

IT DATA SCIENCE AND ARTIFICIAL INTELLIGENCE: AN INTRODUCTION

Soel Micheletti · March 2022 ·

WELCOME TO THE SEMINAR IN
MACHINE LEARNING! I HOPE YOU
WILL HAVE FUN WITH THE DATA
TECHNOLOGY THAT WE USE AND
ALSO HOW TO USE IT!

WELC
MACF
WILL
TECH
ALSO



Write With Transformer

Get a modern neural network to
auto-complete your thoughts.

This web app, built by the Hugging Face team, is the official demo of the `/transformers` repository's text generation capabilities. 🗨️



58,894

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Plan

1. Introduction to Machine Learning
2. Context and history
3. Fundamental concepts
4. Why this is super exciting

Plan

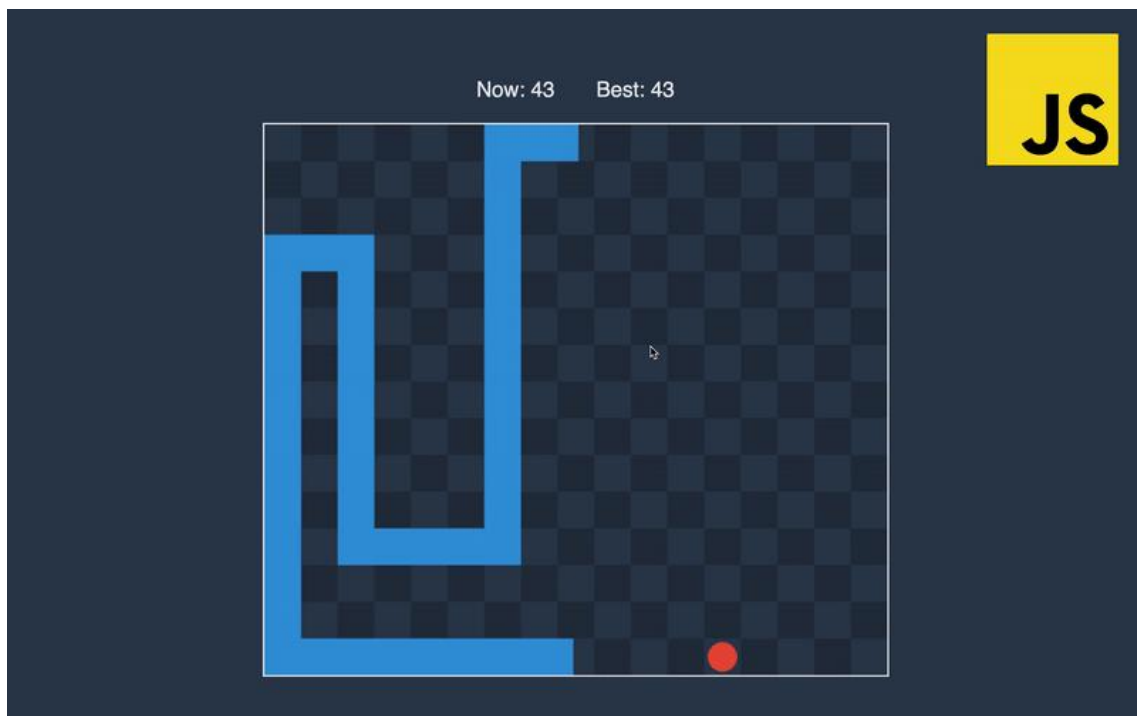
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WHAT IS MACHINE LEARNING?

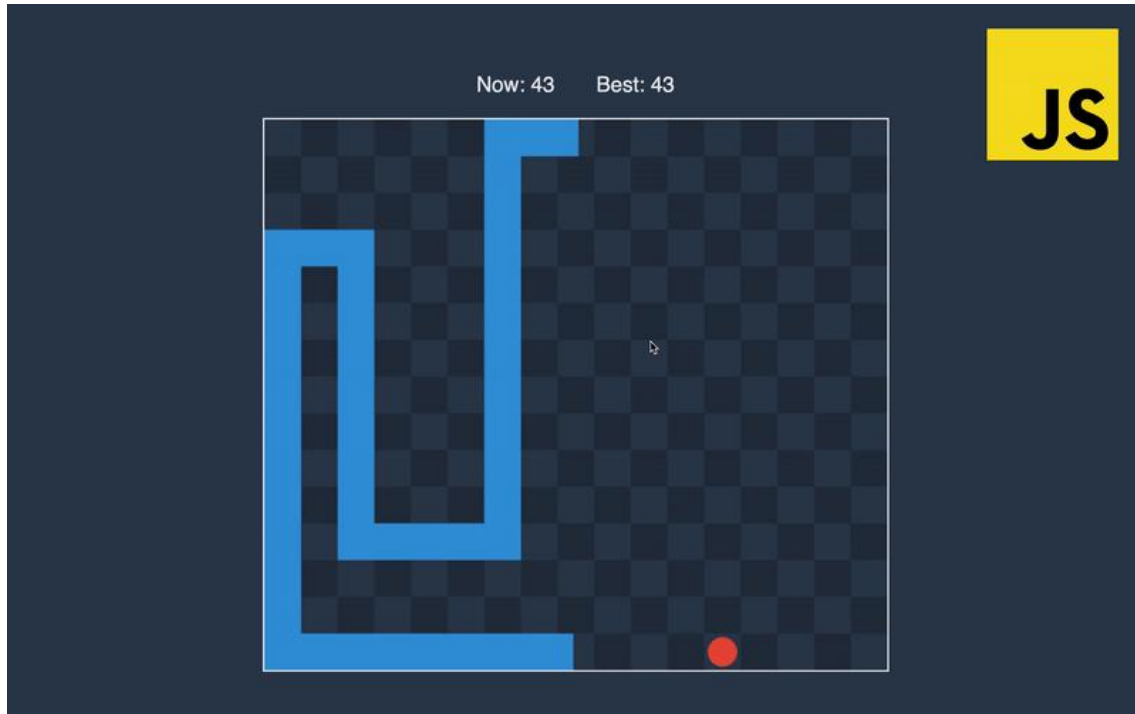
“Field of study that gives computers the ability to learn without being explicitly programmed.” (A. Samuel, 1959)

WHAT IS MACHINE LEARNING?

“Field of study that gives computers the ability to learn without being **explicitly** programmed.” (A. Samuel, 1959)



Source: <https://github.com/RodionChachura>

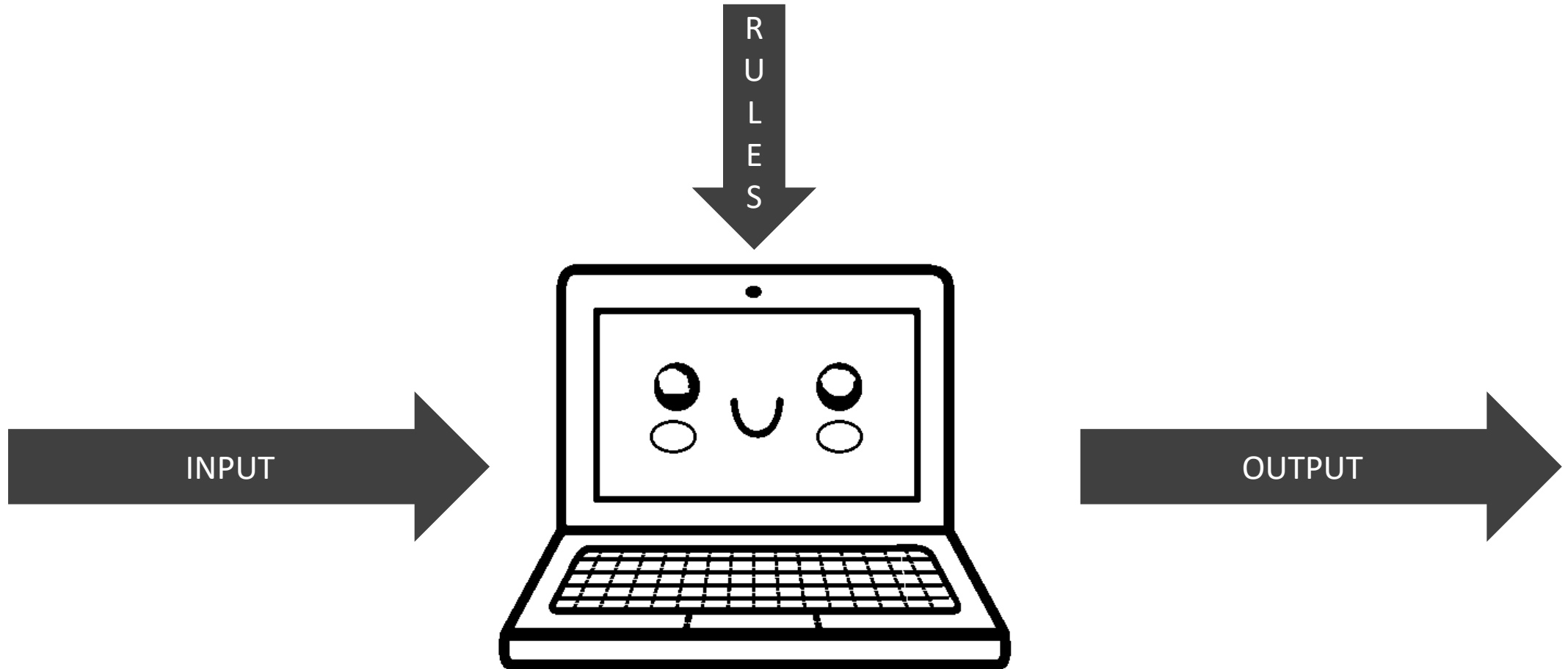


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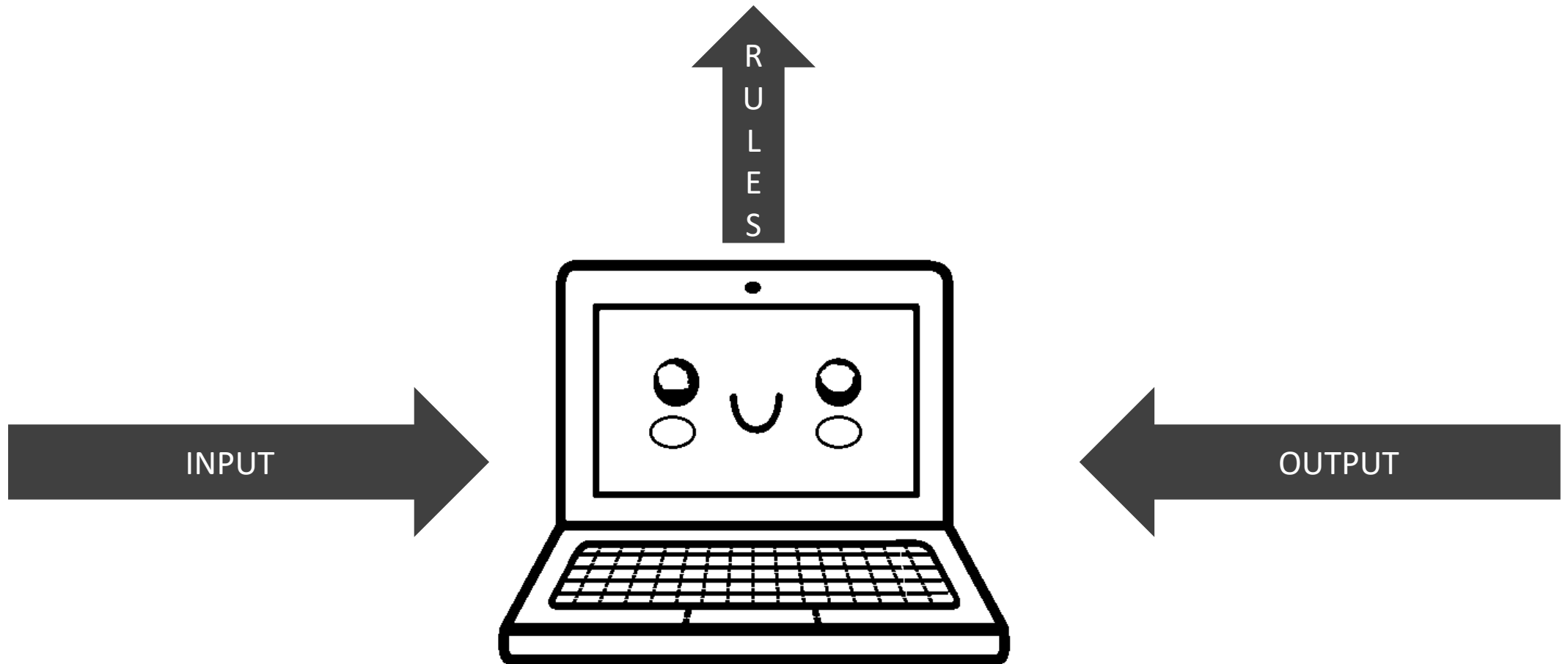


Source: <https://www.perficient.com>

“TRADITIONAL” PROGRAMMING

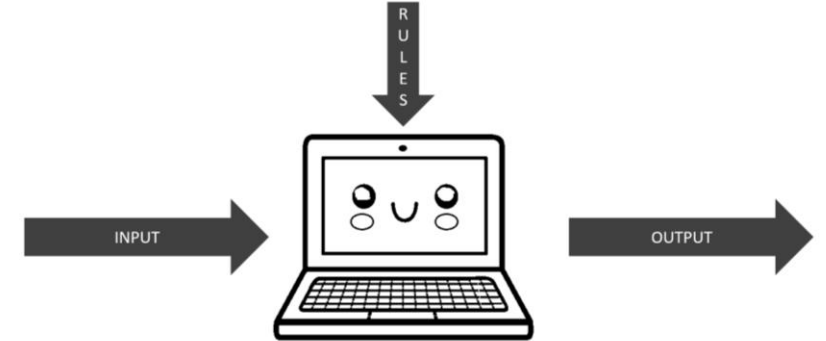


MACHINE LEARNING

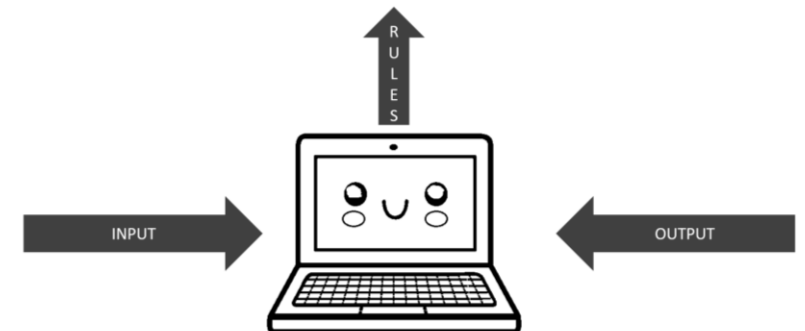


Two models

“TRADITIONAL” PROGRAMMING



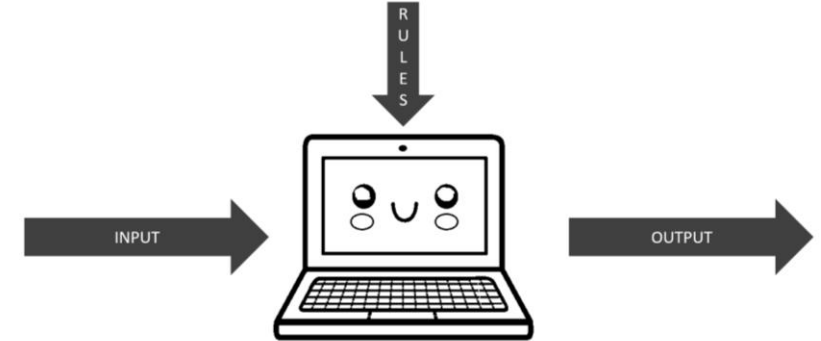
MACHINE LEARNING



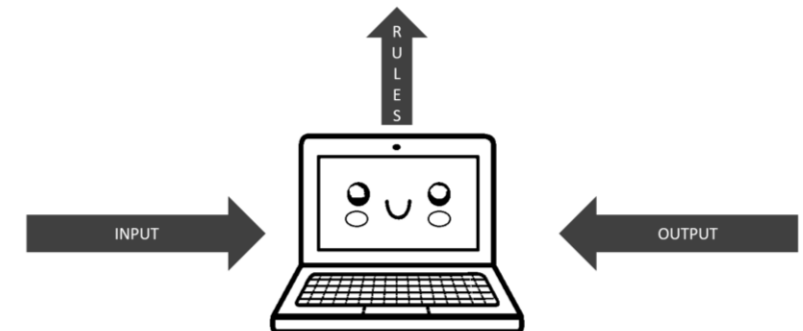
Two models

- If you need to compute average of a column in a database → Traditional Programming
- If you want to build a machine that beats the Go Master → Machine Learning

“TRADITIONAL” PROGRAMMING



MACHINE LEARNING

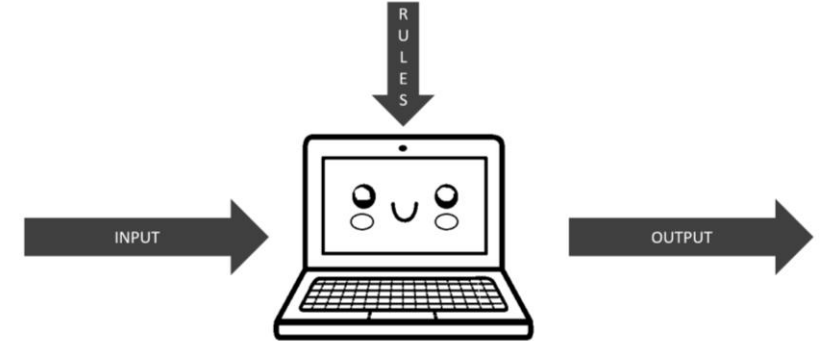


Two models

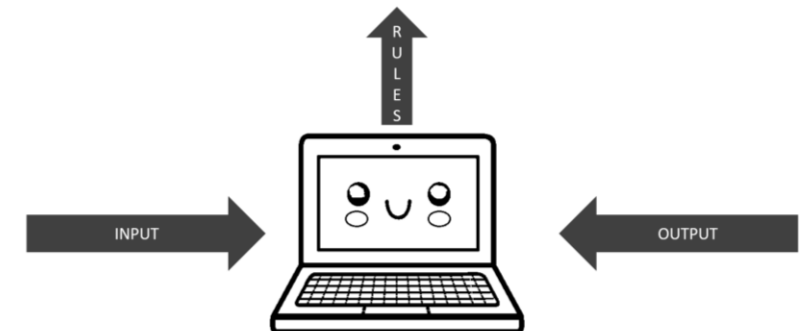
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“TRADITIONAL” PROGRAMMING



MACHINE LEARNING



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ARTIFICIAL INTELLIGENCE

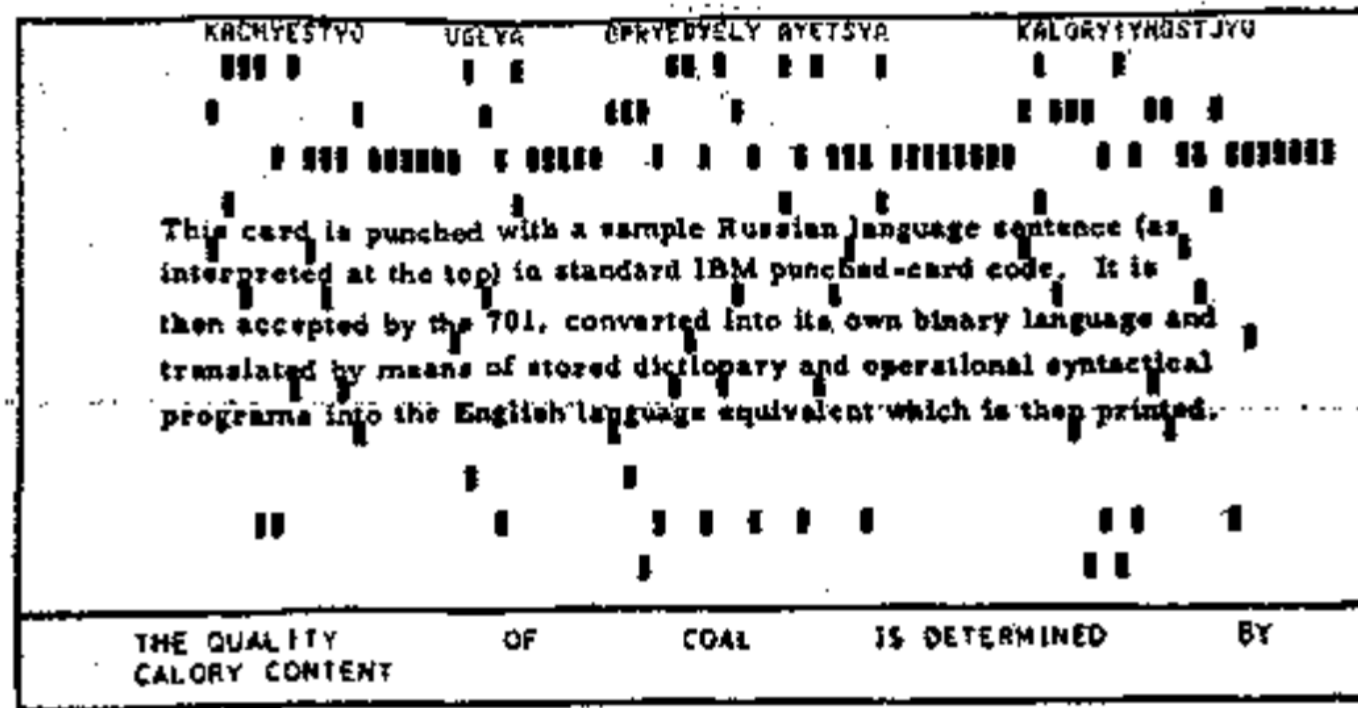
A PROPOSAL FOR THE
DARTMOUTH SUMMER RESEARCH PROJECT
ON ARTIFICIAL INTELLIGENCE

August 31, 1955

J. McCarthy, Dartmouth College
M. L. Minsky, Harvard University
N. Rochester, I.B.M. Corporation
C.E. Shannon, Bell Telephone Laboratories

We propose that a 2 month, 10 man study of artificial intelligence be carried out during the summer of 1956 at Dartmouth College in Hanover, New Hampshire. The study is to proceed on the basis of the conjecture that every aspect of learning or any other feature of intelligence can in principle be so precisely described that a machine can be made to simulate it. An attempt will be made to find how to make machines use language, form abstractions and concepts, solve kinds of problems now reserved for humans, and improve themselves. We think that a significant advance can be made in one or more of these problems if a carefully selected group of scientists work on it together for a summer.

FIRST EXPERIMENT



SPECIMEN punched card with, below, a strip with translation, printed within a few seconds of being fed into the machine.

FIRST EXPERIMENT

The **spirit** is strong, but the **flesh** is weak

The **whiskey** is strong, but the **meat** is rotten



ARTIFICIAL INTELLIGENCE

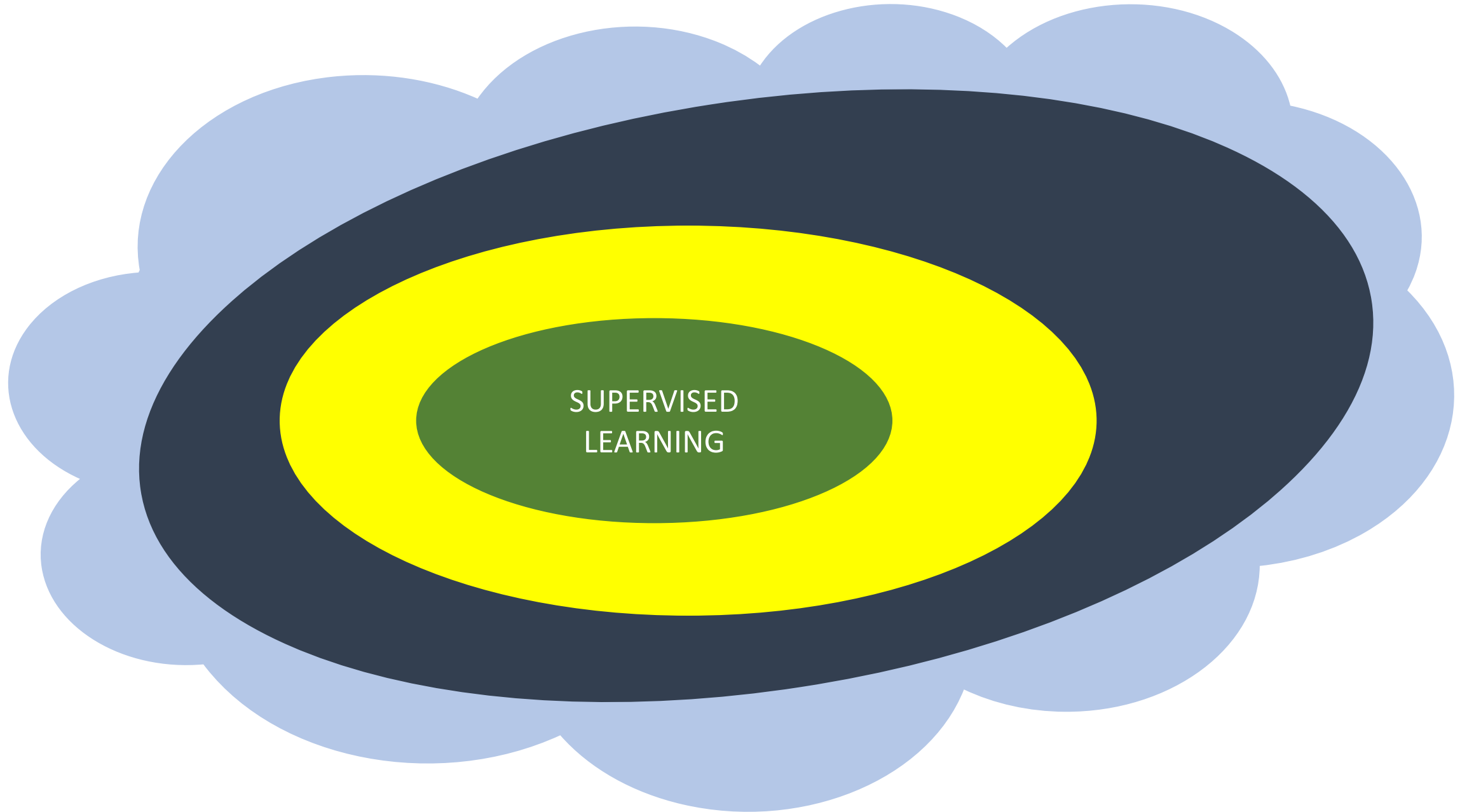


DATA SCIENCE



A graphic featuring three concentric ovals. The innermost oval is yellow and contains the text "MACHINE LEARNING". The middle oval is dark blue. The outermost layer is a light blue cloud-like border. The text "MACHINE LEARNING" is centered within the yellow oval.

**MACHINE
LEARNING**



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$$Y = f(X)$$

$$Y = f(X)$$

SUPERVISED LEARNING

REGRESSION	CLASSIFICATION
<ul style="list-style-type: none">• Continuous output• Given various information about a house, what is its price?	<ul style="list-style-type: none">• Discrete output• Given an image, is it a dog or a cat?• Famous examples: segmentation, image recognition, object detection, fraud detection...

DOG

=

f

(



)

CAT

=

f

(



)

CAT

=

f

(



)

DOG

=

f

(



)

AFTER “ENOUGH” EXAMPLES...

?

=

f

(



)

DOG

=

f

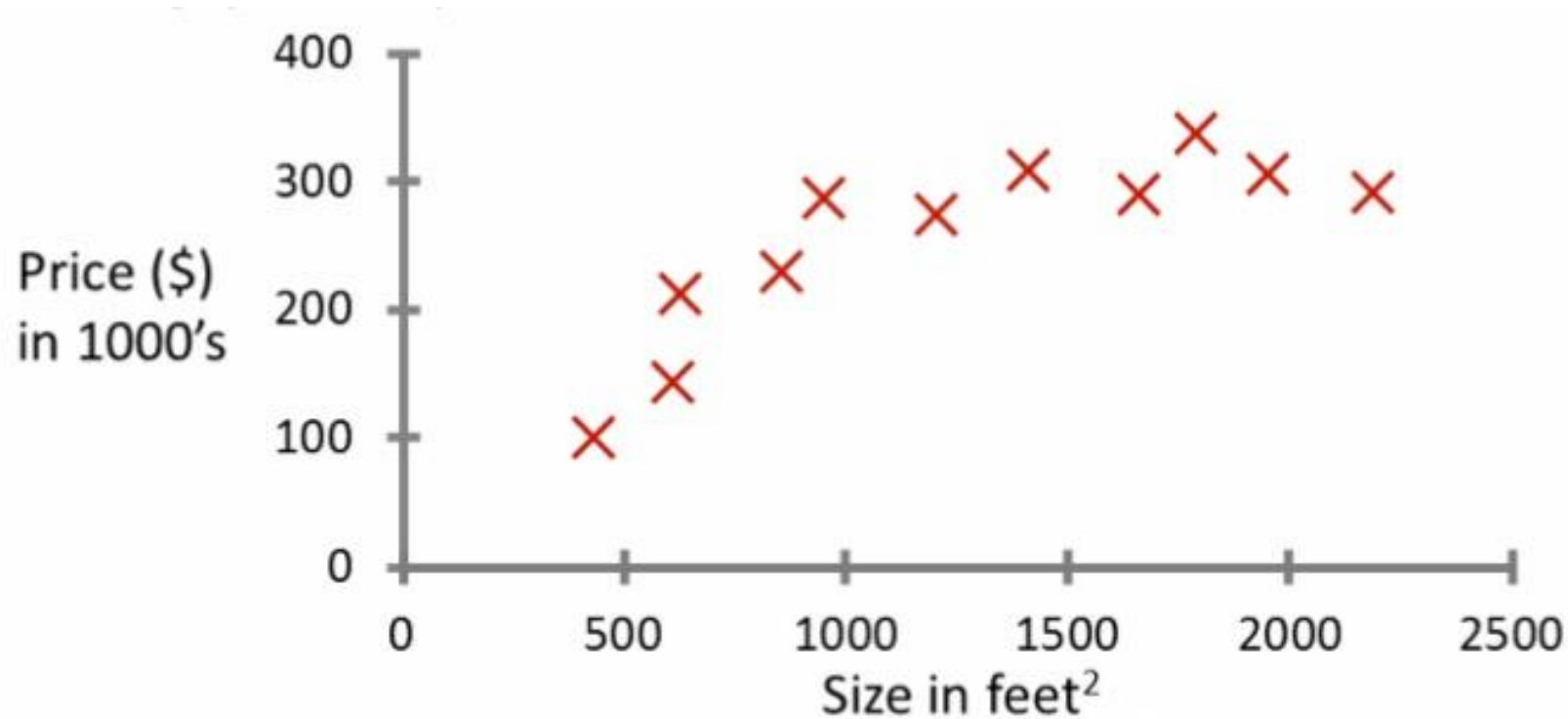
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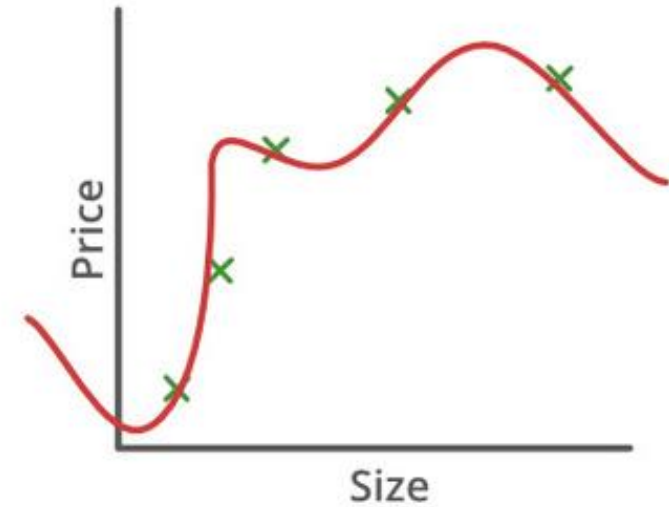
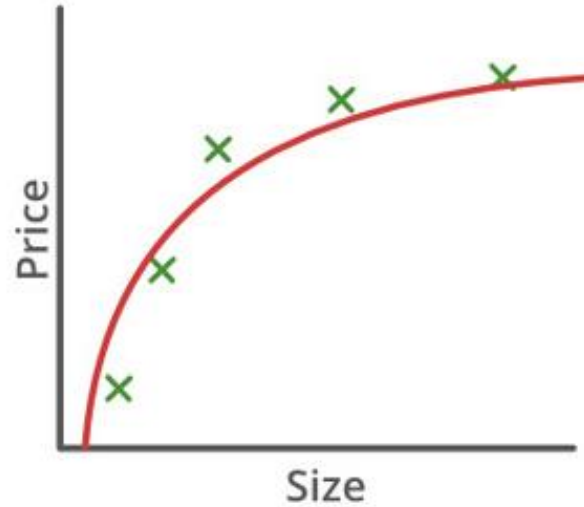
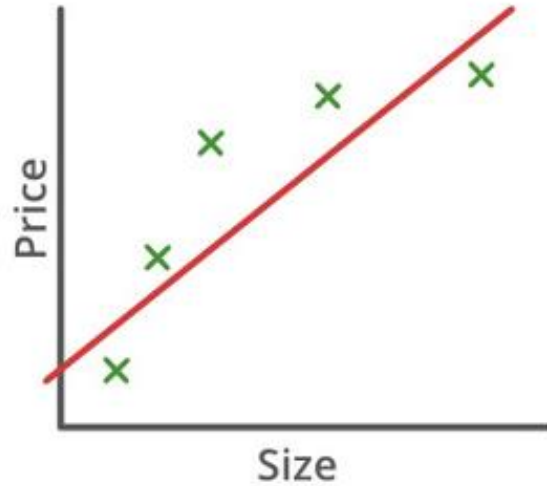
HOUSE PRICING EXAMPLE

- **The Problem:** given the size of a house, we want to predict its price.



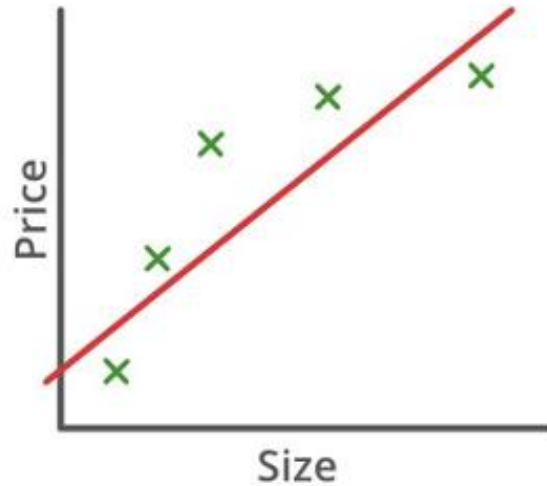
Source: <https://www.udemy.com>

WHAT IS THE “BEST” FUNCTION?

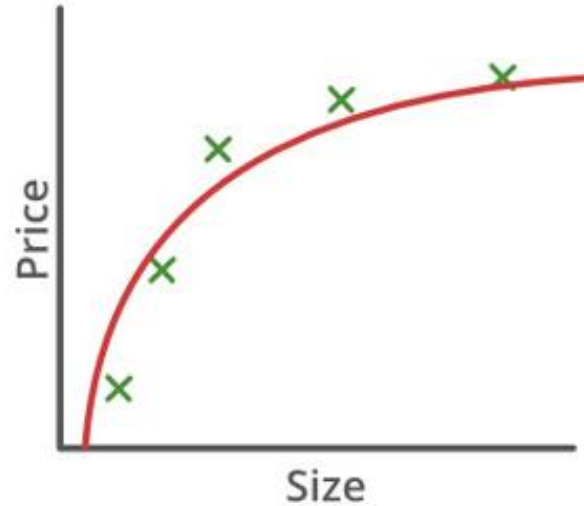


Source: <https://www.geeksforgeeks.com>

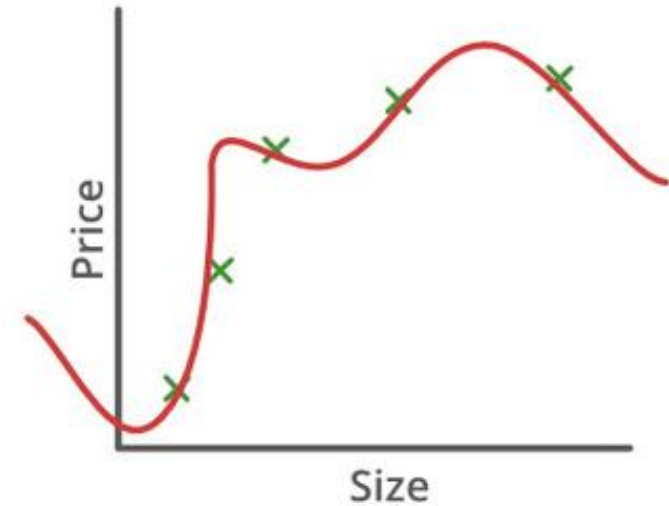
WHAT IS THE “BEST” FUNCTION?



Underfit



(Maybe) good fit



Overfit

GOAL OF SUPERVISED LEARNING

Find a “good” function f that maps the features X to the labels Y such that

GOAL OF SUPERVISED LEARNING

Find a “good” function f that maps the features X to the labels Y such that the **error is small...**

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!! ON NEW DATA !!

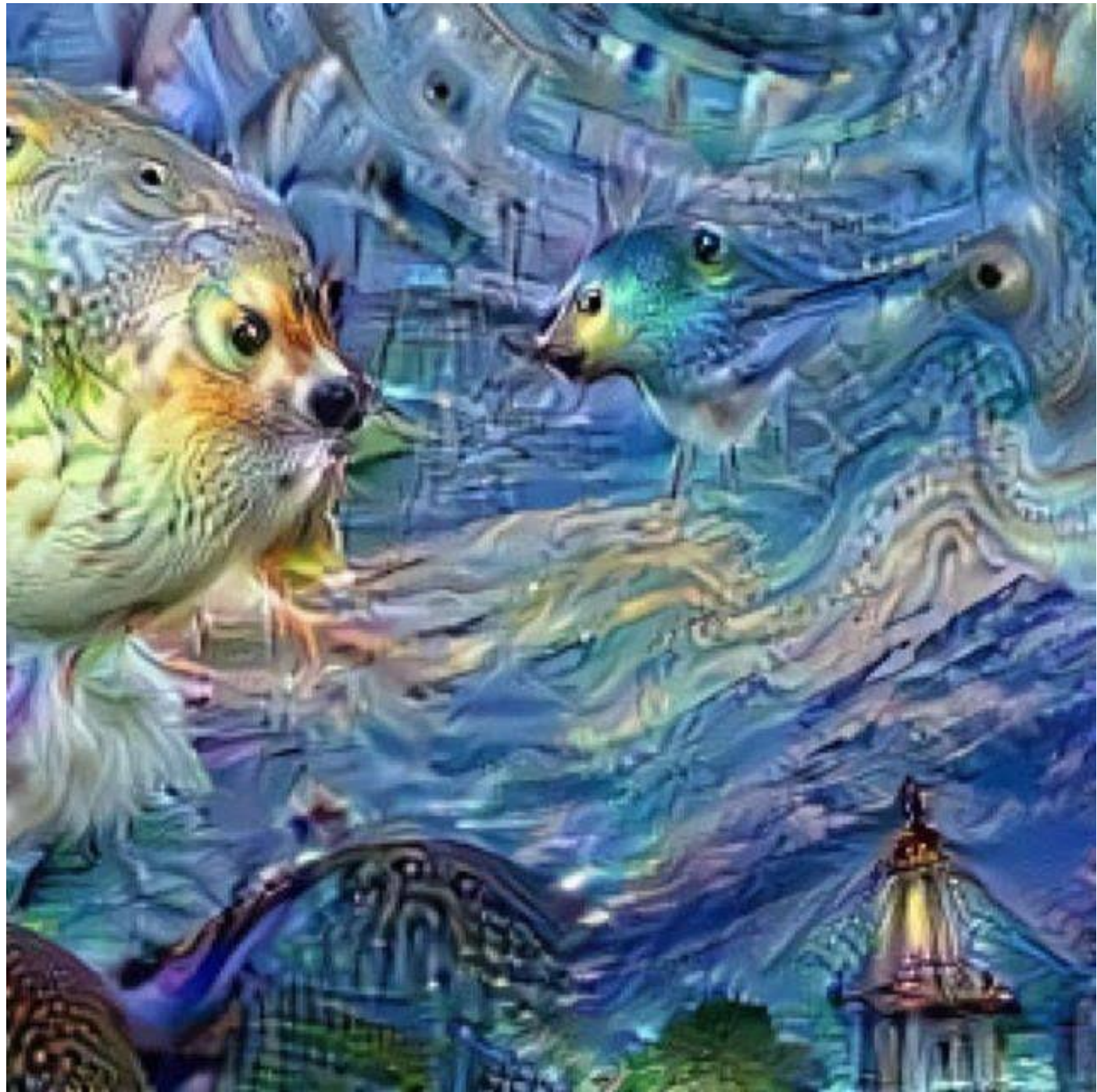
GOAL OF SUPERVISED LEARNING

GENERALIZATION

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COOL = f (MACHINE LEARNING IS)



GOAL OF SUPERVISED LEARNING

Find a “good” function f that maps the features X to the labels Y such that the **error is small...**

!! ON NEW DATA !!

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DATA

!! ON NEW DATA !!

GOAL OF SUPERVISED LEARNING

ALGORITHM

Find a “good” function f that maps the features X to the labels Y such that the **error is small...**

DATA

!! ON NEW DATA !!



COMPUTING POWER



DATA



ALGORITHMS