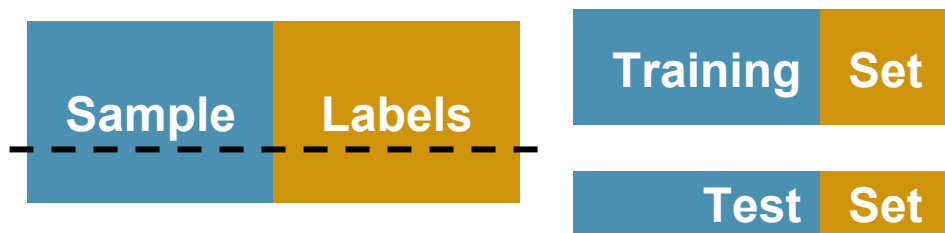
Evaluation

Accuracy of a Classifier

The accuracy of a classifier on a labeled data set is the proportion of examples that are labeled correctly

Need to compare classifier predictions to true labels

If the labeled data set is sampled at random from a population, then we can infer accuracy on that population



(Demo)

Decision Boundaries

- A change in input attributes might change the prediction
- Inputs that are very close but result in different predicted labels are on either side of a ***decision boundary***
- To visualize, plot predictions of a regular set of inputs

(Demo)
