Metis

INTRO TO MACHINE LEARNING

Paul Burkard
09/26/16

I. WHAT IS MACHINE LEARNING?

from Wikipedia:

“Machine learning, a branch of artificial intelligence, is about the construction and study of systems that can learn from data.”

source: http://en.wikipedia.org/wiki/Machine_learning

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"Machine learning, a branch of artificial intelligence, is about the construction and study of systems that can learn from data."

"The core of machine learning deals with representation and generalization…"

- representation – extracting structure from data
- generalization – making predictions from data

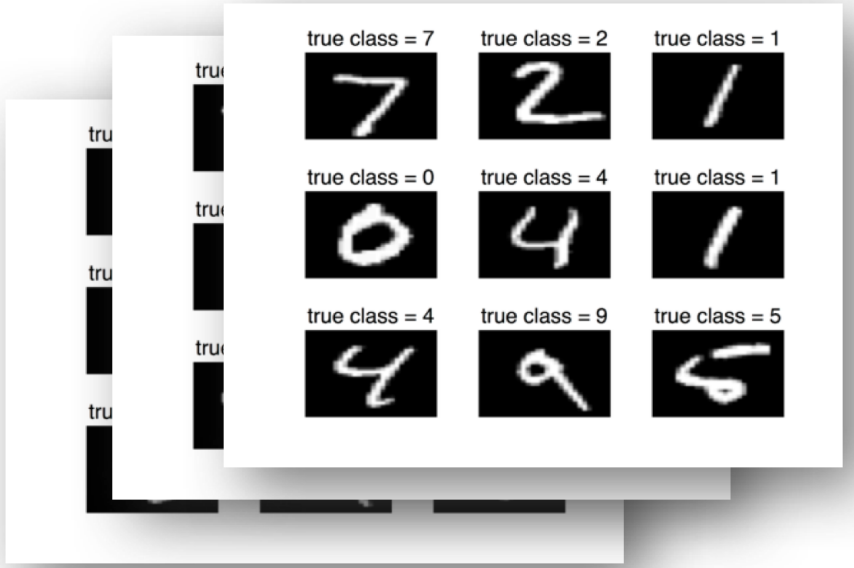
source: http://en.wikipedia.org/wiki/Machine_learning

Learning is not about memorizing and being able to recall, it is about generalizing the conclusions to previously unseen examples

II. MACHINE LEARNING PROBLEMS

Supervised learning: the goal is to learn mapping from given inputs x to outputs y, given a **labeled** set of input-output pairs


OCR


true class = 7
true class = 2
true class = 1
true class = 0
true class = 4
true class = 1
true class = 4
true class = 9
true class = 5

	Client 1	*Client 2*	*Client 3*
Age	*23*	*30*	*19*
Gender	*M*	*F*	*M*
Annual salary	*$30,000*	*$45,000*	*$15,000*
Years in residence	*3 years*	*1 year*	*3 month*
Years in job	*1 year*	*1 year*	*1 month*
Current debt	*$5,000*	*$1,000*	*$10,000*
Paid off credit	*Yes*	*Yes*	*No*

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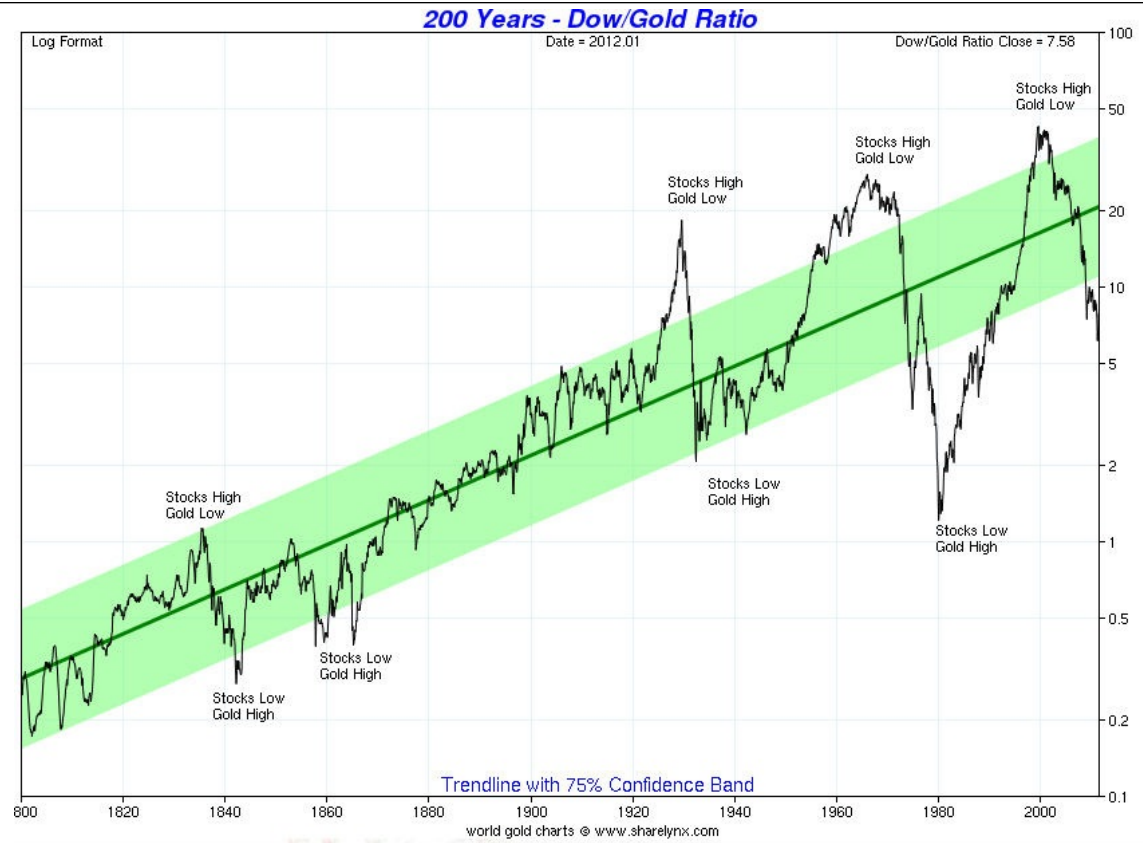
Current debt	$5,000	$1,000	$10,000
Paid off credit	Yes	Yes	No

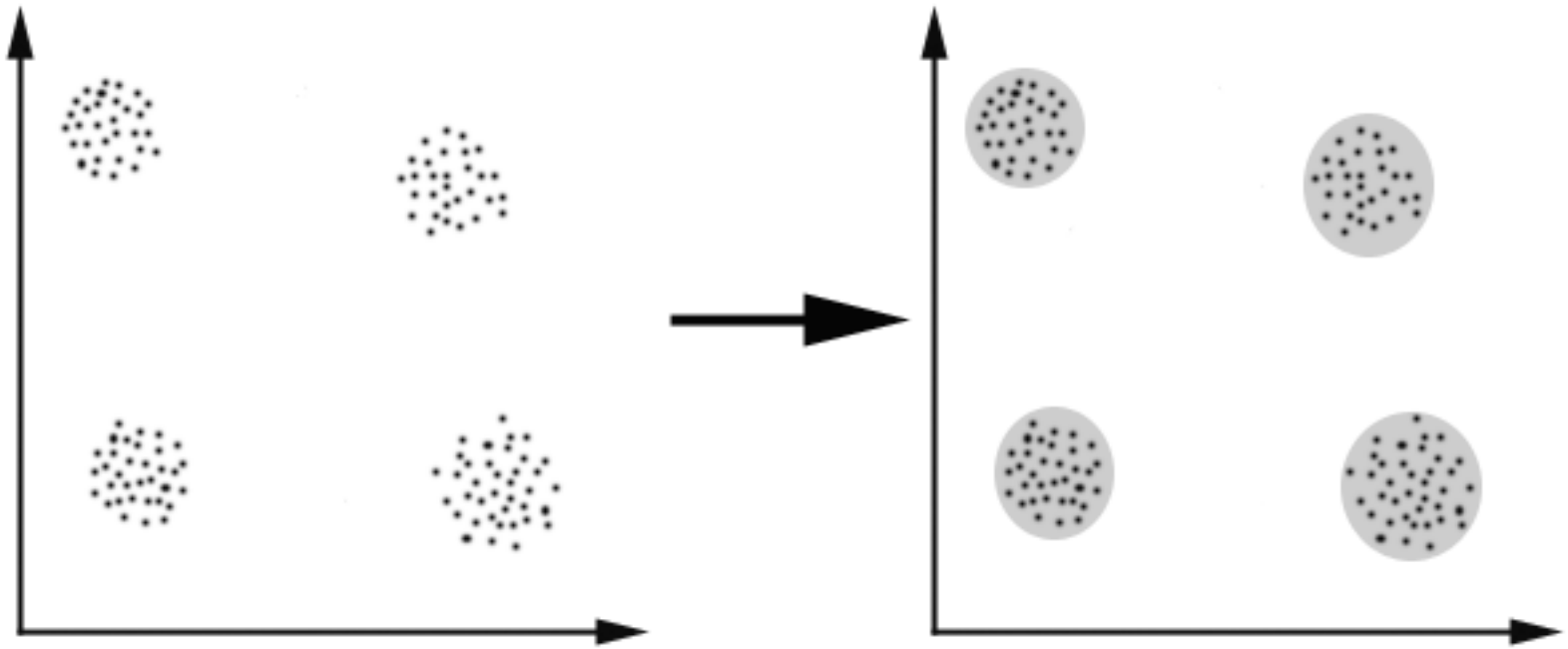
	Applicant
Age	25
Gender	M
Annual salary	$25,000
Years in residence	1 year
Years in job	2 year3
Current debt	$15,000
Credit decision/ score	???


SPAM

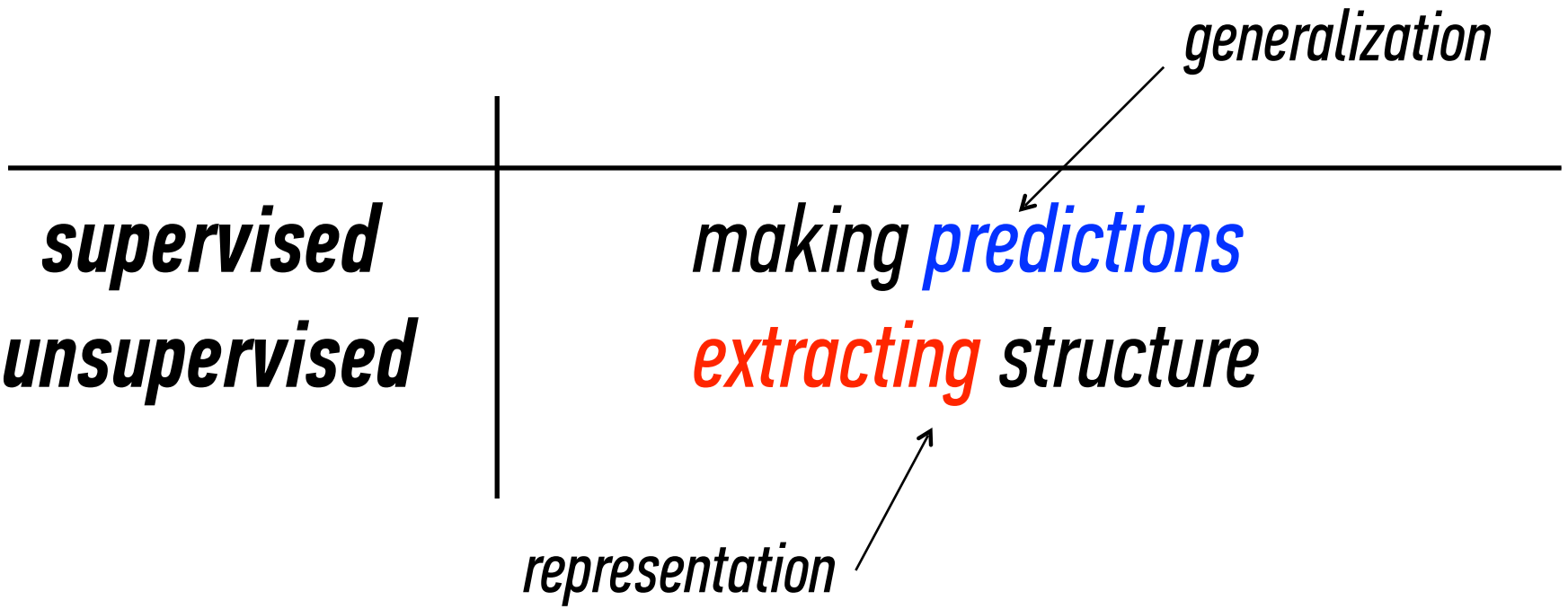

200 Years - Dow/Gold Ratio
Log Format
Date = 2012.01
Dow/Gold Ratio Close = 7.58
Stocks High
Gold Low
Stocks Low
Gold High
Stocks High
Gold Low
Stocks Low
Gold High
Stocks High
Gold Low
Stocks Low
Gold High
Stocks High
Gold Low
Stocks Low
Gold High
Trendline with 75% Confidence Band
100
50
20
10
5
2
1
0.5
0.2
0.1
800
1820
1840
1860
1880
1900
1920
1940
1960
1980
2000
world gold charts © www.sharelynx.com

Unsupervised learning: the goal is to learn interesting patterns and structure in data given only inputs

no label information given at all

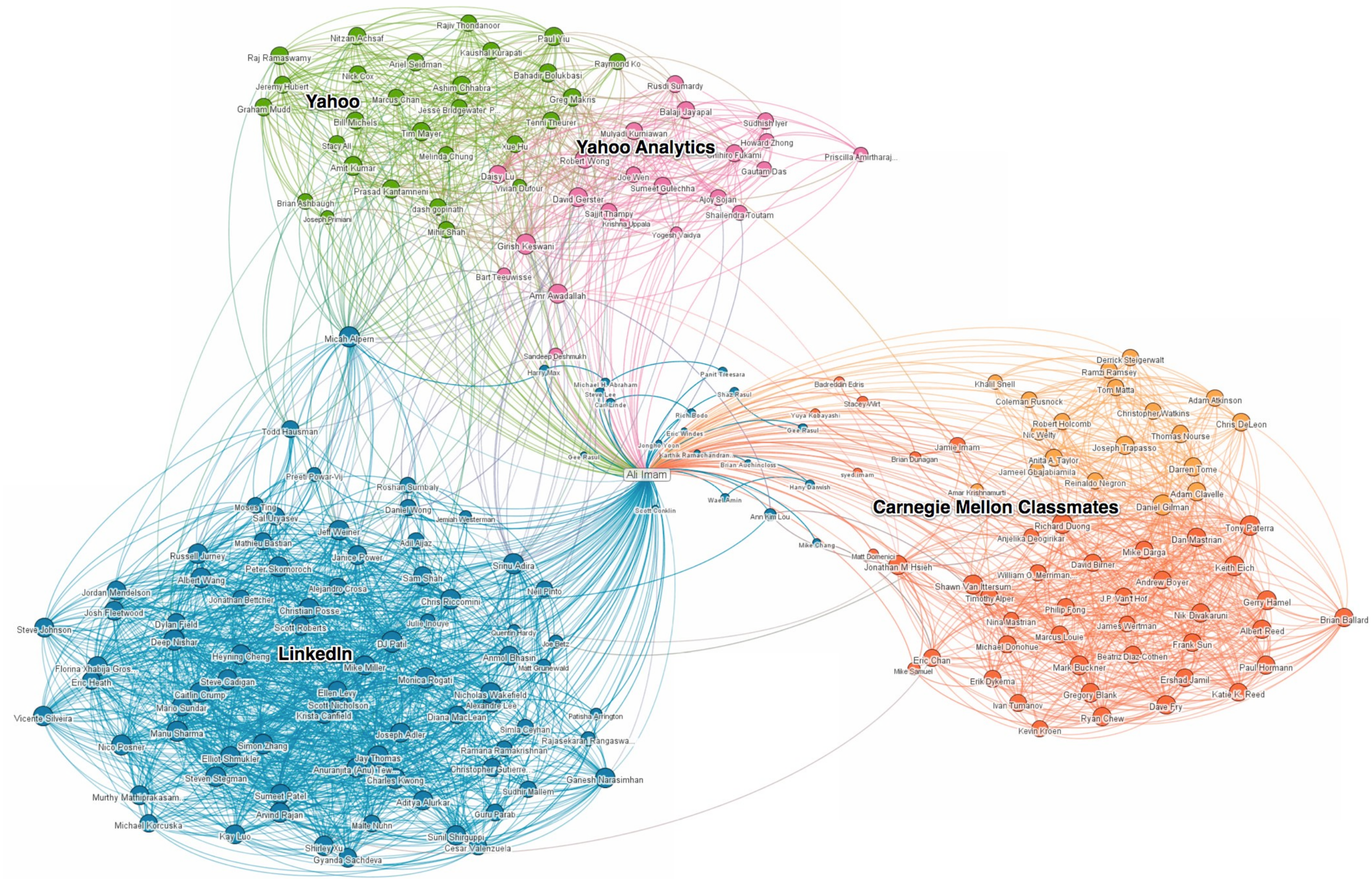


supervised	*making predictions*
unsupervised	*extracting structure*


generalization
supervised
unsupervised
making predictions
extracting structure
representation

EXERCISE:

supervised or unsupervised?



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Rajiv Thondanoor
Nitzan Achsaf
Paul Yiu
Raj Ramaswamy
Kaushal Kurapati
Ariel Seidman
Raymond Ko
Nick Cox
Bahadir Bolukbasi
Jeremy Hubert
Ashim Chhabra
Rusdi Sumardy
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Marcus Chan
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Balaji Jayapal
Bill Michels
Tenni Theurer
Sudhish Iyer
Tim Mayer
Mulyadi Kurniawan
Howard Zhong
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Xue Hu
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Robert Wong
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Gautam Das
Prasad Kantamneni
Vivian Dufour
Sumeet Gulechha
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Ajoy Sojan
dash gopinath
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Diana MacLean
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Manu Sharma
Simla Ceyhan
Joseph Adler
Simon Zhang
Rajasekaran Rangaswa...
Nico Posner
Elliot Shmukler
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Anuranjita (Anu) Tew...
Christopher Gutierre...
Steven Stegman
Charles Kwong
Ganesh Narasimhan
Sudhir Mallem
Murthy Mathiprakasam...
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Aditya Alurkar
Arvind Rajan
Guru Parab
Michael Korcuska
Malte Nuhn
Kay Luo
Sunil Shirguppi
Shirley Xu
Cesar Valenzuela
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Paul Hormann
Erik Dykema
Ershad Jamil
Gregory Blank
Katie K. Reed
Ivan Tumanov
Dave Fry
Ryan Chew
Kevin Kroen


CHEQUE
APPLICATION
ORDER
CLAIM

	continuous	*categorical*
	quantitative	*qualitative*

continuous	*categorical*
Height of children	*Eye colors*
Weight of cars	*Courses at GA*
Speed of the train	*Highest degree*
Temperature	*Gender*
Stock price	*If an email is spam or not*

	continuous	*categorical*
	quantitative	*qualitative*

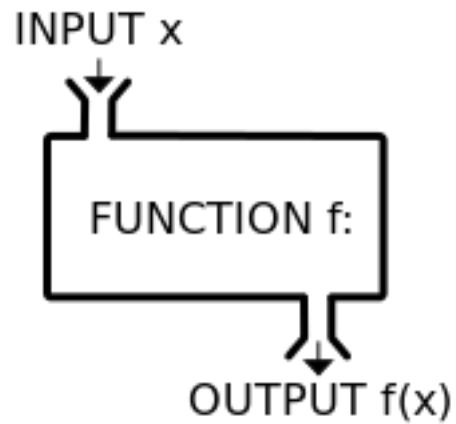
NOTE

The space where data live is called the feature space.

Each point in this space is called a record.

	continuous	*categorical*
supervised	*regression*	*classification*
unsupervised	*dim reduction*	*clustering*

– *At its core*, **Supervised Learning** *boils down to* **Function Approximation**



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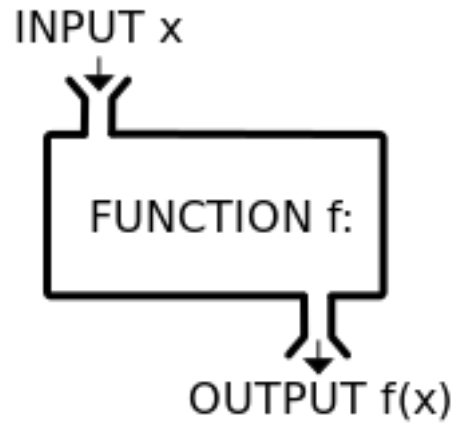

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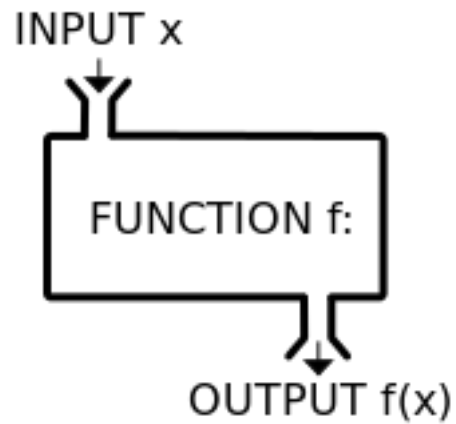

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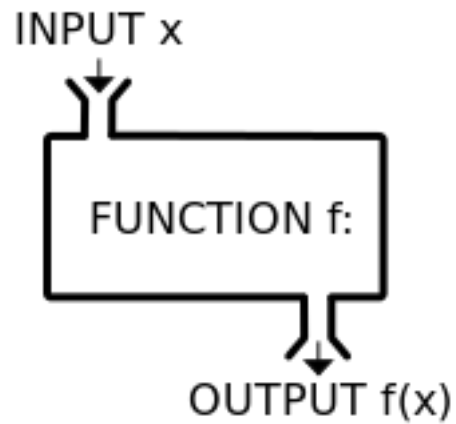
  - *e.g. Linear Regression:* $f(x) = \alpha + \beta x$



TYPES OF LEARNING PROBLEMS

supervised	*labeled examples*
unsupervised	*no labeled examples*

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- ***Labels****: The values on the target variables in Supervised Learning*

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  - *Thus its task is to determine inter feature relationships*

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  - *Data Science runs on Feature Engineering*