K-nearest Neighbor Algorithm and Its Application

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What is K-Nearest Neighbor (KNN)

- One of the simplest machine language algorithms
- It stores all available cases and classifies new cases by a majority vote of its k neighbors.
- It separates unlabeled data points into well defined groups.

When do we use KNN Algorithm

- Can be used for both classification and regression predictive problems, although it is most commonly applied to classification models.
- 3 important aspects to look at to evaluate any technique
  - The simplicity of interpreting the output
  - The Calculation time
  - The Predictive Power

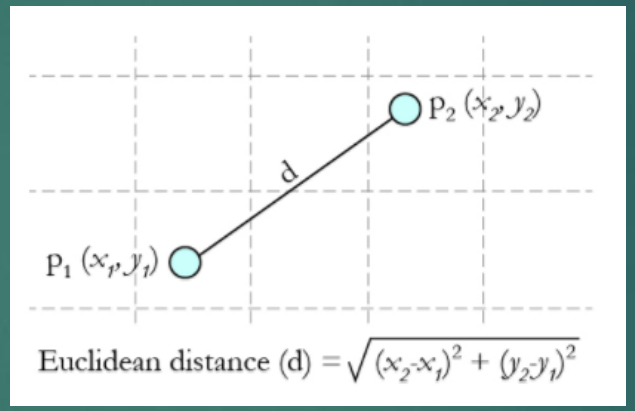
Steps On How To Calculate KNN

(1)Determine k

- k is the number of neighbors considered by the algorithm that the designer must pick in order to get the best possible fit for the data set.
- A small value for k provides the most flexible fit, which will have low bias but high variance.
- A larger value for k averages more voters in each prediction and hence is more resilient to outliers.

(2)Calculate Distance

- There are many distance functions but Euclidean is the most commonly used measure.
  - Euclidean distance formula:



  - The distance calculates the rank in terms of distance.
    - The smallest distance value will be ranked 1 and considered as the current nearest neighbor.

(3)Find Smallest Distance Values and Take The Average

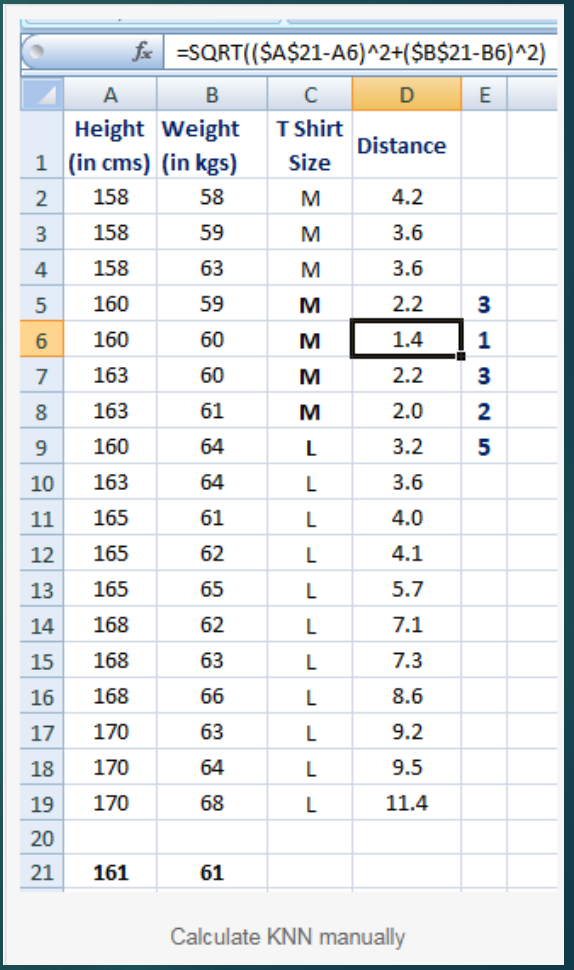
- Find k smallest distance values
- Take k smallest and average the predictions
  - Add k smallest and divide by k
    - If k=1 then only closest value is considered
    - If k is infinity then entire dataset is considered.

Example: Suppose we have height, weight and T-shirt size of some customers and we need to predict the T-shirt size of a new customer given only the height and weight information

Height (in cms)	Weight (in kgs)	T Shirt Size
158	58	M
158	59	M
158	63	M
160	59	M
160	60	M
163	60	M
163	61	M
160	64	L
163	64	L
165	61	L
165	62	L
165	65	L
168	62	L
168	63	L
168	66	L
170	63	L
170	64	L
170	68	L

New customer named 'Monica' has height 161cm and weight 61kg.

Let k=5



```
library(data.table)
mydat <- fread('http://archive.ics.uci.edu/ml/machine-learning-databases/iris/bezdekIris.data')
head(mydat)
View(mydat)
data_norm <- function(x) {((x - min(x))/ (max(x) - min(x)))}
iris_norm <- as.data.frame(lapply(mydat[,-5], data_norm))
View(iris_norm)
summary(mydat[,1:4])
summary(iris_norm)
iris_train <- iris_norm[1:100,]
iris_test <- iris_norm[101:150,]
library(class)
```

```
iris_pred <- knn(iris_train, iris_test, mydat[1:100,5], k=12)
table(iris_pred, mydat[101:150,1])
```

Iris_pred	setosa	versi
setosa	24	3
versi	0	23