



LISBON
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MACHINE LEARNING



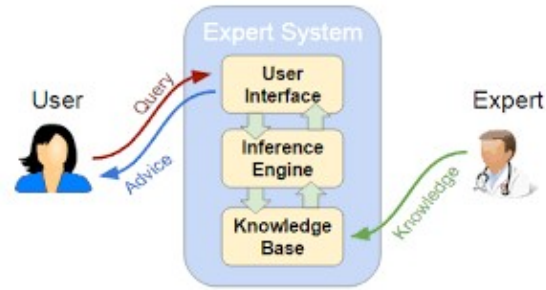
WHAT IS A.I.?



Artificial Intelligence(AI)

- Artificial intelligence refers to the development of computer-based solutions that are able to perform tasks which mimic human intelligence.

Popularity



Explosive Growth

New Hopes

Inflated Hype

AI winter II

Birth

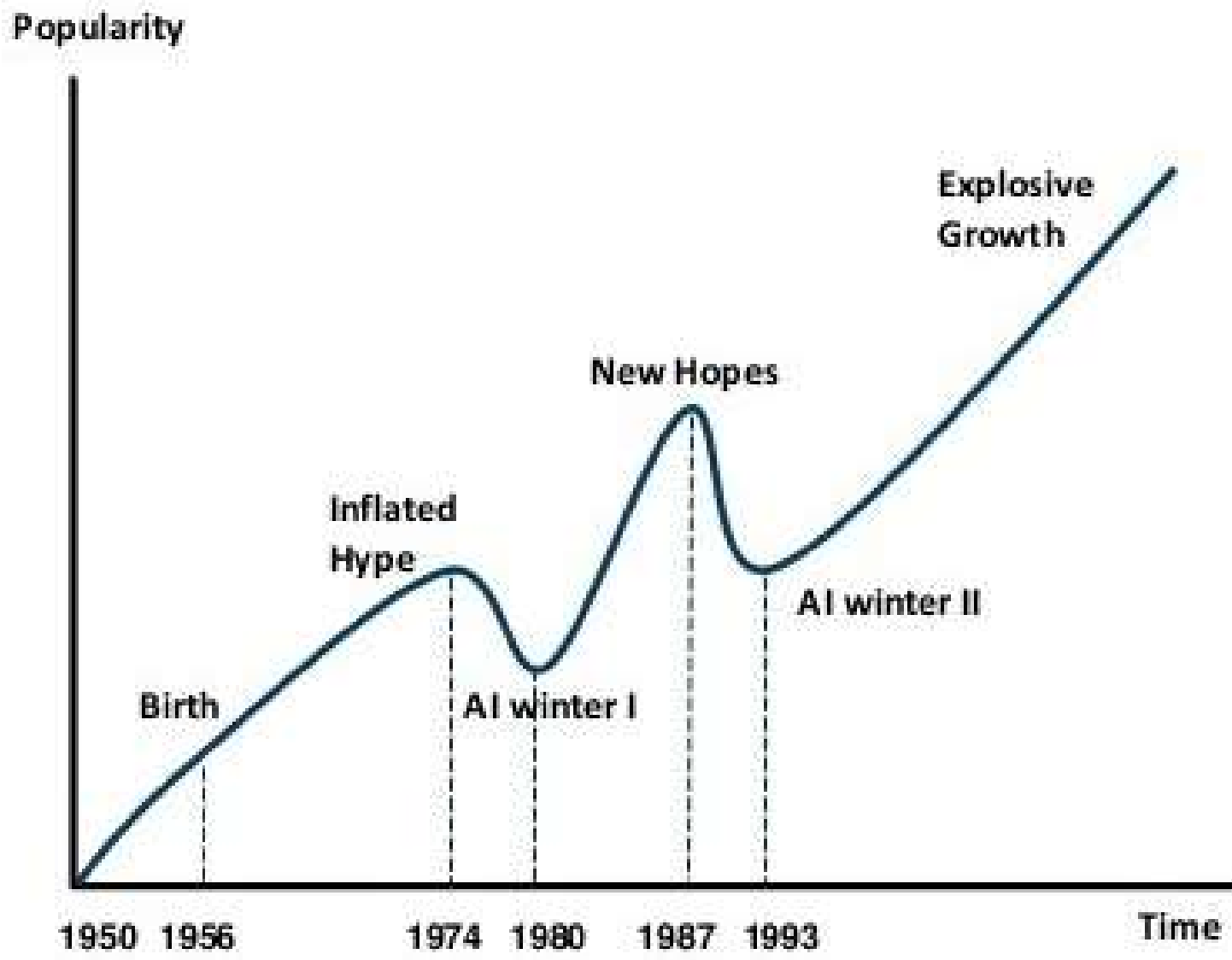
AI winter I



Lim, 2018

50 1956 1974 1980 1987 1993 Time





Lim, 2018

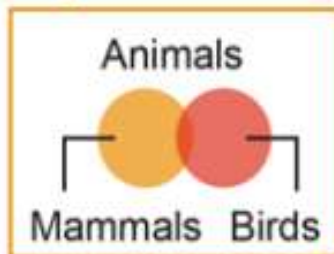


Machine Learning

- It is as a subset of artificial intelligence that enable systems to learn patterns from data and subsequently improve from experience.



Symbolists



Use symbols, rules, and logic to represent knowledge and draw logical inference

Favored algorithm

Rules and decision trees

Bayesians

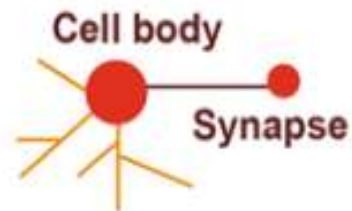


Assess the likelihood of occurrence for probabilistic inference

Favored algorithm

Naive Bayes or Markov

Connectionists



Recognize and generalize patterns dynamically with matrices of probabilistic, weighted neurons

Favored algorithm

Neural networks

Evolutionaries



Generate variations and then assess the fitness of each for a given purpose

Favored algorithm

Genetic programs

Analogizers



Optimize a function in light of constraints ("going as high as you can while staying on the road")

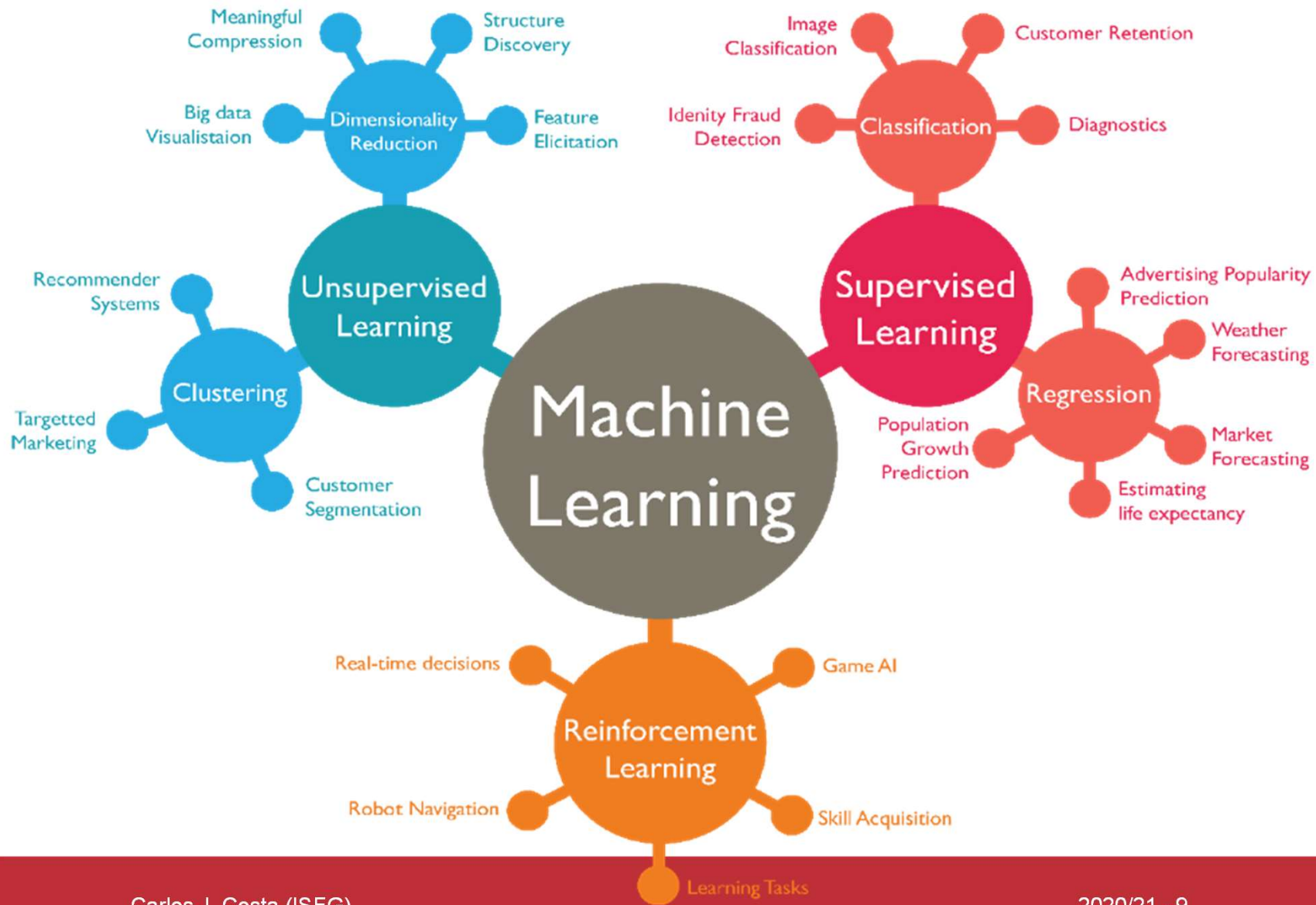
Favored algorithm

Support vectors

Source: Pedro Domingos, *The Master Algorithm*, 2015

Machine Learning

Tribe	Origins	Master Algorithm
Symbolists	Logic, philosophy	Inverse deduction
Connectionists	Neuroscience	Backpropagation
Evolutionaries	Evolutionary biology	Genetic programming
Bayesians	Statistics	Probabilistic inference
Analogizers	Psychology	Kernel machines



Machine Learning

Train-Validate-Test

- Step 1: Making the model examine data.
- Step 2: Making the model learn from its mistakes.
- Step 3: Making a conclusion on how well the model performs



Machine Learning

- Data Processing and Machine Learning
 - Libraries: Numpy, Pandas, statsmodels, sklearn, networkx
 - Tools: IDE – Jupiter



IDE: Integrated
Development
Environment

References

- Albon, Ch. (2018) *Machine Learning with Python Cookbook*. O'Reilly
- Domingos, P. (2015) *The Master Algorithm*, Penguin Books
- Hinton, J.; Sejnowski, T.(1999). *Unsupervised Learning: Foundations of Neural Computation*. MIT Press
- Morgan; P. (2019) *Data Science from Scratch with Python*, AI Science
- Murphy, K. P. (2012). *Machine Learning: A Probabilistic Perspective* (1 edition). Cambridge, MA: The MIT Press.
- Otte, E.; Rousseau, R. (2002). "Social network analysis: a powerful strategy, also for the information sciences". *Journal of Information Science*. 28 (6): 441–453. doi:10.1177/016555150202800601.
- Stuart J. R., Norvig, P. (2010) *Artificial Intelligence: A Modern Approach*, Third Edition, Prentice Hall ISBN 9780136042594.

