# Fundamentos de Data Science, Data Mining e Análise Preditiva

*Aula 1*

**Francisco Nauber Bernardo Gois**

*Uni7*

15 de maio de 2

# Instrutor

**F. Nauber Bernardo Gois**

Dsc. Informática Aplicada
Lider de Aprendizado de Máquina na Secretaria de Saúde do Ceará
Engenheiro de Aprendizado de Máquina
Professor da UFC (2018-2019)
Analista de Desenvolvimento Serpro (2004-2018)

# Instrutor

**https://www.linkedin.com/in/n**

https://www.linkedin.com
/in/naubergois/
Envie recomendações, depoimentos e competÊncias

# Instrutor

**https://www.youtube.com/can**

https://www.youtube.com/canaldaciencia
Instagram: @canaldaciencia

# Índice

## Índice

Material Utilizado no Curso
Introdução
DataScience e Aprendizado de Máquina
- SKLearn
- TesteAB

Conclusão

# Material do Curso

## Chris Albon

Curso de Aprendizado de Máquina
https://chrisalbon.com/

CHRIS ALBON TECHNICAL NOTES ARTIC

Notes On Using

**Data Science & Artificial Intelligenc**

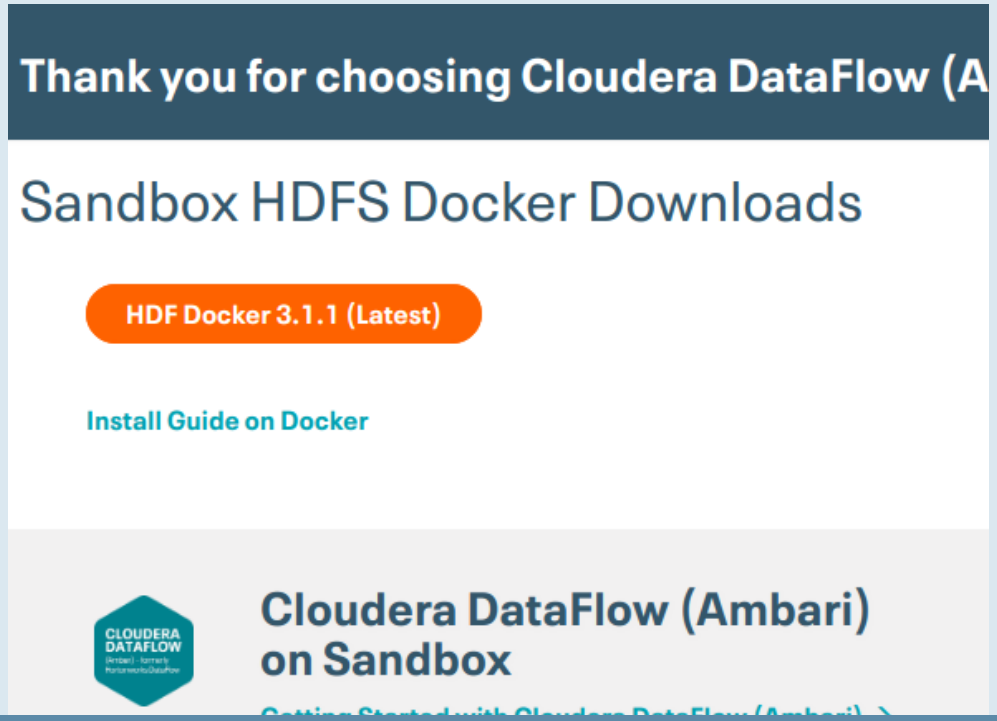
To Fight For Something That Matters

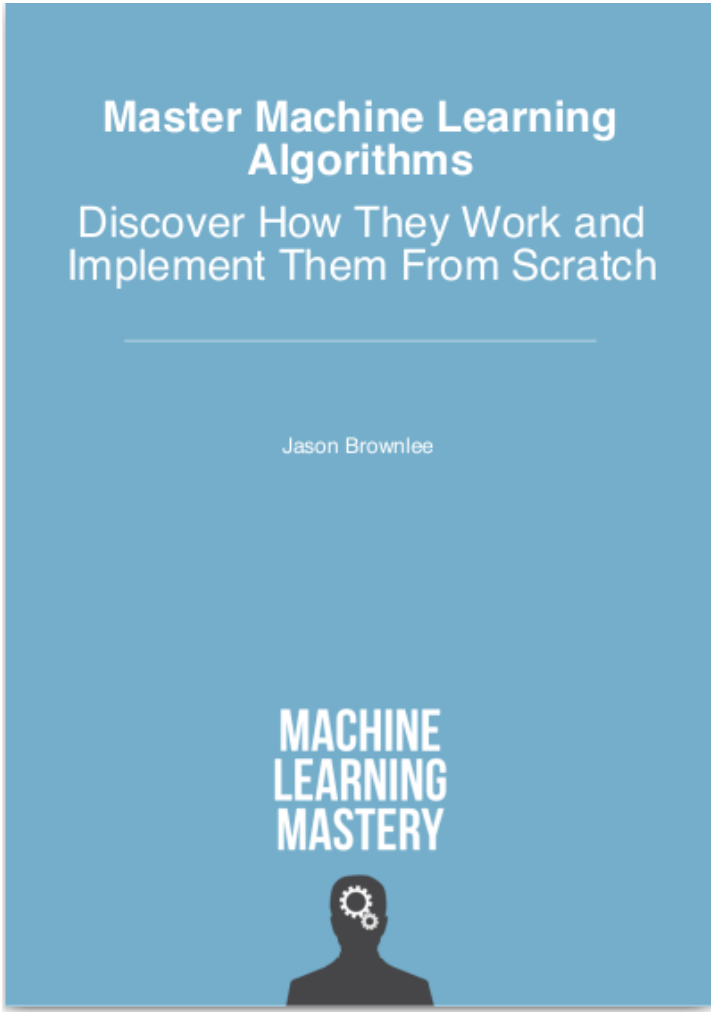
I am a data scientist with a decade of experience applying statistical learning, artificial
and software engineering to political, social, and humanitarian efforts -- from election r
disaster relief. I lead the data science team at Devoted Health, helping fix America's he

# Material do Curso

## HDP 2.5 sandbox image

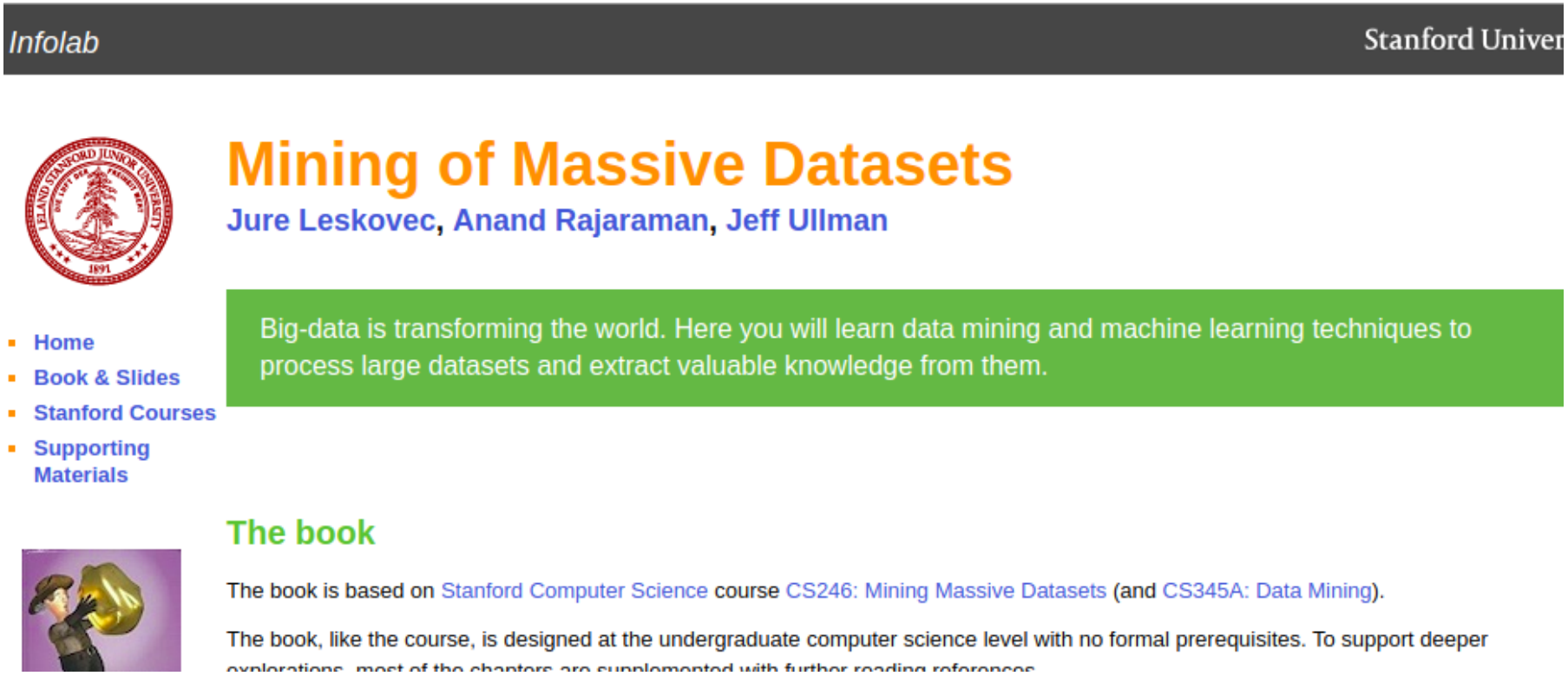
Baixe a imagem no endereço `https://www.cloudera.com/downloads/hortonworks-sandbox/hdf.html?utm_source=`






Livro Recomendado

# Livro




http://mmds.org/

# Data is Power

**Data contains value and knowledge**

http://web.stanford.edu/class/cs246/slides/

# DATA IS THE NEW OIL!

"Dados são o novo Petróleo"

**Perry Rotella**
Contributor

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TECH 4/02/2012 @ 11:09AM | 10,791 views

## Is Data The New Oil?

+ Comment Now + Follow Comments

Recently, on a CNBC Squawk Box segment, "The Pulse of Silicon Valley," host Joe Kernan posed the question, "What is the next really big thing?" to Ann Winblad, the legendary investor and senior partner at Hummer-Winblad. Her response: "Data is the new oil."

Como petróleo, precisam ser refinados !

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https://www.slideshare.net/MarcoGarcia/construindo-data-lakes-viso-prtica-com-hadoop-e-bigdata

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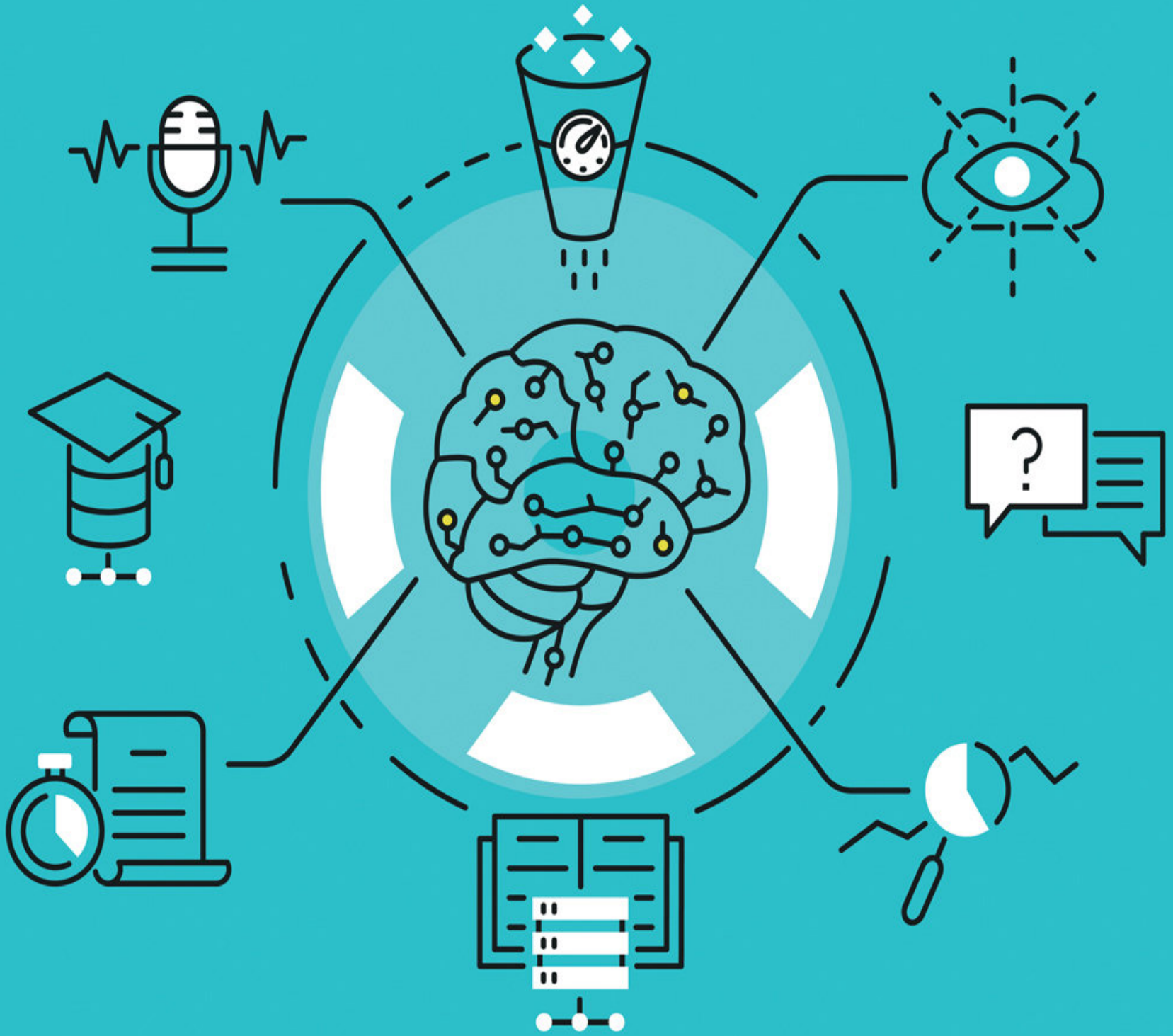


# O QUE É CIÊNCIA DE DADOS?

# DATA SCIENCE É MAIS UM TERMO USADO PARA DESCREVER O PROCESSO DE TRANSFORMAÇÃO DE DADOS EM CONHECIMENTO.

(LOUKIDES, 2016)

# MODERN DATA SCIENTIST

Data Scientist, the sexiest job of the 21th century, requires a mixture of multidisciplinary skills ranging from an intersection of mathematics, statistics, computer science, communication and business. Finding a data scientist is hard. Finding people who understand who a data scientist is, is equally hard. So here is a little cheat sheet on who the modern data scientist really is.

## MATH & STATISTICS

- Machine learning
- Statistical modeling
- Experiment design
- Bayesian inference
- Supervised learning: decision trees, random forests, logistic regression
- Unsupervised learning: clustering, dimensionality reduction
- Optimization: gradient descent and variants

## PROGRAMMING & DATABASE

- Computer science fundamentals
- Scripting language e.g. Python
- Statistical computing packages, e.g., R
- Databases: SQL and NoSQL
- Relational algebra
- Parallel databases and parallel query processing
- MapReduce concepts
- Hadoop and Hive/Pig
- Custom reducers
- Experience with xaaS like AWS

## DOMAIN KNOWLEDGE & SOFT SKILLS

- Passionate about the business
- Curious about data
- Influence without authority
- Hacker mindset
- Problem solver
- Strategic, proactive, creative, innovative and collaborative

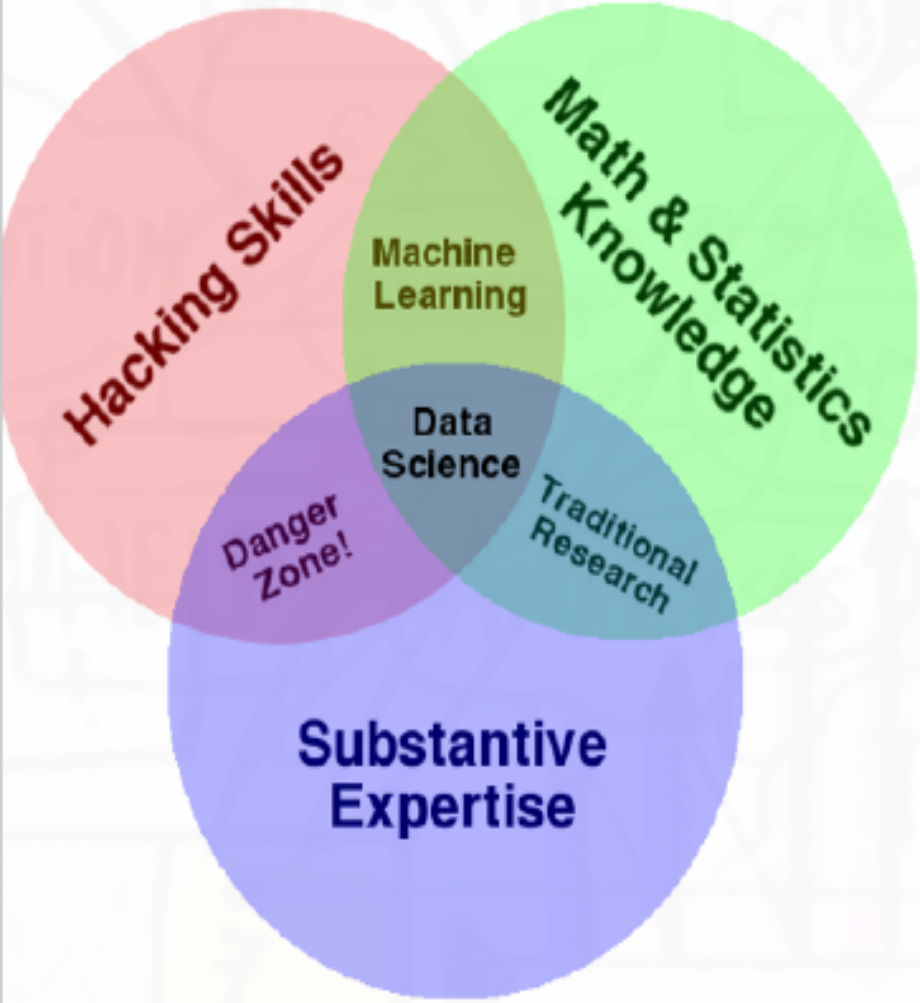
## COMMUNICATION & VISUALIZATION

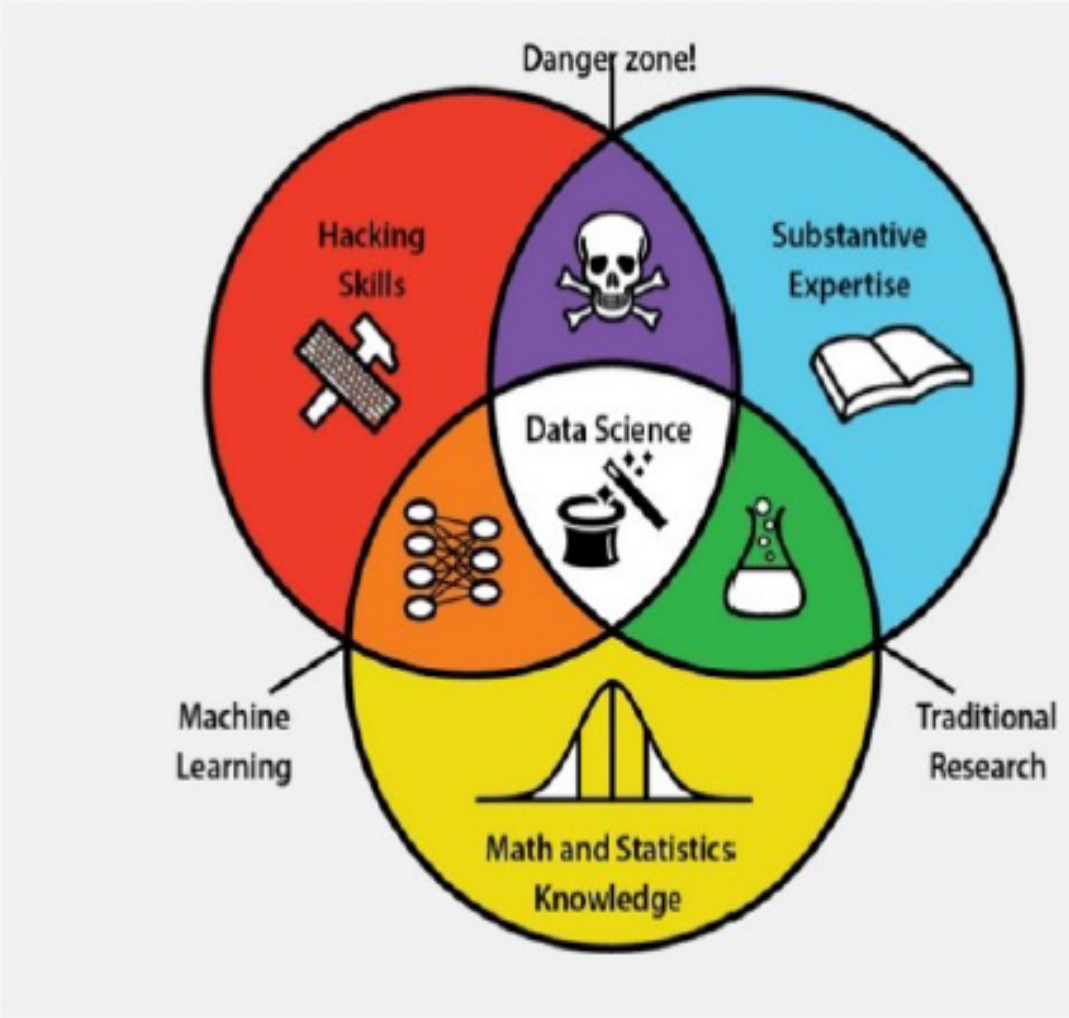
- Able to engage with senior management
- Story telling skills
- Translate data-driven insights into decisions and actions
- Visual art design
- R packages like ggplot or lattice
- Knowledge of any of visualization tools e.g. Flare, D3.js, Tableau

# CIENTISTA DE DADOS

- Matemática e estatística
- Banco de Dados e Programação
- Conhecimento de Negócio
- Comunicação

# DATA SCIENCE VENN DIAGRAM



# Aprendizado Estatístico

## Algoritmo é o processo de aprendizado dos dados

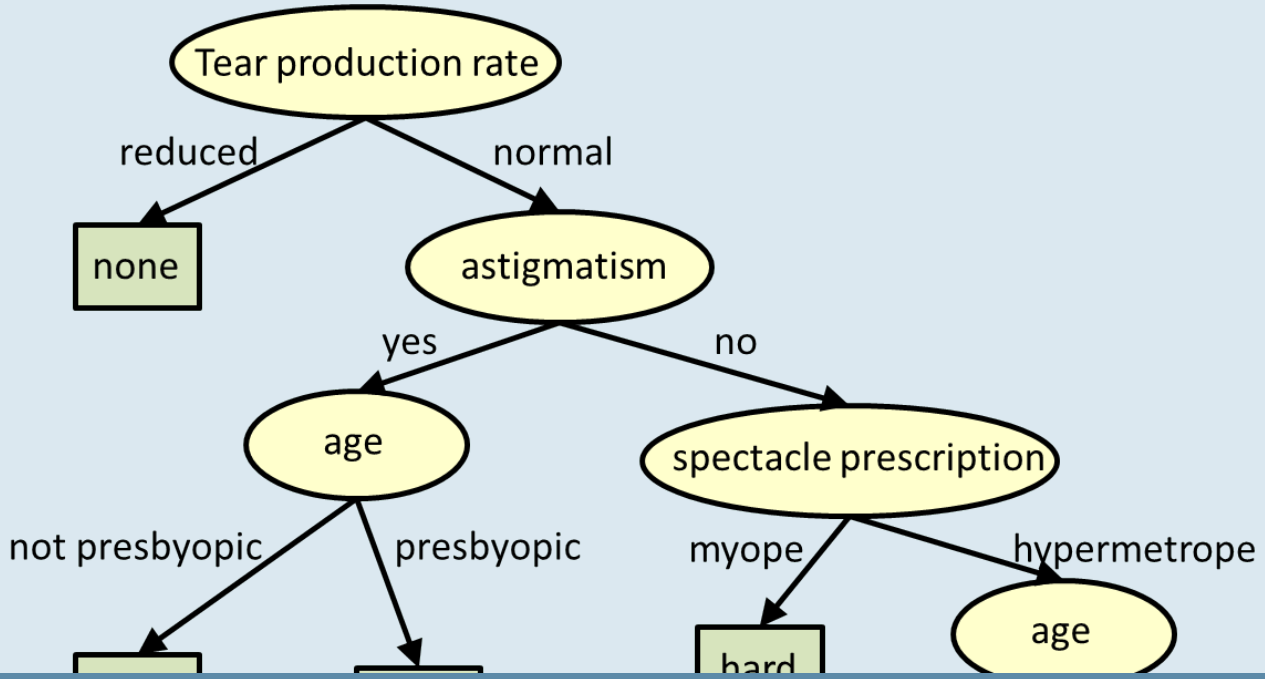
VariavelSaida = função(VetorEntrada)
A variável de saída é a variável dependente. Isso ocorre porque no enquadramento do problema de previsão, a saída é dependente (uma função) da entrada (também chamada de variáveis independentes).

| | A | B |
|---|---|---|
| 1 | X (Variável Independente) | Y (Variável Dependente) |
| 2 | 2 | 5 |
| 3 | 3 | 7 |
| 4 | 4 | 9 |
| 5 | 5 | 11 |
| 6 | 6 | 13 |
| 7 | 7 | 15 |
| 8 | 8 | 17 |
| 9 | 9 | 19 |
| 10 | 10 | 21 |
| 11 | 11 | 23 |

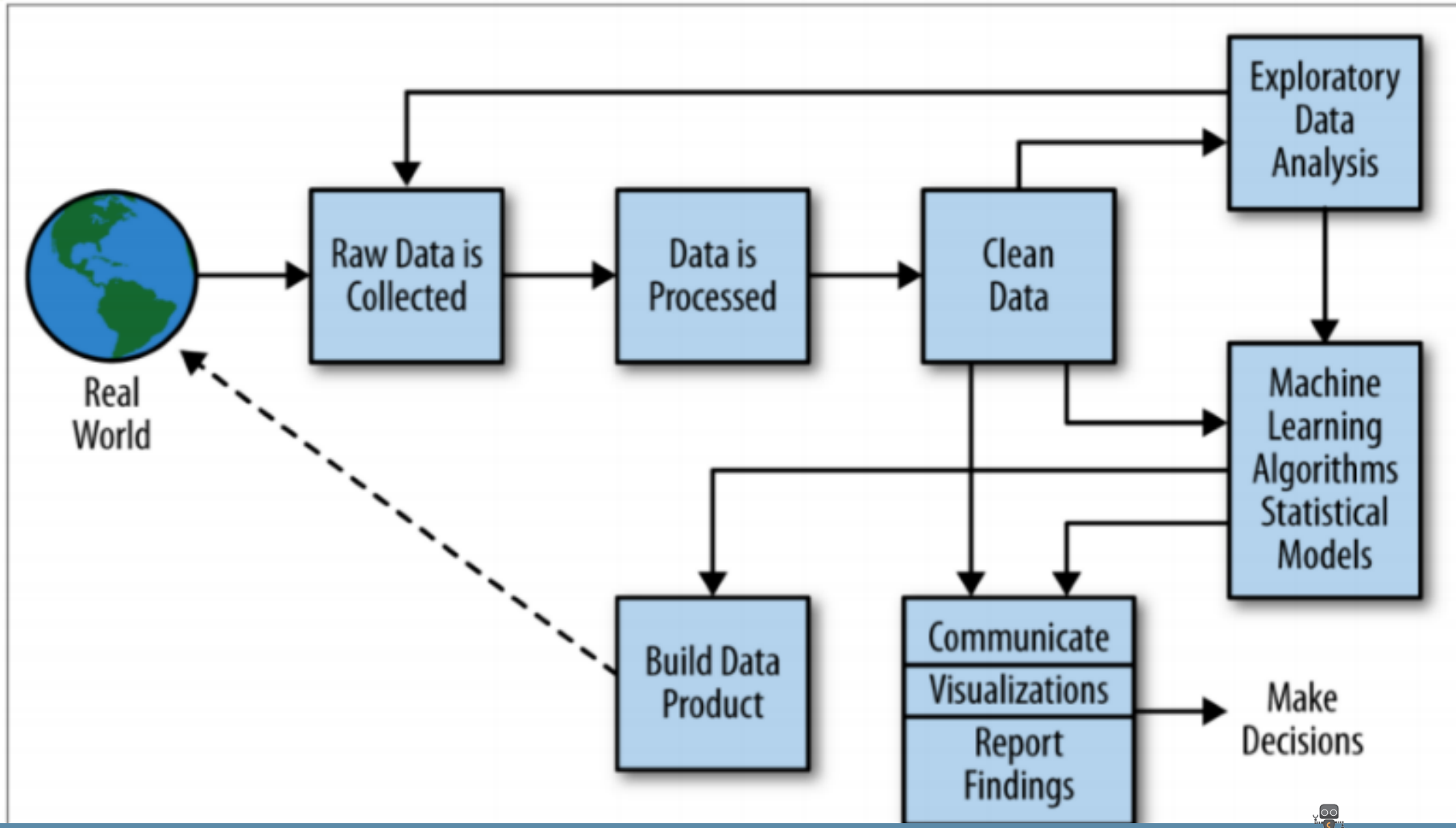
# Modelos e Algoritmos

## Variáveis dependentes e independentes

Model = Algorithm(Data)
Modelo é a representação do que foi aprendido com os dados.



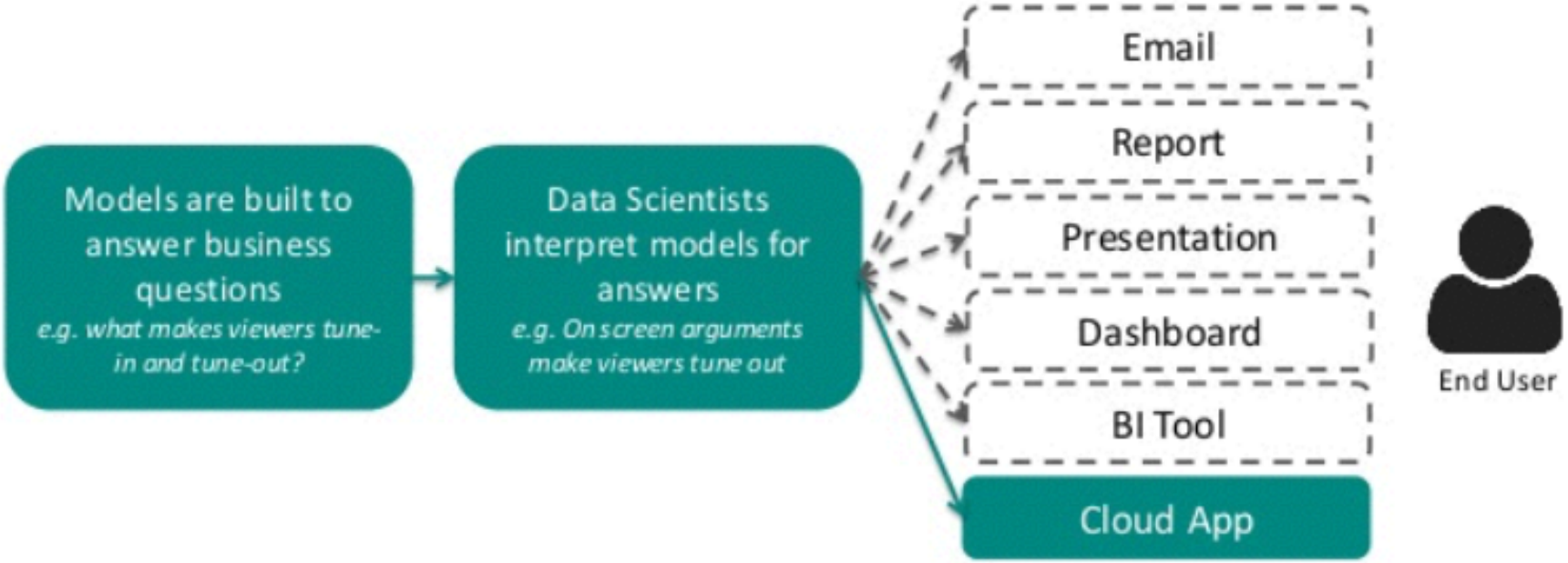
# Processo Análise de Dados



# Insight

## Models → Insights → Actions

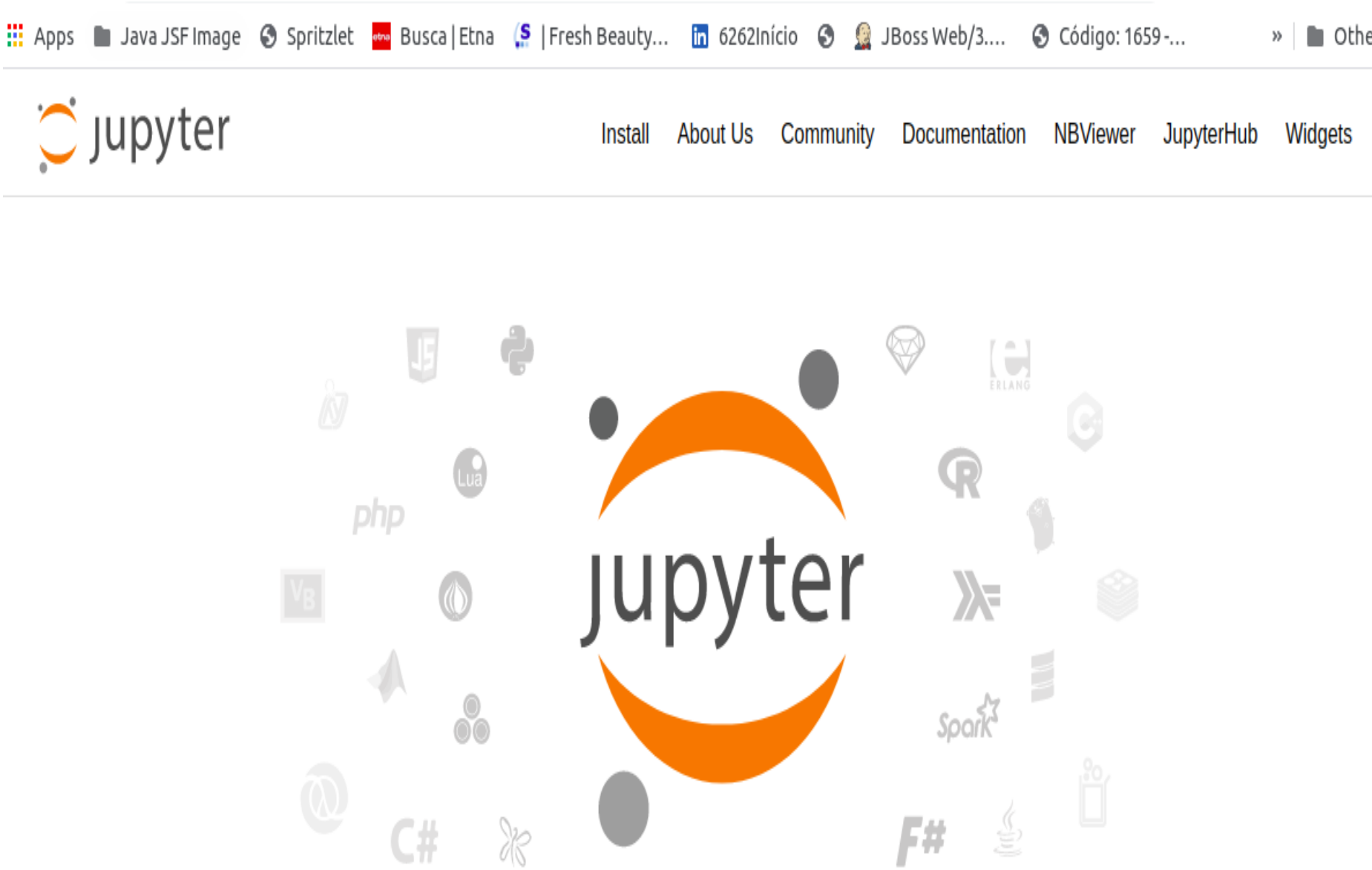
*A good insight drives action that will generate value for stakeholders*



# Tipos de Análise

# RELATÓRIOS

- Notebooks online: iPython, Jupyter
- permitem a criação de documentos
- interativos em várias linguagens de análise.
- ¨ Reproducible Research!


Apps
Java JSF Image
Spritzlet
Busca | Etna
| Fresh Beauty...
6262Início
JBoss Web/3....
Código: 1659 -...
jupyter
Install
About Us
Community
Documentation
NBViewer
JupyterHub
Widgets
jupyter

pandas

About us ▾ Getting started Documentation Community ▾ Co

# pandas

**pandas** is a fast, powerful, flexible and easy to use open source data analysis and manipulation tool, built on top of the Python programming language.

Install pandas now!

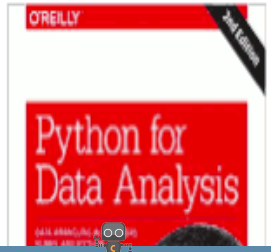
## Latest version: 1.0.

- What's new in 1.0.1
- Release date: Feb 05, 2020
- Documentation (web)
- Documentation (pdf)
- Download source code

## Follow us

Follow @pandas_dev

## Get the book




## Getting started

- Install pandas
- Getting started

## Documentation

- User guide
- API reference

## Community

- About pandas
- Ask a question

NODE 01
NODE 04
NODE 05
NODE 03
BLOCK 01
NODE 01

UCI

Machine Learning Repository

Center for Machine Learning and Intelligent Systems

About Citation Policy Donate a Da

Repository Web

View AL

Browse Through: **488** Data Sets

Table V

**Default Task**

Classification (360)
Regression (107)
Clustering (90)
Other (55)

**Attribute Type**

Categorical (38)
Numerical (325)
Mixed (55)

**Data Type**

Multivariate (374)
Univariate (24)
Sequential (51)
Time-Series (99)
Text (55)

| Name | Data Types | Default Task | Attribute Types | # Instances | # Attrib |
|---|---|---|---|---|---|
| Abalone | Multivariate | Classification | Categorical, Integer, Real | 4177 | 8 |
| Adult | Multivariate | Classification | Categorical, Integer | 48842 | 14 |
| Annealing | Multivariate | Classification | Categorical, Integer, Real | 798 | 38 |
| Anonymous Microsoft Web Data | | Recommender-Systems | Categorical | 11 | 294 |

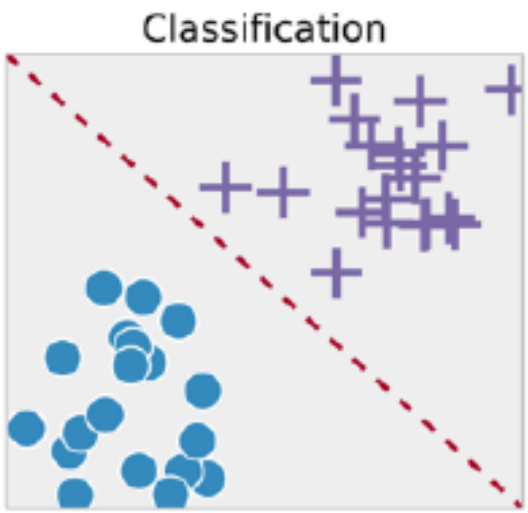
# Data Mining Methods

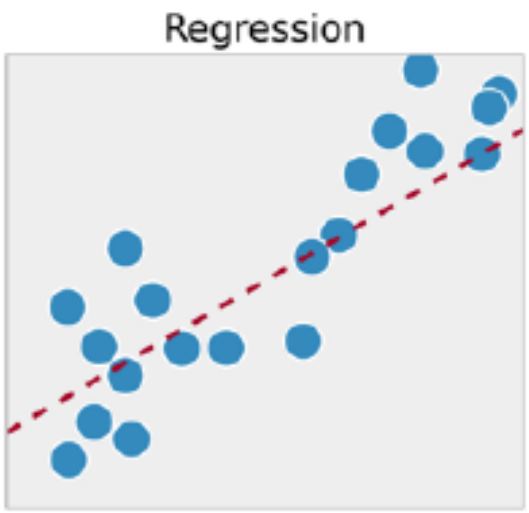
- **Descriptive methods**
  - Find human-interpretable patterns that describe the data
    - **Example:** Clustering
- **Predictive methods**
  - Use some variables to predict unknown or future values of other variables
    - **Example:** Recommender systems

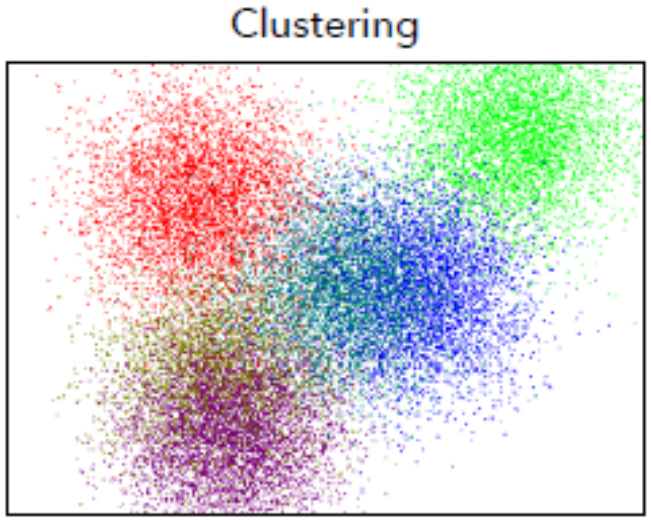
http://web.stanford.edu/class/cs246/slides/01-intro.pdf

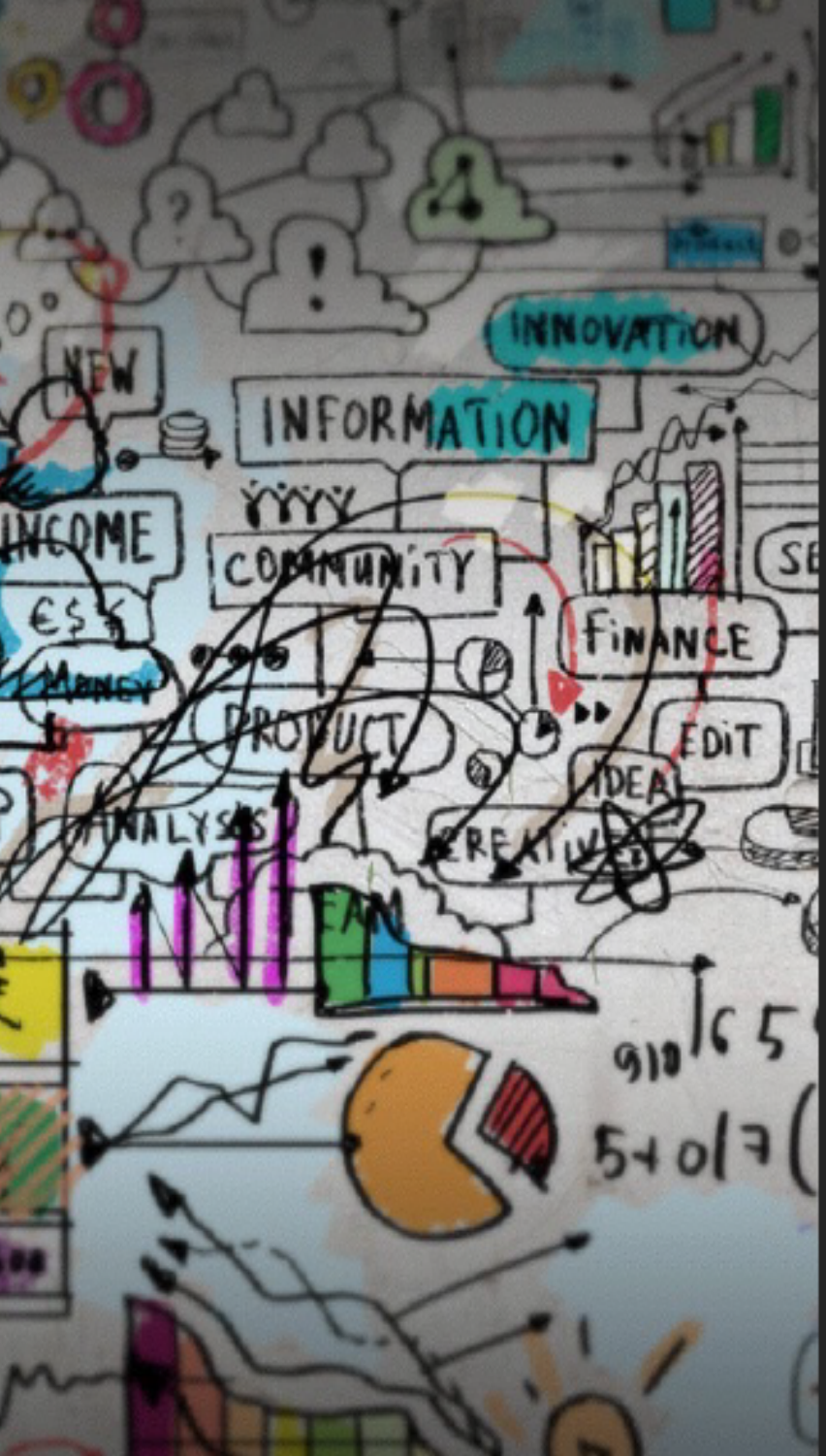
# FORMULAÇÃO DE UM PROBLEMA

## Identificação de uma área de interesse e o tipo de modelo



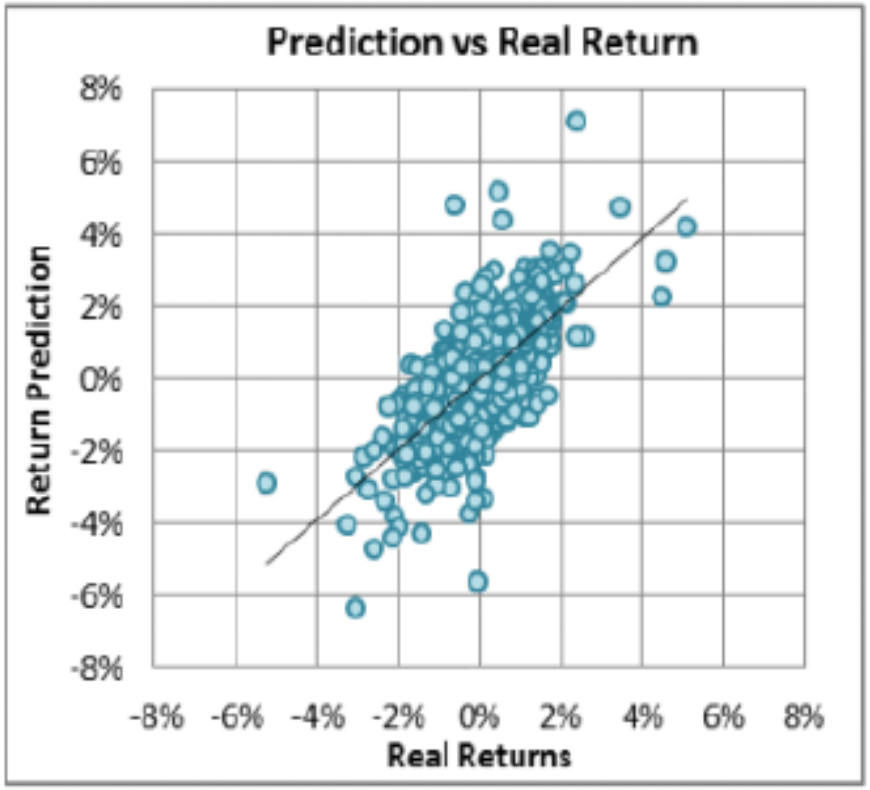


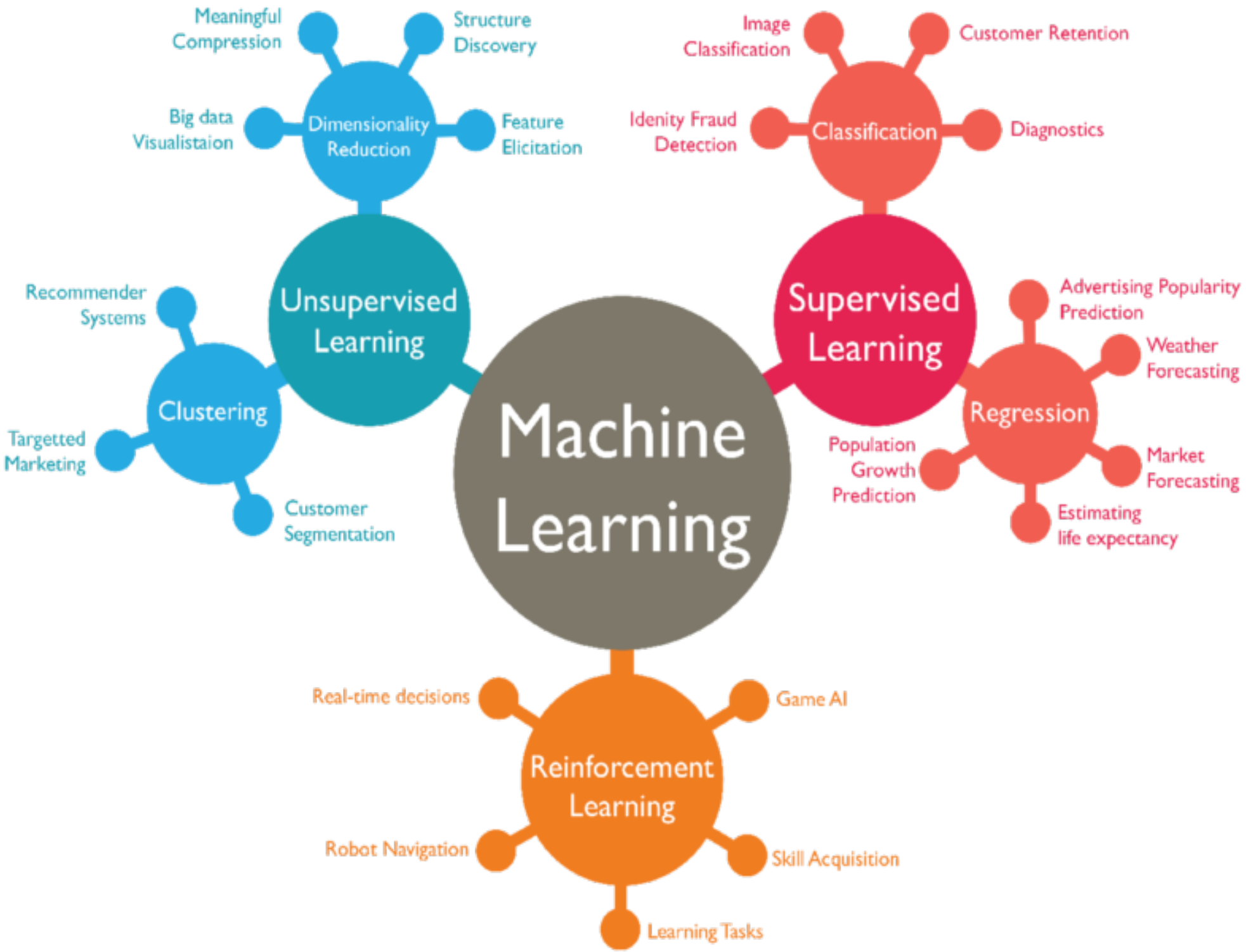

# TIPOS DE MODELOS

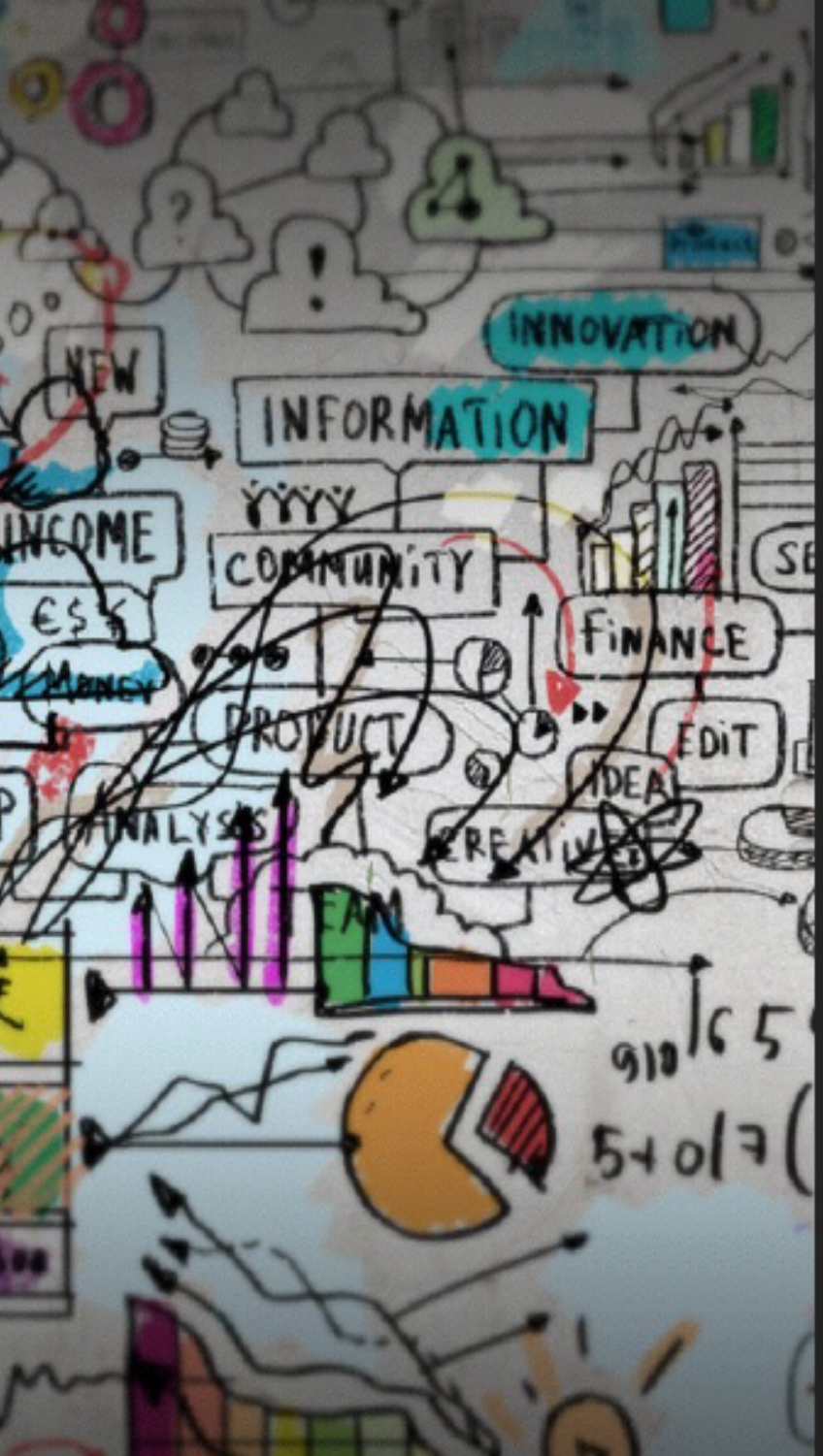
- REGRESSÃO
- CLASSIFICAÇÃO
- AGRUPAMENTO

# CLASSIFICAÇÃO VS REGRESSÃO

## Regression vs Classification



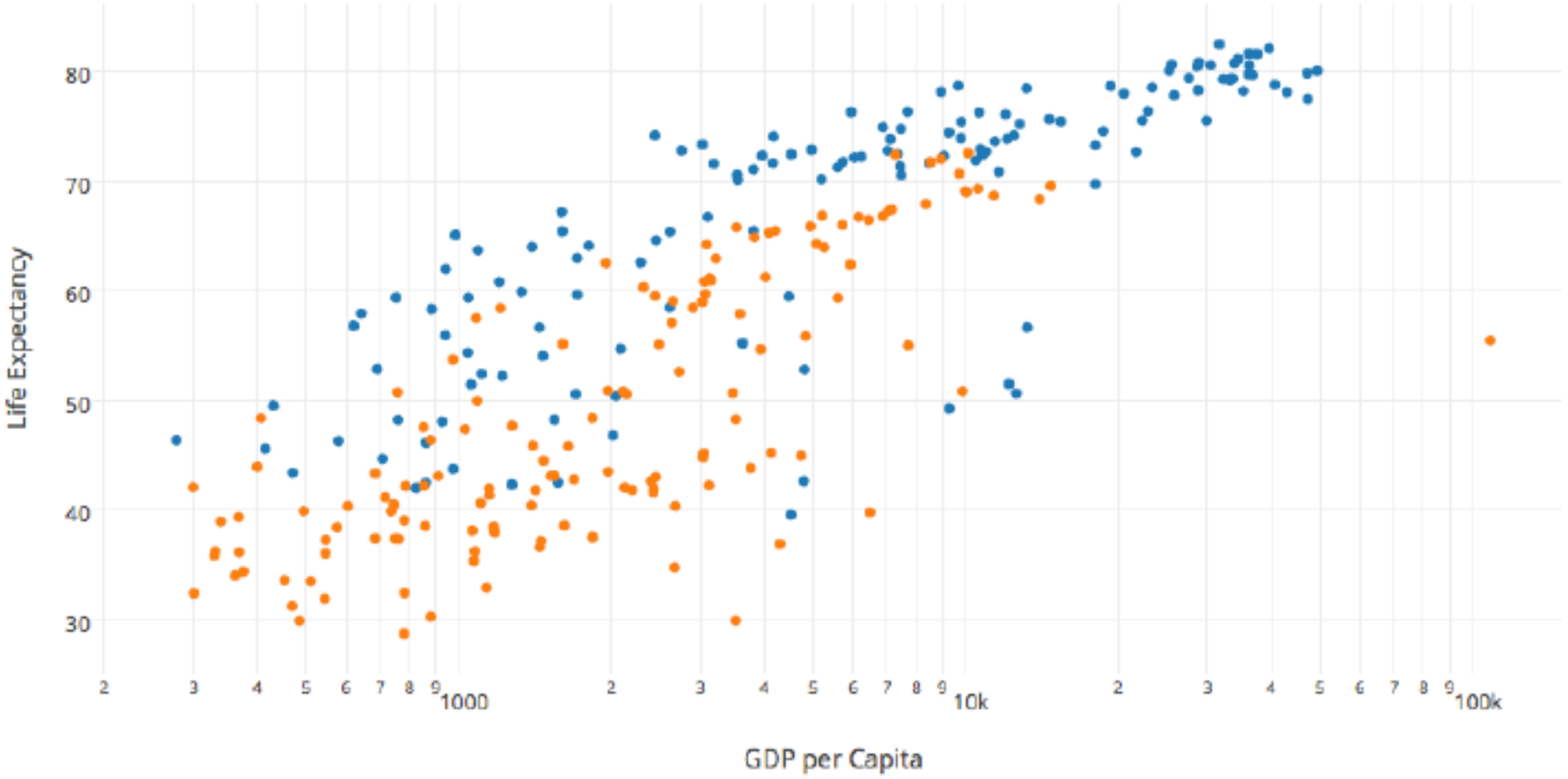

Machine Learning
Unsupervised Learning
Dimensionality Reduction
Meaningful Compression
Structure Discovery
Big data Visualistaion
Feature Elicitation
Clustering
Recommender Systems
Targetted Marketing
Customer Segmentation
Supervised Learning
Classification
Image Classification
Customer Retention
Idenity Fraud Detection
Diagnostics
Regression
Advertising Popularity Prediction
Weather Forecasting
Population Growth Prediction
Market Forecasting
Estimating life expectancy
Reinforcement Learning
Real-time decisions
Game AI
Robot Navigation
Skill Acquisition
Learning Tasks




# O QUE É REGRESSÃO ?

# REGRESSÃO

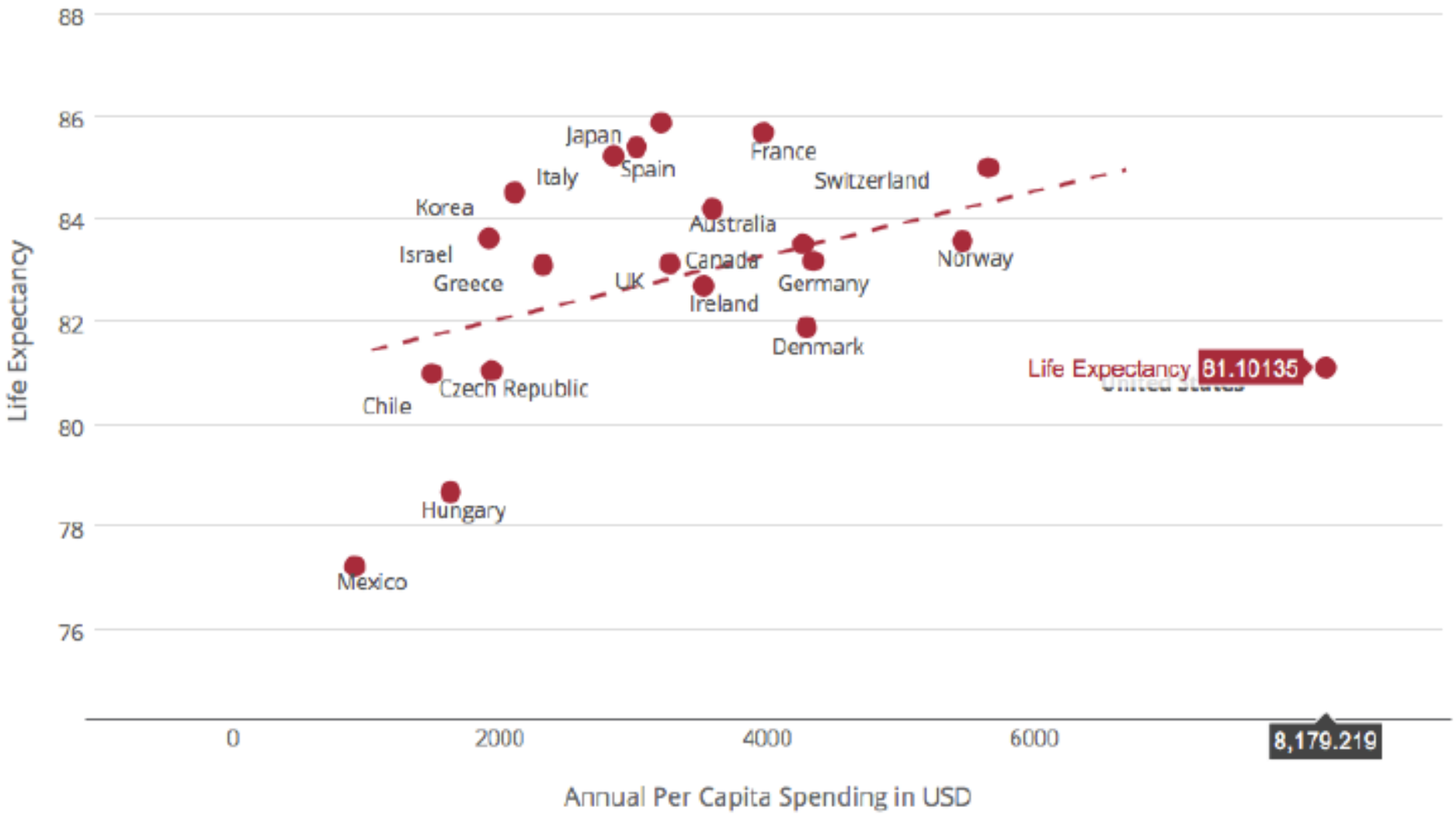
*https://plot.ly/pandas/line-and-scatter/*



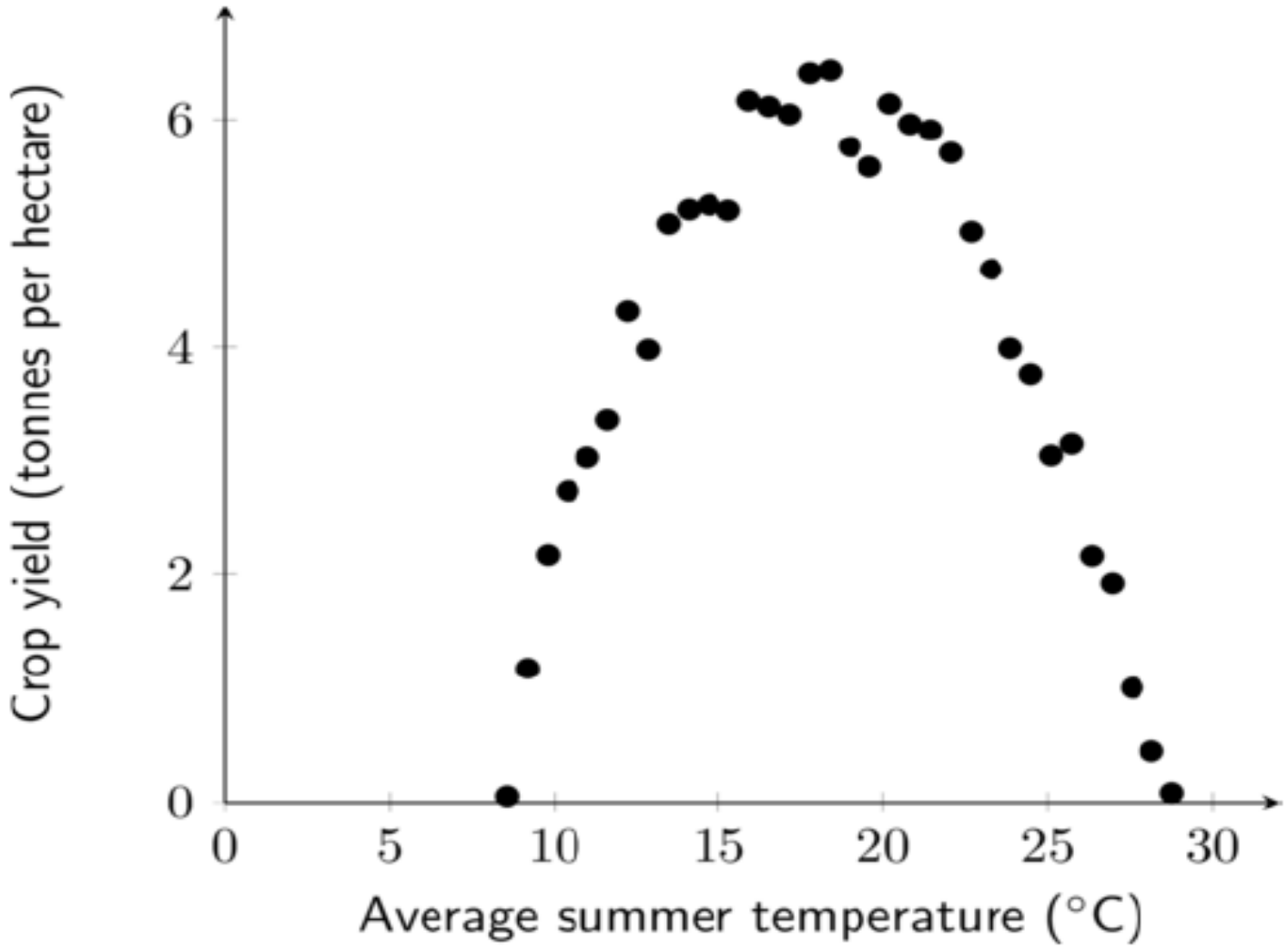
# REGRESSÃO

https://plot.ly

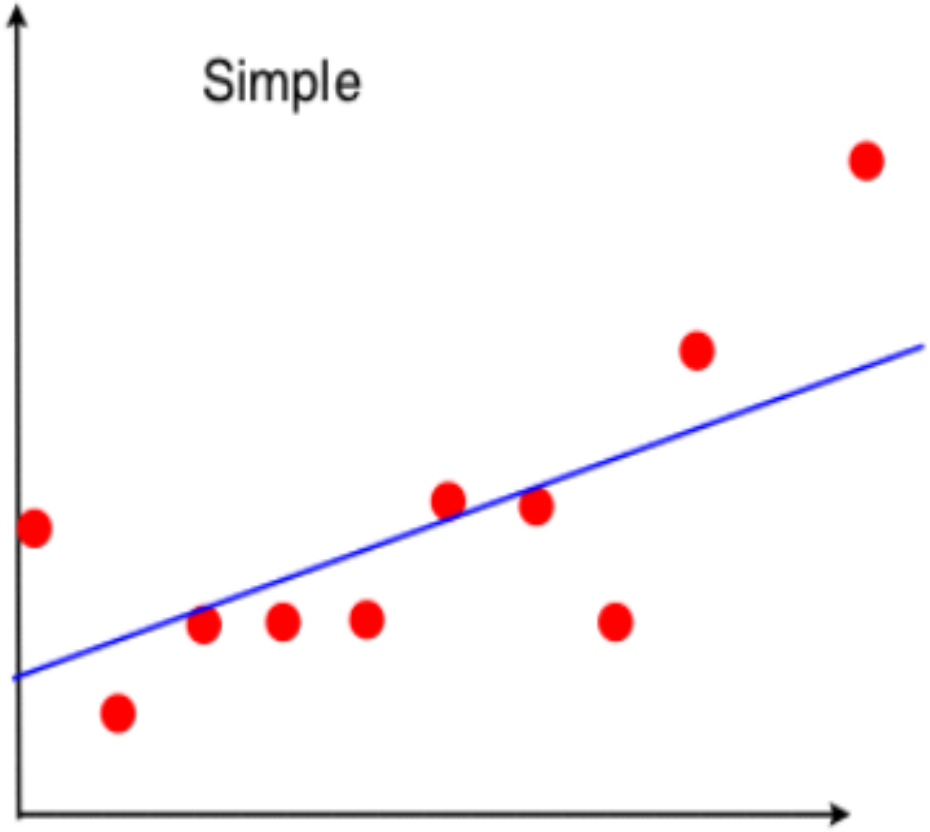
```
('Coefficients: \n', array([ 0.00118801]))
Mean squared error: 9.71
Variance score: -2.38
```

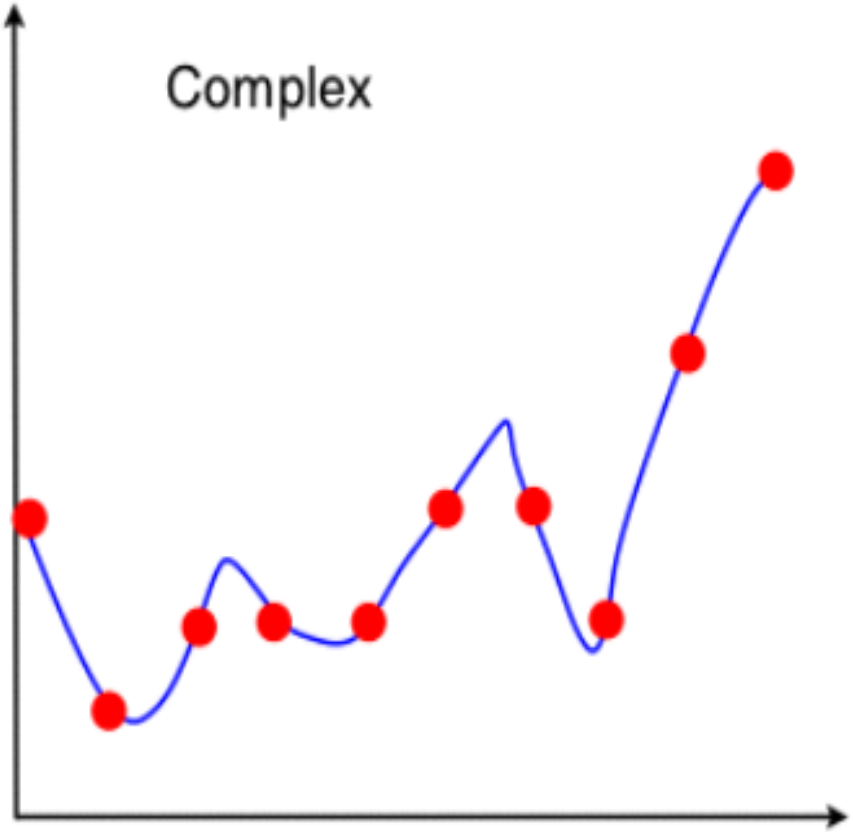


# REGRESSÃO

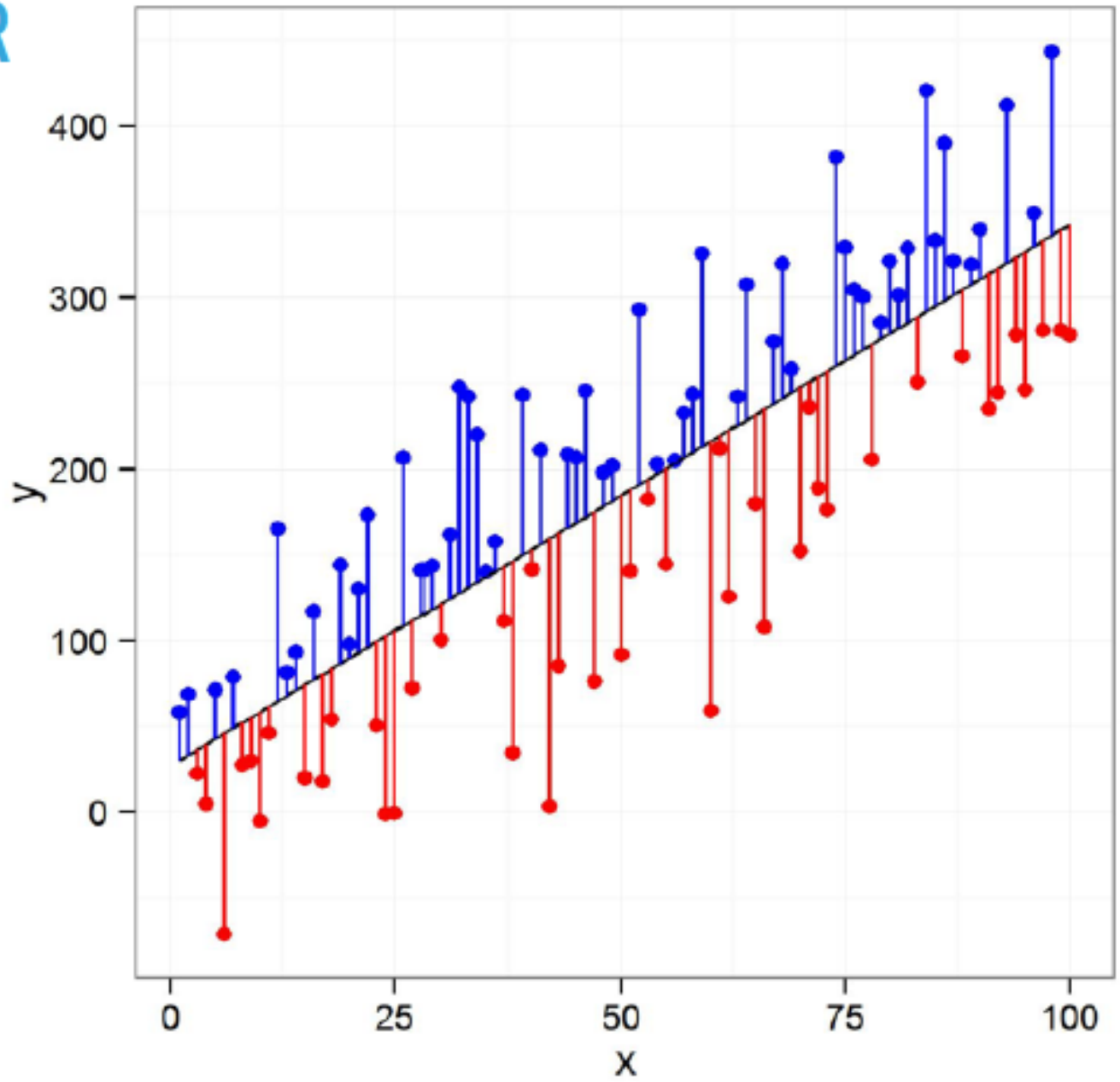

Crop yield (tonnes per hectare)
0
2
4
6
0
5
10
15
20
25
30
Average summer temperature (°C)

# QUAL A MELHOR PREDIÇÃO

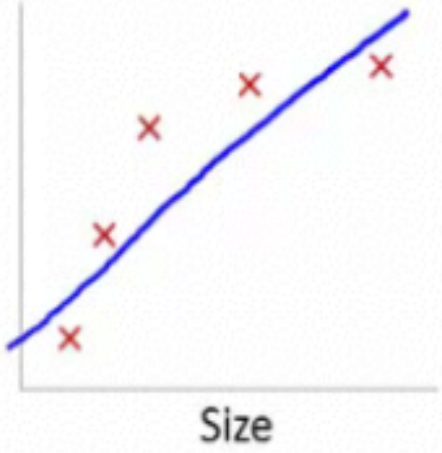


# REGRESSION ERROR

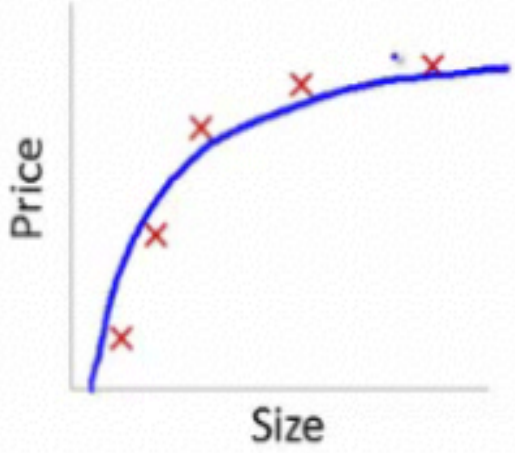


# BIAS E OVERFITTING



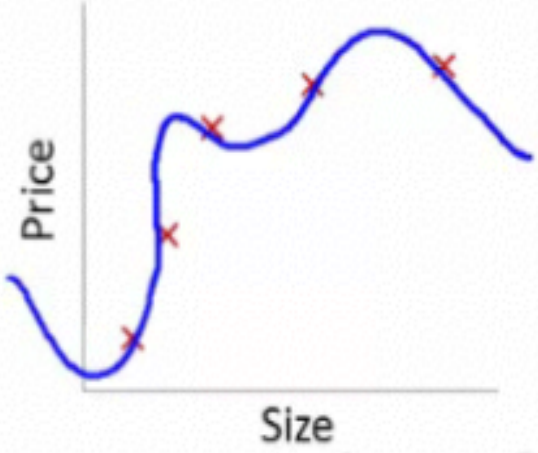

$$\theta_0 + \theta_1 x$$

High bias
(underfit)




$$\theta_0 + \theta_1 x + \theta_2 x^2$$

"Just right"




$$\theta_0 + \theta_1 x + \theta_2 x^2 + \theta_3 x^3 + \theta_4 x^4$$

High variance
(overfit)

# OCCAM'S RAZOR

- ***Se os resultados forem semelhantes escolha a solução mais simples.***
- ***Em Data Science prefira sempre o modelo mais simples***

14th-century English logician William of Ockham

# EXEMPLO DE PROBLEMA – ÁREA (BIOLOGIA) – TIPO: REGRESSÃO

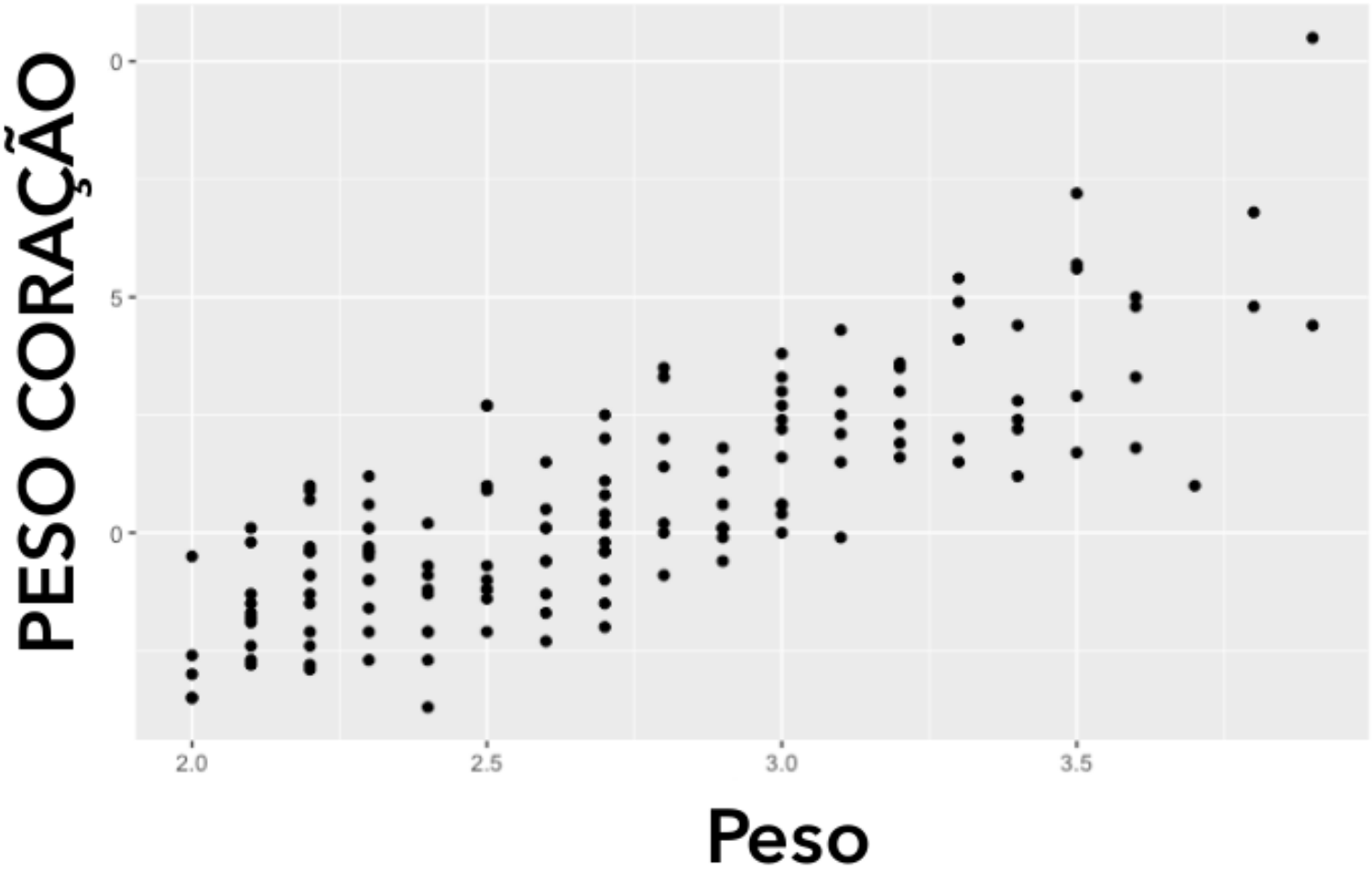
| ID | SEXO | CORAÇÃO | PESO |
|---|---|---|---|
| 1 | F | 2.0 | 7.0 |
| 2 | F | 2.0 | 7.4 |
| 3 | F | 2.0 | 9.5 |
| 4 | F | 2.1 | 7.2 |
| 5 | F | 2.1 | 7.3 |
| 6 | F | 2.1 | 7.6 |
| 7 | F | 2.1 | 8.1 |
| 8 | F | 2.1 | 8.2 |

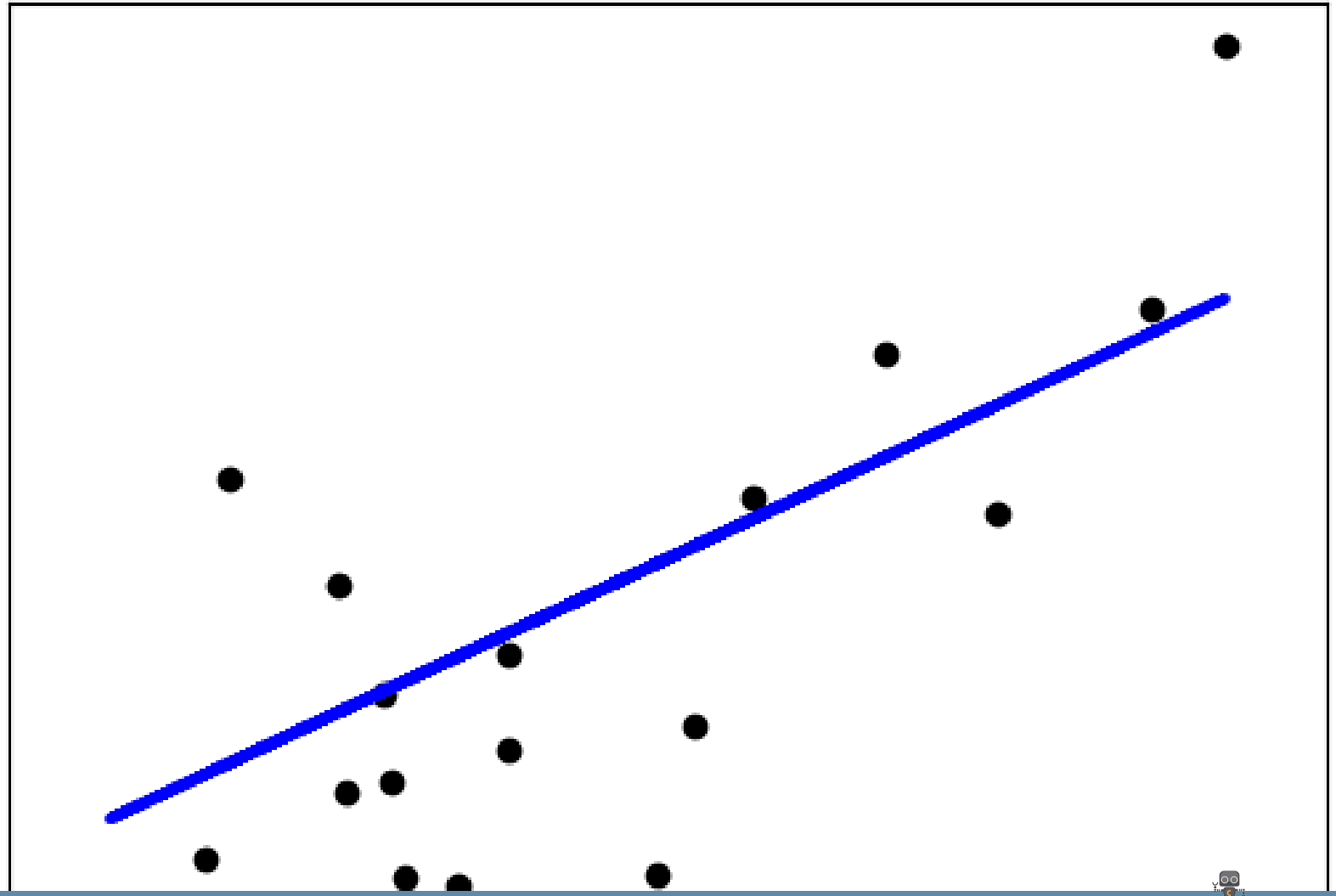
*library("MASS")*

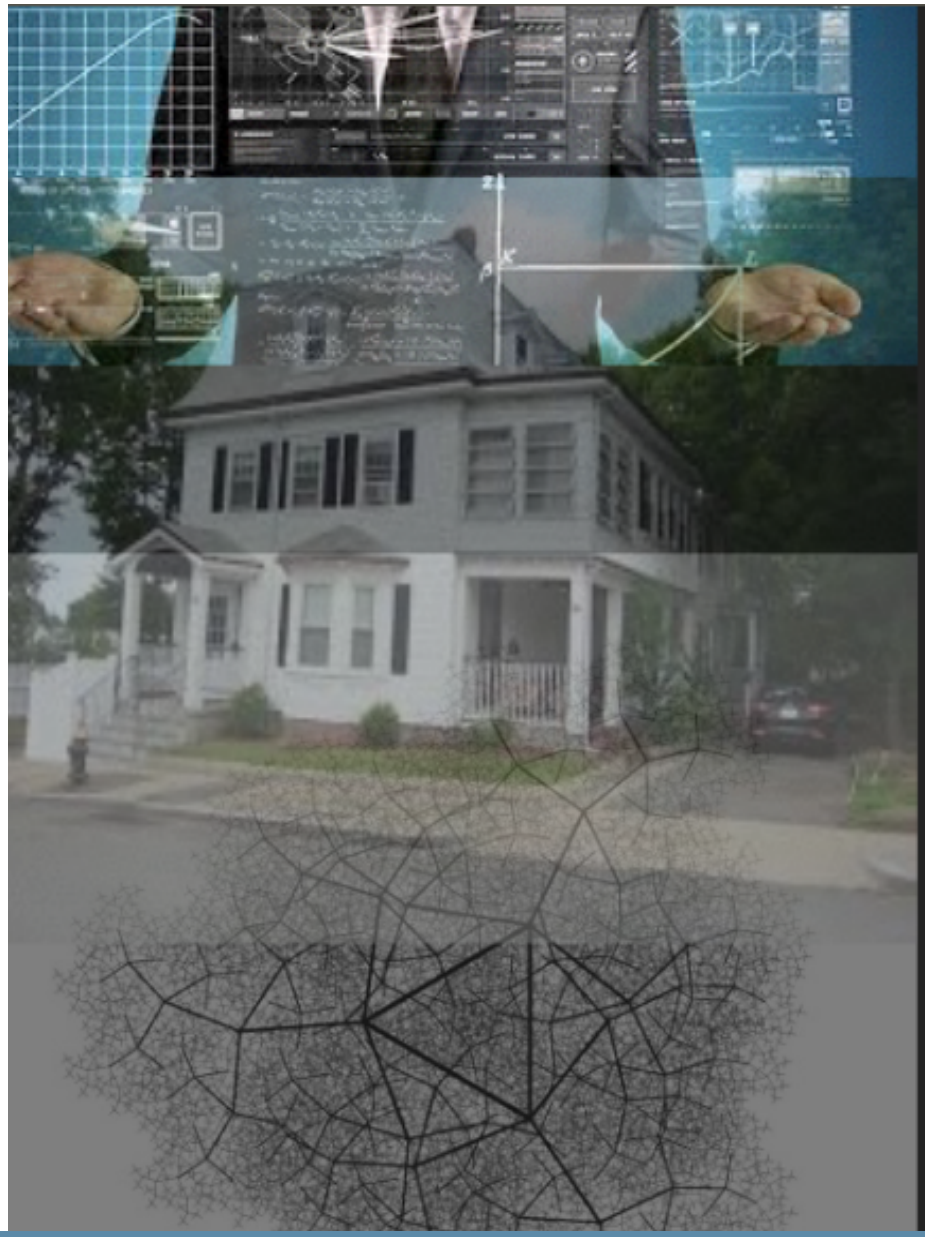
*data(cats)*

R is a free software environment for statistical computing and graphics. It compiles and runs on a wide variety of UNIX platforms, Windows and MacOS. To download R, please choose your preferred CRAN mirror.

# EXEMPLO DE PROBLEMA – ÁREA (BIOLOGIA) – TIPO: REGRES







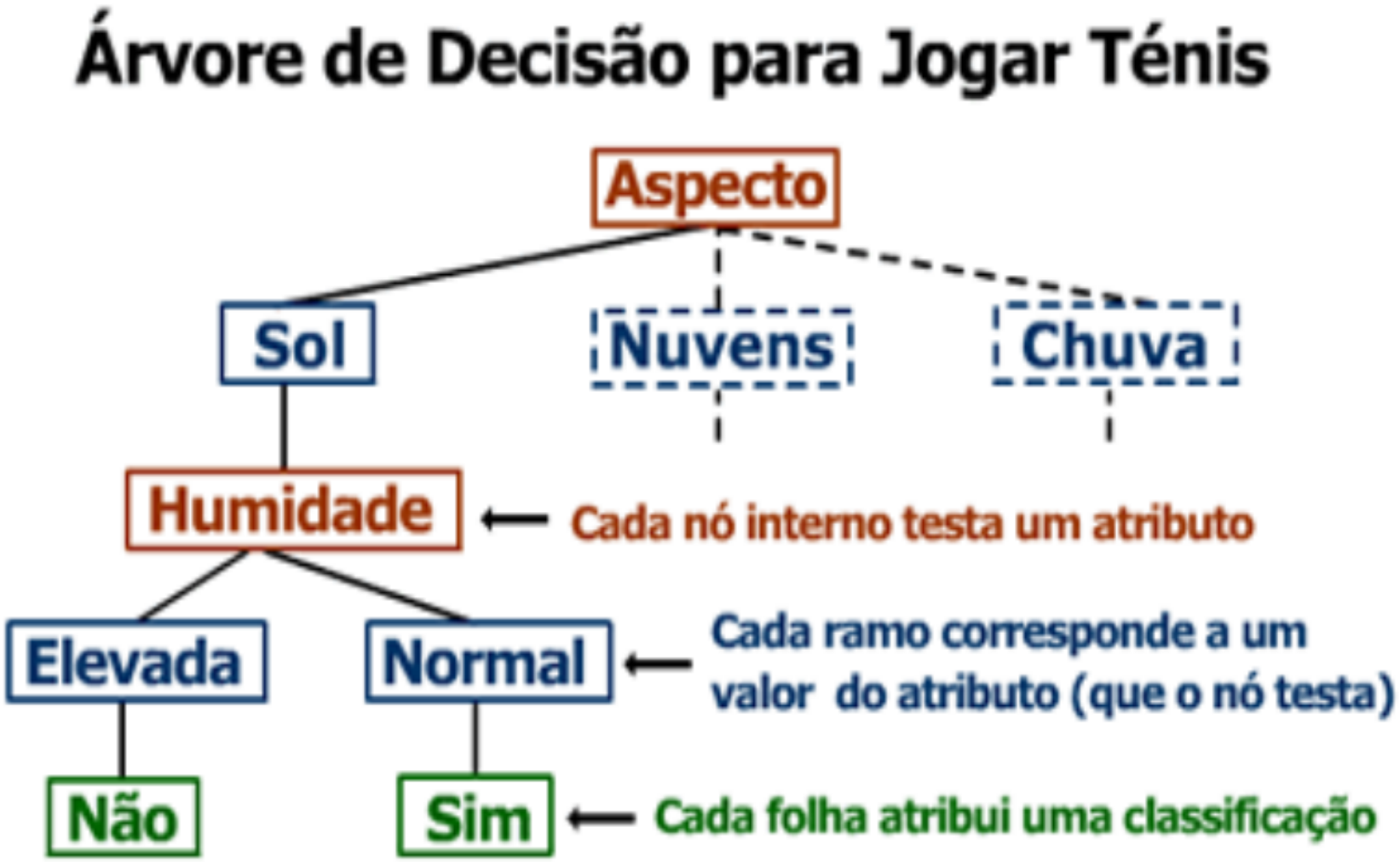
# EXEMPLO PREDIZER PREÇOS DE CASAS EM BOSTON

# EXEMPLO DE PROBLEMA – PREÇO DE IMÓVEIS EM BOSTON

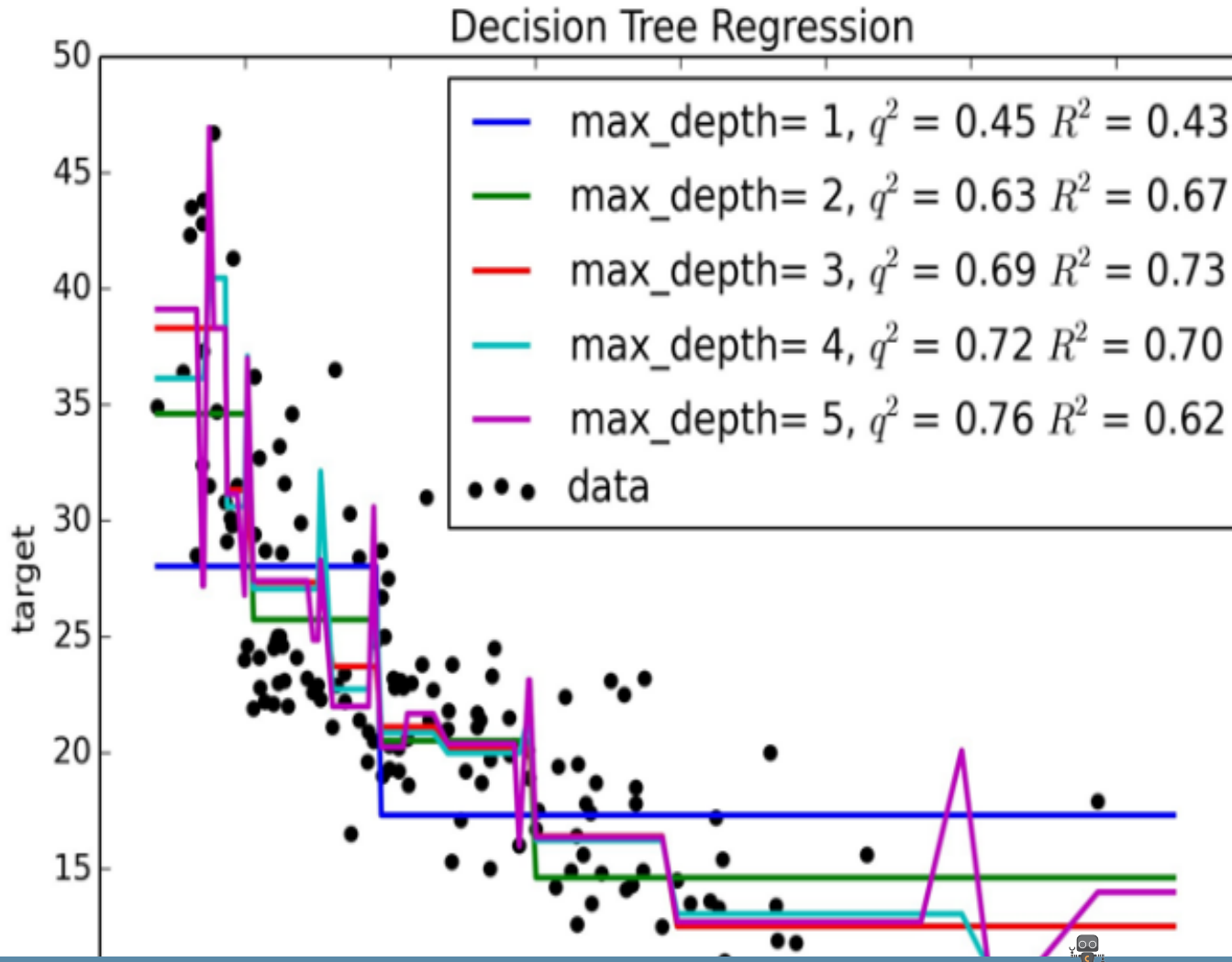
- `RM'` -Média do número de quartos
- `'LSTAT'` percentual de proprietários considerados "lower class" (working poor).
- `'PTRATIO'` razão do número de estudantes por professor no bairro

| RM | LMRATIO | PTRATIO | PREÇO |
|---|---|---|---|
| 6.575 | 4.98 | 15.3 | 504000 |
| 6.421 | 9.14 | 17.8 | 453600 |
| 7.185 | 4.03 | 17.8 | 728700 |
| 6.998 | 2.94 | 18.7 | 701400 |
| 7.147 | 5.33 | 18.7 | 760200 |
| 6.43 | 5.21 | 18.7 | 602700 |
| 6.012 | 12.43 | 15.2 | 480900 |
| 6.172 | 19.15 | 15.2 | 569100 |
| 5.631 | 29.93 | 15.2 | 346500 |
| 6.004 | 17.1 | 15.2 | 396900 |
| 6.377 | 20.45 | 15.2 | 315000 |
| 6.009 | 13.27 | 15.2 | 396900 |
| 5.889 | 15.71 | 15.2 | 455700 |
| 5.949 | 8.26 | 21 | 428400 |
| 6.096 | 10.26 | 21 | 382200 |

# ARVORES DE DECISÃO



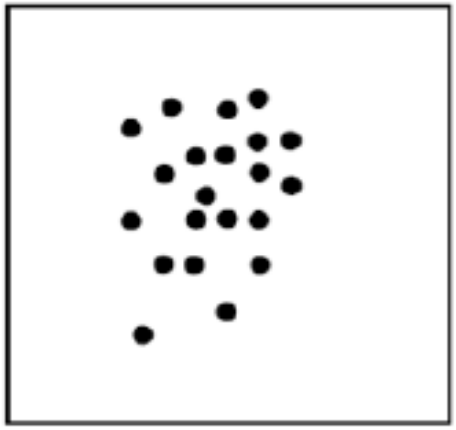
# PREÇOS DAS CASAS EM BOSTON



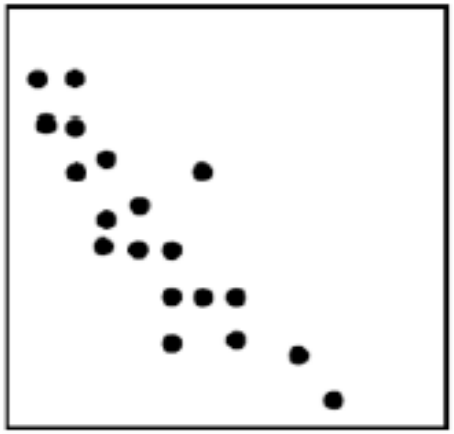
# CORRELAÇÃO DOS DADOS

Strong positive correlation

Moderate positive correlation



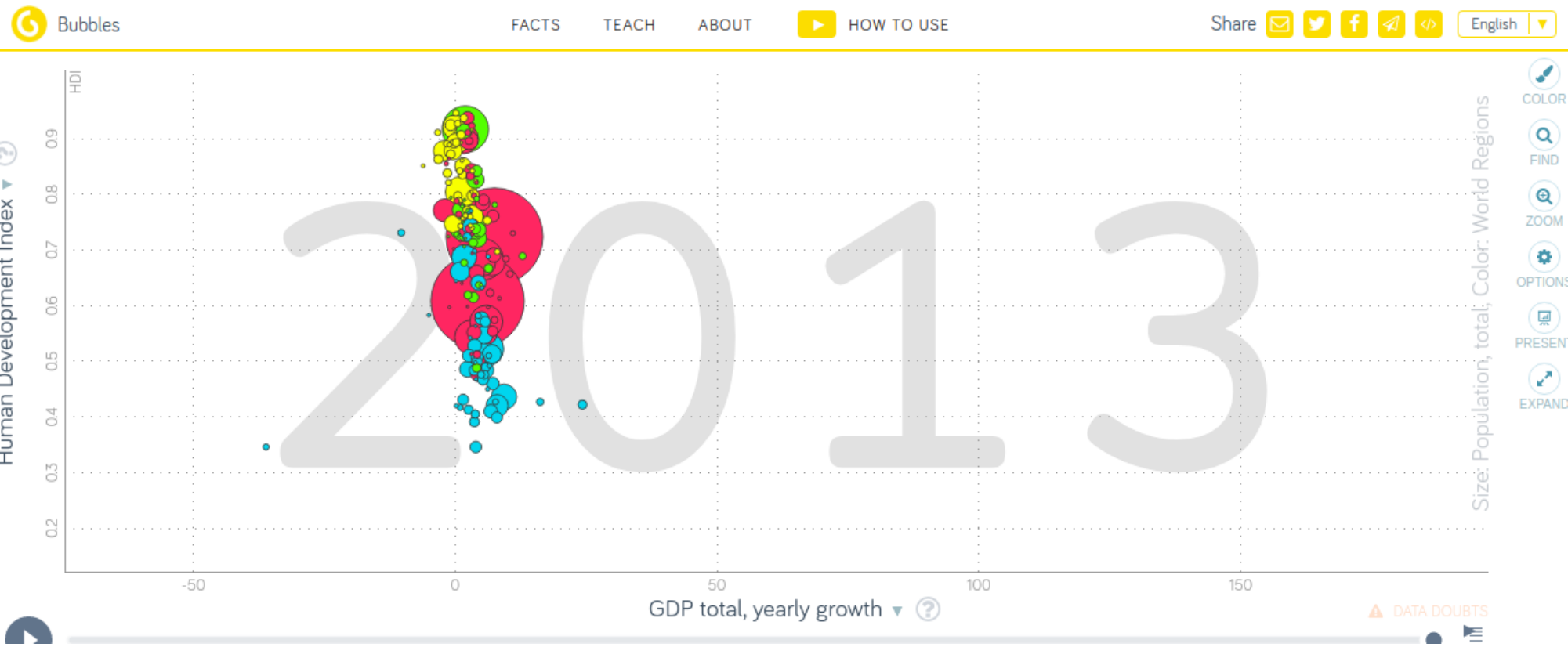
No correlation

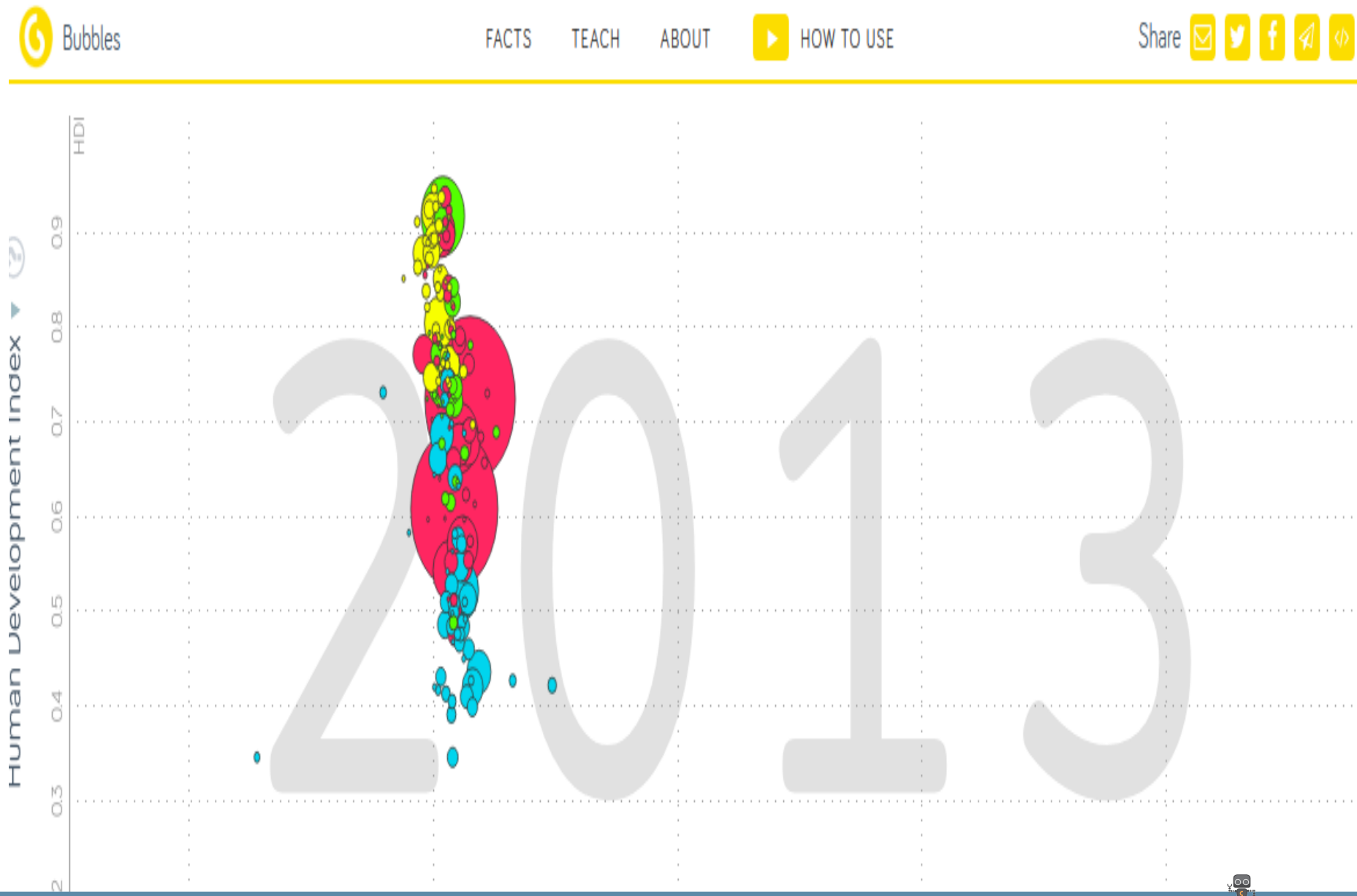


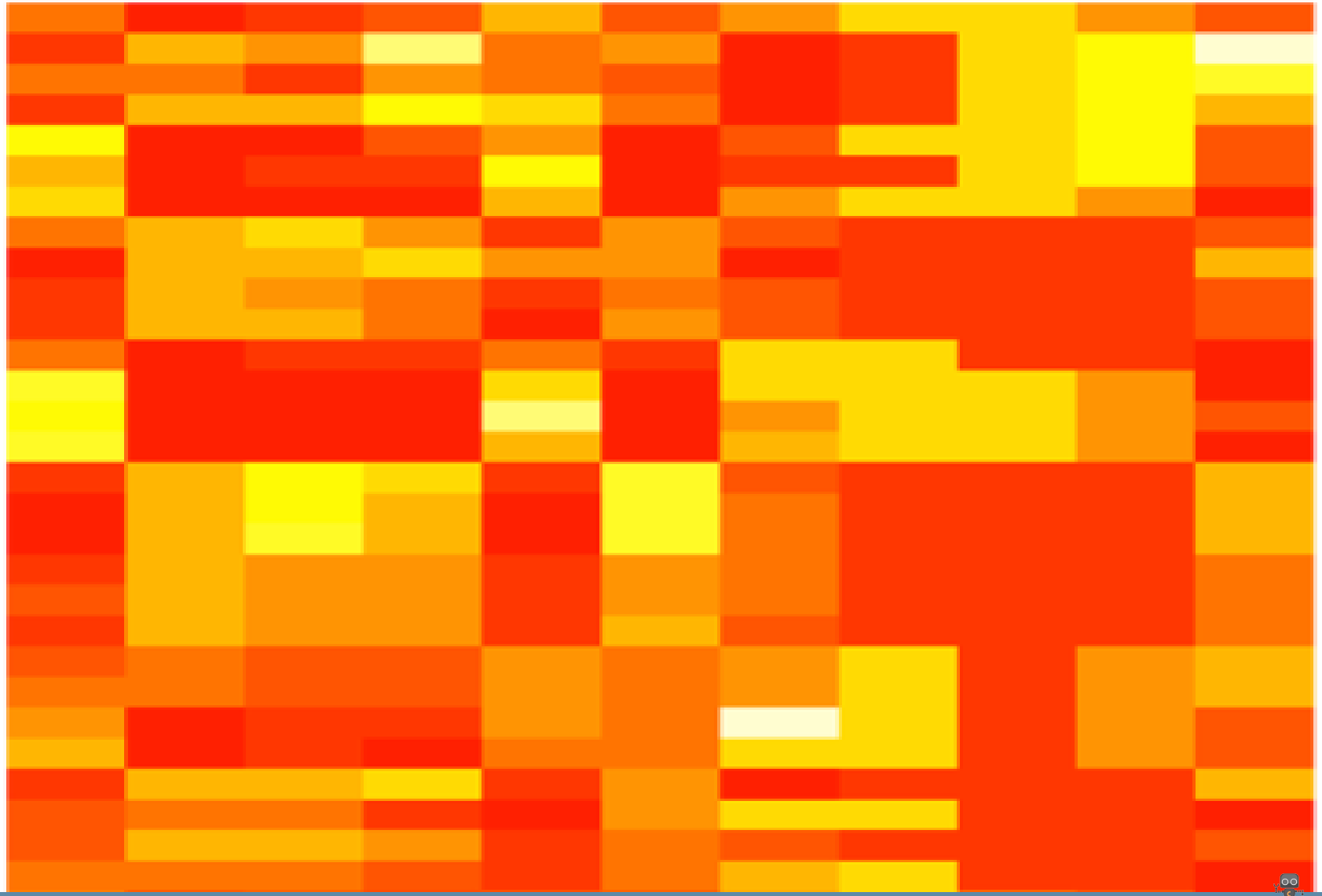
Moderate negative correlation

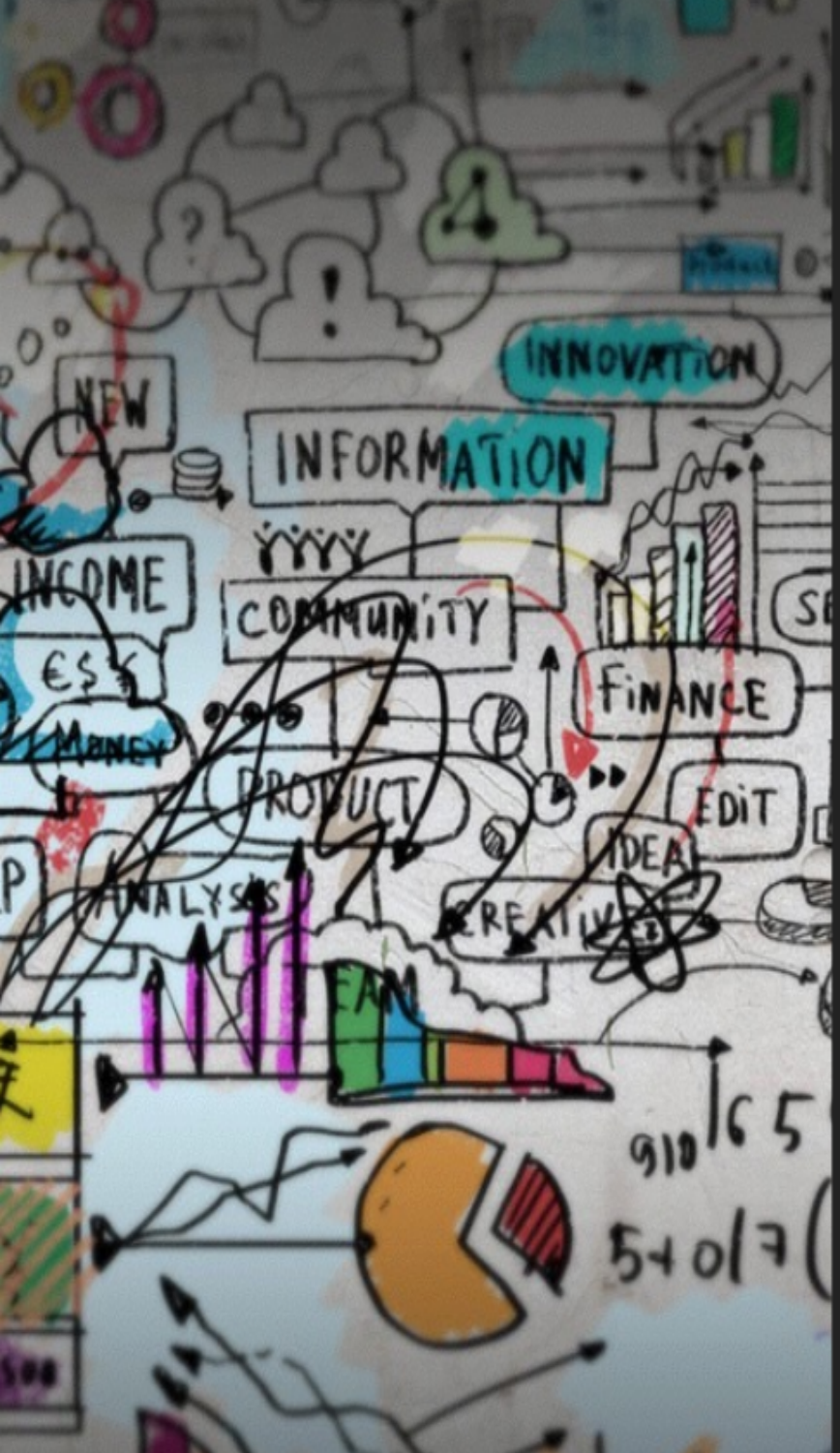
Strong negative correlation

Curvilinear relationship


Bubbles
FACTS
TEACH
ABOUT
HOW TO USE
Share
English
HDI
Human Development Index
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
2013
-50
0
50
100
150
GDP total, yearly growth
Size: Population, total; Color: World Regions
COLOR
FIND
ZOOM
OPTIONS
PRESENT
EXPAND
DATA DOUBTS

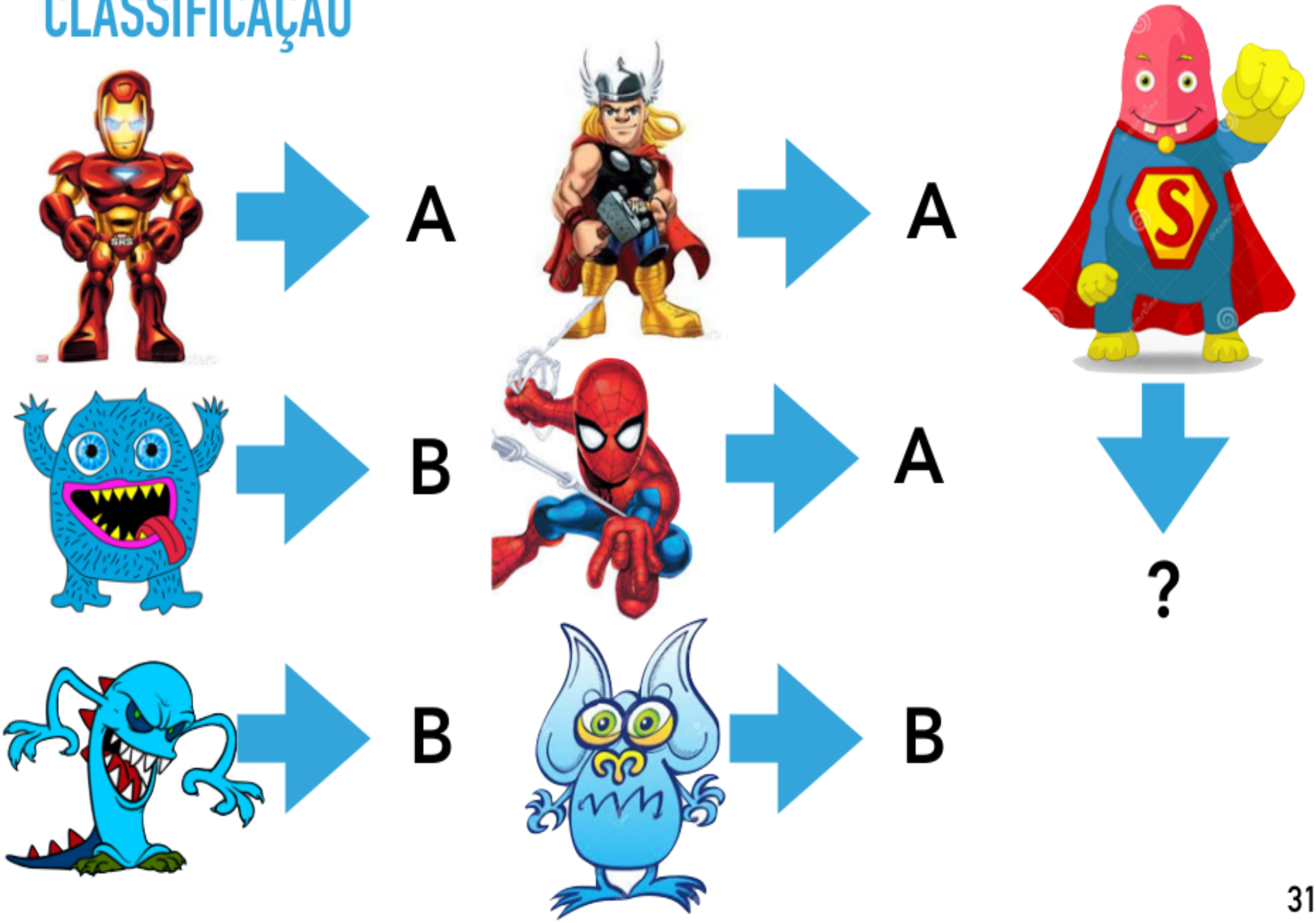

Bubbles
FACTS
TEACH
ABOUT
HOW TO USE
Share
Human Development Index
HDI
0.9
0.8
0.7
0.6
0.5
0.4
0.3
2013


Volvo 1
Masera
Ferrari
Ford P
Lotus E
Porsch
Fiat X1
Pontiac
Caman
AMC J
Dodge
Toyota
Toyota
Honda
Fiat 12
Chrysle
Lincoln
Cadilla
Merc 4
Merc 4
Merc 4
Merc 2
Merc 2
Merc 2
Merc 2
Duster
Valiant
Hornet
Hornet

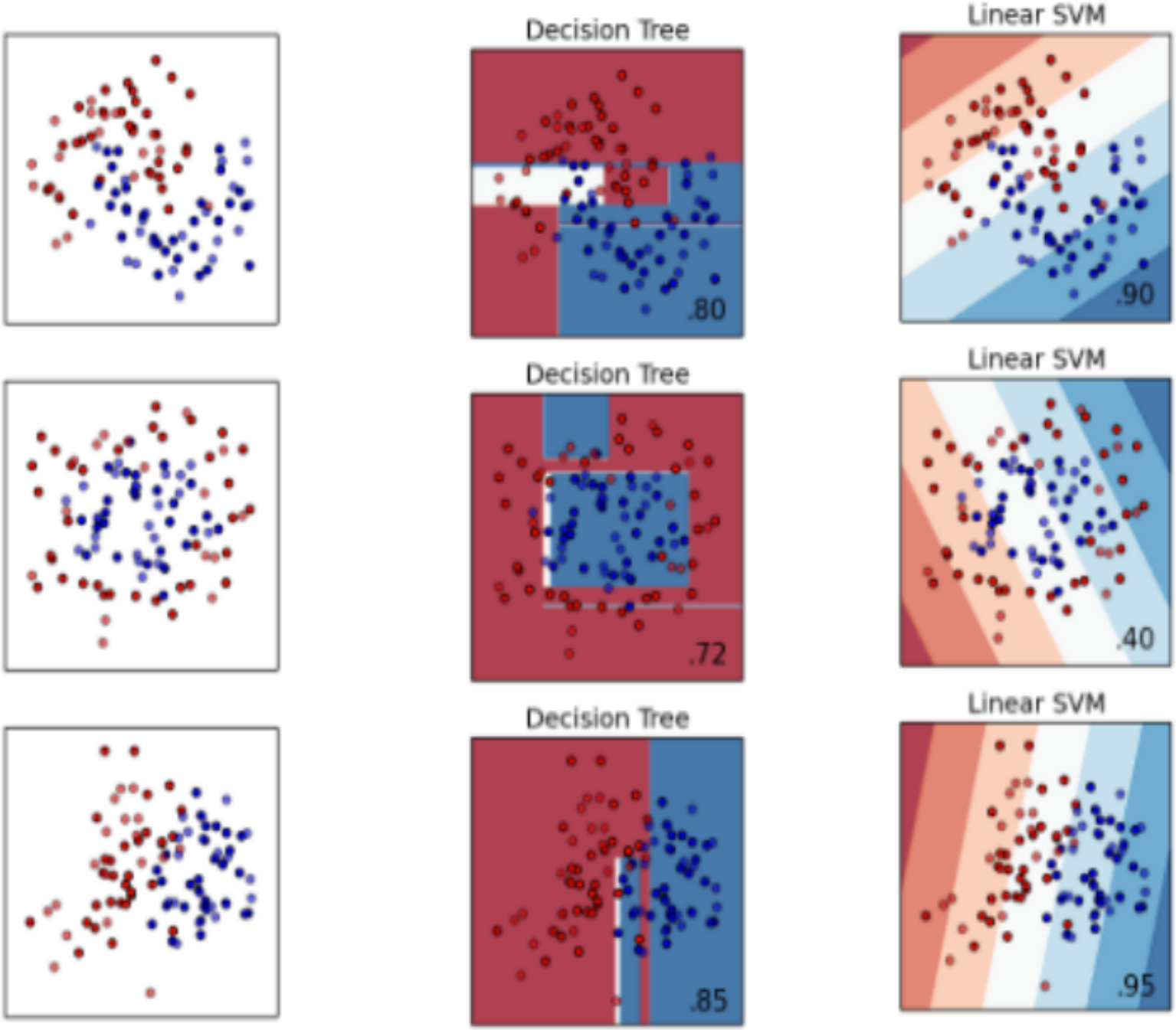



# O QUE É CLASSIFICAÇÃO ?

# CLASSIFICAÇÃO



# CLASSIFICADORES



# QUAL A TAG A APLICAR?

?

?

# QUAL A TAG A APLICAR?

A

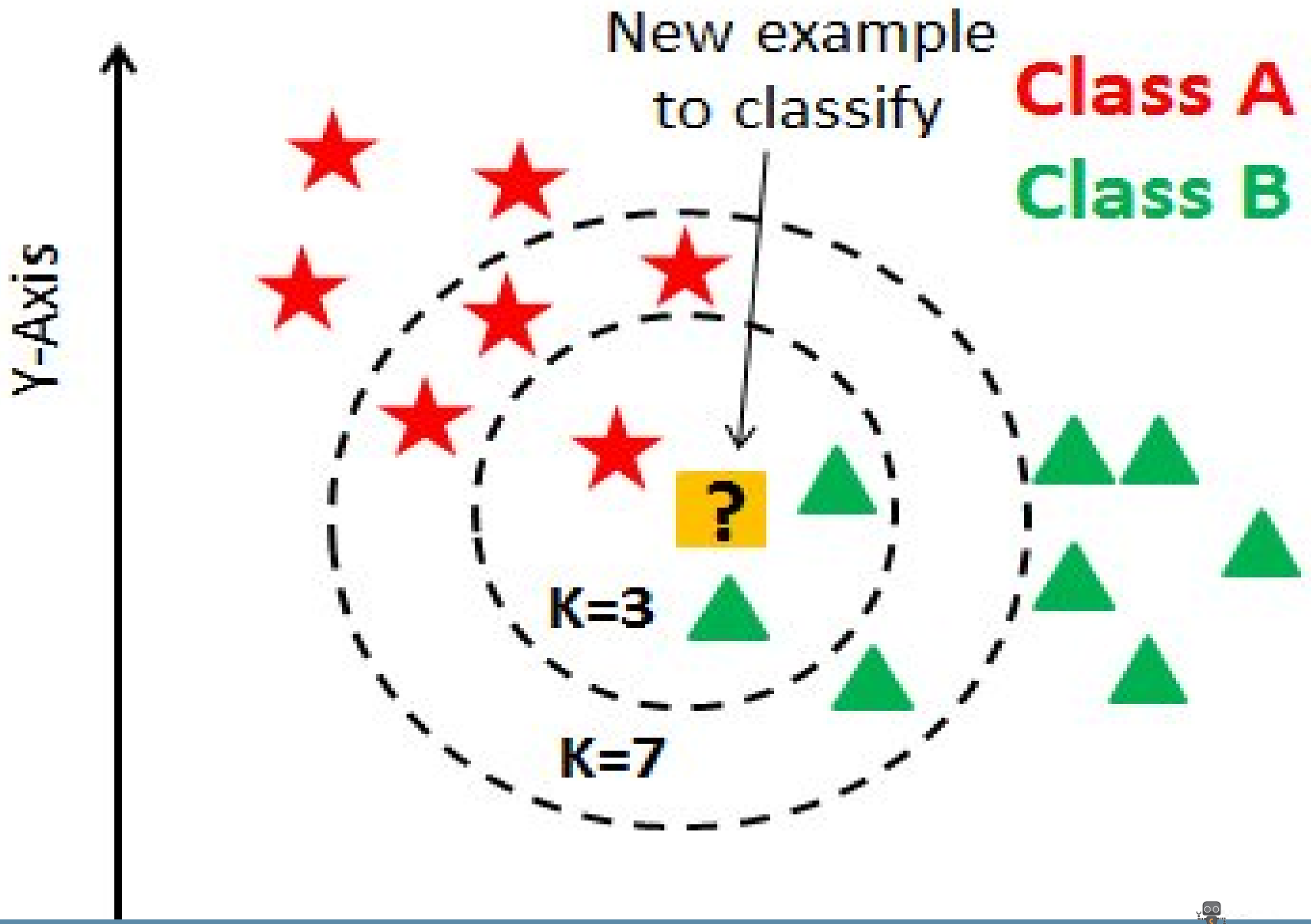
B

A

?

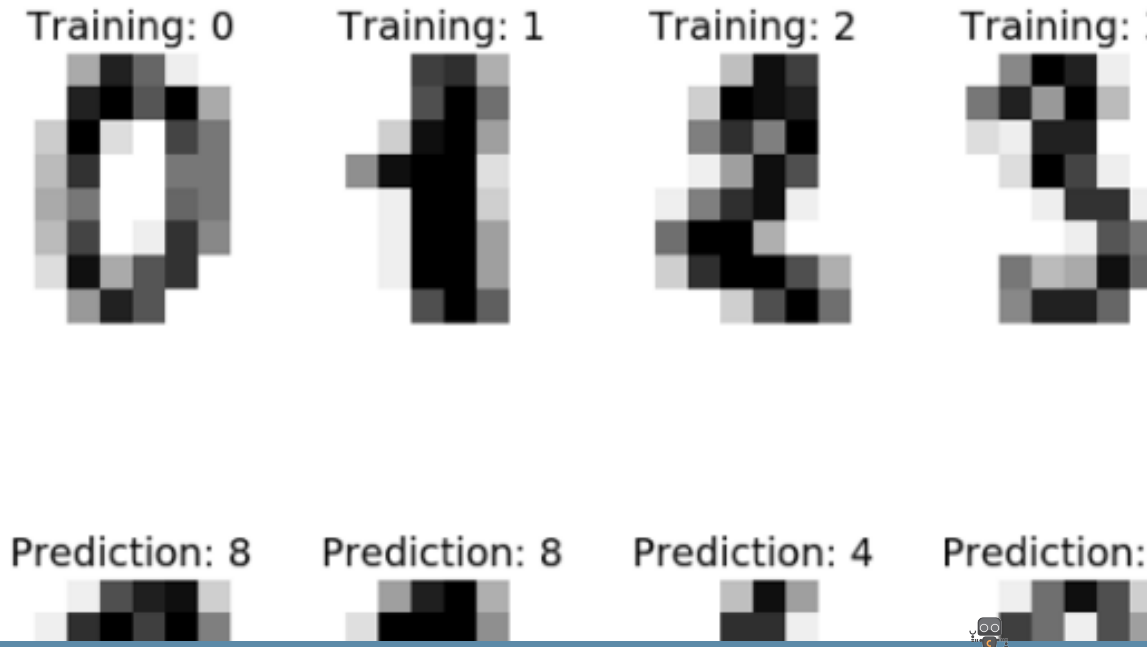
B

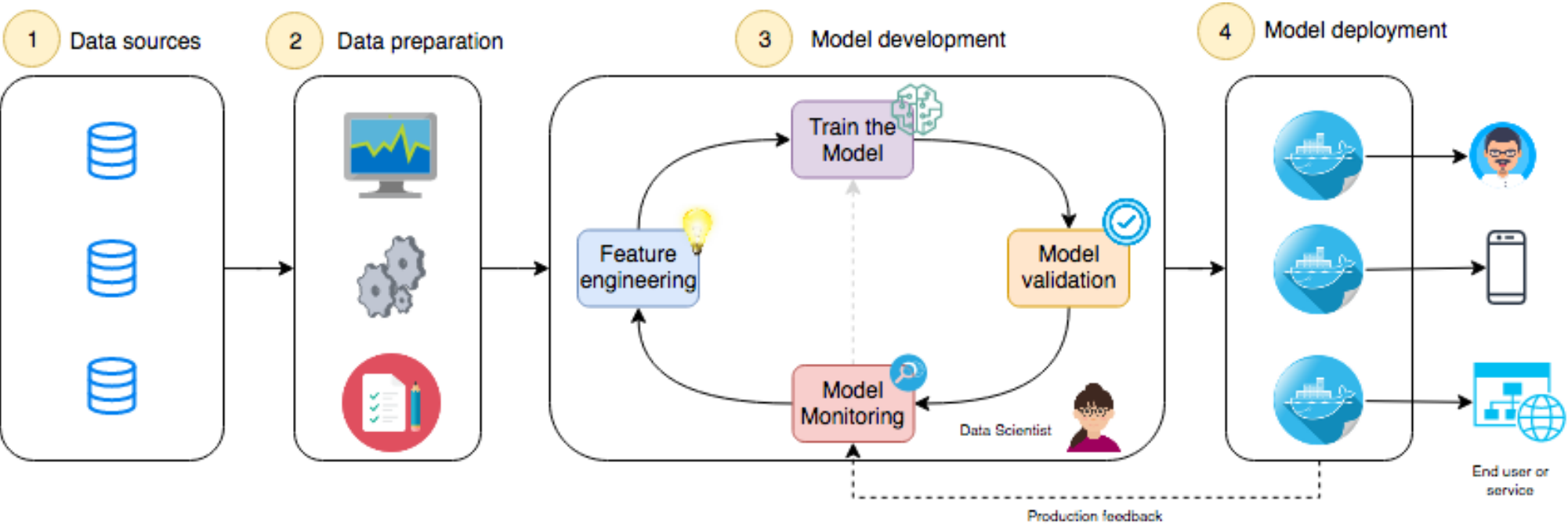
C

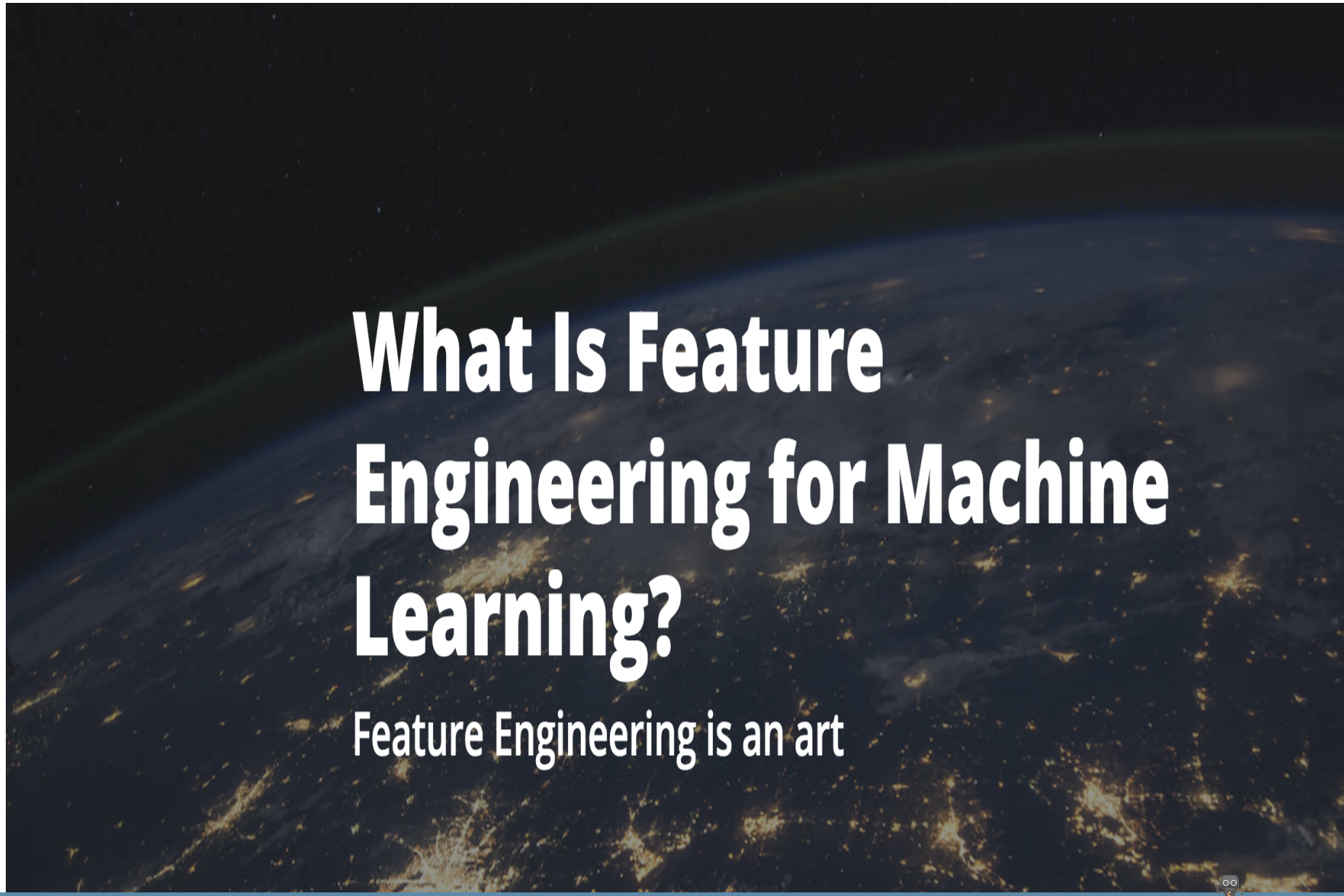

New example
to classify
Class A
Class B
Y-Axis
?
K=3
K=7

# CLASSIFICAÇÃO NO SKLEARN

```
# Create a classifier: a support vector classifier
classifier = svm.SVC(gamma=0.001)

# We learn the digits on the first half of the digits
classifier.fit(data[:n_samples / 2], digits.target[:n_sample
2])
```




1
Data sources
2
Data preparation
3
Model development
4
Model deployment
Train the Model
Feature engineering
Model validation
Model Monitoring
Data Scientist
End user or service
Production feedback


What Is Feature Engineering for Machine Learning?
Feature Engineering is an art

# EXEMPLO INTERVENÇÃO DE ESTUDANTES

# INTERVENÇÃO DE ESTUDANTES

```
Feature values:
  school sex  age address famsize Pstatus  Medu  Fedu     Mjob      Fjob  \
0     GP   F   18       U     GT3       A     4     4  at_home   teacher
1     GP   F   17       U     GT3       T     1     1  at_home     other
2     GP   F   15       U     LE3       T     1     1  at_home     other
3     GP   F   15       U     GT3       T     4     2   health  services
4     GP   F   16       U     GT3       T     3     3    other     other

    ...    higher internet  romantic  famrel  freetime goout Dalc Walc health  \
0   ...       yes       no        no       4         3     4    1    1      3
1   ...       yes      yes        no       5         3     3    1    1      3
2   ...       yes      yes        no       4         3     2    2    3      3
3   ...       yes      yes       yes       3         2     2    1    1      5
4   ...       yes       no        no       4         3     2    1    2      5

  absences
0        6
1        4
2       10
3        2
4        4
```

## PREPARANDO OS DADOS

```
# If data type is non-numeric, replace all yes/no values with 1/0
  if col_data.dtype == object:
      col_data = col_data.replace(['yes', 'no'], [1, 0])
```

## SEPARANDO DADOS DE TREINO E TESTE

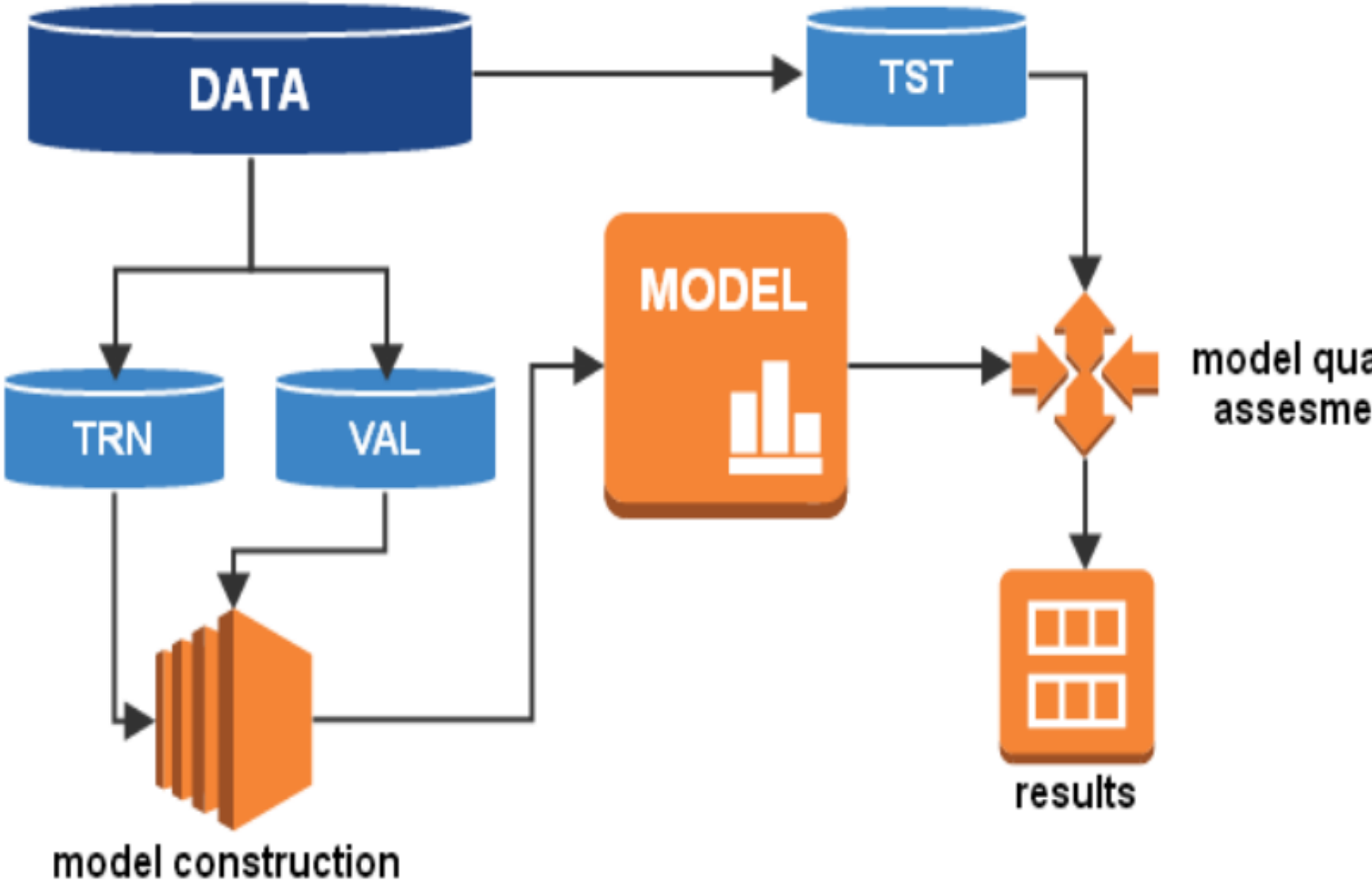
```
X_train, X_test, y_train, y_test = train_test_split(X_all, y_all,
stratify=y_all, train_size=train_size,test_size=0.24)
```

# DADOS DE TREINO VS DADOS DE TESTE

- ***Dados de Treino***
  - Usados para treinar um modelo
  - Exemplos

- ***Dados de Teste***
  - Usados para testar a performance do modelo
  - Dados de validação.

e.g. facial gender classification

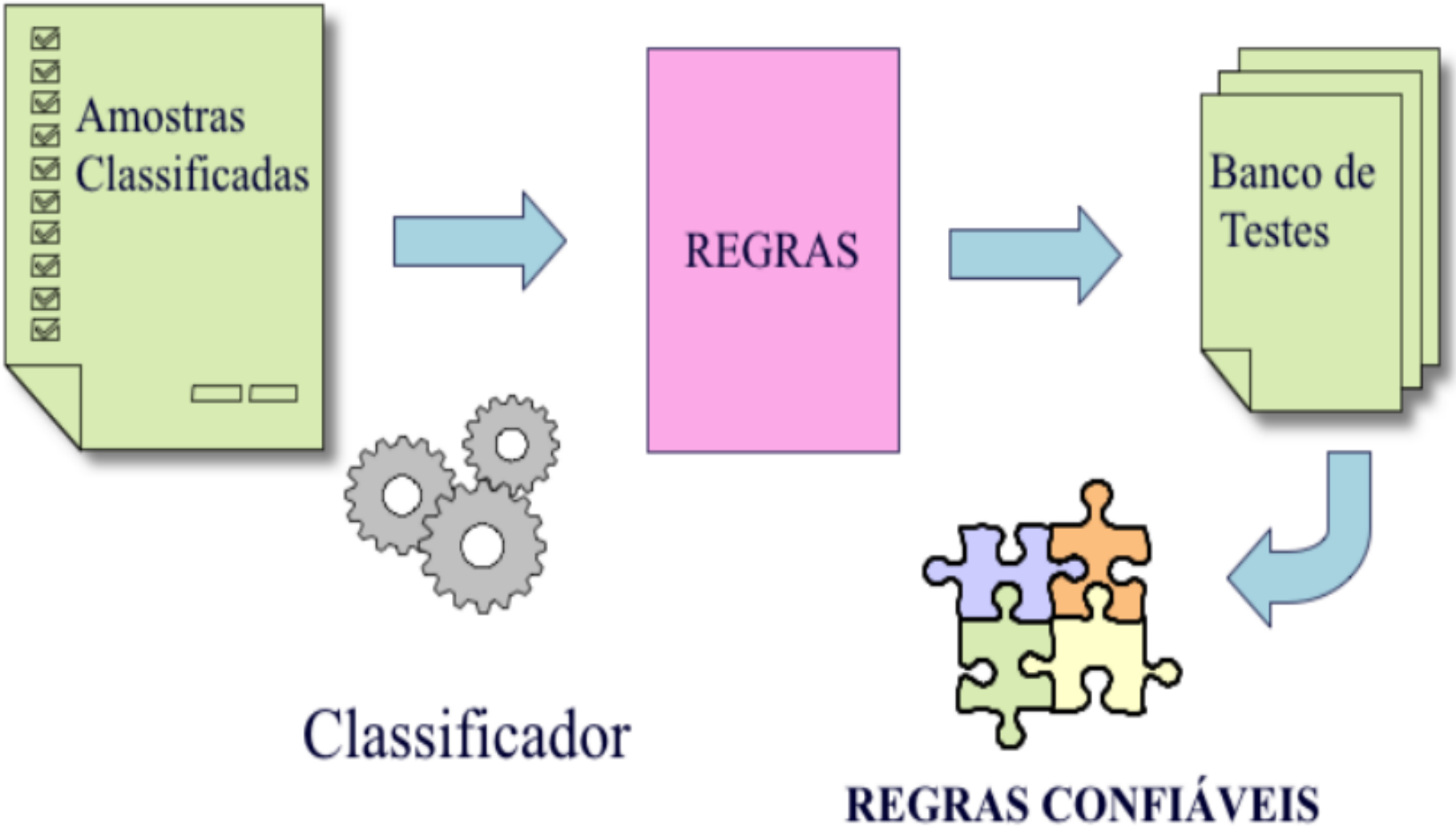

DATA
TST
TRN
VAL
MODEL
model qua
assesme
results
model construction

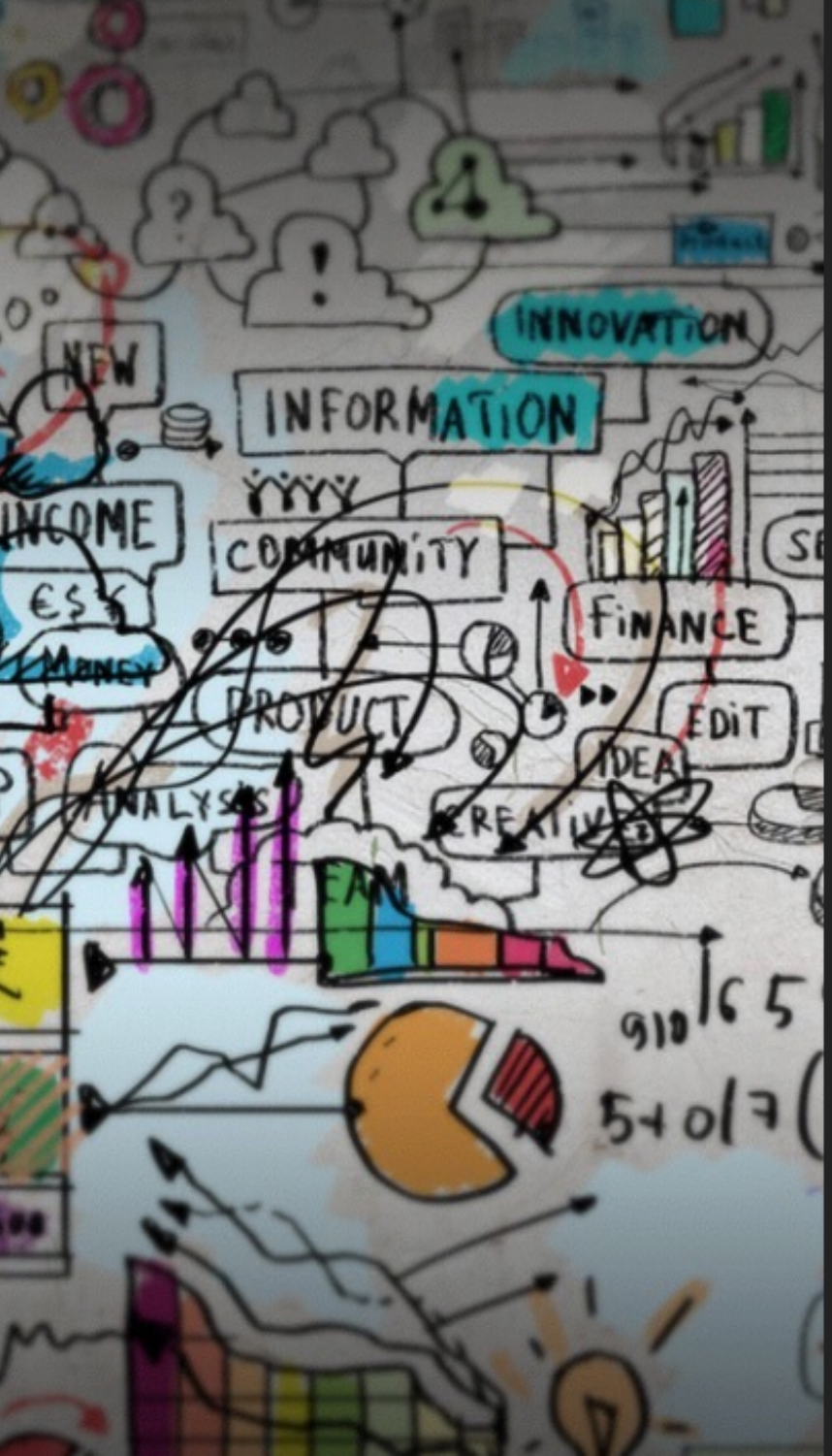
# Classificação

| Nome | Idade | Renda | Profissão | Classe |
|---|---|---|---|---|
| Daniel | $\leq 30$ | Média | Estudante | Sim |
| João | 31..50 | Média-Alta | Professor | Sim |
| Carlos | 31..50 | Média-Alta | Engenheiro | Sim |
| Maria | 31..50 | Baixa | Vendedora | Não |
| Paulo | $\leq 30$ | Baixa | Porteiro | Não |
| Otavio | $> 60$ | Média-Alta | Aposentado | Não |

**SE. Idade $\leq 30$ E Renda é Média ENTÃO Compra-Produto-Eletrônico = SIM.**

# Etapas do Processo

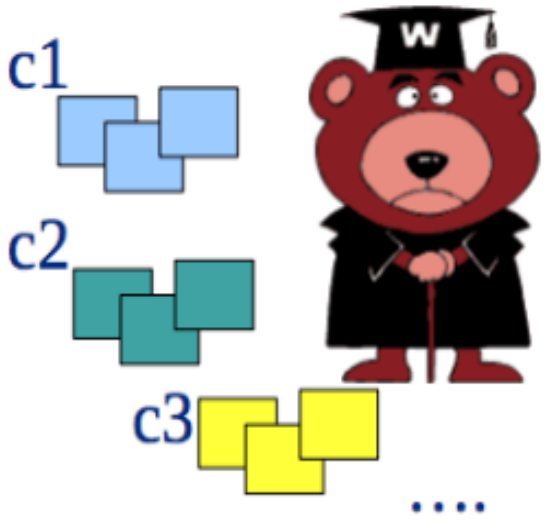




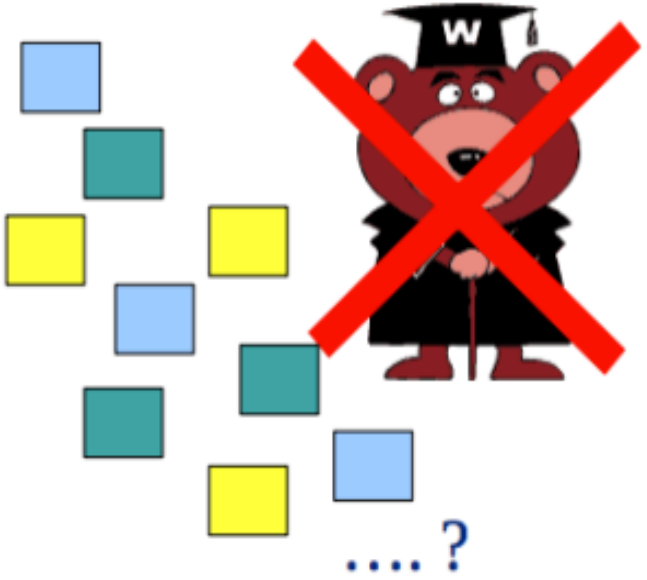

# APRENDIZADO SUPERVISIONADO VS NÃO SUPERVISIONADO

# APRENDIZADO SUPERVISIONADO VS NÃO SUPERVISIONADO

- ***Supervisionado***
  - Conhecimento das entradas e saídas de dados
  - Os dados possuem um label
  - O objetivo é predizer a classe ou o label do dado




- ***Não Supervisionado***
  - Sem conhecimento prévio dos dados
  - O objetivo é determinar padrões



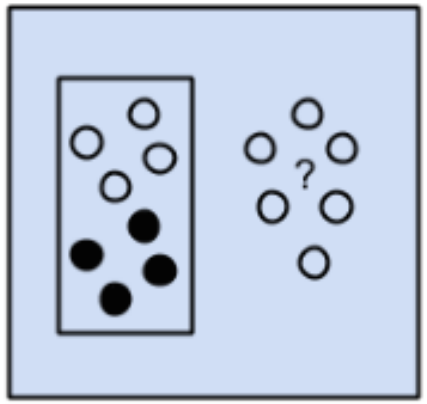
### 1. Supervised Learning

Input data is called training data and has a known label or result such as spam/not-spam or a stock price at a time.

A model is prepared through a training process in which it is required to make predictions and is corrected when those predictions are wrong. The training process continues until the model achieves a desired level of accuracy on the training data.

Example problems are classification and regression.

Example algorithms include: Logistic Regression and the Back Propagation Neural Network.




Supervised Learning Algorithms

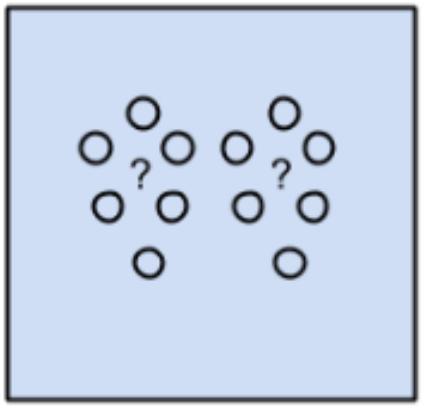
### 2. Unsupervised Learning

Input data is not labeled and does not have a known result.

A model is prepared by deducing structures present in the input data. This may be to extract general rules. It may be through a mathematical process to systematically reduce redundancy, or it may be to organize data by similarity.

Example problems are clustering, dimensionality reduction and association rule learning.

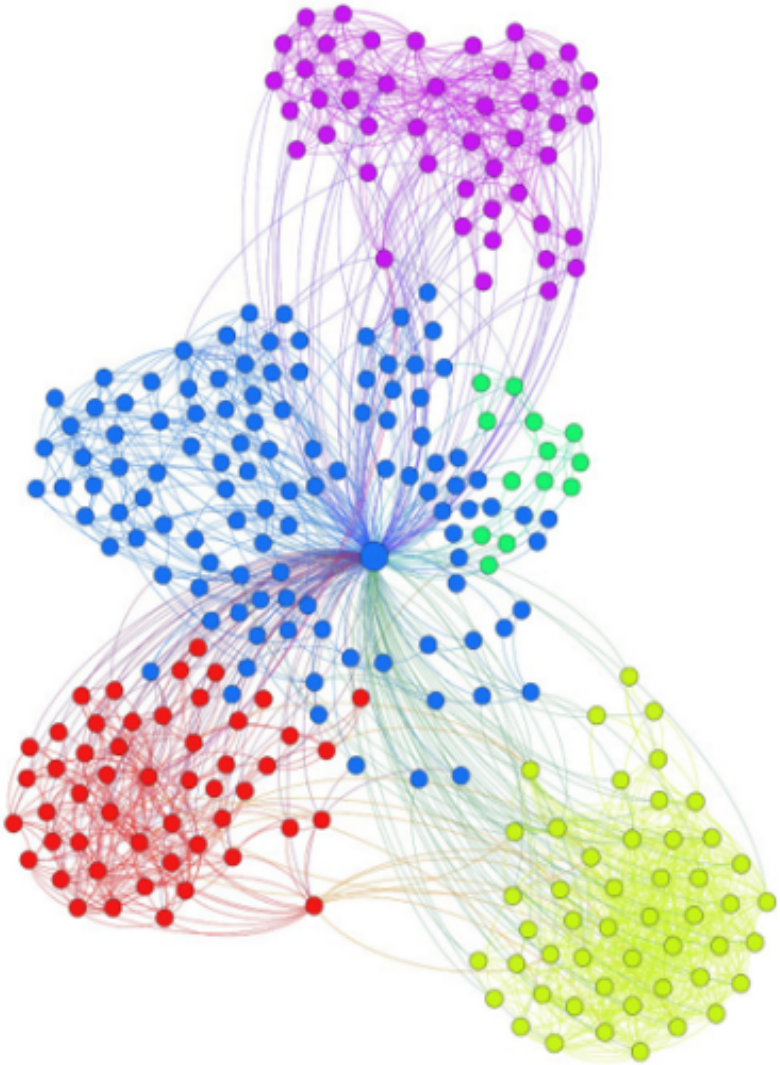
Example algorithms include: Apriori algorithm and K-Means.

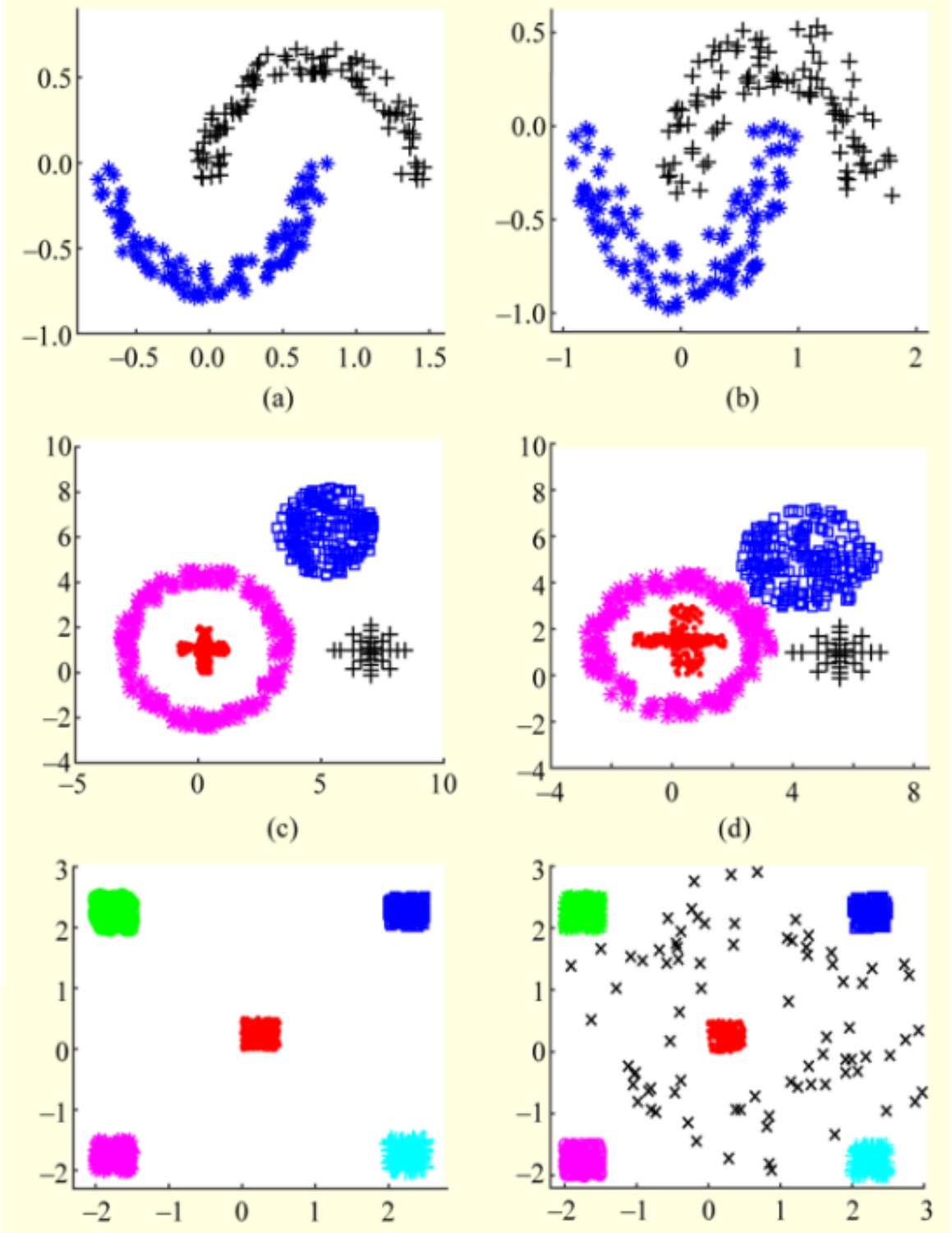



Unsupervised Learning Algorithms

https://machinelearningmastery.com/a-tour-of-machine-learning-algorithms/

# O QUE É AGRUPAMENTO ?



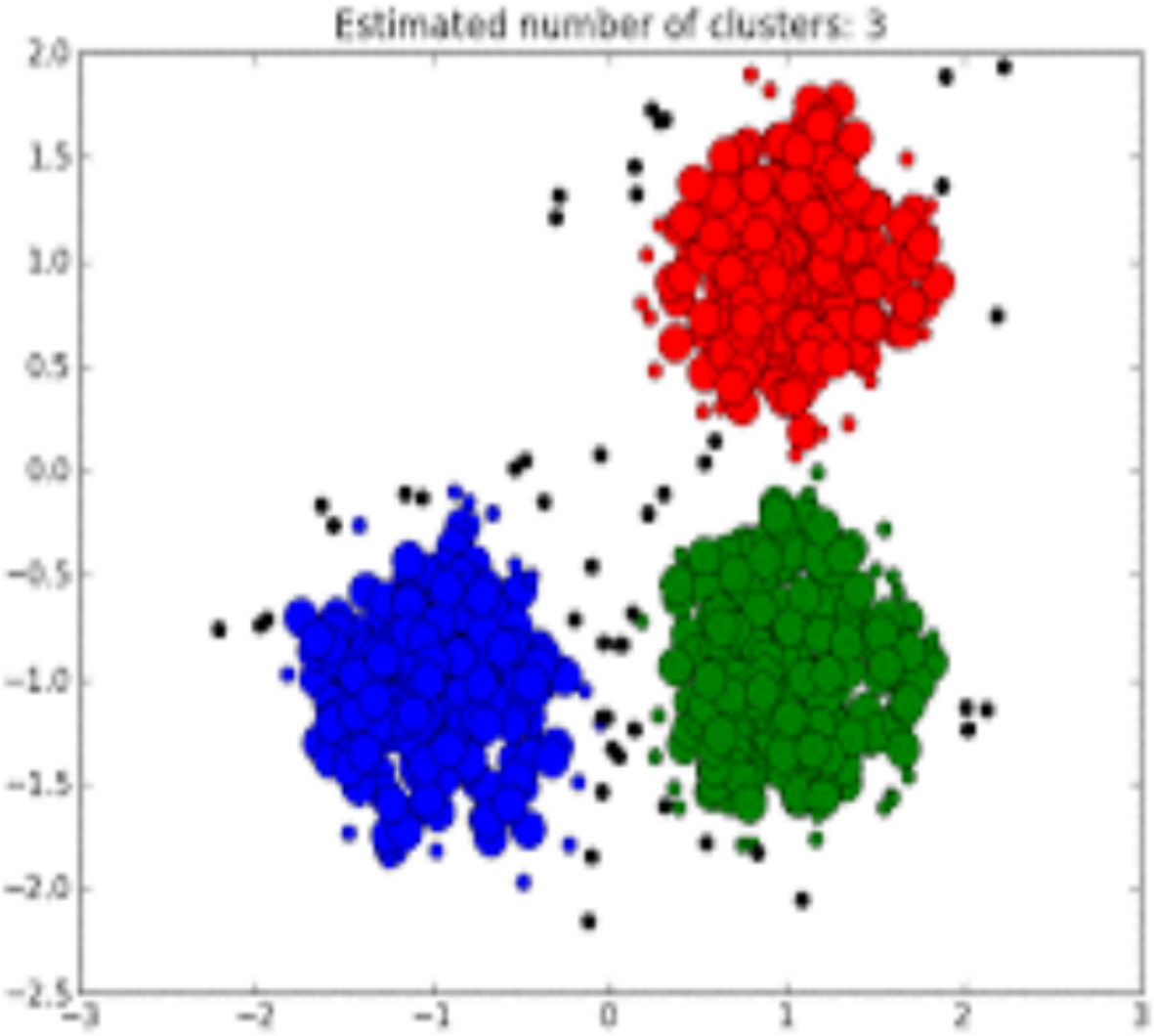

(a)
(b)
(c)
(d)

# AGGLOMERATIVE CLUSTERING

All observations start as their own cluster. Clusters meeting some criteria are merged. This process is repeated, growing clusters until some end point is reached.

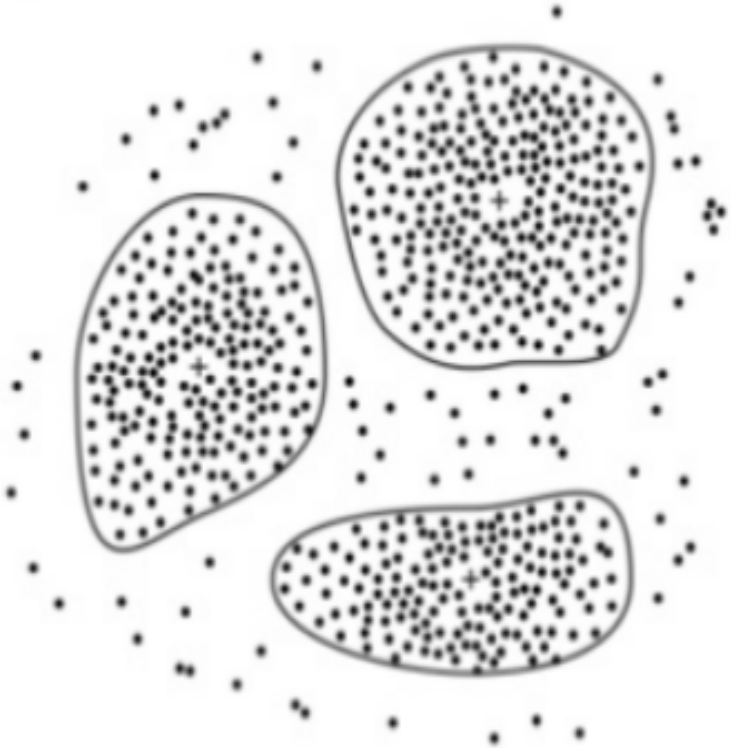
# AGRUPAMENTO

Processo de agrupar objetos com características semelhantes



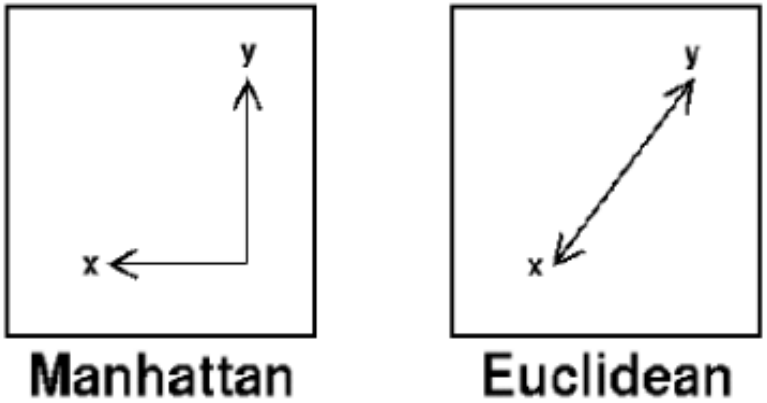
# Cluster

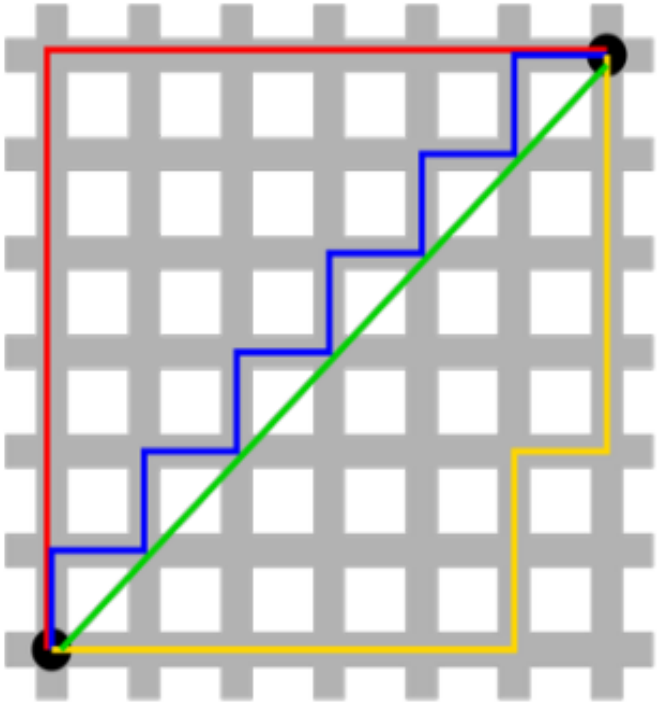
- Uma coleção de objetos que são similares entre si, e diferentes dos objetos pertencentes a outros clusters.



# COMO AGRUPAR?

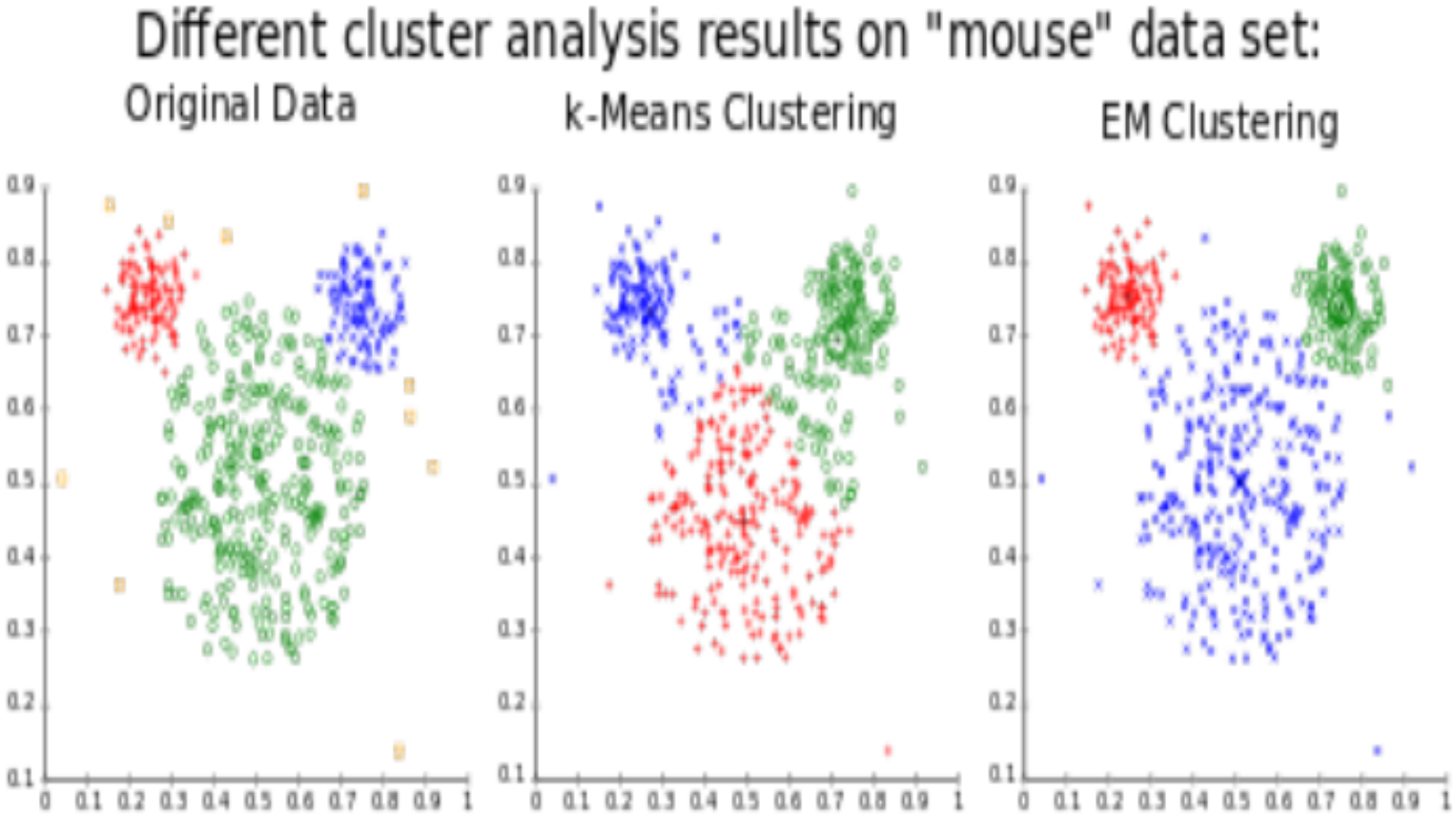
# DISTÂNCIA


y
x
y
x
Manhattan
Euclidean

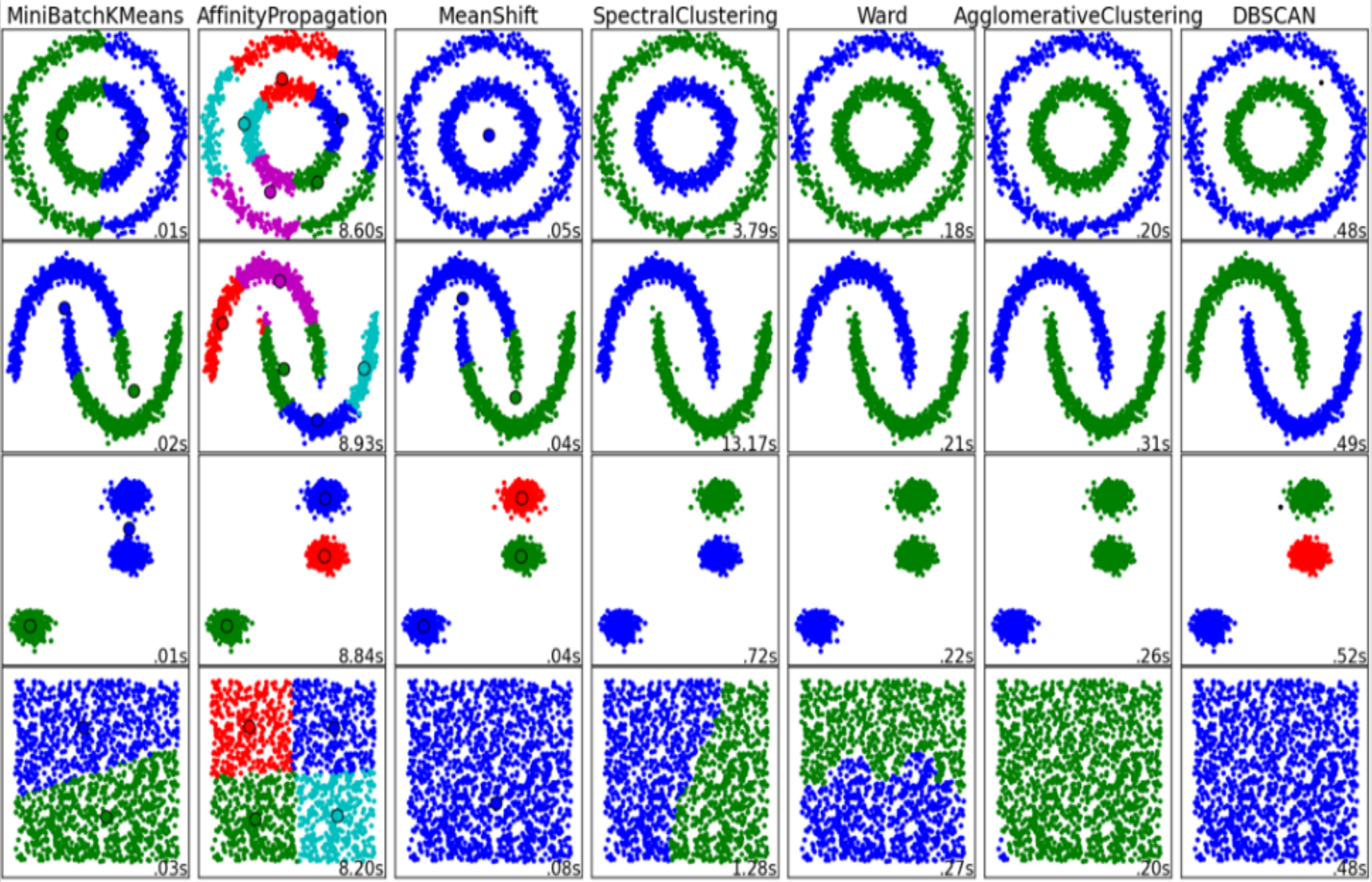


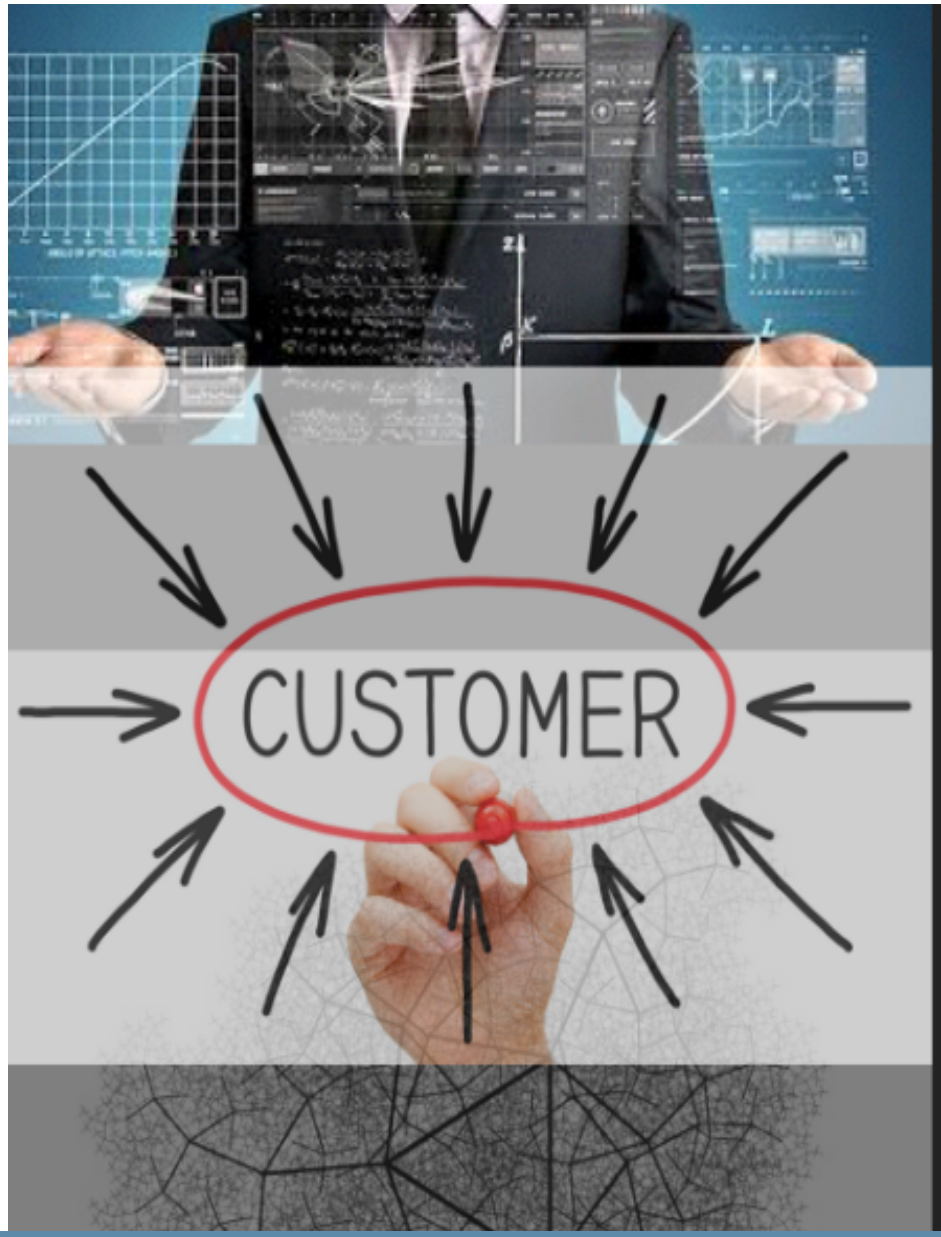
Clinton
Hell's Kitchen
21 Club
Midtown East
Korea Town
Murray Hill
Kips Bay
Flatiron

# MODELOS DE AGRUPAMENTO



# ALGORITMOS DE AGRUPAMENTO DO SKLEARN






# SEGMENTANDO FORNECEDORE

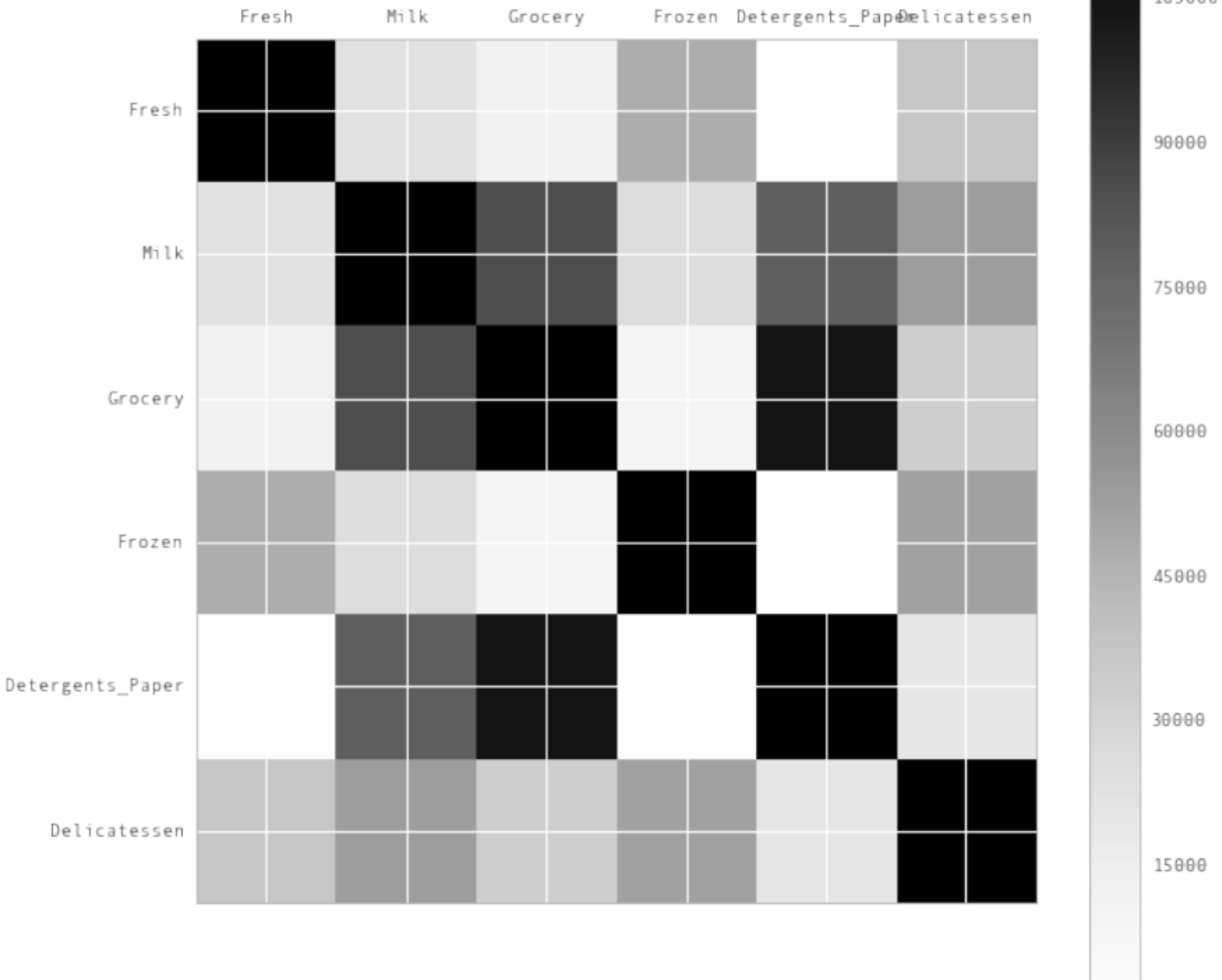
# BANCO DE DADOS DE PRODUTOS

| | Fresh | Milk | Grocery | Frozen | Detergents_Paper | Delicatessen |
|---|---|---|---|---|---|---|
| **count** | 440.000000 | 440.000000 | 440.000000 | 440.000000 | 440.000000 | 440.000000 |
| **mean** | 12000.297727 | 5796.265909 | 7951.277273 | 3071.931818 | 2881.493182 | 1524.870455 |
| **std** | 12647.328865 | 7380.377175 | 9503.162829 | 4854.673333 | 4767.854448 | 2820.105937 |
| **min** | 3.000000 | 55.000000 | 3.000000 | 25.000000 | 3.000000 | 3.000000 |
| **25%** | 3127.750000 | 1533.000000 | 2153.000000 | 742.250000 | 256.750000 | 408.250000 |
| **50%** | 8504.000000 | 3627.000000 | 4755.500000 | 1526.000000 | 816.500000 | 965.500000 |
| **75%** | 16933.750000 | 7190.250000 | 10655.750000 | 3554.250000 | 3922.000000 | 1820.250000 |
| **max** | 112151.000000 | 73498.000000 | 92780.000000 | 60869.000000 | 40827.000000 | 47943.000000 |

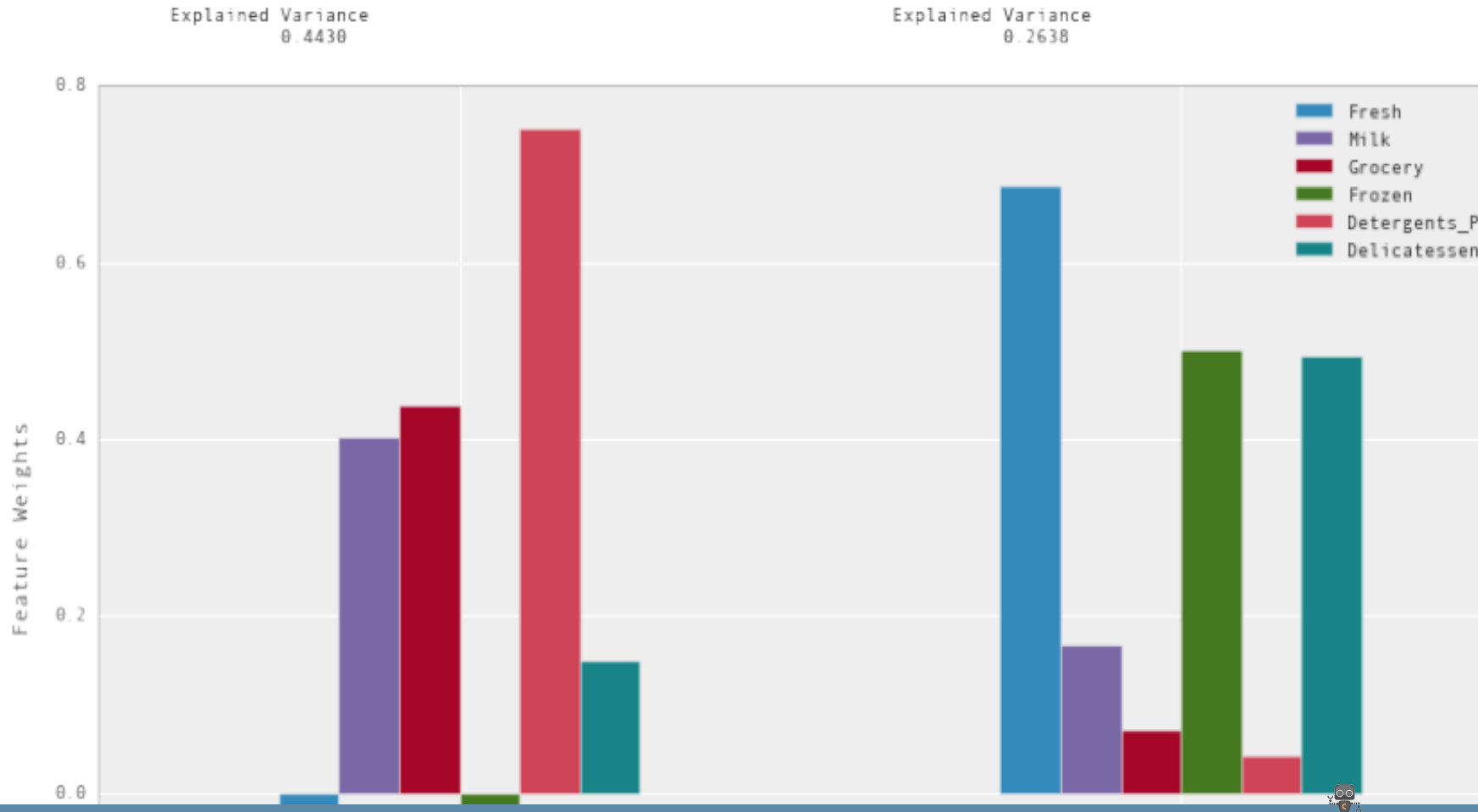
# VERIFICANDO CORRELACIONAMENTO

```
for product in products:

    y_array=data[product]
    new_data = data.drop([product],axis=1)


    X_train, X_test, y_train, y_test = train_test_split( new_data, y_array, test_size=0.25, random_state=

    for reg in regressors:
        reg.fit(X_train,y_train)
        score = reg.score(X_test, y_test)
        print('Product '+product+' Score is '+ str(score))
        parameters=regressors_parameters.get(reg)
        clf = GridSearchCV(reg, parameters)
        clf.fit(X_train,y_train)
        score = clf.score(X_test, y_test)
        print('Product '+product+' Score is '+ str(score)+' after GridSearchCV ')
```

```
Product Fresh Score is -0.333070533605
Product Fresh Score is -0.329449950604 after GridSearchCV
Product Milk Score is 0.173438009379
Product Milk Score is 0.205871721893 after GridSearchCV
Product Grocery Score is 0.699248196675
Product Grocery Score is 0.699248196675 after GridSearchCV
Product Detergents_Paper Score is 0.348777454691
Product Detergents_Paper Score is 0.348777454691 after GridSearchCV
Product Frozen Score is -0.278249148824
Product Frozen Score is -1.30732144534 after GridSearchCV
Product Delicatessen Score is -11.0236279005
Product Delicatessen Score is -9.55743305081 after GridSearchCV
```

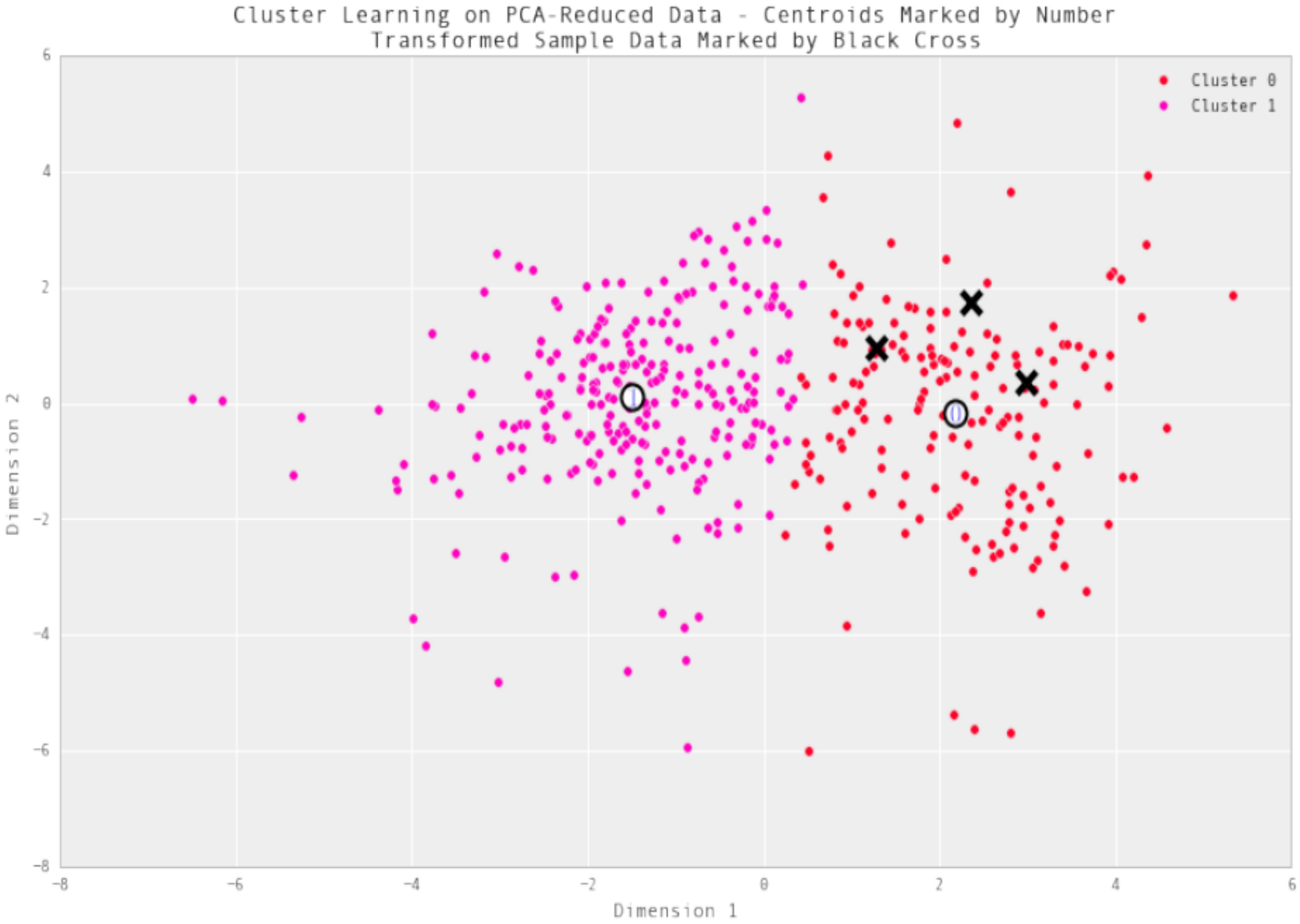

Fresh
Milk
Grocery
Frozen
Detergents_Paper
Delicatessen
105000
90000
75000
60000
45000
30000
15000

# PCA -REDUZINDO DIMENSÕES



# GERANDO OS CLUSTERS

```
clusterer = KMeans(n_clusters=i,
random_state=29).fit(reduced_data)

preds = clusterer.predict(reduced_data)
```

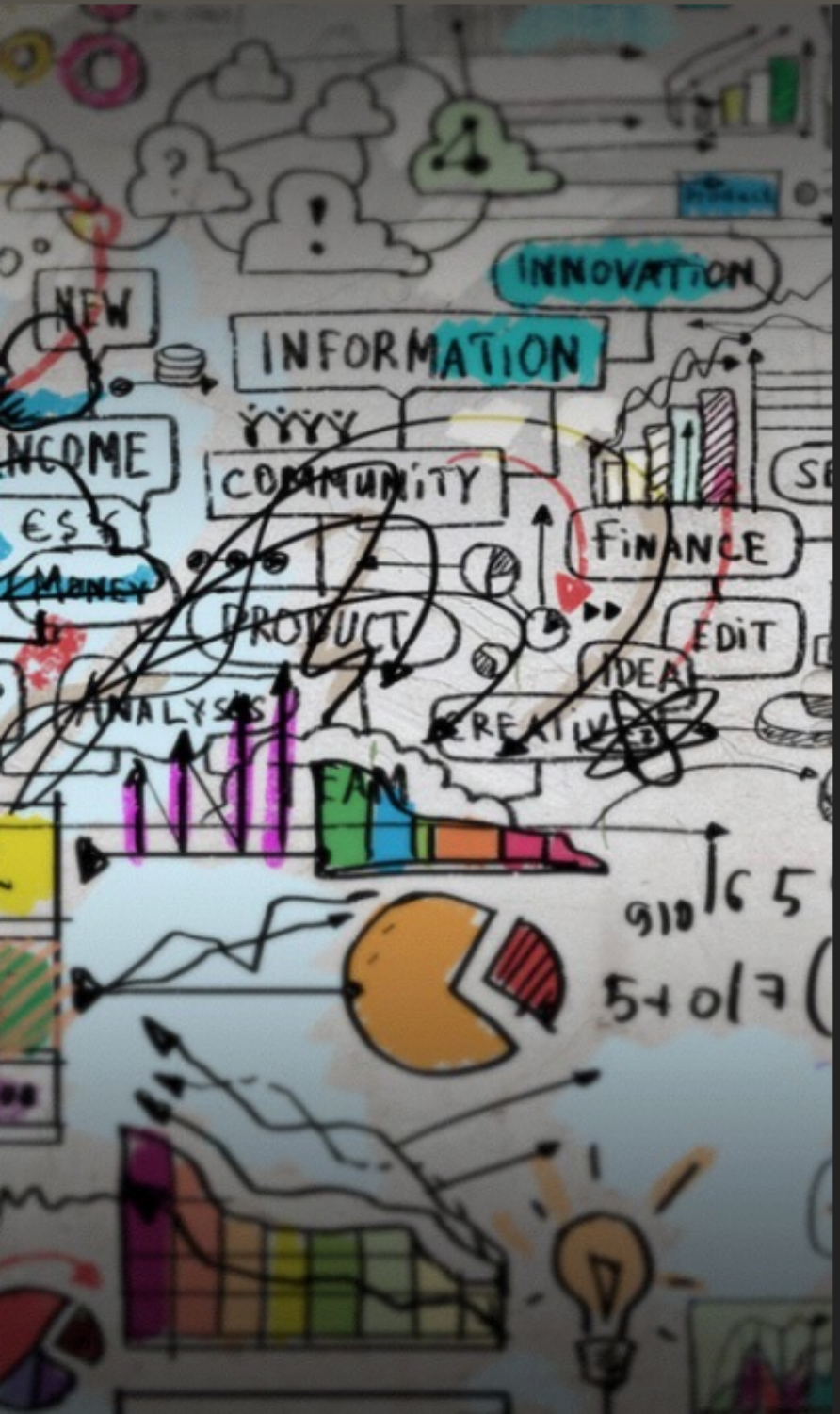

Cluster Learning on PCA-Reduced Data - Centroids Marked by Number
Transformed Sample Data Marked by Black Cross
Cluster 0
Cluster 1
Dimension 1
Dimension 2
6
4
2
0
-2
-4
-6
-8
-8
-6
-4
-2
0
2
4
6

| | Predicted 0 | Predicted 1 |
|---|---|---|
| Actual 0 | TN | FP |
| Actual 1 | FN | TP |

# F1 SCORE

$$F_1 = 2 \times \frac{\text{Precision} \times \text{Recall}}{\text{Precision} + \text{Recall}}$$

F1 score is the harmonic mean of precision and recall. Values range from 0 (bad) to 1 (good).




# ANALISANDO A PERFORMANCE DE UM MODELO

# Acurácia – Taxa de erros

- Acc(M) = porcentagem das tuplas dos dados de teste que sao corretamente classificadas.
- Err(M) = 1 – Acc(M)
- Matriz de Confusão

Classes Preditas

Classes Reais

| | C1 | C2 |
|---|---|---|
| C1 | **Positivos verdadeiros** | **Falsos Negativos** |
| C2 | **Falsos Positivos** | **Negativos verdadeiros** |

# Outras medidas mais precisas

- **Exemplo** : acc(M) = 90%
  C1 = tem-câncer (4 pacientes)
  C2 = não-tem-câncer (500 pacientes)

Classificou corretamente 454 pacientes que não tem câncer

Não acertou nenhum dos que tem câncer

**Pode ser classificado como "bom classificador" mesmo com acurácia alta ?**

- **Sensitividade** $= \frac{\text{true-pos}}{\text{pos}}$
- **Especificidade** $= \frac{\text{true-neg}}{\text{neg}}$

% pacientes classificados **corretamente com câncer** dentre todos os que **realmente tem câncer**

- **Precisão** $= \frac{\text{true-pos}}{\text{true-pos} + \text{falso-pos}}$

% pacientes classificados **corretamente com câncer** dentre todos os que foram classificados **com câncer**

# PERFORMANCE DE UM CLASSIFICADOR

- Acuracia = classificados corretamente /total de exemplos
- Erro = 1-Acuracia

# PERFORMANCE DE UMA REGRESSÃO

**Uma das formas de avaliar a qualidade do ajuste do modelo é através do coeficiente de determinação. Basicamente, este coeficiente indica quanto o modelo foi capaz de explicar os dados coletados. O coeficiente de determinação é dado pela expressão**

$$R^2 = \frac{SQR}{SQT} = 1 - \frac{SQE}{SQT} = \frac{\hat{\beta}_1 \sum_{i=1}^{n}(x_i - \bar{x})Y_i}{\sum_{i=1}^{n}(Y_i - \bar{Y})^2},$$

**Razão entre a soma de quadrados da regressão e a soma de quadrados total.**

$$0 \leq R^2 \leq 1.$$

## TABELA CONFUSÃO

| | | Classe real | |
|---|---|---|---|
| | | p | n |
| Classe predita | p | Verdadeiro Positivo | Falso Positivo |
| | n | Falso Negativo | Verdadeiro Negativo |

## MEAN SQUARE ERROR

$$\mathrm{MSE} = \frac{1}{n} \sum_{i=1}^{n} (y_i - \tilde{y}_i)^2$$

# FERRAMENTAS E LINGUAGENS

- NUMPY
- PANDAS
- SKLEARN
- R STUDIO

# NUMPY

Biblioteca em python para manipulação de arrays e matrizes

# PANDAS

Biblioteca de Manipulação de dados e analise em python

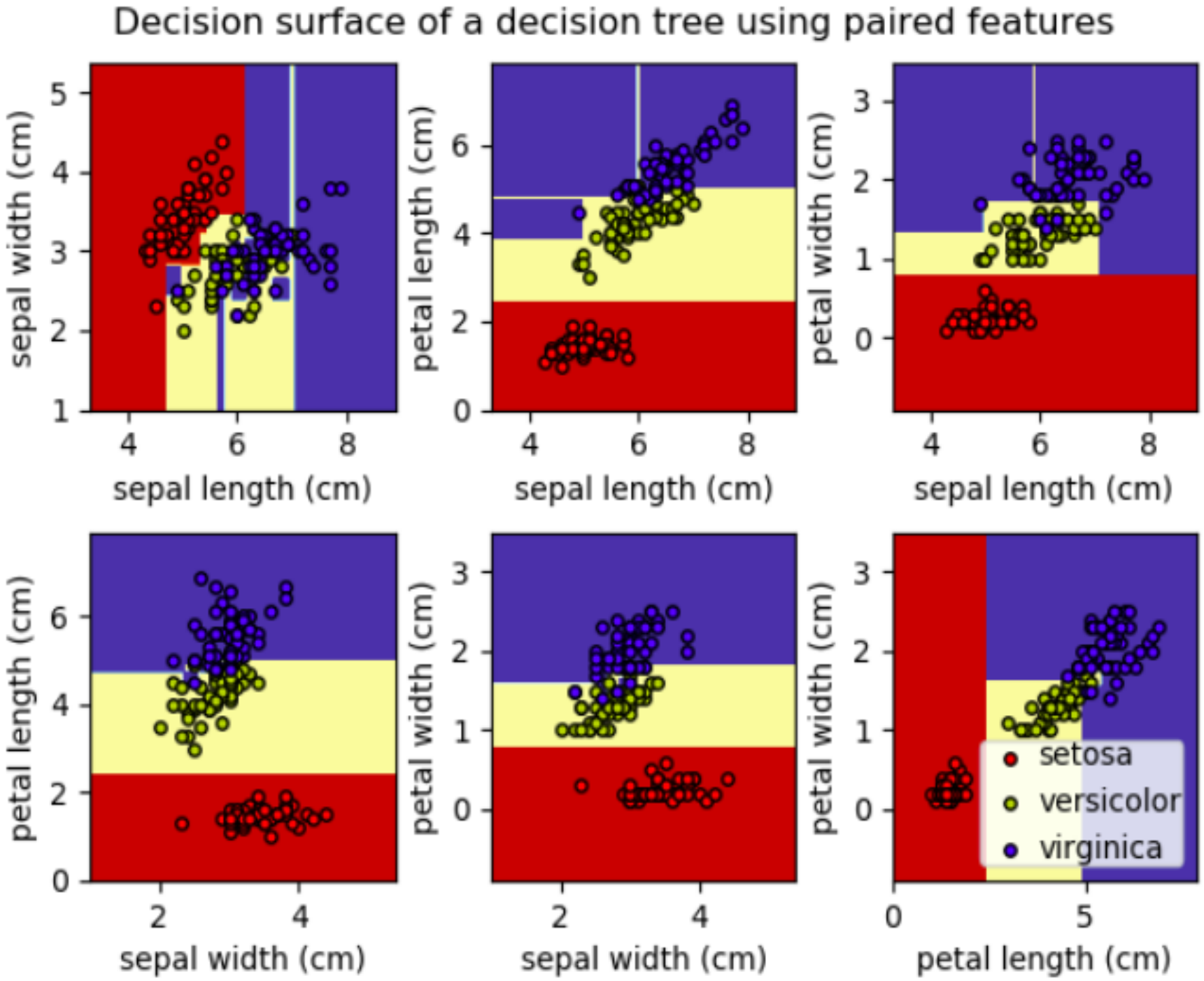
# NUMPY E PANDAS- LENDO ARQUIVO CSV

```
import numpy as np
import pandas as pd
import visuals as vs # Supplementary code
from sklearn.cross_validation import ShuffleSplit
```

```
# Load the Boston housing dataset
data = pd.read_csv('housing.csv')
prices = data['MEDV']
features = data.drop('MEDV', axis = 1)
```

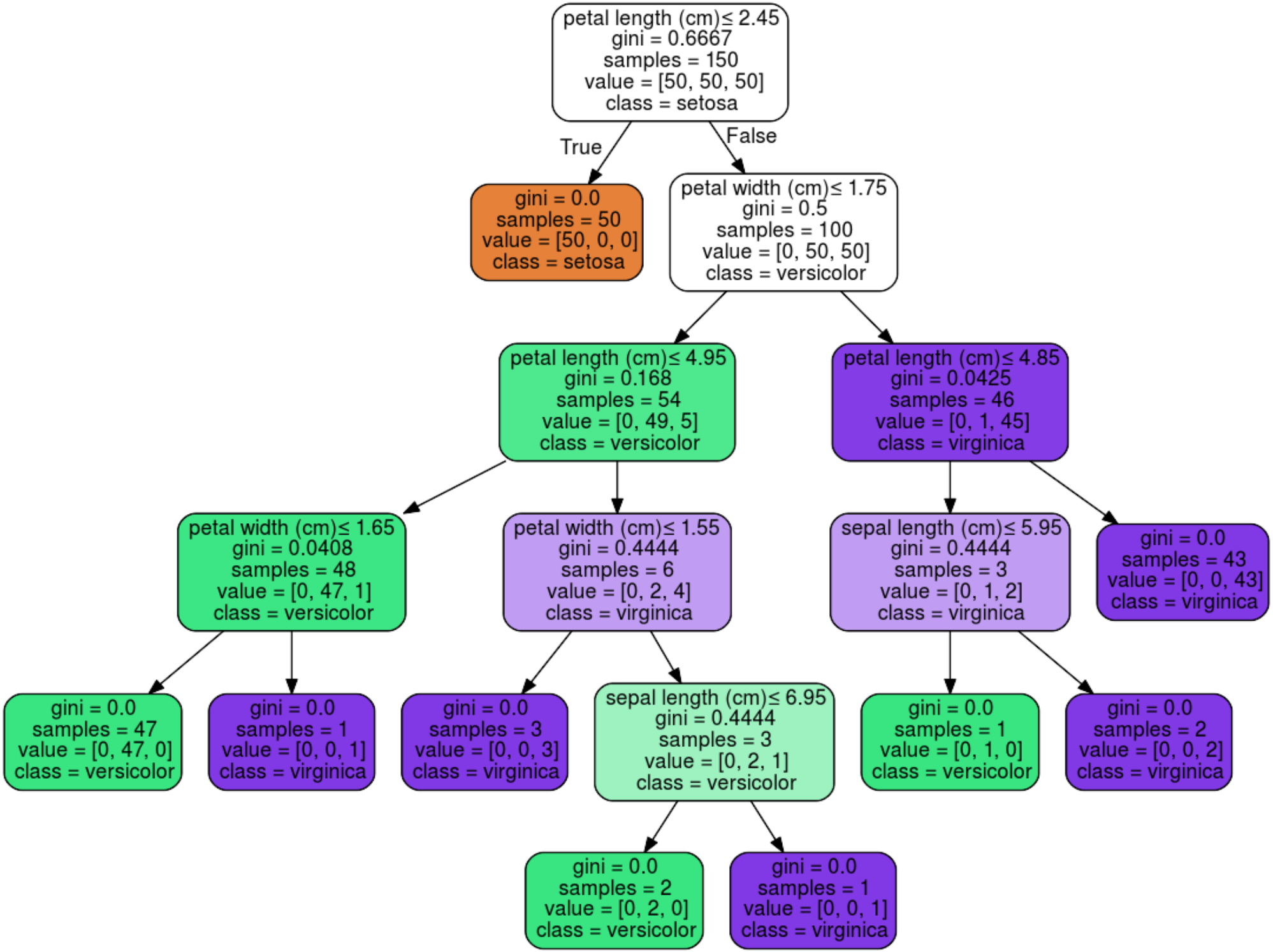
# SKLEARN

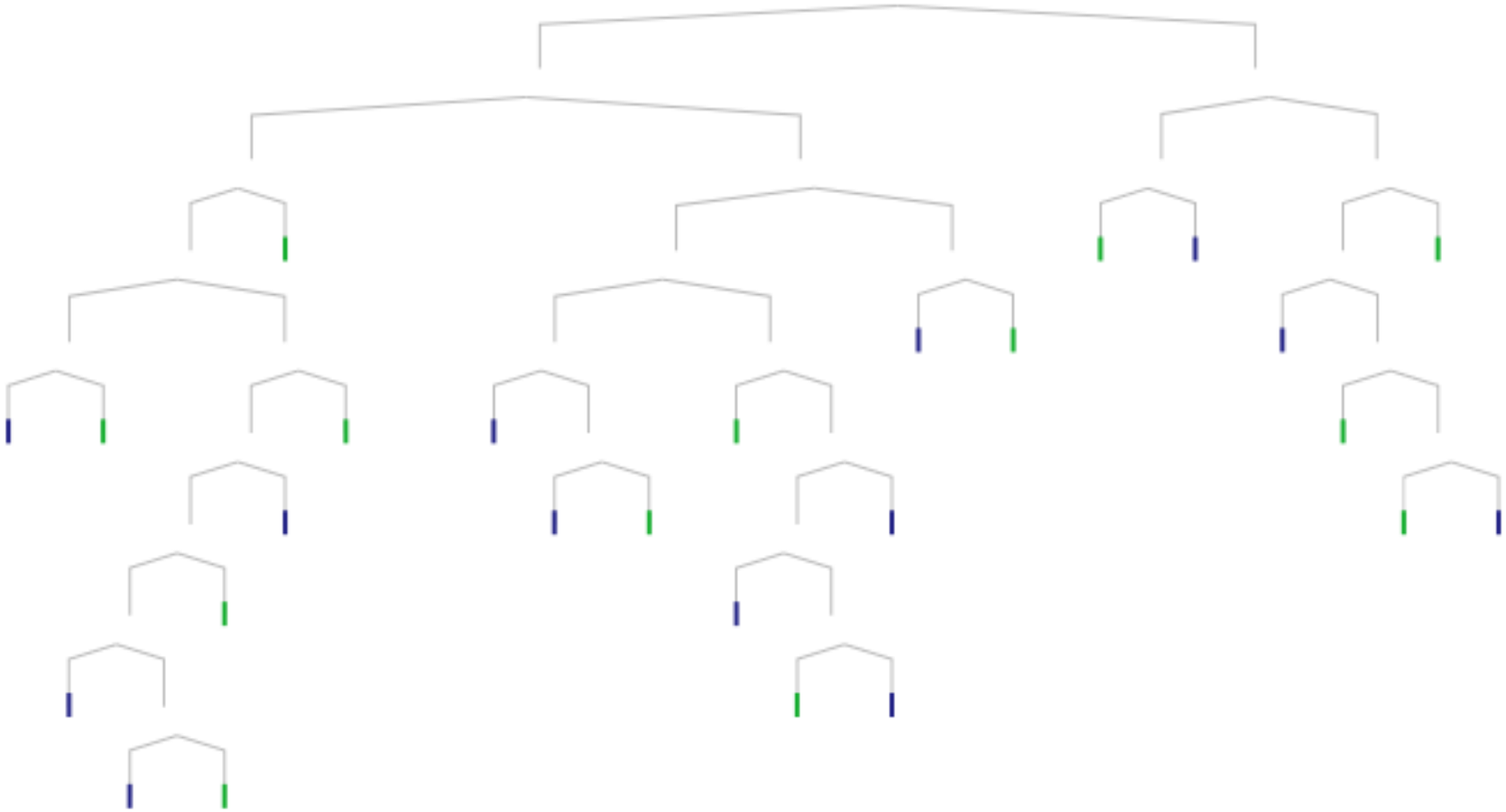
- Aplicação simples e eficiente para data mining e data analysis
- Feito com NumPy, SciPy, e matplotlib
- Open source, commercially usable – BSD license


Decision surface of a decision tree using paired features
sepal width (cm)
sepal length (cm)
petal length (cm)
petal width (cm)
sepal width (cm)
setosa
versicolor
virginica

# DT Advantages/Disadvantages

- Advantages:
  - Easy to understand.
  - Easy to generate rules
- Disadvantages:
  - May suffer from overfitting.
  - Classifies by rectangular partitioning.
  - Does not easily handle nonnumeric data.
  - Can be quite large – pruning is necessary.


petal length (cm)≤ 2.45
gini = 0.6667
samples = 150
value = [50, 50, 50]
class = setosa
True
False
gini = 0.0
samples = 50
value = [50, 0, 0]
class = setosa
petal width (cm)≤ 1.75
gini = 0.5
samples = 100
value = [0, 50, 50]
class = versicolor
petal length (cm)≤ 4.95
gini = 0.168
samples = 54
value = [0, 49, 5]
class = versicolor
petal length (cm)≤ 4.85
gini = 0.0425
samples = 46
value = [0, 1, 45]
class = virginica
petal width (cm)≤ 1.65
gini = 0.0408
samples = 48
value = [0, 47, 1]
class = versicolor
petal width (cm)≤ 1.55
gini = 0.4444
samples = 6
value = [0, 2, 4]
class = virginica
sepal length (cm)≤ 5.95
gini = 0.4444
samples = 3
value = [0, 1, 2]
class = virginica
gini = 0.0
samples = 43
value = [0, 0, 43]
class = virginica
gini = 0.0
samples = 47
value = [0, 47, 0]
class = versicolor
gini = 0.0
samples = 1
value = [0, 0, 1]
class = virginica
gini = 0.0
samples = 3
value = [0, 0, 3]
class = virginica
sepal length (cm)≤ 6.95
gini = 0.4444
samples = 3
value = [0, 2, 1]
class = versicolor
gini = 0.0
samples = 1
value = [0, 1, 0]
class = versicolor
gini = 0.0
samples = 2
value = [0, 0, 2]
class = virginica
gini = 0.0
samples = 2
value = [0, 2, 0]
class = versicolor
gini = 0.0
samples = 1
value = [0, 0, 1]
class = virginica



Test Accuracy

# GINI INDEX

Proportion of observations in the mth leaf of $K^{th}$ class.

$$G = \sum_{k=1}^{K} \hat{p}_{mk}\left(1 - \hat{p}_{mk}\right)$$

leaf Class leaf Class

Used at each node to decide which feature is best

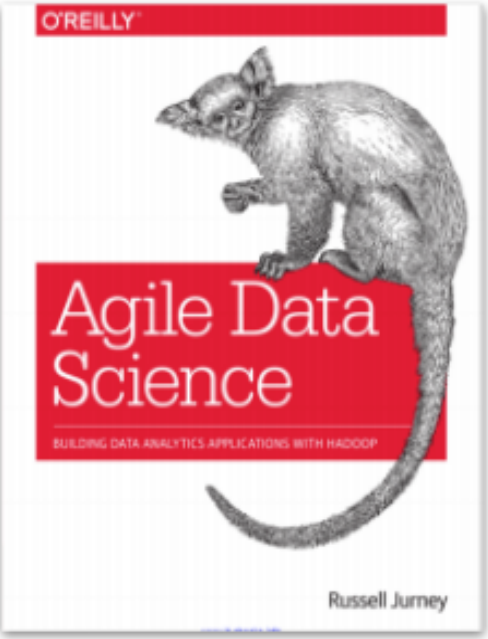
The smaller the value of the more purite there is in the node.

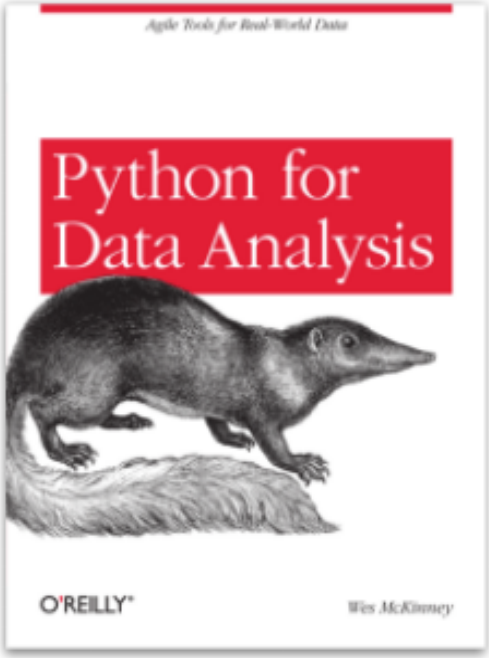
# Iniciando a Trabalhar com modelos de Regressão

Modelo de Regressão Linear

```
>>> from sklearn import tree
>>> X = [[0, 0], [2, 2]]
>>> y = [0.5, 2.5]
>>> clf = tree.DecisionTreeRegressor()
>>> clf = clf.fit(X, y)
>>> clf.predict([[1, 1]])
array([0.5])
```

# LIVROS


O'REILLY
Agile Data Science
BUILDING DATA ANALYTICS APPLICATIONS WITH HADOOP
Russell Jurney


Agile Tools for Real-World Data
Python for Data Analysis
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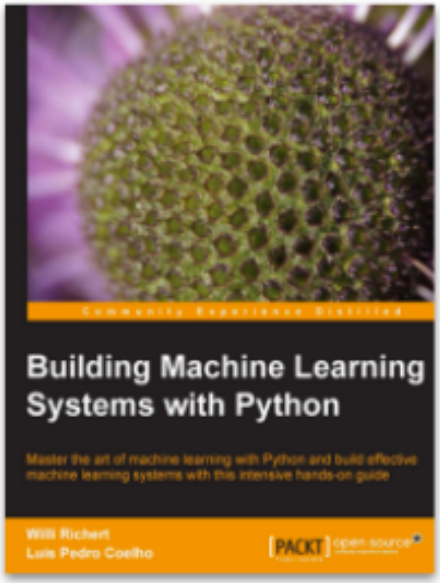
Wes McKinney

O'REILLY
Doing Data Science
STRAIGHT TALK FROM THE FRONTLINE
Rachel Schutt & Cathy O'Neil


Building Machine Learning Systems with Python
Willi Richert
Luis Pedro Coelho
PACKT

Python Data Visualization Cookbook
Igor Milovanović
PACKT

# A Tour of Machine Learning Algorithms

by **Jason Brownlee** on August 12, 2019 in **Machine Learning Algorithms**

Tweet Share Share

Last Updated on December 5, 2019

In this post, we will take a tour of ***the most popular machine learning algorithms***.

It is useful to tour the main algorithms in the field to get a feeling of what methods are available.

There are so many algorithms that it can feel overwhelming when algorithm names are thrown around and you are expected to just know what they are and where they fit.

I want to give you two ways to think about and categorize the algorithms you may come across in the field.

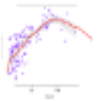
- The first is a grouping of algorithms by their **learning style**.
- The second is a grouping of algorithms by their **similarity** in form or function (like grouping similar animals together).

Both approaches are useful, but we will focus in on the grouping of algorithms by similarity

**Welcome!**
My name is *Jason Brownlee* PhD, and I **help developers** get results with **machine learning**.
Read more

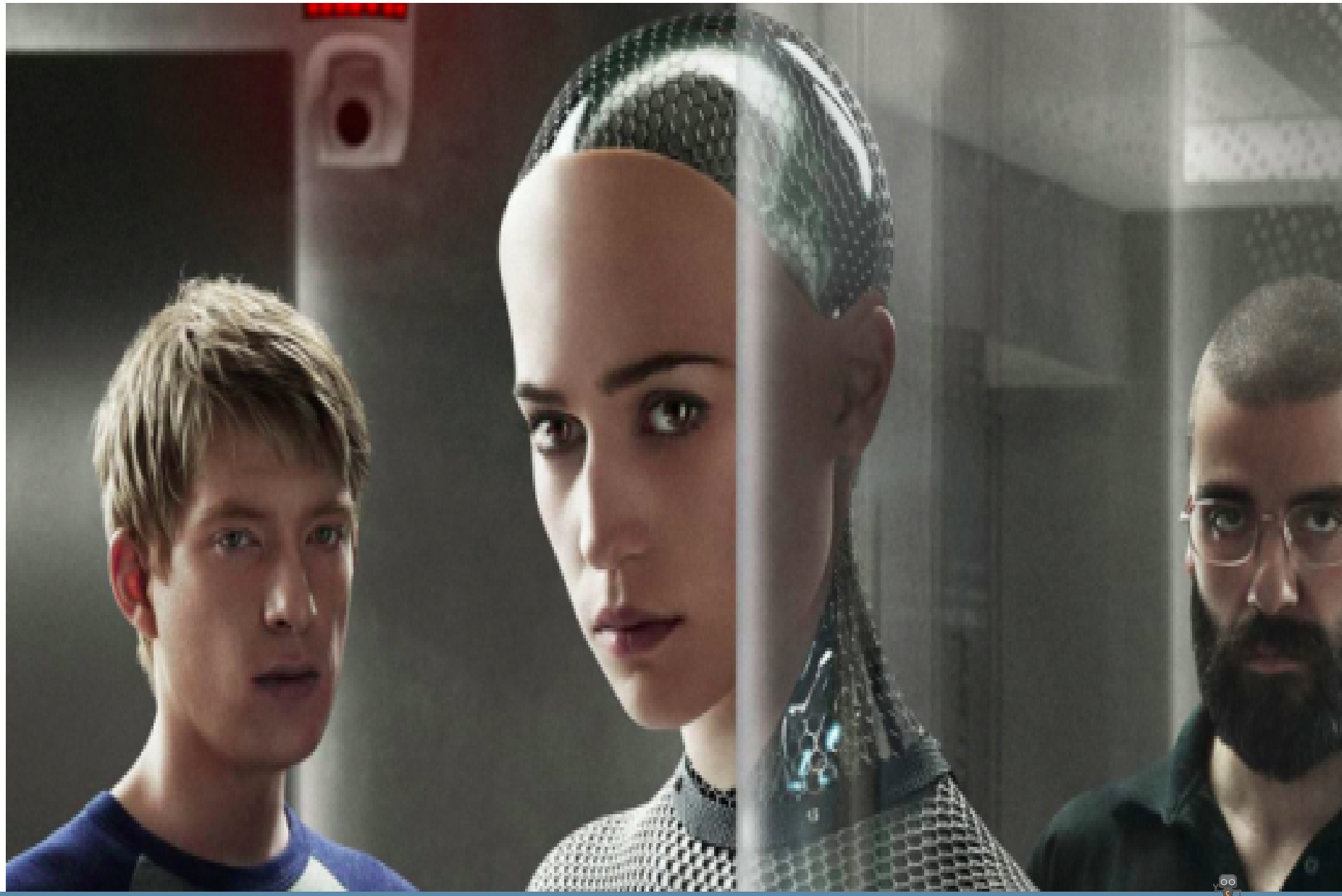
**Never miss a tutorial:**

**Picked for you:**


A Tour of Machine Learning Algorithms

Supervised and Unsupervised Machine Learning Algorithms

Logistic Regression Tutorial for Machine Learning



# scikit-learn

*Machine Learning in Python*

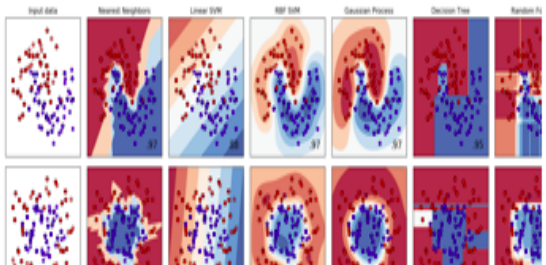
Getting Started | What's New in 0.22.1 | GitHub

- Simple and efficient tools for predictive data analysis
- Accessible to everybody, and reusable in various contexts
- Built on NumPy, SciPy, and matplotlib
- Open source, commercially usable - BSD license

## Classification

Identifying which category an object belongs to.

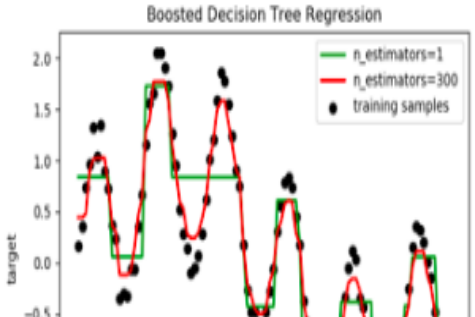
**Applications:** Spam detection, image recognition.
**Algorithms:** SVM, nearest neighbors, random forest, and more...



## Regression

Predicting a continuous-valued attribute associated with an object.

**Applications:** Drug response, Stock prices.
**Algorithms:** SVR, nearest neighbors, random forest, and more...

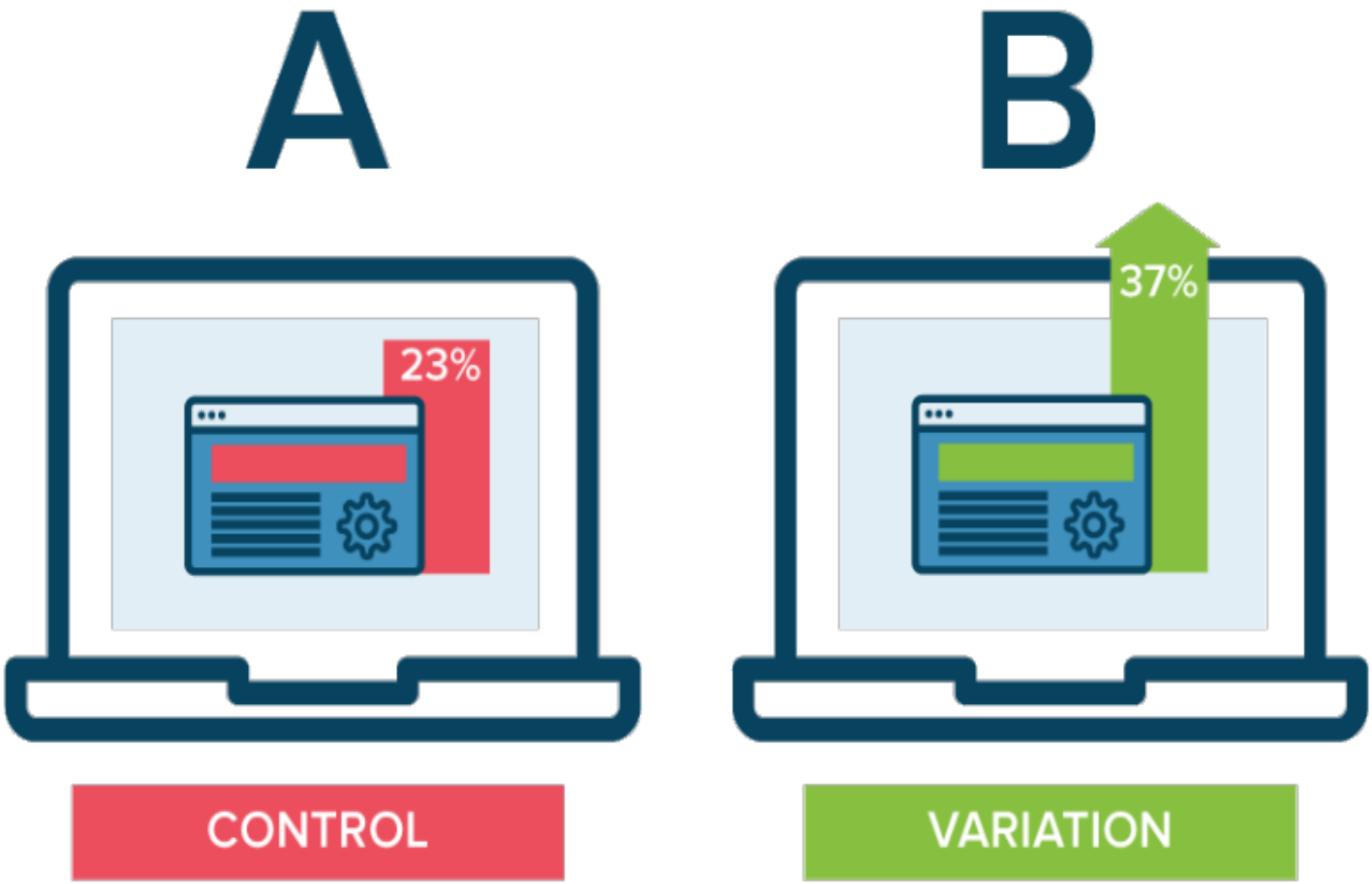



## Clustering

Automatic grouping of similar objects into sets.

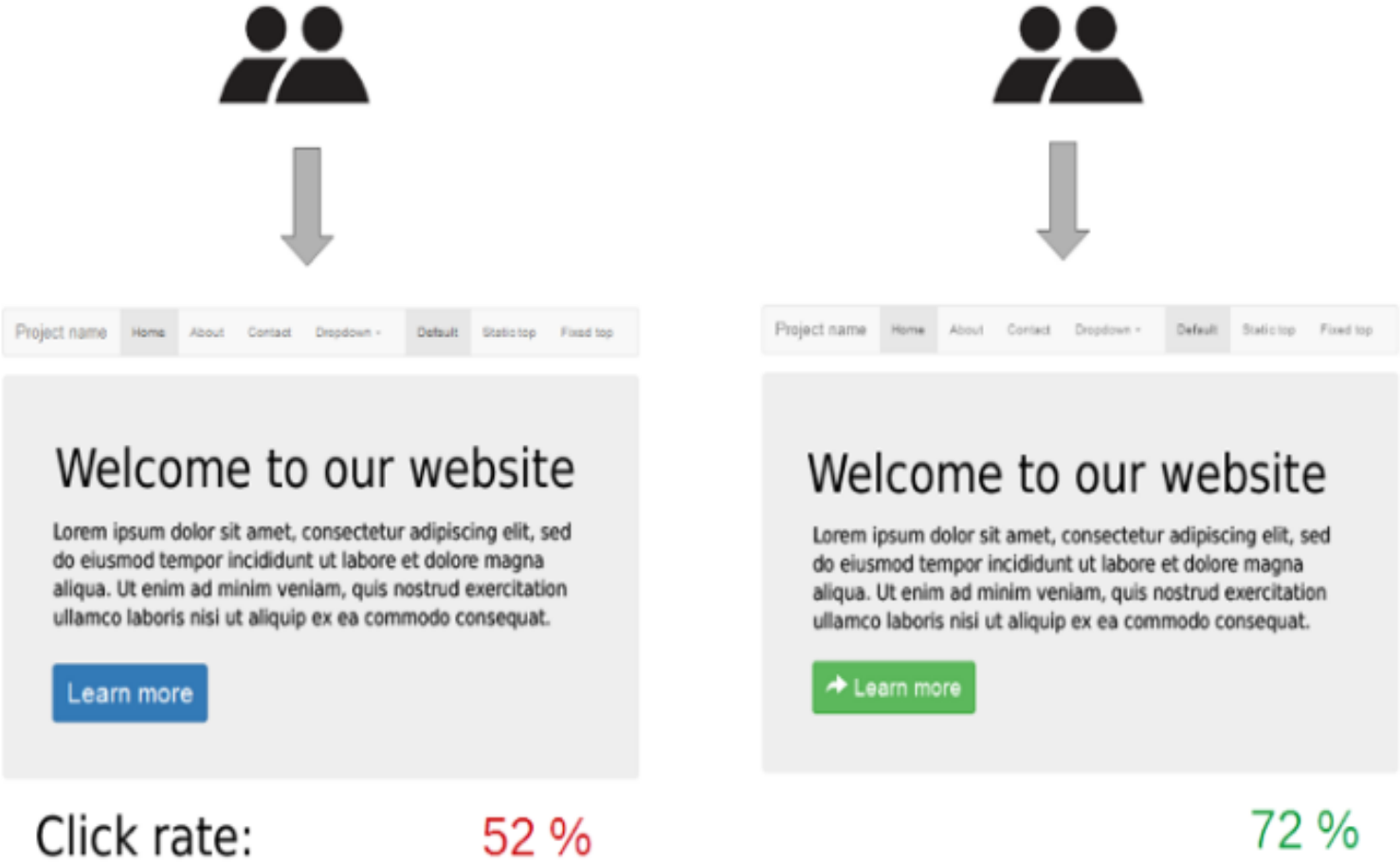
**Applications:** Customer segmentation, Grouping experiment outcomes
**Algorithms:** k-Means, spectral clustering, mean-shift, and more...

# TESTE A/B



# TESTE A/B

**Teste A/B é um método de teste onde se comparam duas práticas, A e B, em que estes são o controle e o tratamento de uma experiência controlada, com o objetivo de melhorar a percentagem de aprovação.**



# LINGUAGEM R

R é uma linguagem e também um ambiente de desenvolvimento integrado para cálculos estatísticos e gráficos.

Foi criada originalmente por Ross Ihaka e por Robert Gentleman no departamento de Estatística da universidade de Auckland, Nova Zelândia.

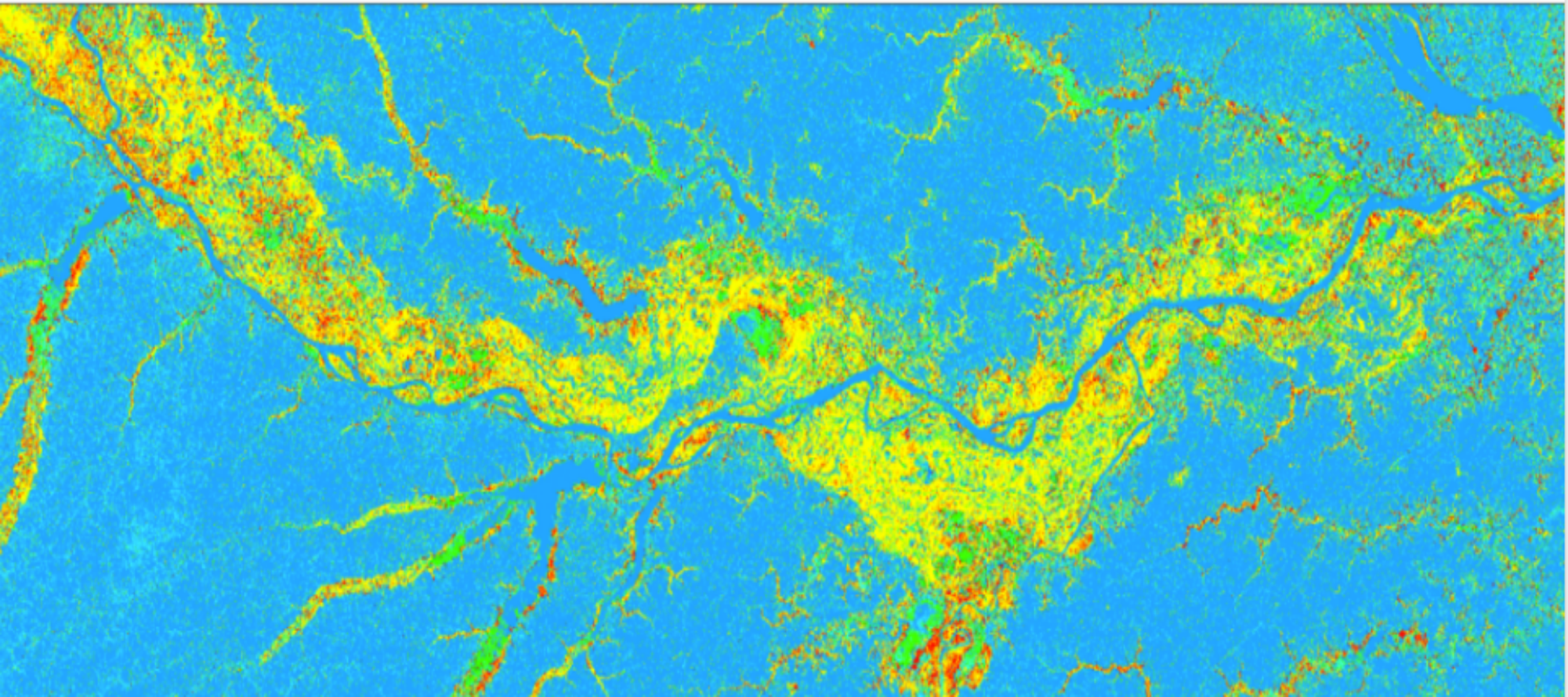
# SITES ONDE CONSEGUIR INFORMAÇÃO

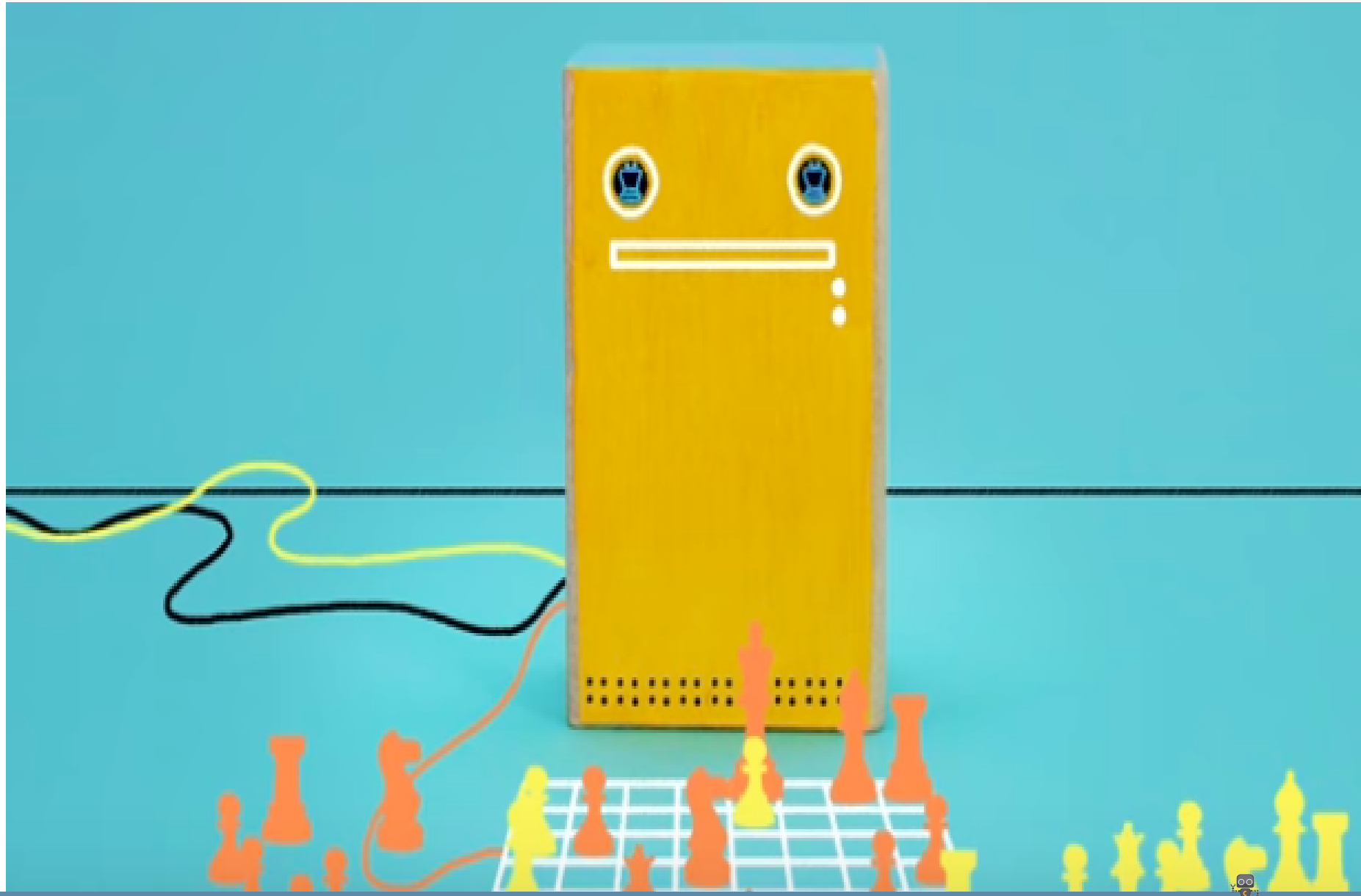
# HTTPS://ENSINANDOMAQUINASBLOG.WORDPRESS.COM

INTELIGÊNCIA COMPUTACIONAL PARA MINERAÇÃO DE DADOS

## ENSINANDO MÁQUINAS

SOBRE





# Conclusão

**Você esta apto a:**

Compreender o que é Aprendizado de Máquina e DataScience
Entender o que é classificação, regressão e clustering

# Bibliografia I