CLUSTER ANALYSIS IN R

What is Cluster Analysis?

Dmitriy (Dima) Gorenshteyn
Sr. Data Scientist,
Memorial Sloan Kettering Cancer Center

What is Clustering?

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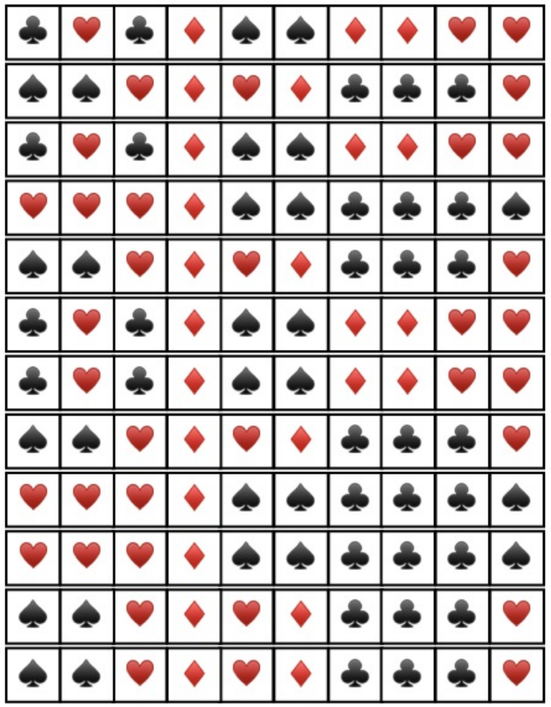

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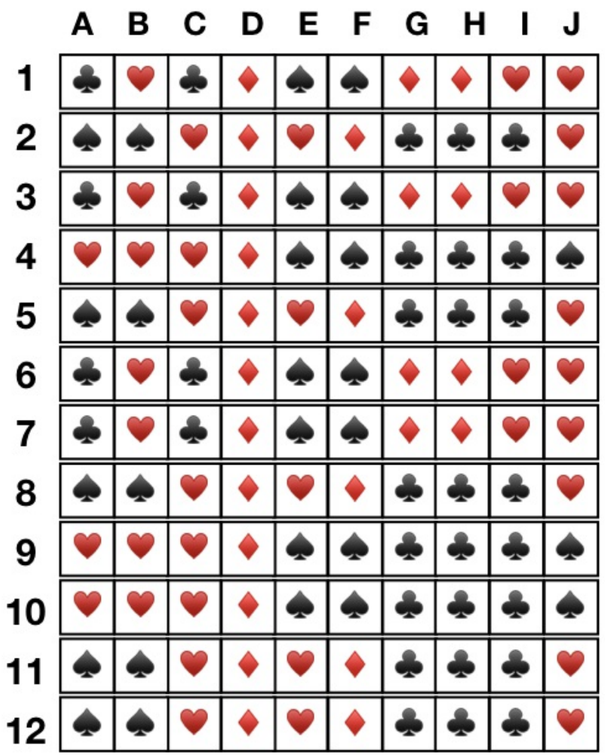
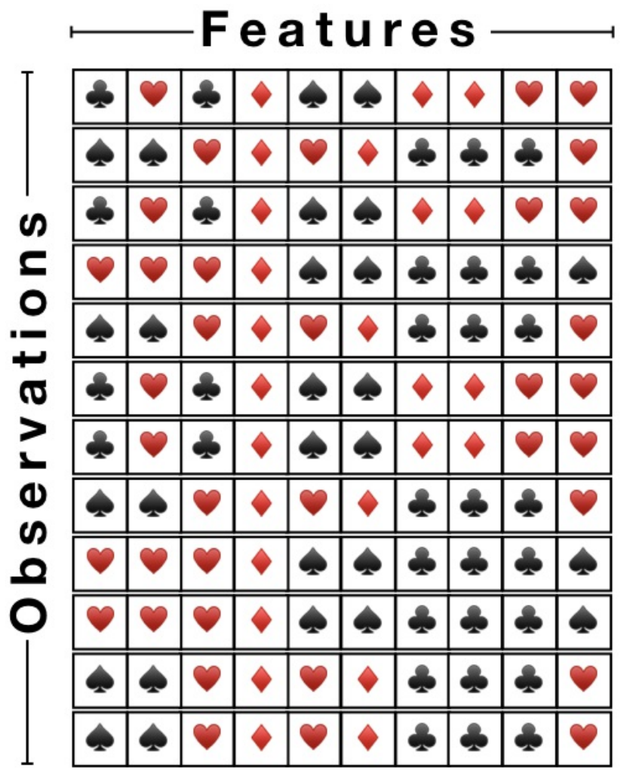
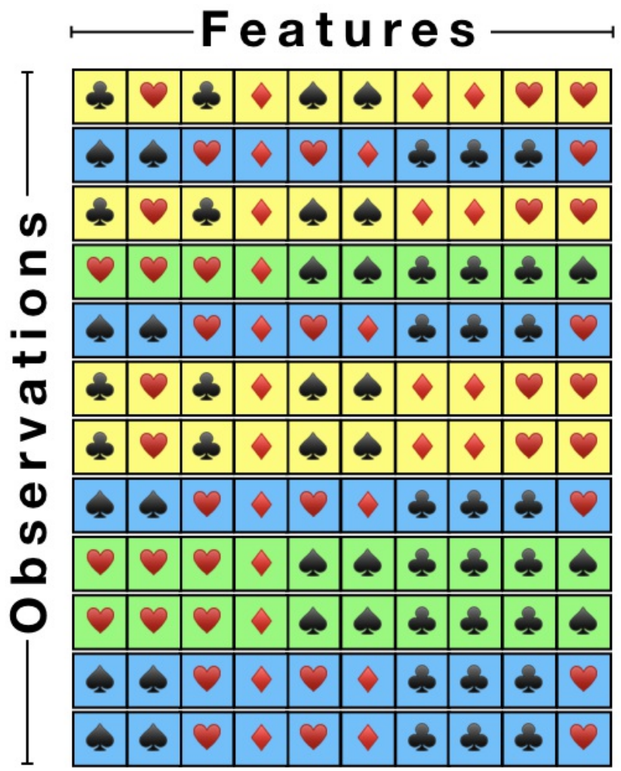


What is Clustering?



What is Clustering?



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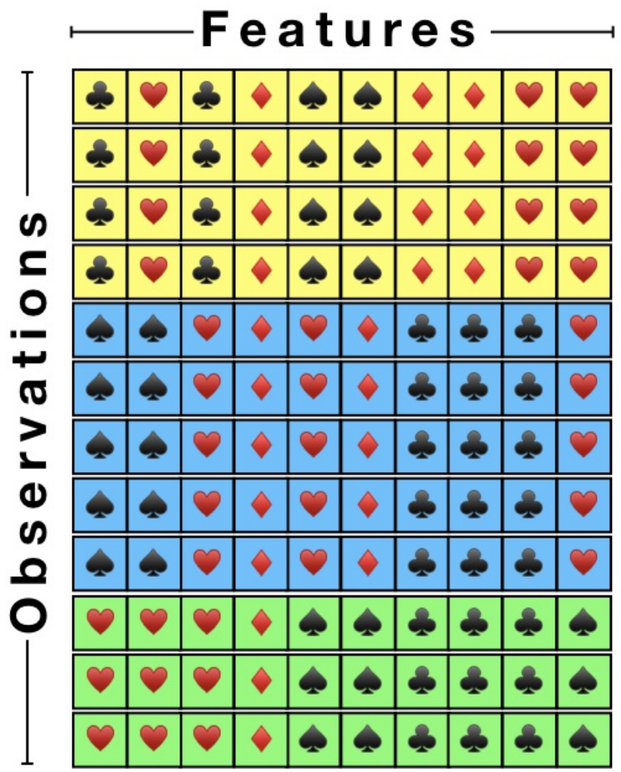
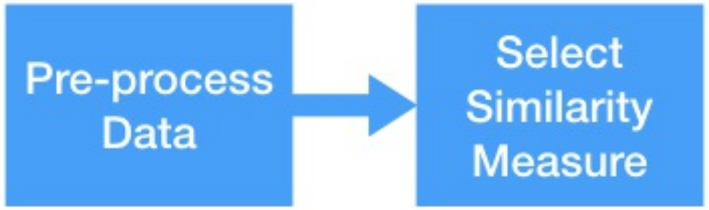


What is Clustering?

*A form of exploratory data analysis (**EDA**) where **observations** are divided into meaningful groups that share common characteristics (**features**).*

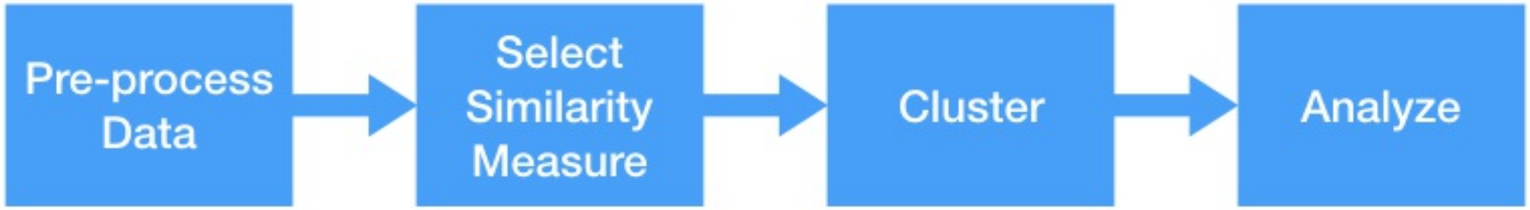
The Flow of Cluster Analysis

The Flow of Cluster Analysis

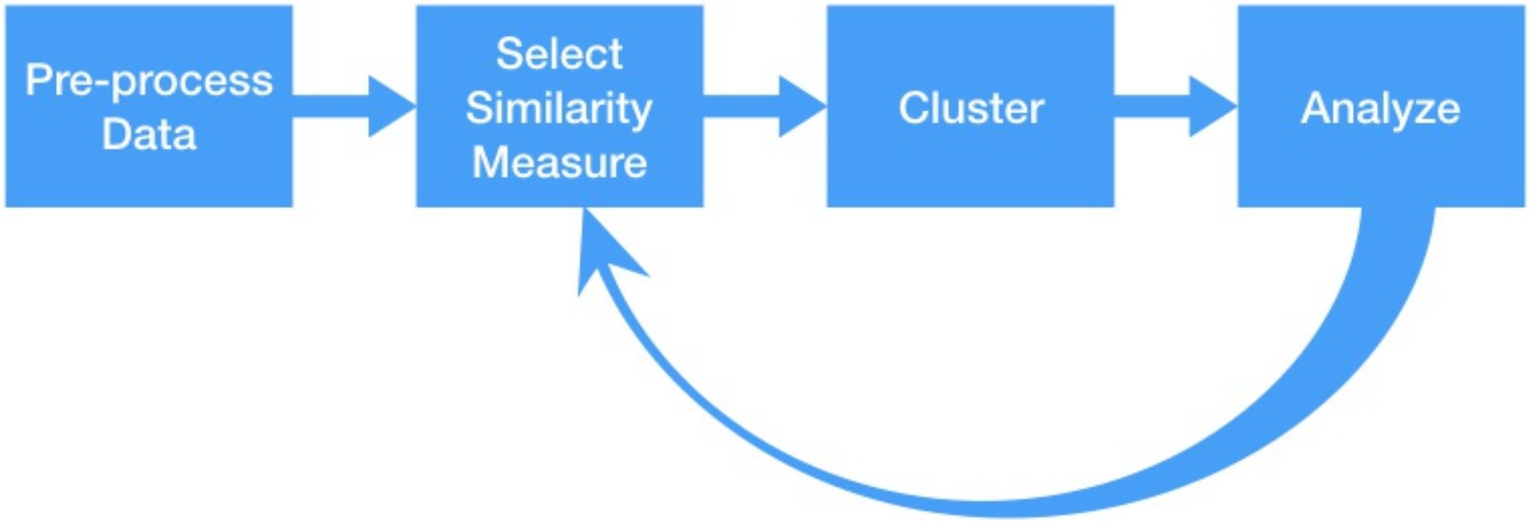


The Flow of Cluster Analysis

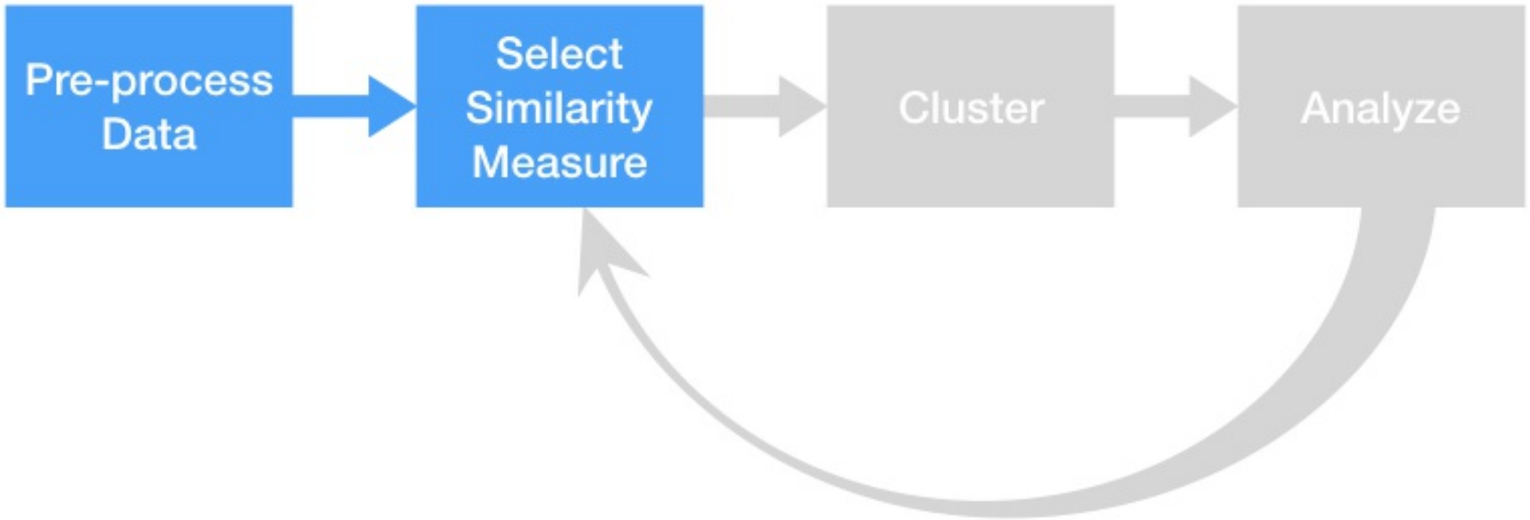
The Flow of Cluster Analysis



The Flow of Cluster Analysis



Structure of This Course



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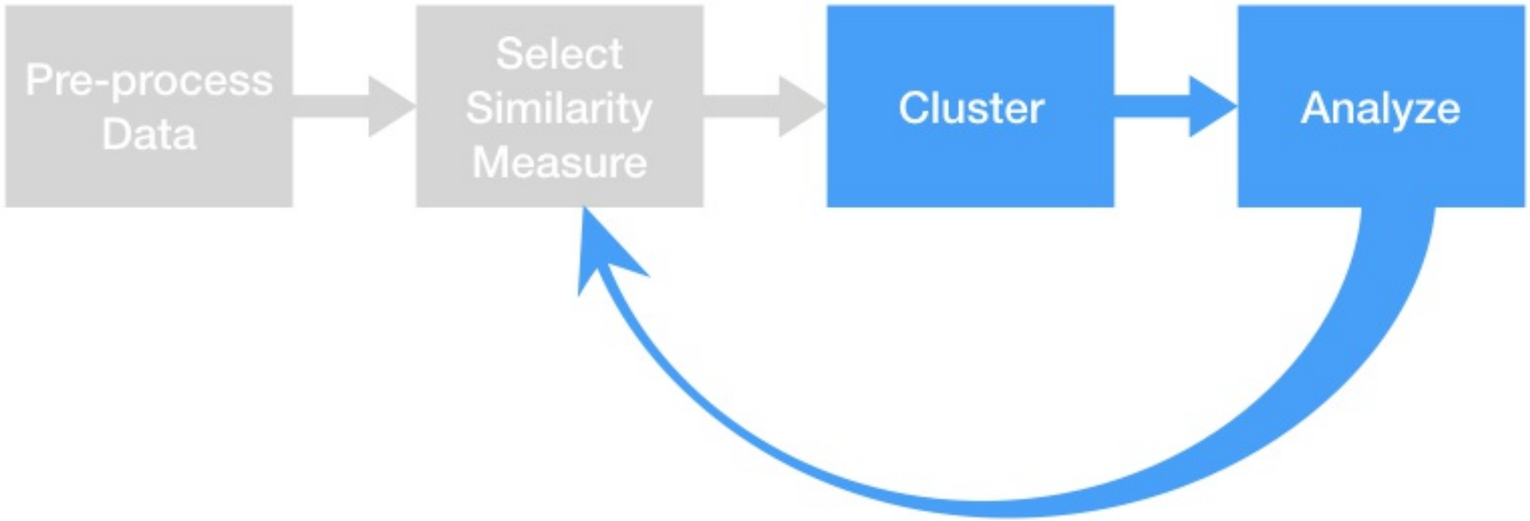


CLUSTER ANALYSIS IN R

Let's Learn!

CLUSTER ANALYSIS IN R

Distance Between Two Observations

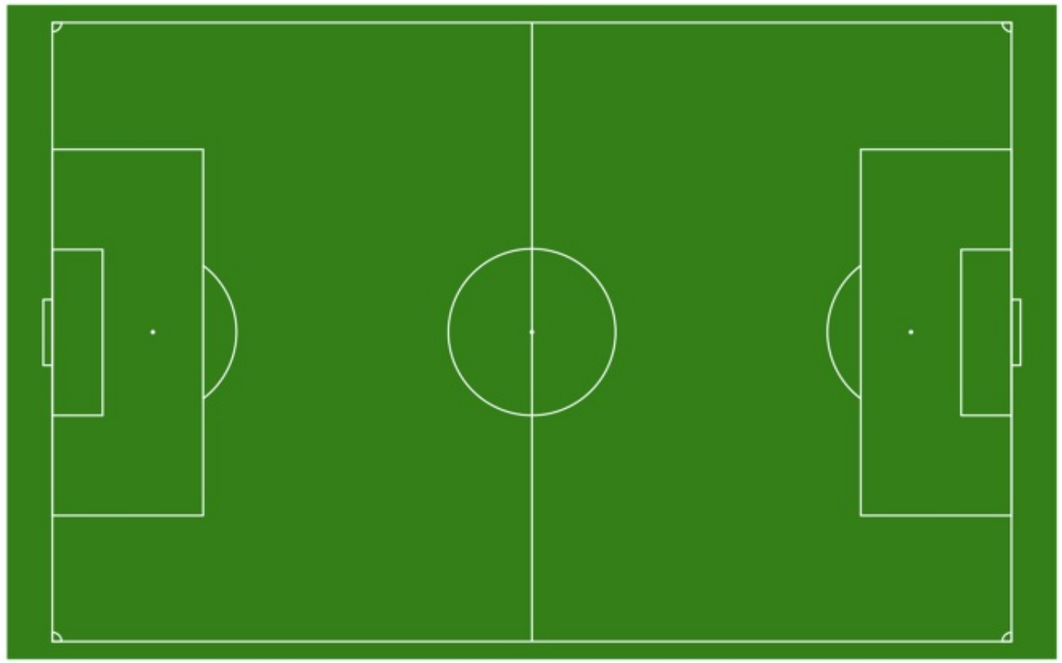
Dmitriy (Dima) Gorenshteyn
Sr. Data Scientist,
Memorial Sloan Kettering Cancer Center

Distance vs Similarity

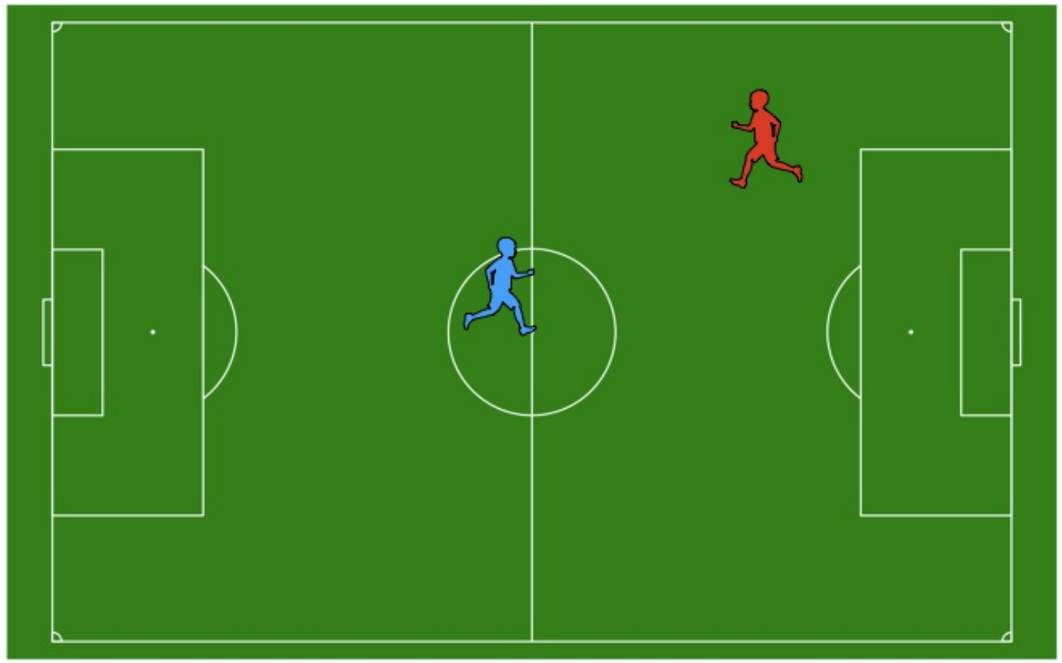
Distance vs Similarity

$$DISTANCE = 1 - SIMILARITY$$

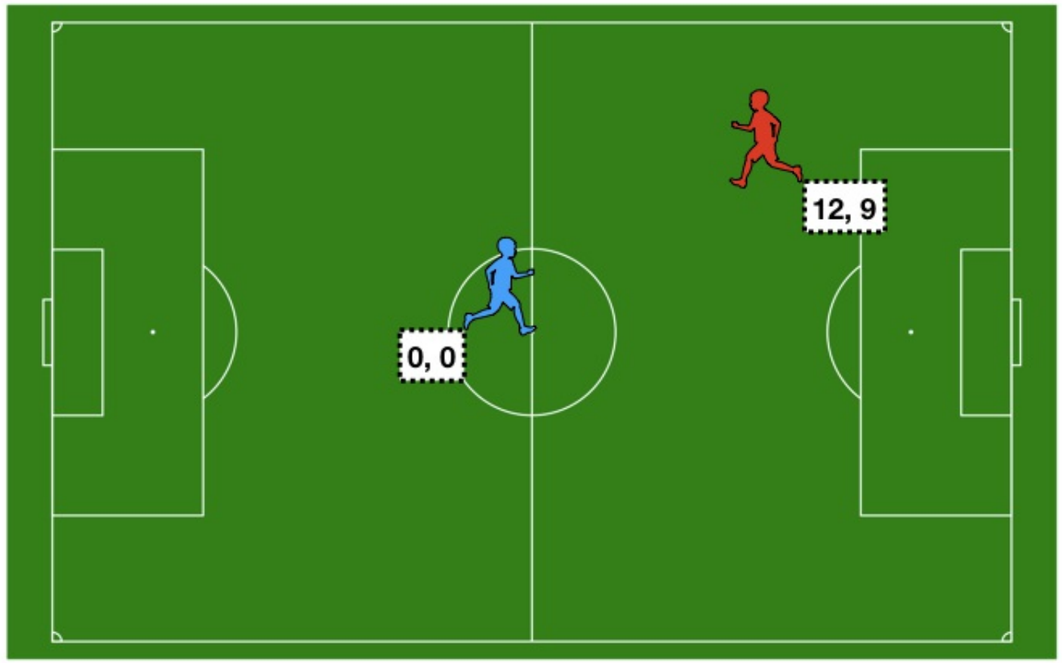
Distance Between Two Players



Distance Between Two Players

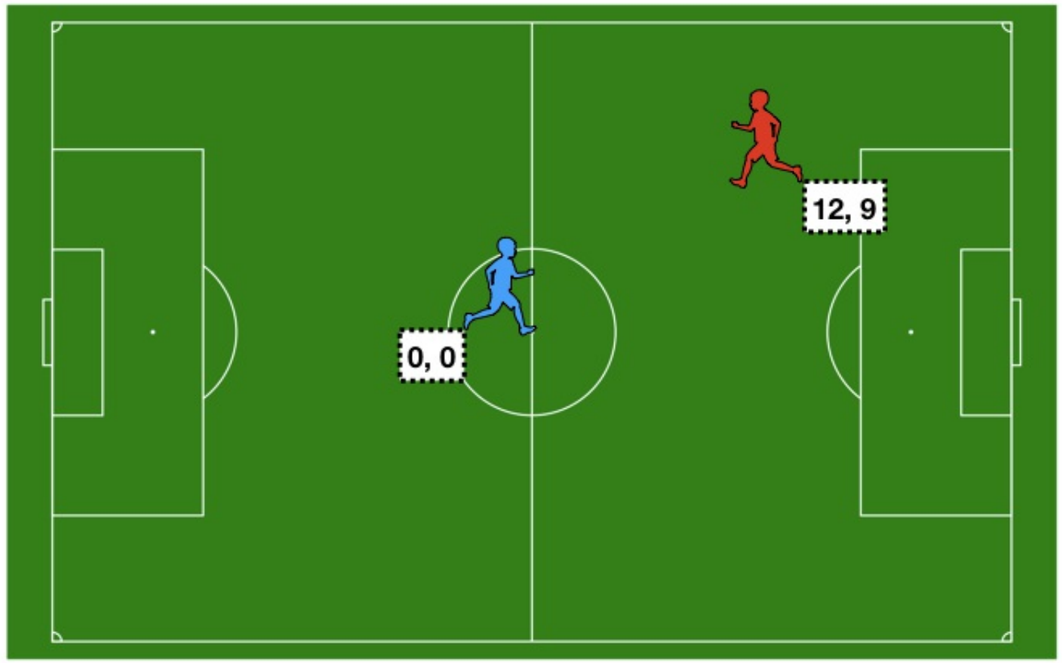


Distance Between Two Players



Distance Between Two Players

	X	Y
Blue	0	0
Red	12	9



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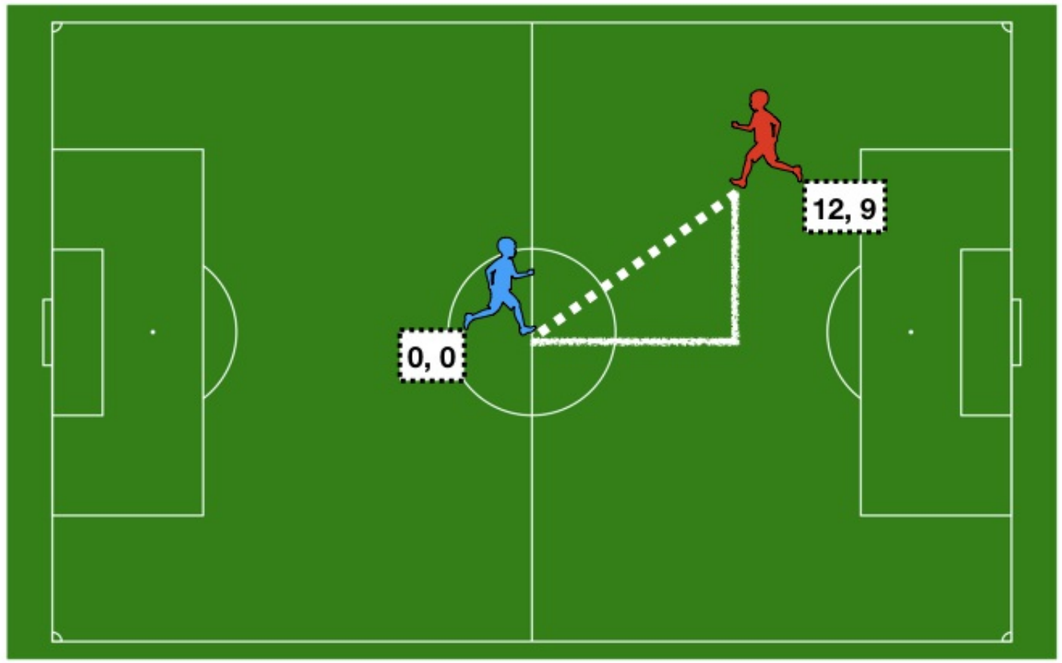

Distance Between Two Players

	X	Y
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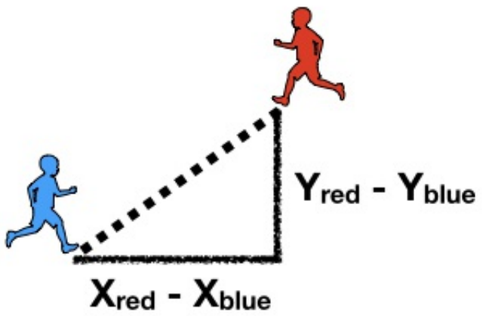

Distance Between Two Players

	X	Y
Blue	0	0
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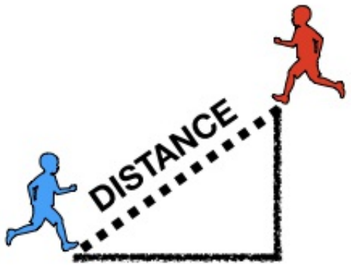
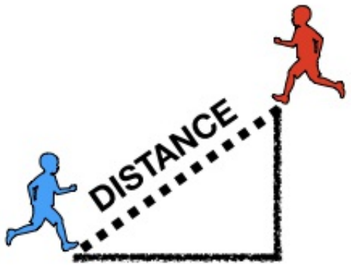


$$= \sqrt{(X_{red} - X_{blue})^2 + (Y_{red} - Y_{blue})^2}$$

Distance Between Two Players

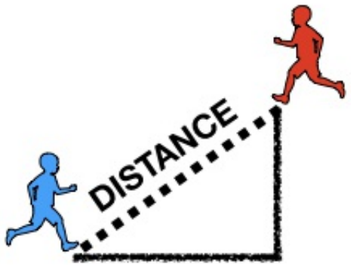
	X	Y
Blue	0	0
Red	12	9



$$= \sqrt{(12 - 0)^2 + (9 - 0)^2}$$

Distance Between Two Players

	X	Y
Blue	0	0
Red	12	9



= 15

dist() Function

```
print(two_players)
     X  Y
BLUE 0  0
RED  9 12
```

```
dist(two_players, method = 'euclidean')

      BLUE
RED   15
```

More than 2 Observations

```
print(three_players)
       X  Y
BLUE   0  0
RED    9 12
GREEN -2 19
```

```
dist(three_players)

          BLUE      RED
RED   15.00000
GREEN 19.10497 13.03840
```

CLUSTER ANALYSIS IN R

Let's practice!

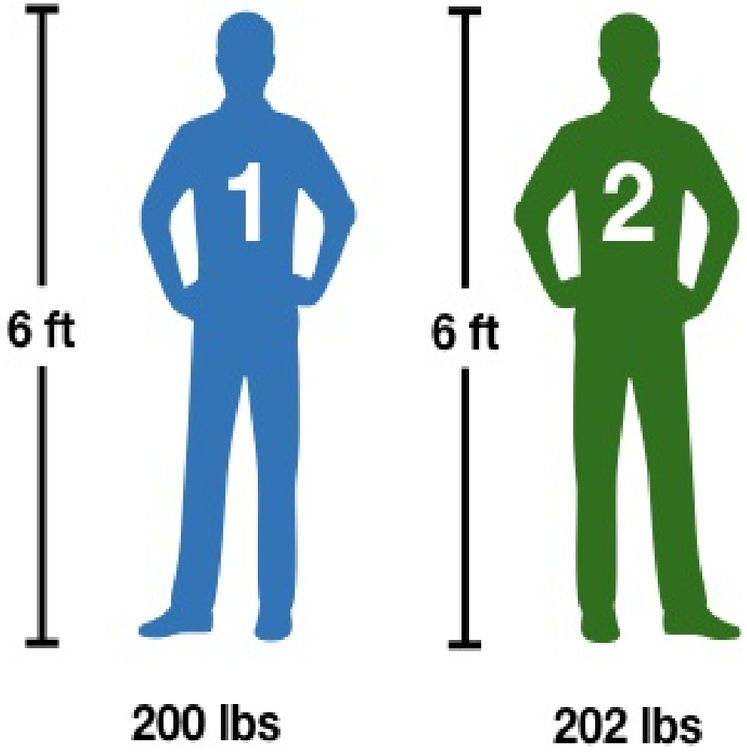
CLUSTER ANALYSIS IN R

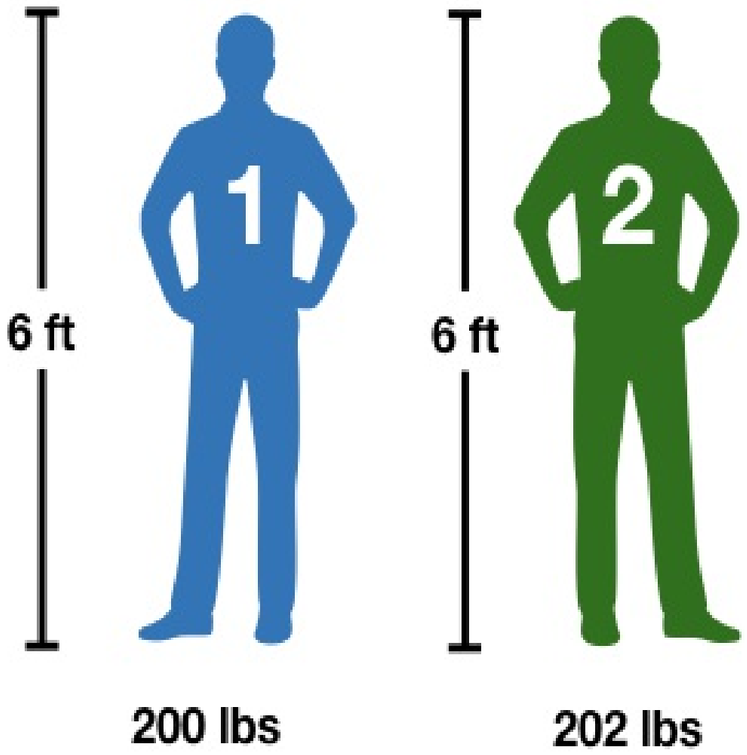
The Scales of Your Features

Dmitriy (Dima) Gorenshteyn
Sr. Data Scientist,
Memorial Sloan Kettering Cancer Center

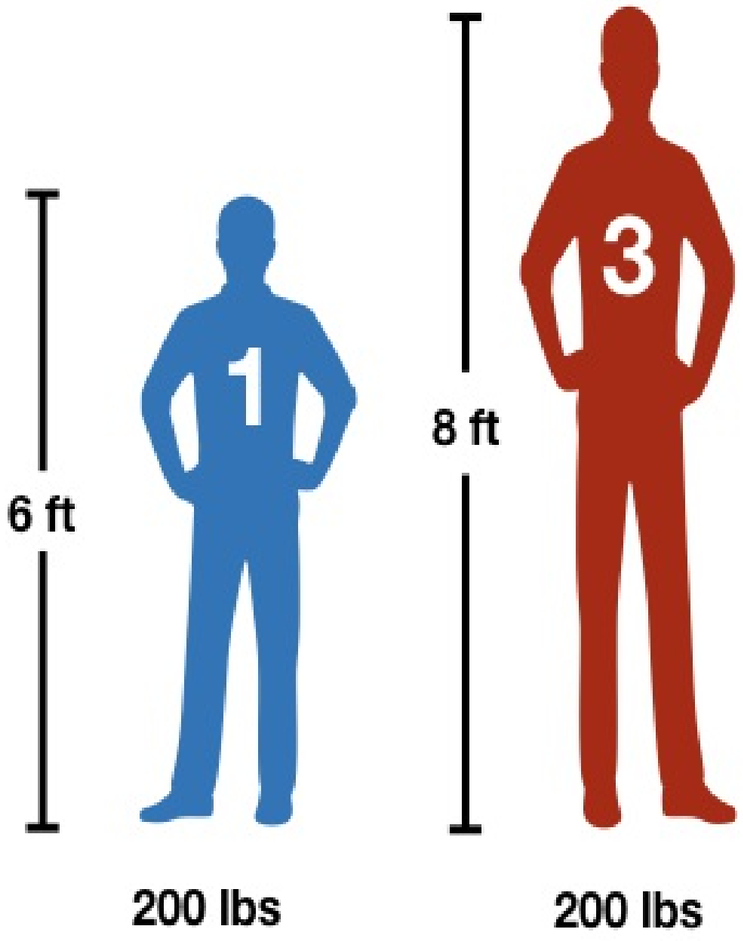
Distance Between Individuals

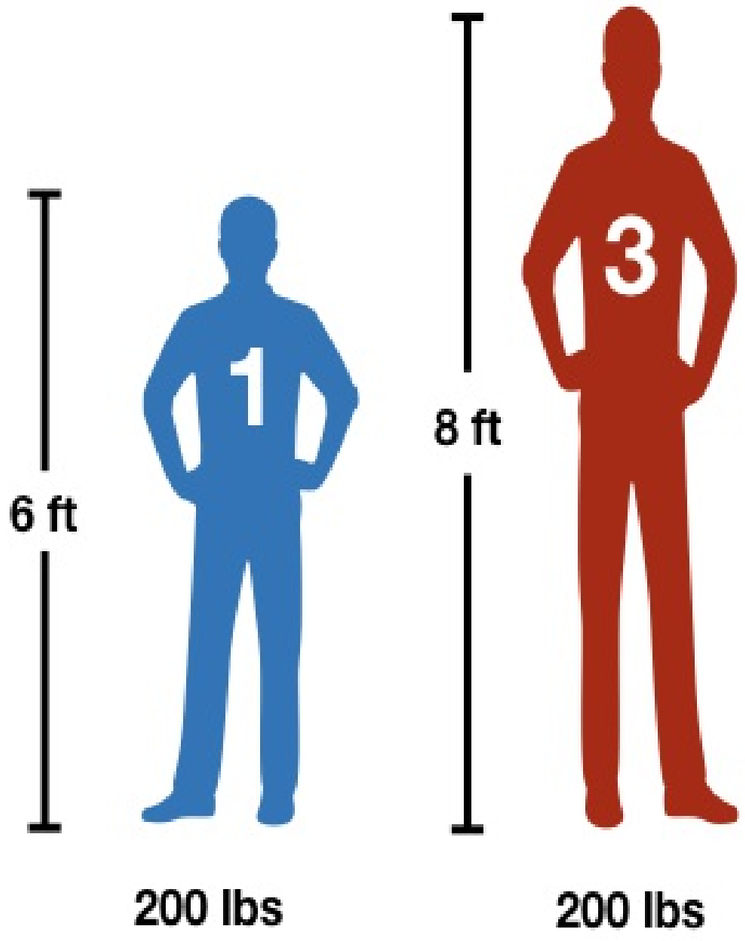
Observation	Height (feet)	Weight (lbs)
1	6.0	200
2	6.0	202
3	8.0	200
...	...	...
...	...	...


6 ft
1
200 lbs
6 ft
2
202 lbs

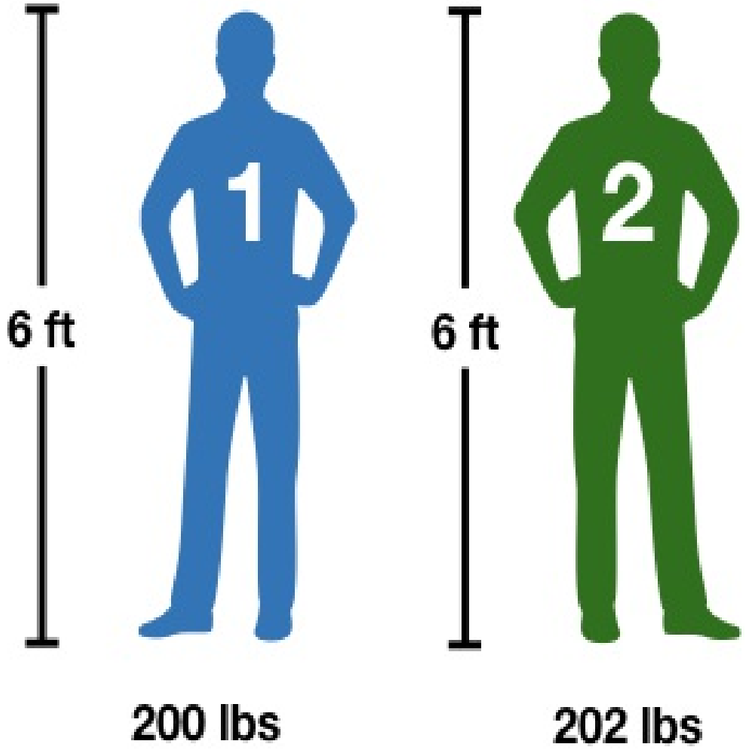


DISTANCE: **2**

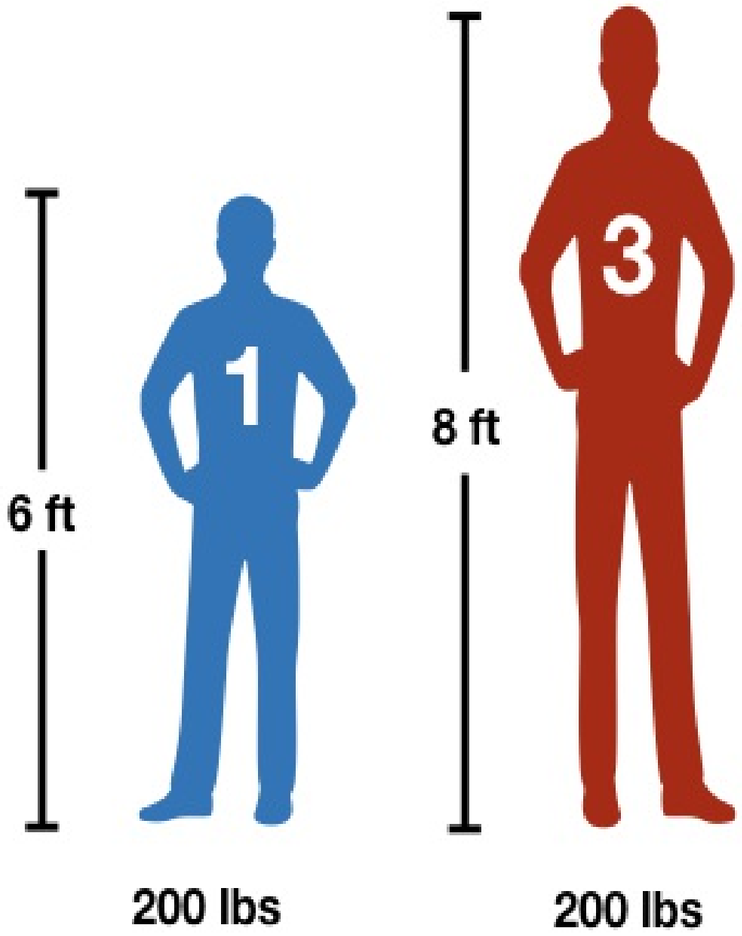

6 ft
1
200 lbs
8 ft
3
200 lbs



DISTANCE: **2**



DISTANCE: **2**

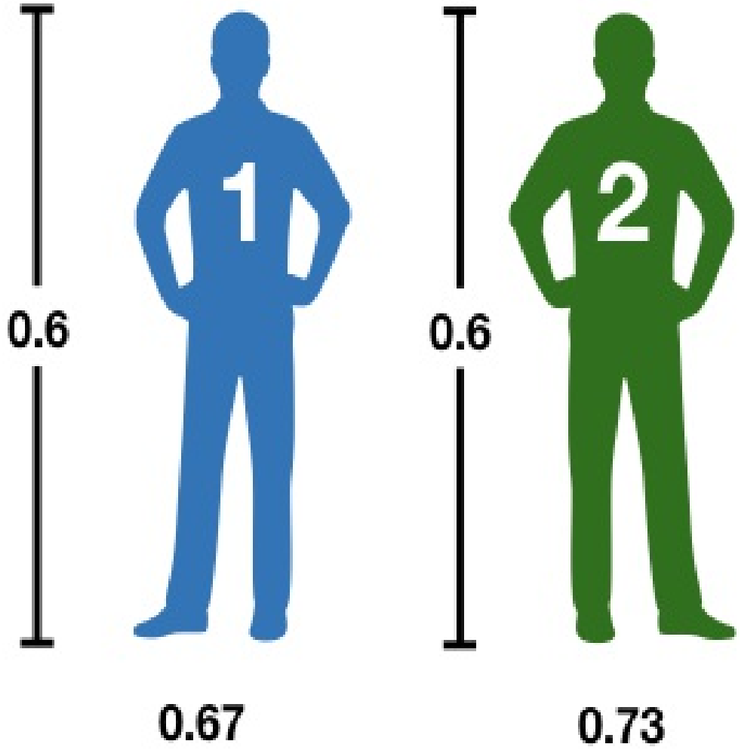


DISTANCE: **2**

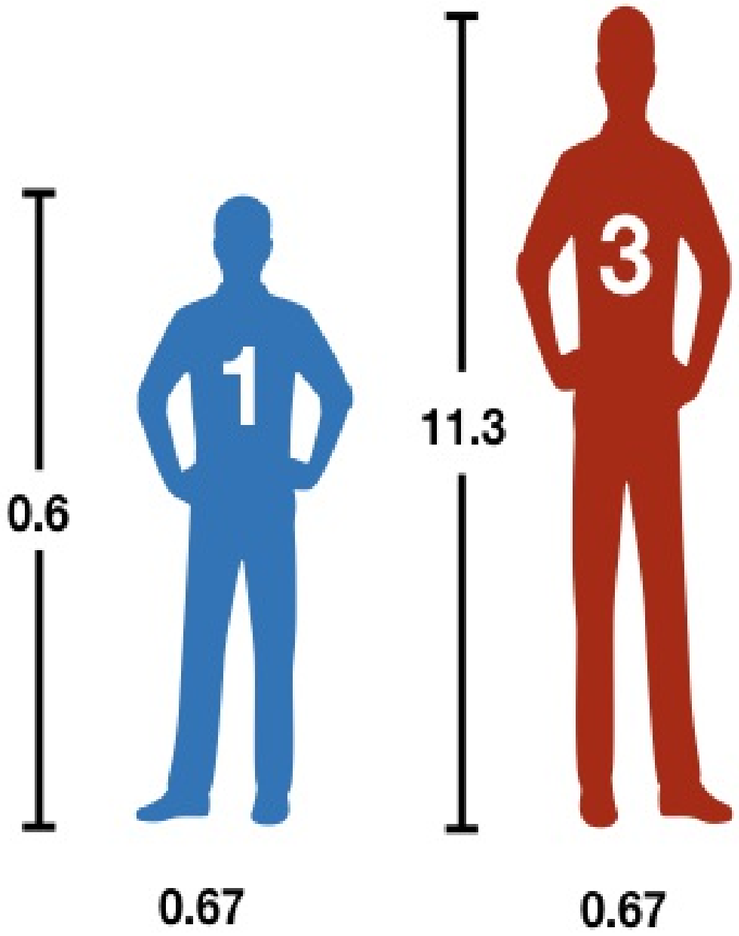
Scaling our Features

$$height_{scaled} = \frac{height - mean(height)}{sd(height)}$$


0.6
1
0.67
0.6
2
0.73
0.6
1
0.67
11.3
3
0.67



DISTANCE: **0.06**



DISTANCE: **10.7**

scale() function

```
print(height_weight)

  Height Weight
1      6    200
2      6    202
3      8    200
...   ...    ...

scale(height_weight)

   Height   Weight
1    0.60    0.67
2    0.60    0.73
3    11.3    0.67
...   ...    ...
```

CLUSTER ANALYSIS IN R

Let's practice!

CLUSTER ANALYSIS IN R

Measuring Distance For Categorical Data

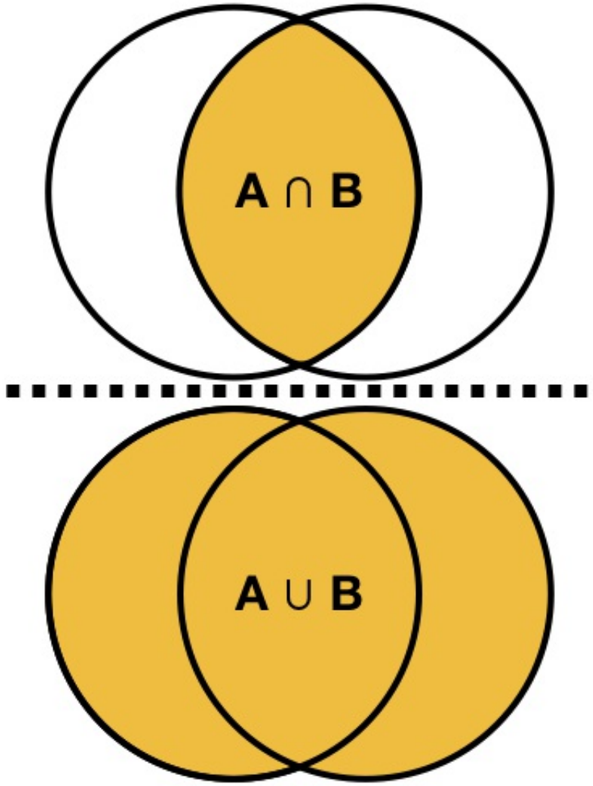
Dmitriy (Dima) Gorenshteyn
Sr. Data Scientist,
Memorial Sloan Kettering Cancer Center

Binary Data

	wine	beer	whiskey	vodka
1	**TRUE**	**TRUE**	FALSE	FALSE
2	FALSE	**TRUE**	**TRUE**	**TRUE**
...	...	...	...	...

Jaccard Index

$$J(A, B) = \frac{A \cap B}{A \cup B}$$



Calculating Jaccard Distance

	wine	beer	whiskey	vodka
1	**TRUE**	**TRUE**	FALSE	FALSE
2	FALSE	**TRUE**	**TRUE**	**TRUE**

$$J(1,2) = \frac{1 \cap 2}{1 \cup 2} = \frac{1}{4} = 0.25$$

$$Distance(1,2) = 1 - J(1,2) = 0.75$$

Calculating Jaccard Distance in R

```
print(survey_a)

   wine  beer whiskey vodka
  <lgl> <lgl>   <lgl> <lgl>
1  TRUE  TRUE    FALSE FALSE
2 FALSE  TRUE    TRUE  TRUE
3  TRUE FALSE    TRUE FALSE

dist(survey_a, method = "binary")

          1         2
2 0.7500000
3 0.6666667 0.7500000
```

More Than Two Categories

	color	sport
1	red	soccer
2	green	hockey
3	blue	hockey
4	blue	soccer
...	...	...

	colorblue	colorgreen	colorred	sporthockey	sportsocce
1	0	0	1	0	1
2	0	1	0	1	0
3	1	0	0	1	0
4	1	0	0	0	1
...	...	...	...	...	...

Dummification in R

```
print(survey_b)

  color  sport
1   red soccer
2 green hockey
3  blue hockey
4  blue soccer

library(dummies)

dummy.data.frame(survey_b)

  colorblue colorgreen colorred sporthockey sportsoccer
1         0          0        1            0           1
2         0          1        0            1           0
3         1          0        0            1           0
4         1          0        0            0           1
```

Generalizing Categorical Distance in R

```
print(survey_b)

  color  sport
1   red soccer
2 green hockey
3  blue hockey
4  blue soccer

dummy_survey_b <- dummy.data.frame(survey_b)

dist(dummy_survey_b, method = 'binary')

          1         2         3
2 1.0000000
3 1.0000000 0.6666667
4 0.6666667 1.0000000 0.6666667
```

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Let's practice!