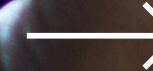


MLUP: Fundamentals of Machine Learning

Presented by Gabriel Rodrigues Palma

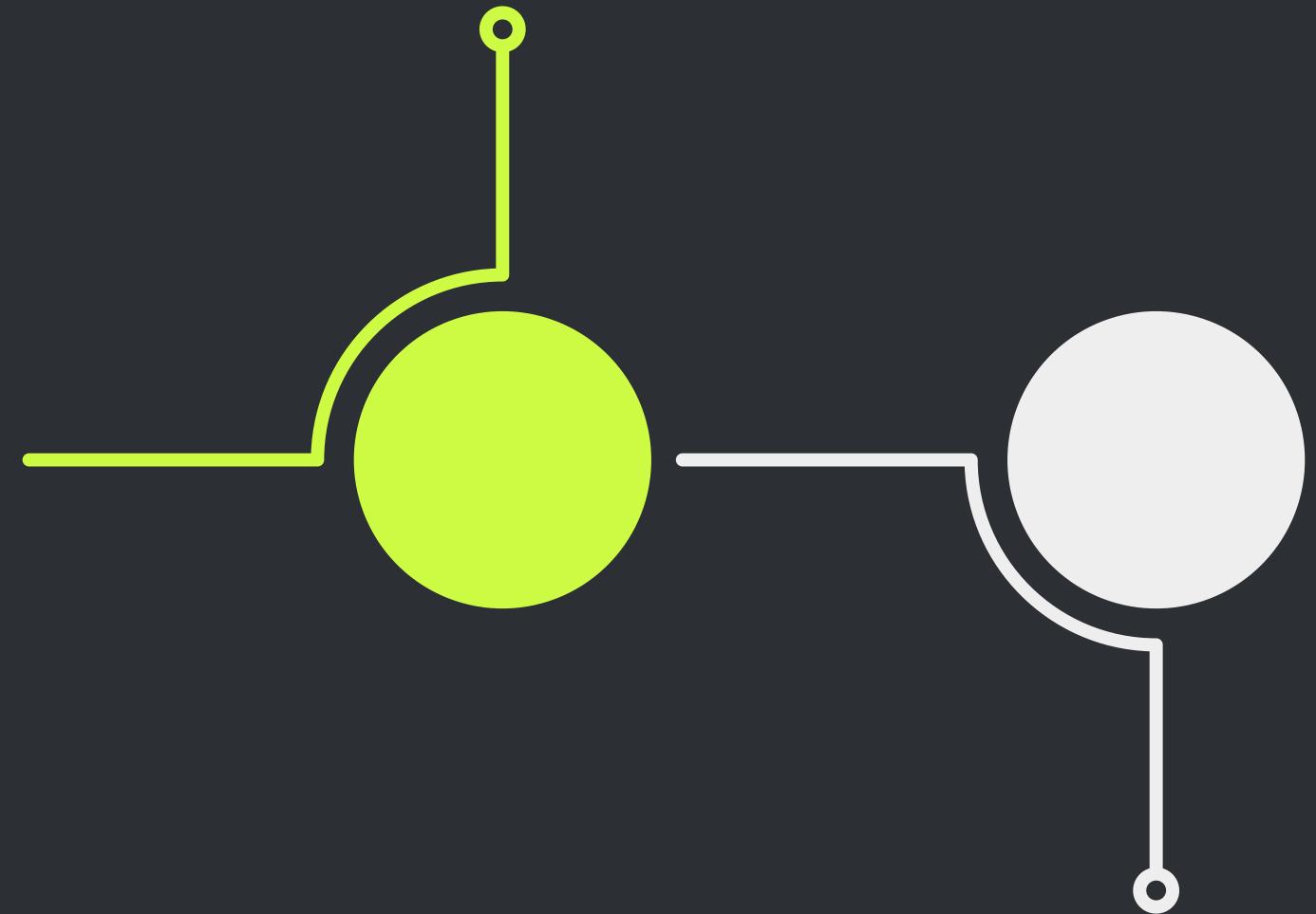


Machine Learning using
Python (MLUP01)



Day 3 (13:30 - 17:30)

Your First Steps into ML
(13:35 - 14:30)



ML definitions
(14:30 - 15:30)

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ML definitions

The area of Machine Learning (ML) is interested in answering how a computer can “learn” specific tasks

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ML definitions

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ML definitions

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Python (MLUP01)



ML definitions



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Python (MLUP01)

R stats



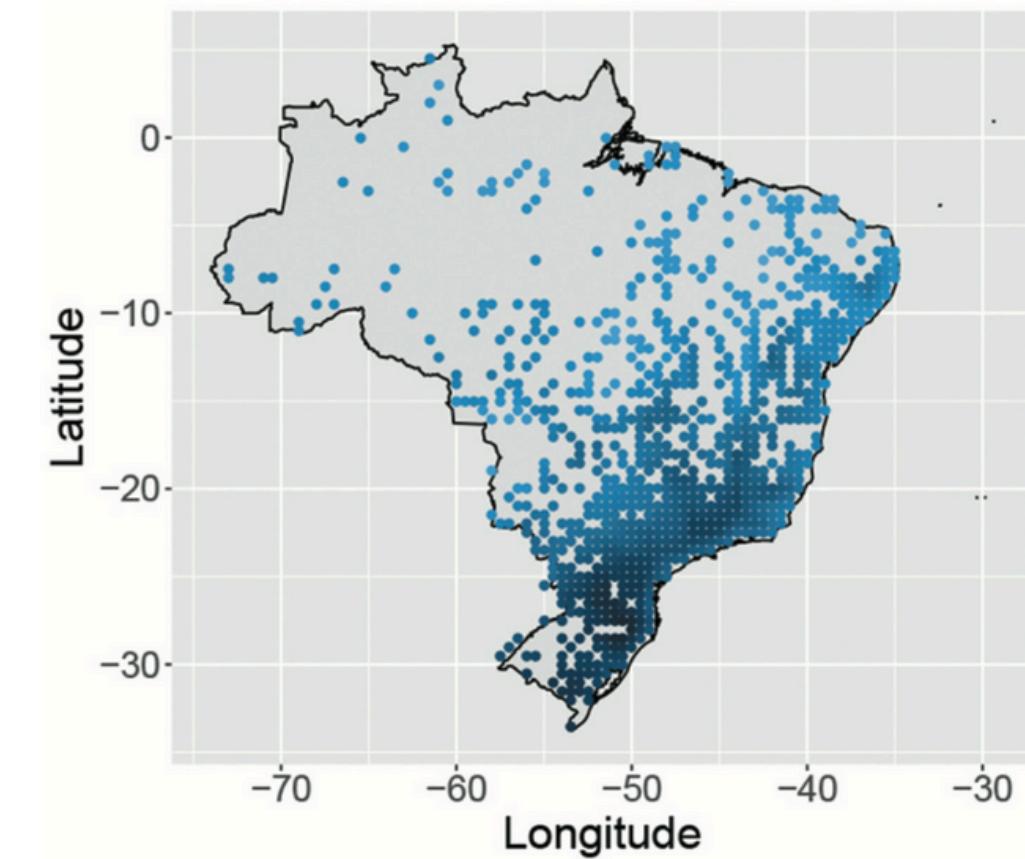
ML definitions



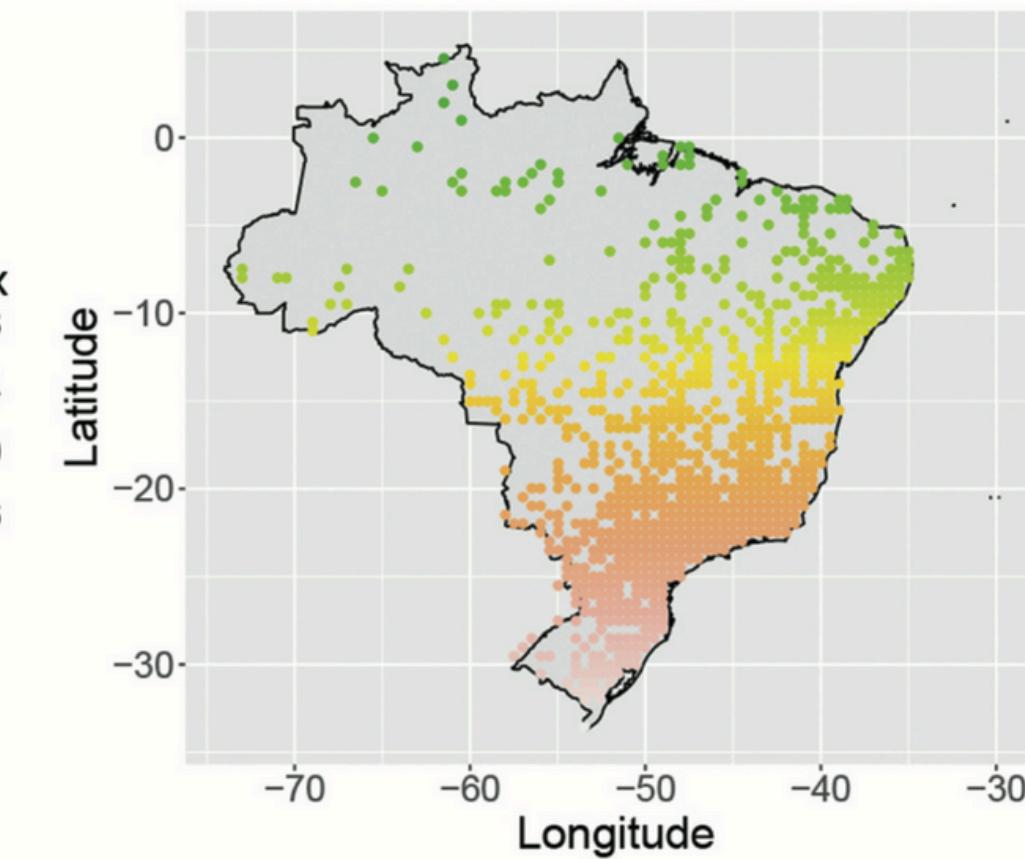
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ML definitions



(a)



(b)

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R stats



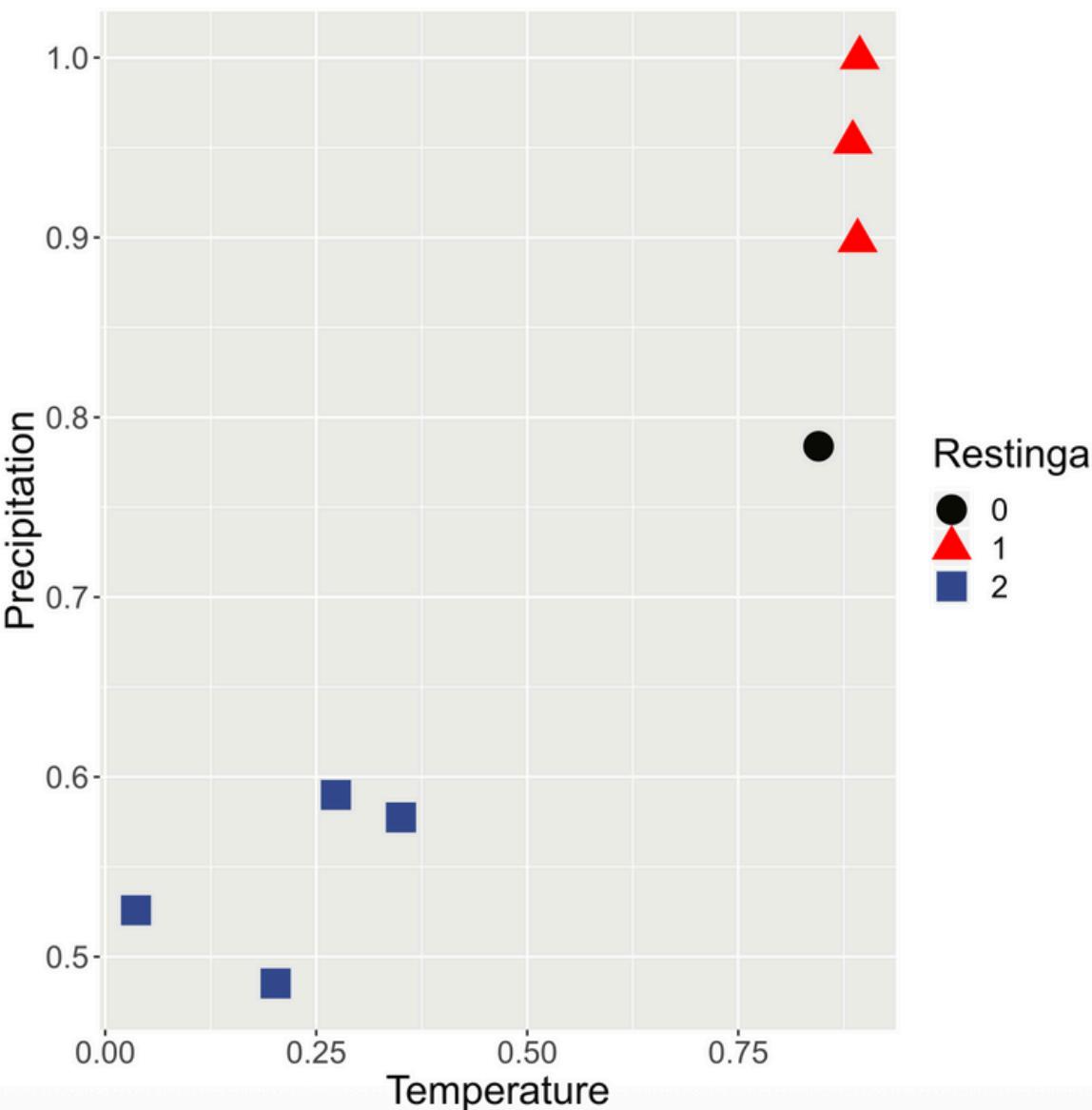
ML definitions

Temp. Range	Humidity	Precipitation	Atm	Wind	FAPAR	Ludwigia leptocarpa	Restinga
0.72	0.61	0.59	0.98	0.19	0.67	1	1
0.92	0.58	0.52	0.99	0.17	0.37	0	0
0.86	0.82	0.62	1.00	0.12	0.80	0	1
0.82	0.87	0.63	1.00	0.17	1.00	0	0

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ML definitions



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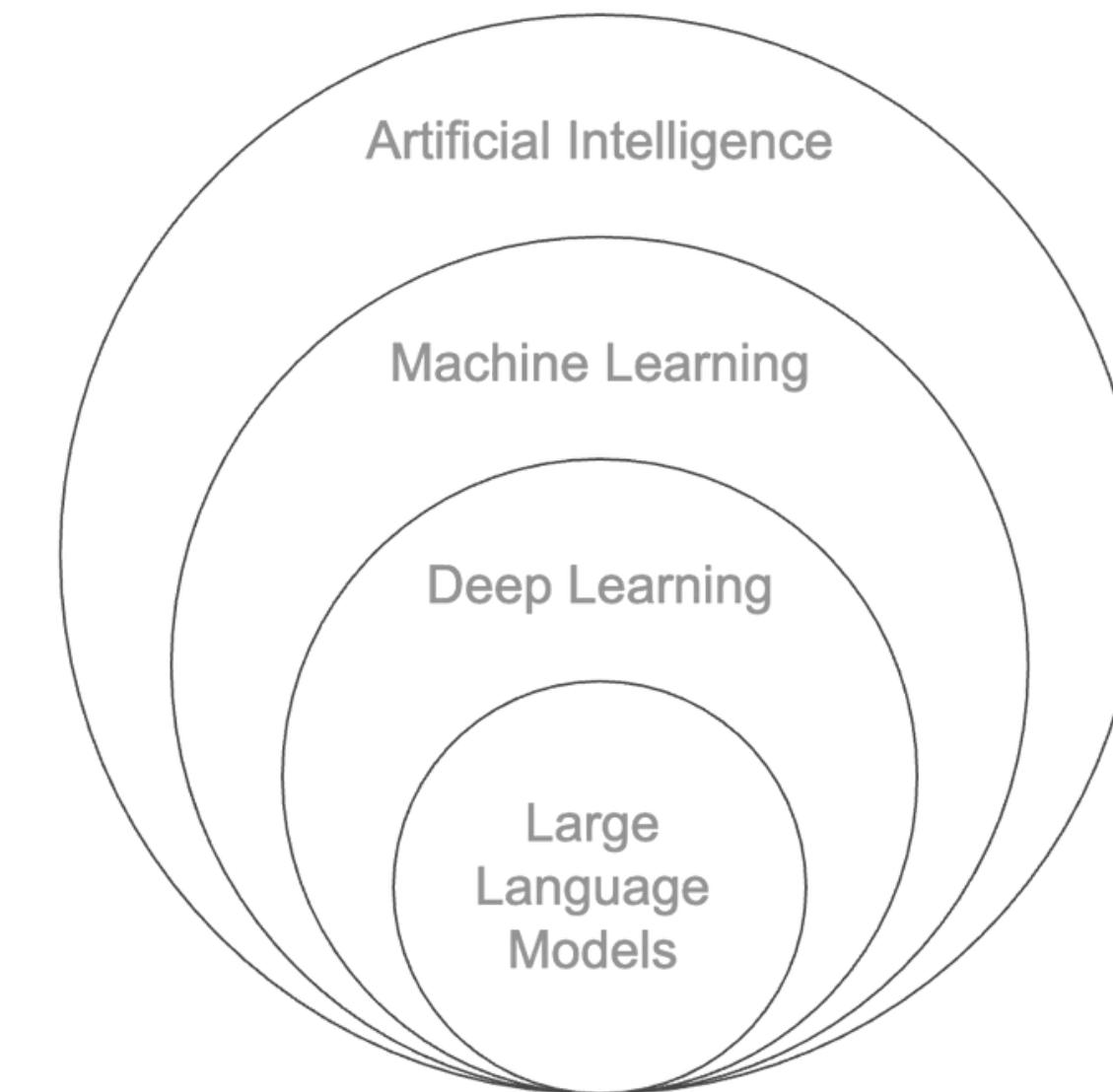
ML definitions

Broadest field of study

Subset of AI

Specialized subset of
Machine Learning

Specific applications
of Deep Learning



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ML definitions

McCulloch and Pitts (1943)

- proposed a computational model based on biological neural networks
- Model called Threshold logic

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ML definitions

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Hebb (1940s)

- psychologist, proposed the learning hypothesis based on neural plasticity mechanism
- Neural plasticity:
 - Brain's ability to remodel itself based on subject's experiences
 - Reformulation of connections according to needs and environmental factors
- Gave rise to Hebbian Learning (used in Computing from 1948)

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ML definitions

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 - A linear and binary classifier

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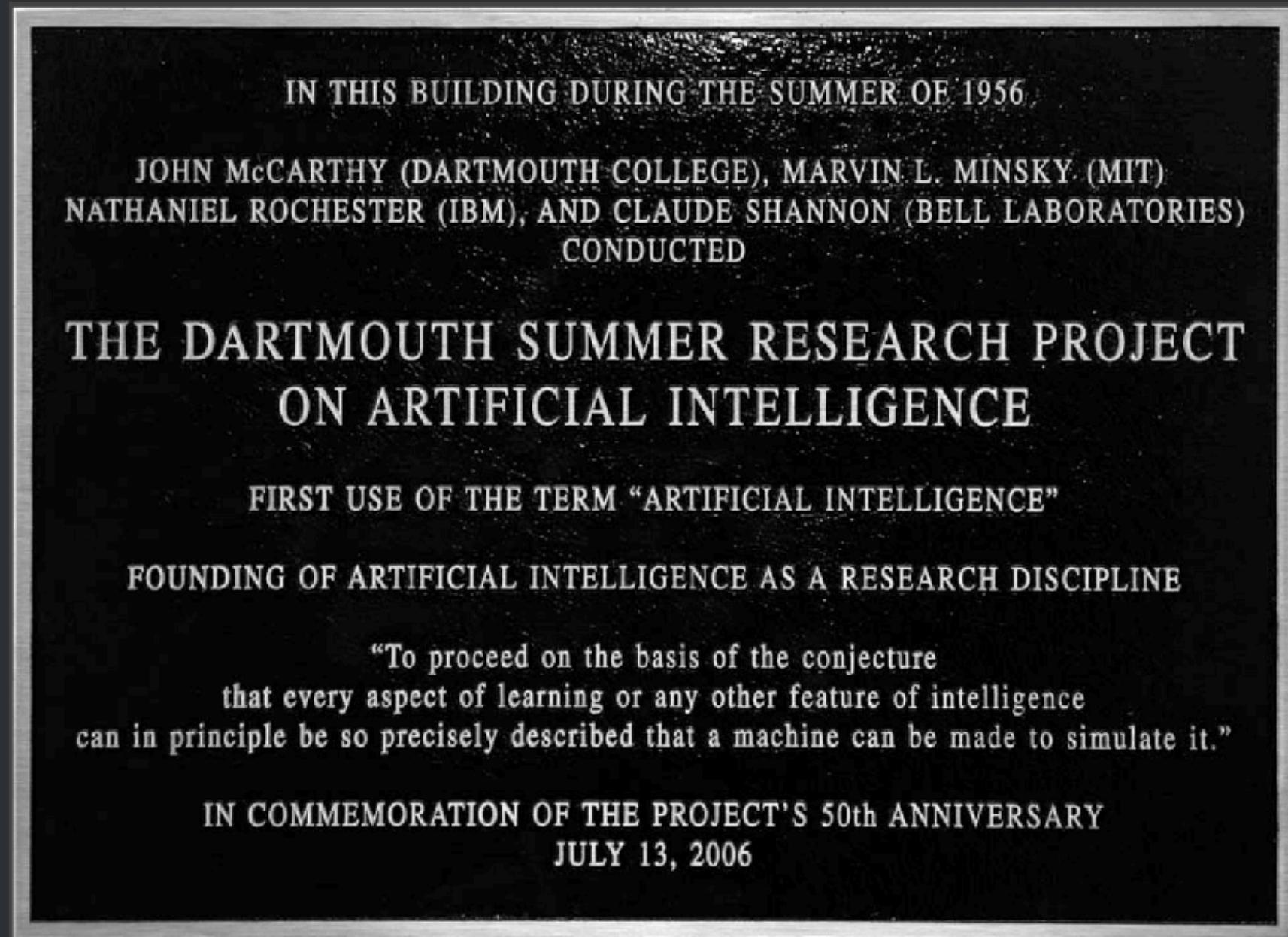
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ML definitions



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ML definitions

1956 Dartmouth Conference: The Founding Fathers of AI



John McCarthy



Marvin Minsky



Claude Shannon



Ray Solomonoff



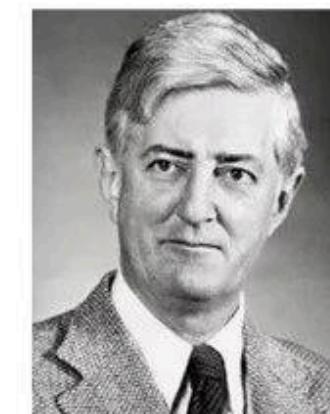
Alan Newell



Herbert Simon



Arthur Samuel



Oliver Selfridge



Nathaniel Rochester



Trenchard More

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ML definitions

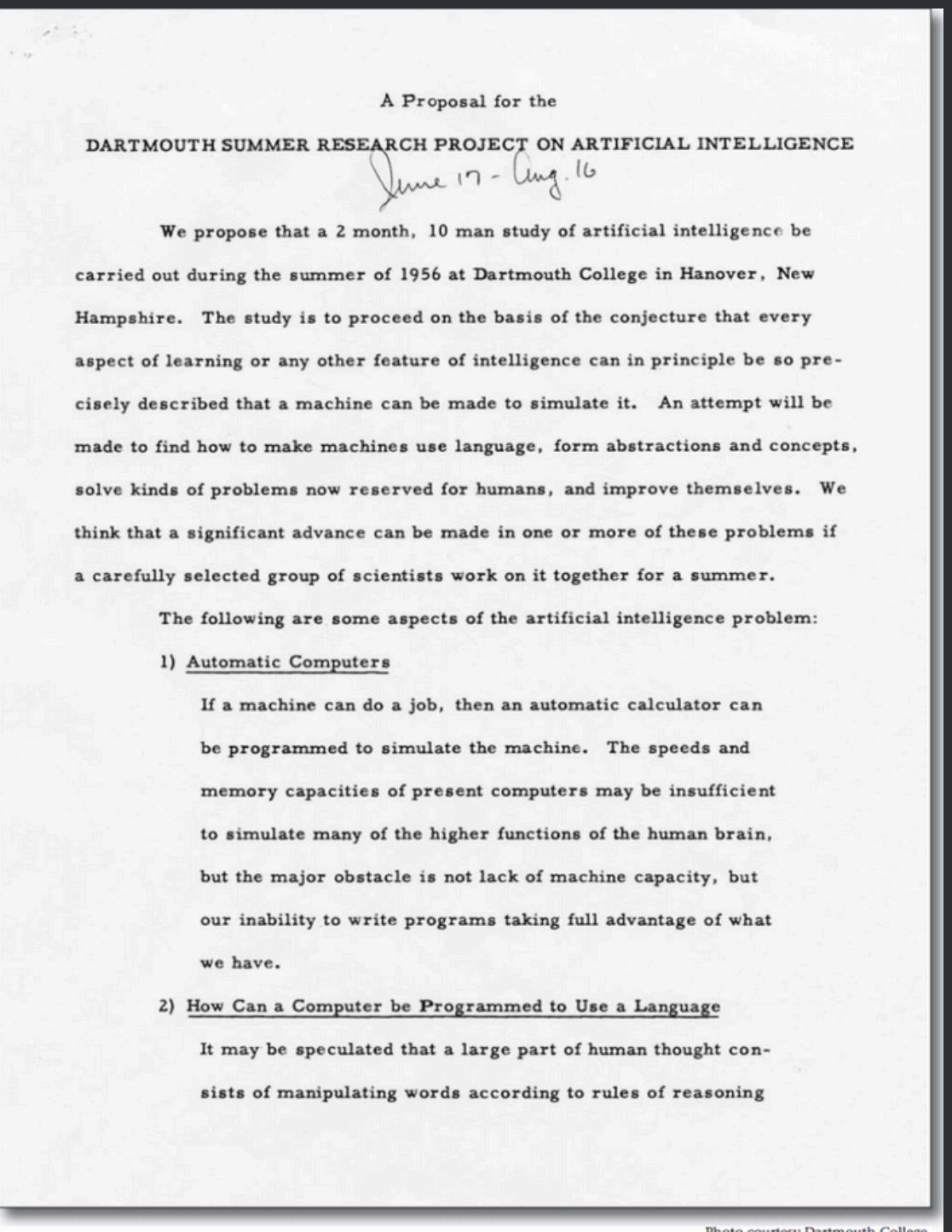


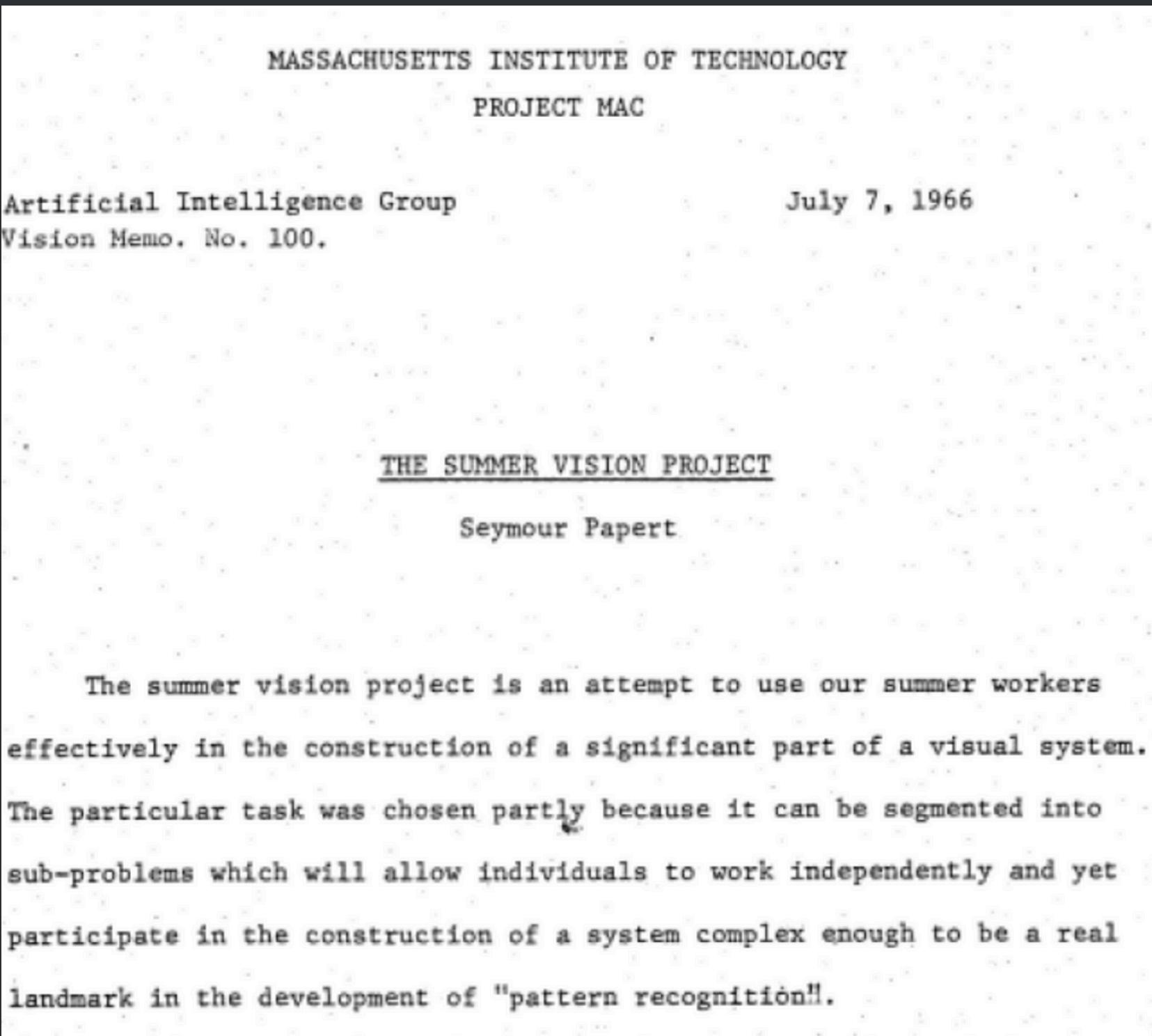
Photo courtesy Dartmouth College.

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ML definitions



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ML definitions

After Minsky and Papert's publication (1969), the field became stagnant because they discovered:

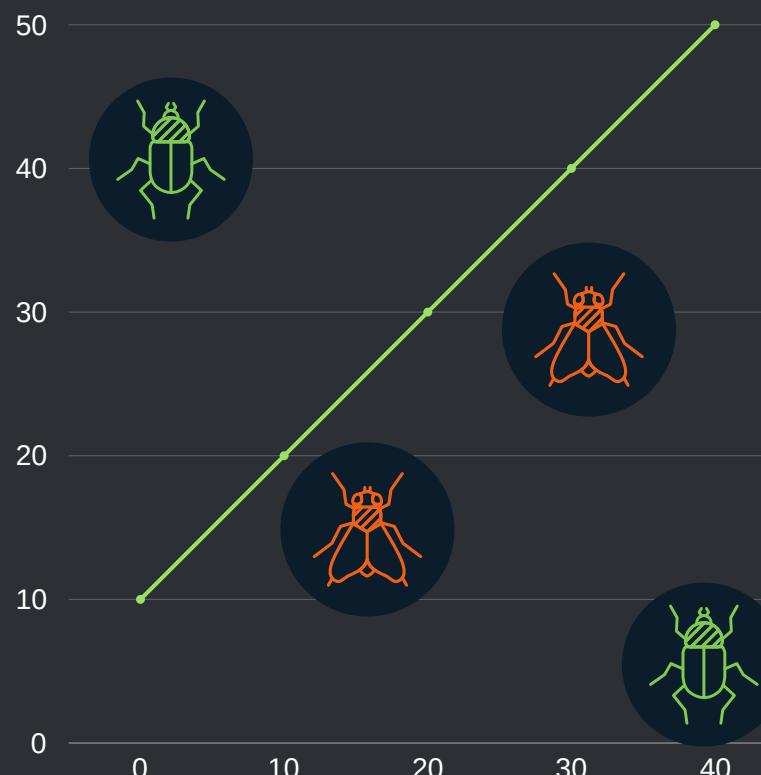
- That problems like Exclusive-OR could not be solved using the Perceptron
- Computers did not have sufficient capacity to process larger artificial neural networks

ML definitions

This discovery led to the first "AI winter" in neural network research, which lasted until the development and popularisation of backpropagation in the mid-1980s. The XOR problem demonstrated a fundamental limitation of single-layer perceptrons in their inability to solve non-linearly separable problems.

ML definitions

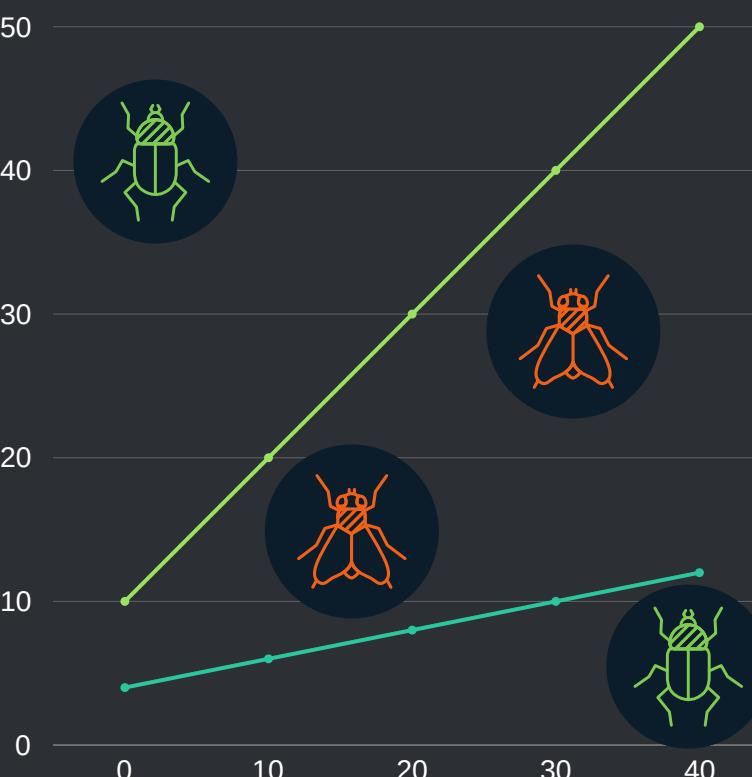
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ML definitions

Research in the field resumed after the proposal of the Backpropagation algorithm (Webos 1975):

- Solved the Exclusive-OR (xOR) problem



ML definitions

In the mid-1980s, the field of parallel and distributed processing emerged under the name of connectionism:

- Due to its use in implementing Artificial Neural Networks
- "Rediscovery" of the Backpropagation algorithm through the paper "Learning Internal Representations by Error Propagation" (1986)
- Motivated adoption and popularized usage

ML definitions

		Observed	
		Predicted	
		Yes	No
Yes		TP	FP
No		FN	TN

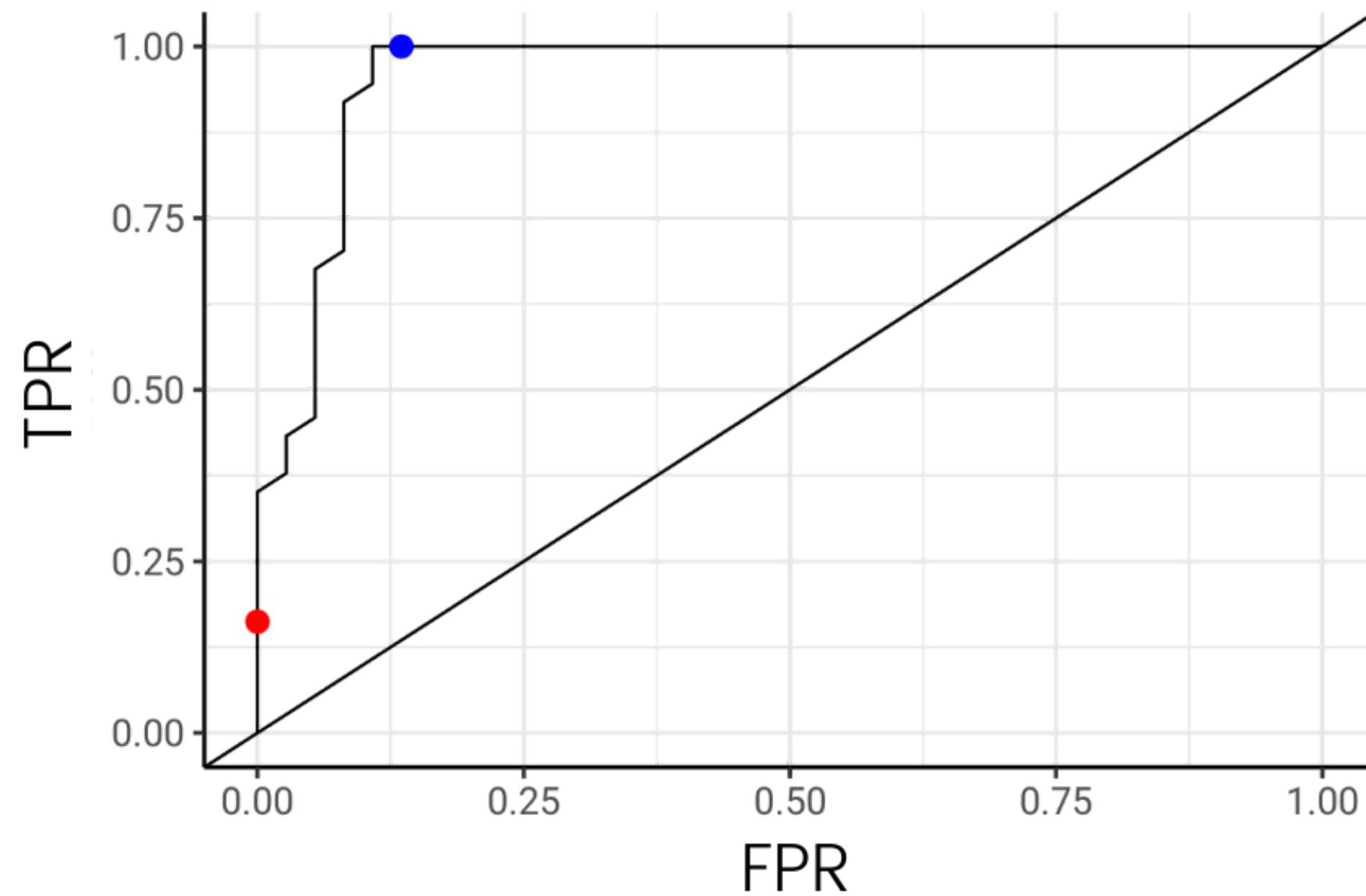
ML definitions

$$\text{TPR} = \frac{\text{TP}}{\text{TP} + \text{FN}},$$

$$\text{FPR} = \frac{\text{FP}}{\text{TN} + \text{FP}},$$

$$\text{Accuracy} = \frac{\text{TP} + \text{TN}}{\text{TP} + \text{TN} + \text{FP} + \text{FN}}.$$

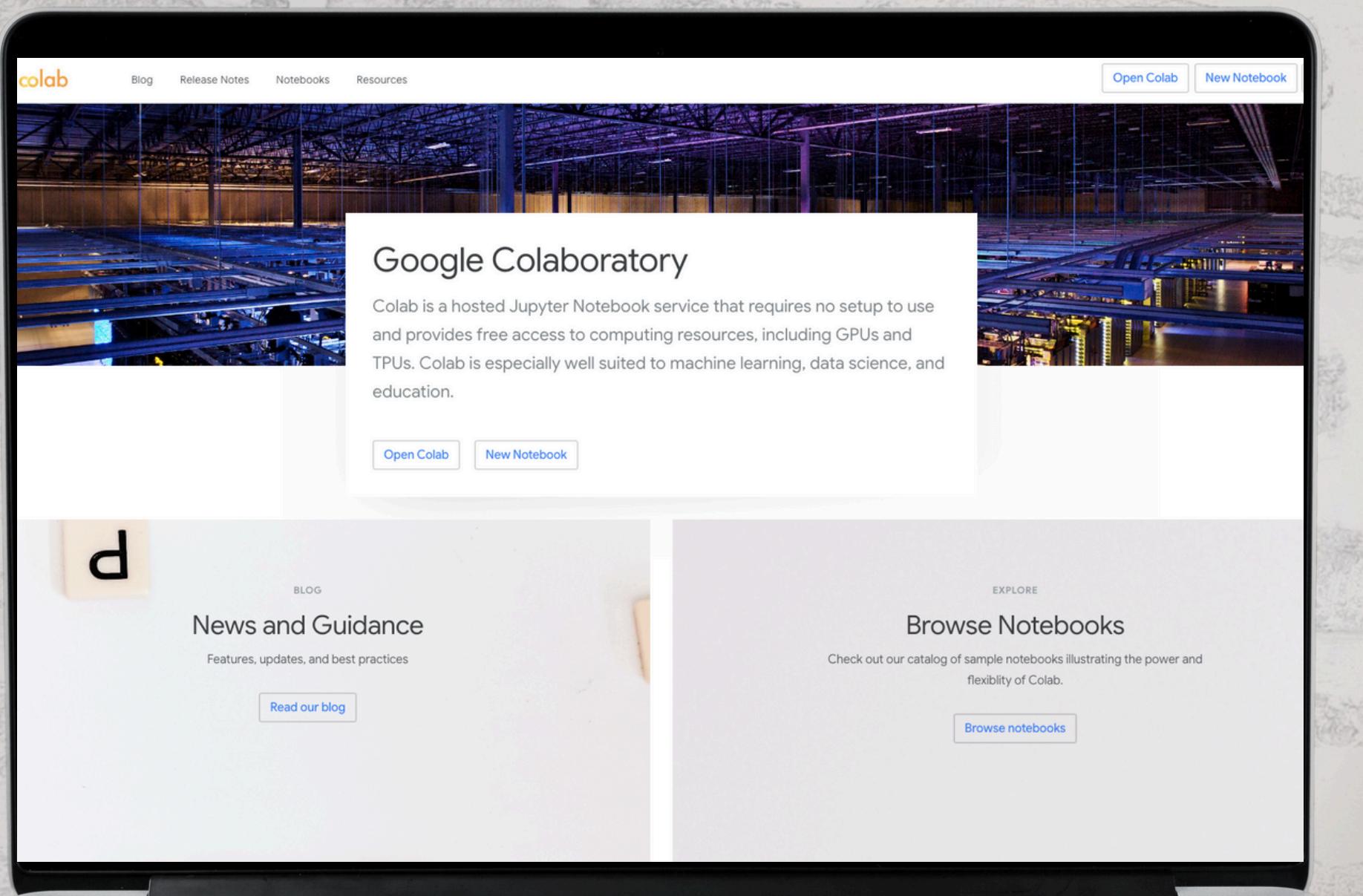
ML definitions



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ML definitions



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R stats

