CompSci 190: Lecture 14: Classification

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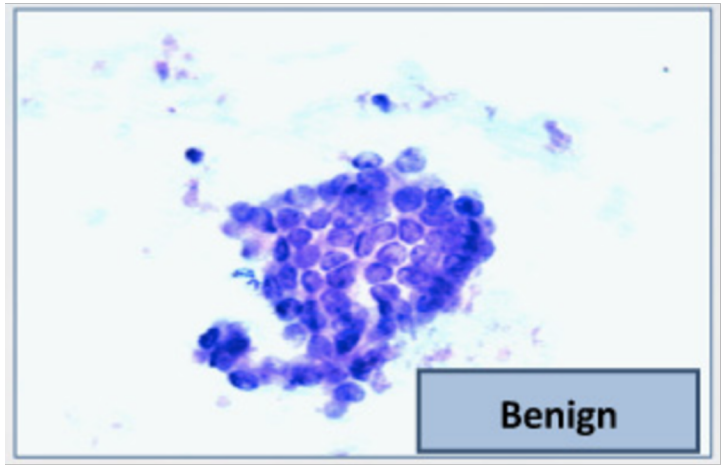
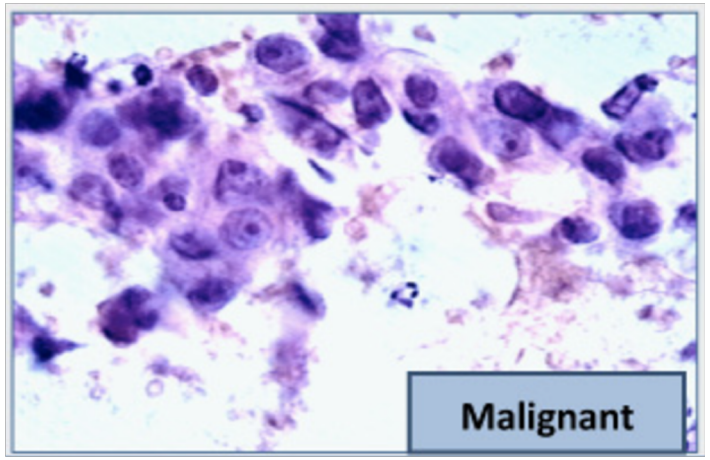
November 28, 2018

The Google Science Fair

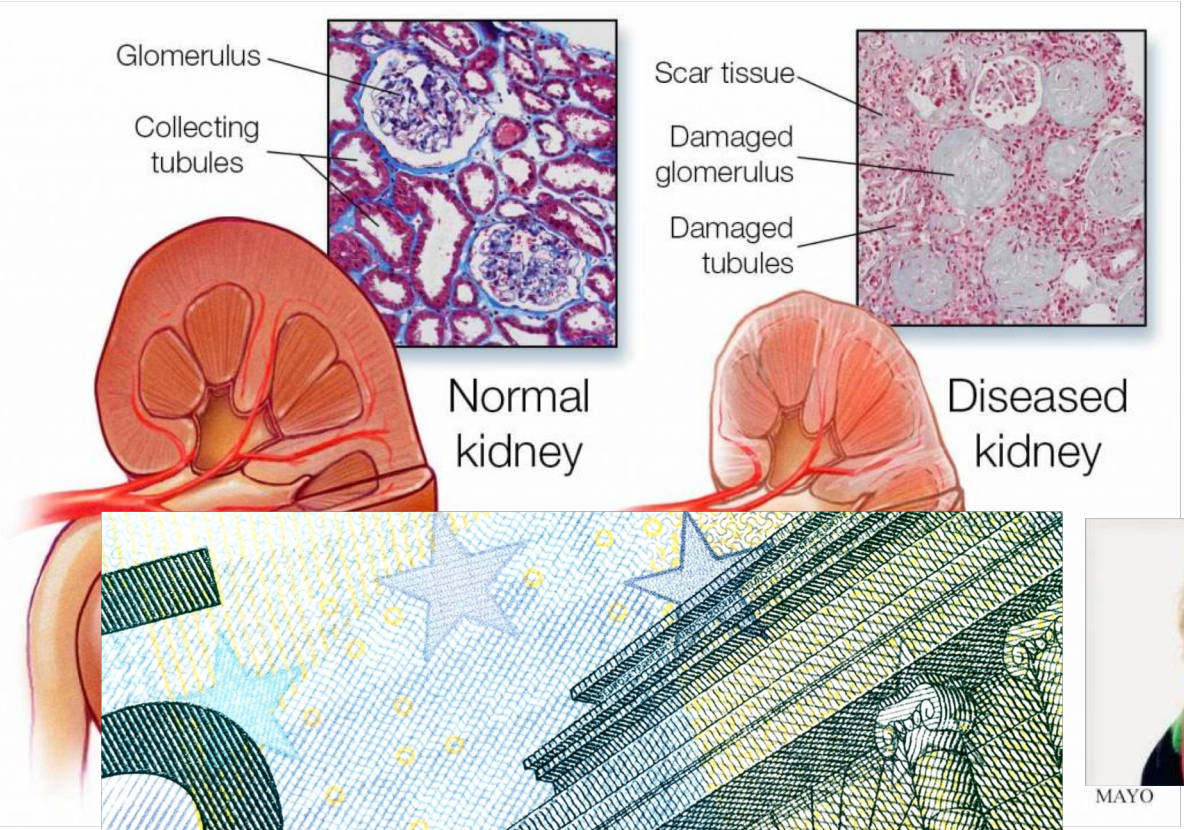
- Brittany Wenger, Trinity 2017
- Won by 2012 Science Fair building a breast cancer classifier with 99% accuracy

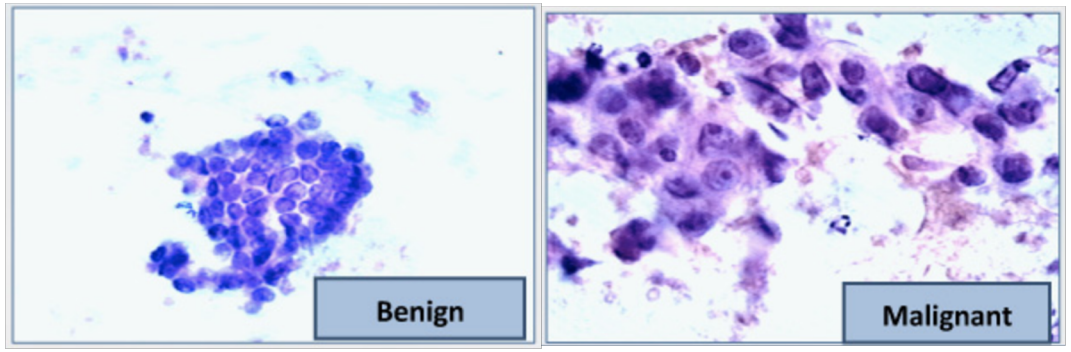




April 22, 2013

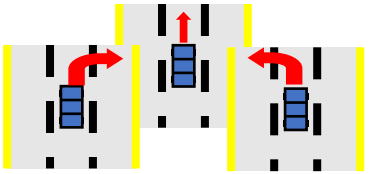
Classification Examples





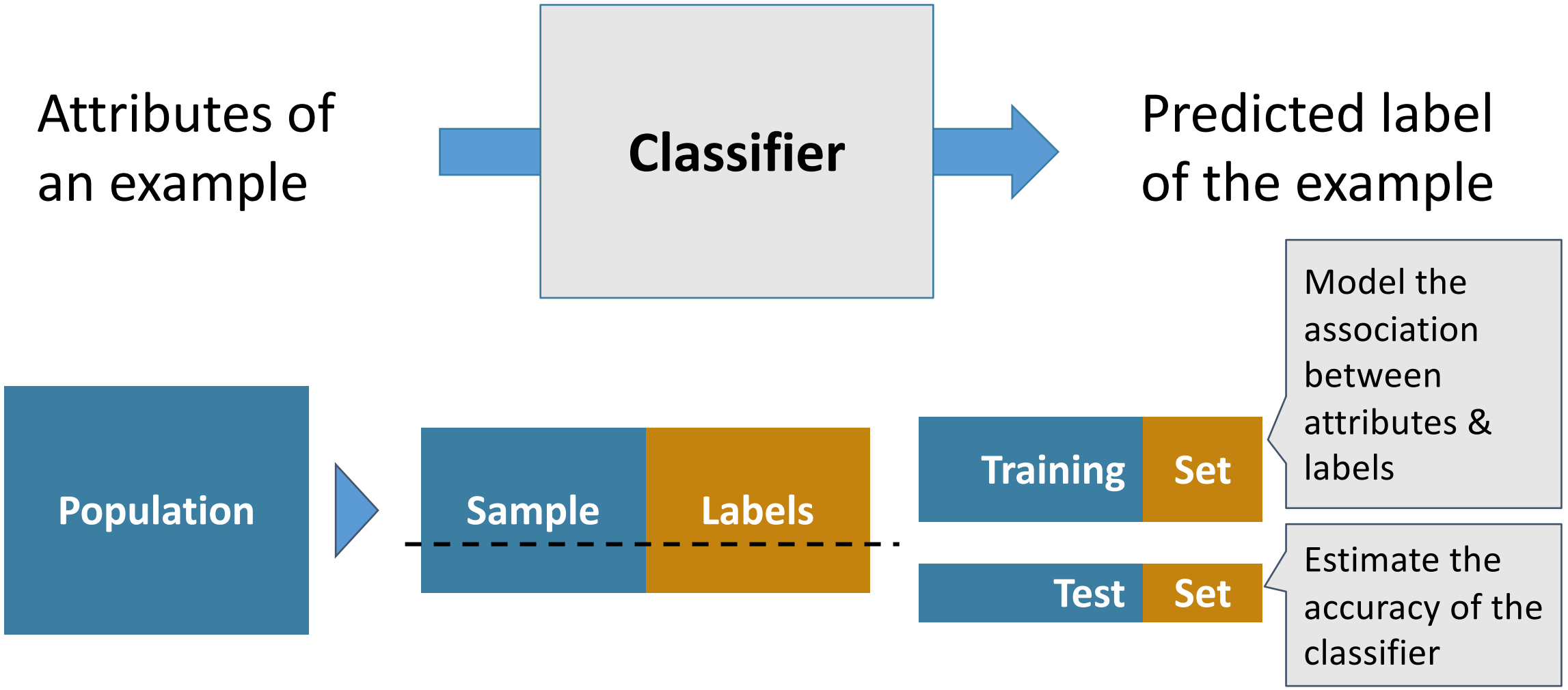
Wenger 2012

(Demo)

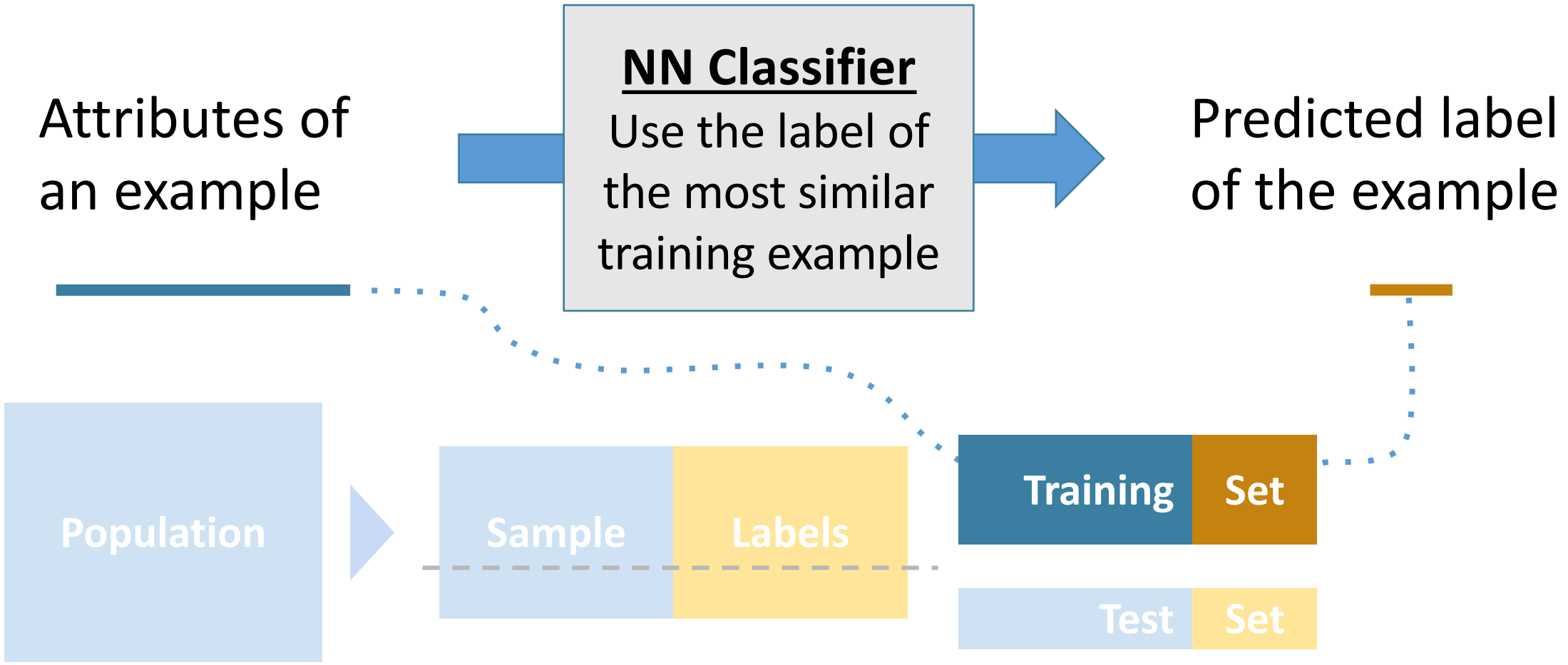


Forbes, 1998

Training a Classifier



Nearest Neighbor Classifier



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 … **http://bit.ly/FoDS-f18-1128**

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) ...
```

(Demo)

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)

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)

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)