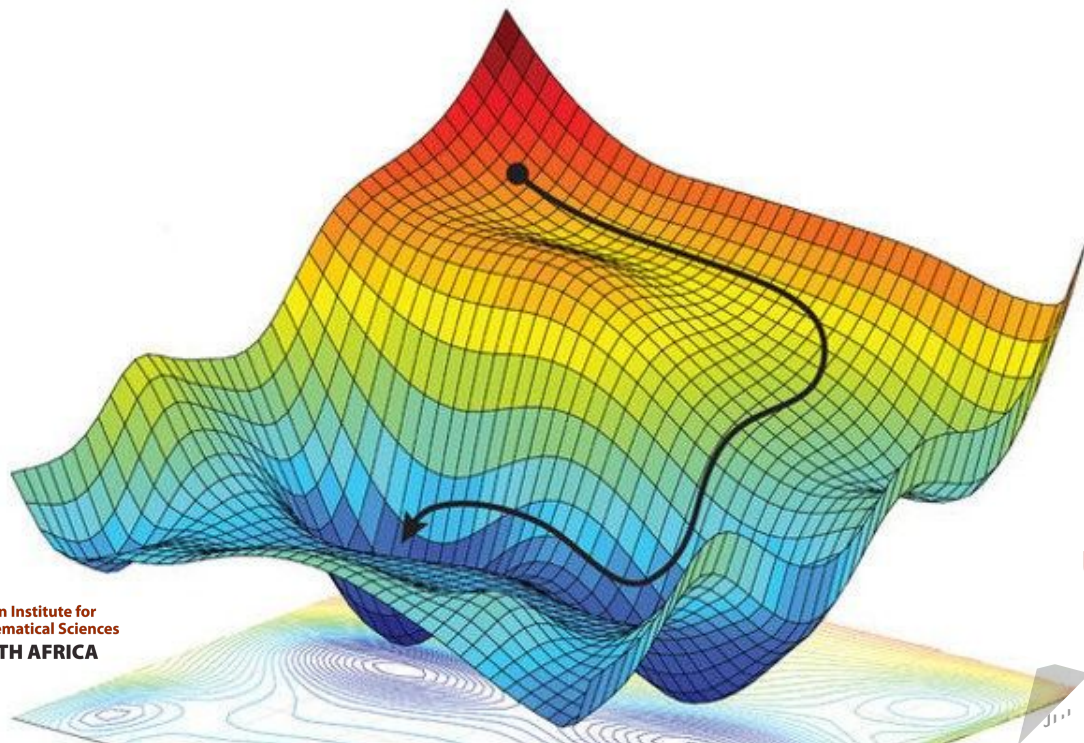


# EASY-ML 2025

## What is Artificial Intelligence, what is Machine Learning?



Claire David



**AIMS**

African Institute for  
Mathematical Sciences  
SOUTH AFRICA

University of Nairobi

July 2025

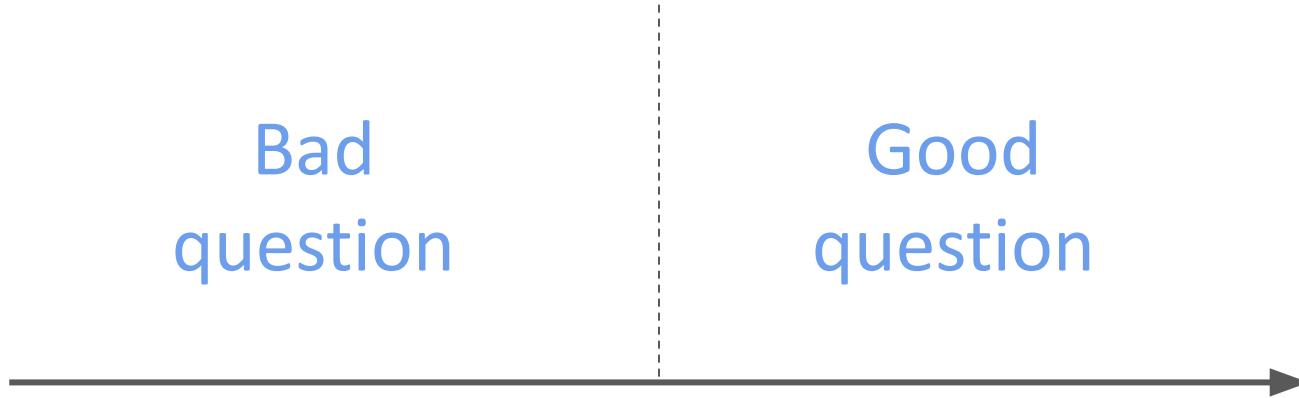
A caribou



# Course Goals

1. Fun
2. Understand the basic math behind Machine Learning
3. Learn how to write beautiful code in python
4. Learn how to ask for help
5. Learn how to learn

# Question ranking



# Question ranking



You will likely be confused.

And it's okay.

Quote of the day:

“Confusion is the sweat of learning”



# How do we learn?

# With questions

# Ready?

## Game 1:

In groups of four, write one or two sentences to answer the question:

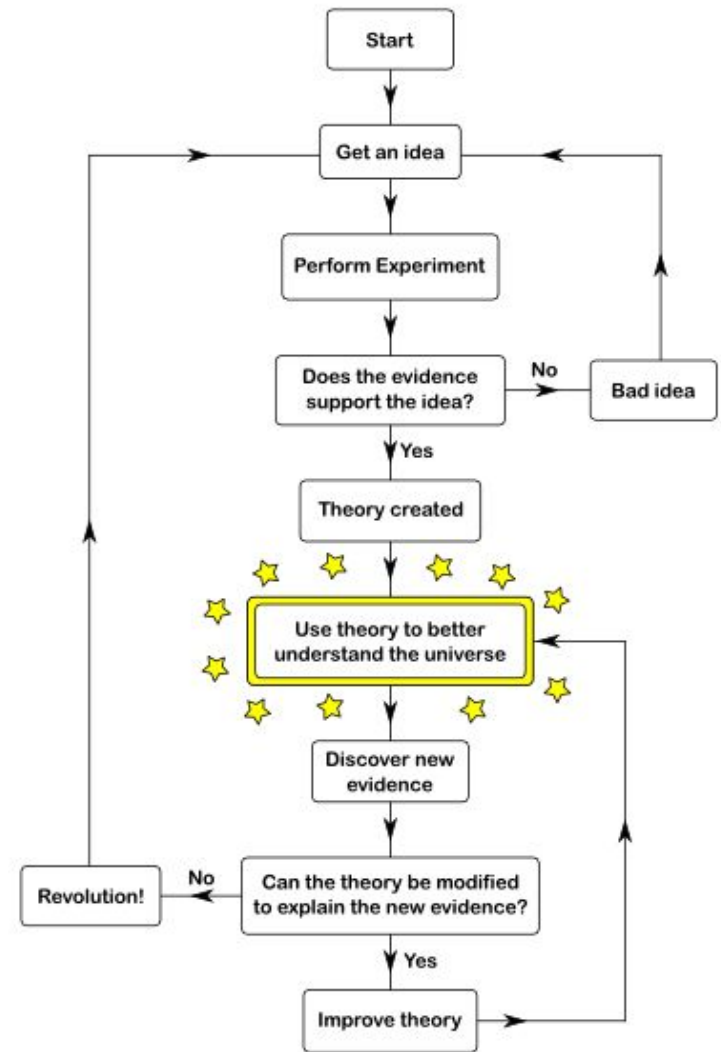
# What is the scientific method?

## Definition Scientific Method

Protocol to acquire knowledge starting with a formulated **hypothesis** whose validity is examined through an **experiment** and **accepted/rejected** depending on the observed results.

Shorter version: *Guess and Check*

As an experimental particle physicist,  
**I check models.**



# How does the scientific method work in practice?

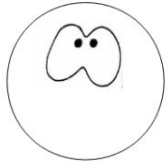
# What is my job?

I am an...

# Experimental Particle Physicist

I need:

Particles



Detector



Computers





# The Large Hadron Collider

[Video CERN](#)



---

## E A S Y - M L      S T U D E N T      S H U F F L E R

Forming 10 teams with constraints:

- no more than 3 Kenyans in a team
- max 2 students from Kenya University in each team
- parity male/female (except for one team)
- at least 2 MSc students per team (except for one team)

---

[INFO] Loaded 40 participants from EASY-ML\_participants.csv

[INFO] Forming 10 teams per draw, across 100000 draws.

Total number of participants: 40

Gender split:

- 21 males, 19 females

Career stage:

- 20 MSc, 16 PhD and 4 Early Career Scientists

Represented countries:

- 30 student(s) from Kenya
- 4 student(s) from Tanzania
- 3 student(s) from Uganda
- 2 student(s) from Ethiopia
- 1 student(s) from Rwanda

# More questions

Annoyingly basic questions

## Game 2:

Write keywords or one sentence on the next slide's question

First alone (2 min) then in groups of four (3 min)

# What is intelligence?

# Definition(s) of intelligence

## Wikipedia (English)

- Capacity for abstraction, logic, understanding, self-awareness, learning, emotional knowledge, reasoning, planning, creativity, critical thinking, and problem-solving
- Ability to perceive or infer information, and to retain it as knowledge to be applied towards adaptive behaviors within an environment or context.

## Wikipedia (French)

- Faculty of adaptation ; learning to adapt to the environment
- Faculty of modifying the environment to adapt it to one's own needs
- Ability to process information to achieve goals



A fundamental problem in artificial intelligence is that nobody really knows what intelligence is.

## Informal working definition:

“Intelligence measures an agent’s ability to achieve goals in a wide range of environments.”

... “a system may appear to be intelligent without really understanding anything.”

---

## Universal Intelligence: A Definition of Machine Intelligence

---

Shane Legg

IDSIA, Galleria 2, Manno-Lugano CH-6928, Switzerland

shane@vetta.org    www.vetta.org/shane

Marcus Hutter

RSISE @ ANU and SML @ NICTA, Canberra, ACT, 0200, Australia

marcus@hutter1.net    www.hutter1.net

December 2007

### Abstract

A fundamental problem in artificial intelligence is that nobody really knows what intelligence is. The problem is especially acute when we need to consider artificial systems which are significantly different to humans. In this paper we approach this problem in the following way: We take a number of well known informal definitions of human intelligence that have been given by experts, and extract their essential features. These are then mathematically formalised to produce a general measure of intelligence for arbitrary machines. We believe that this equation formally captures the concept of machine intelligence in the broadest reasonable sense. We then show how this formal definition is related to the theory of universal optimal learning agents. Finally, we survey the many other tests and definitions of intelligence that have been proposed for machines.

# What is learning?

# What is understanding?



# What is artificial?

# What is artificial?

## Etymology

from Latin *artificiālis* → artificium → belonging to art, crafted by humans

# How old is Artificial Intelligence?

# Artificial Intelligence

## Dartmouth College, summer 1956

- "AI" attributed to John McCarthy of MIT
- Another founder Marvin Minsky (MIT) defines it as:

“The construction of computer programs that engage in tasks that are currently more satisfactorily performed by human beings because they require high-level mental processes such as: perceptual learning, memory organization and critical reasoning.”

---

“Artificial intelligence is not, by definition, simulation of human intelligence”

John McCarthy

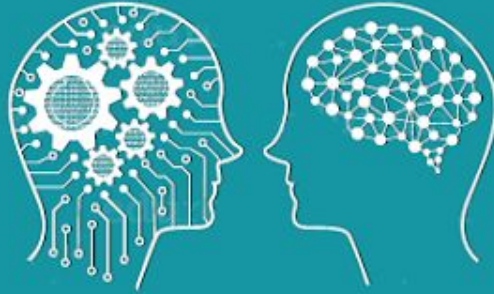
# ARTIFICIAL INTELLIGENCE



Science & engineering  
of making intelligent  
machines

Examples:  
old chatbots, robots

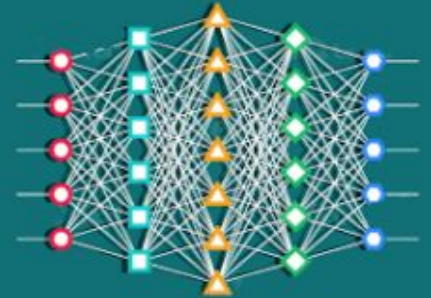
## MACHINE LEARNING



“Field of study that gives  
computers the ability  
to learn without being  
explicitly programmed”

Arthur Samuel

## DEEP LEARNING



Learning based on  
Deep Neural Networks

# What is machine learning?

# Machine Learning

## Definition Machine Learning

A computer program is said to learn from **experience E** with respect to some **task T** and some **performance measure P**,  
if its performance on T, as measured by P, improves with experience E.

Tom Mitchell, computer scientist, 1998

## Game 3: Mission T E P

In groups, list several machine learning examples you know of.  
Then identify the task T, the experience E and performance P?

# Example: checker

**Task:** playing a checker game

**Experience:** repeated action of the program  
to play against itself for thousands of different games

**Performance:** probability of winning  
the next game of checker.



Probability increases → program has learned to play checkers

## Important!

- Assessment (win / lose) should be done on **new data**
- What counts in the experience is **novelty**





## Example: spam filter

**Task:** marking an email either spam or not-spam

**Experience:** repeating the task with a large collection of emails of known type

**Performance:** accuracy = percentage of correct decisions / all decisions

## Example: zip code scan

**Task:** assignment from a picture to digits

**Experience:** expose the program to pictures of envelopes (input images) and answers (digits)

**Performance:** probability of guessing a new envelope with an unknown zip code.

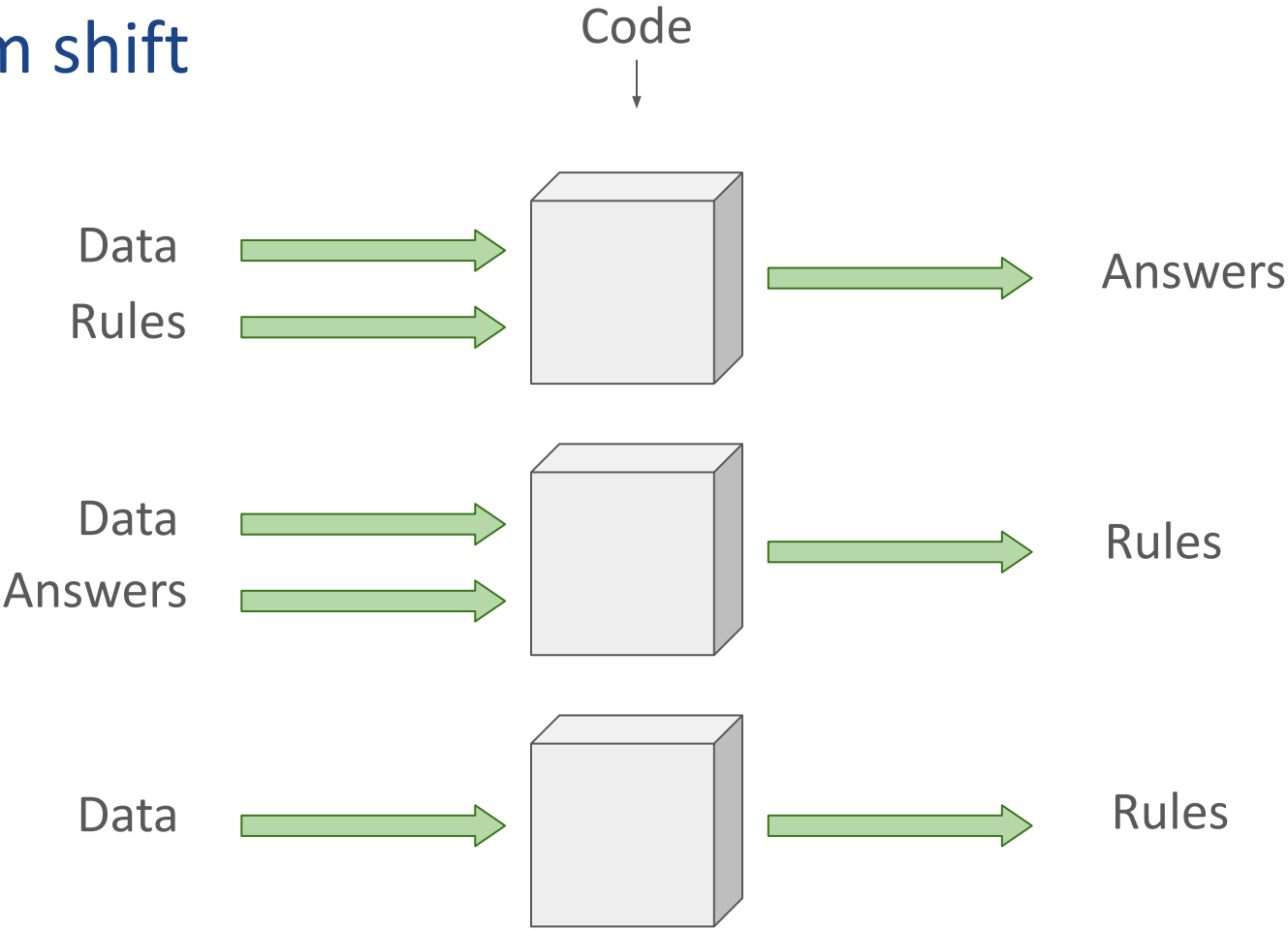


# A paradigm shift

# Paradigm shift

C  
L  
A  
S  
S  
I  
C

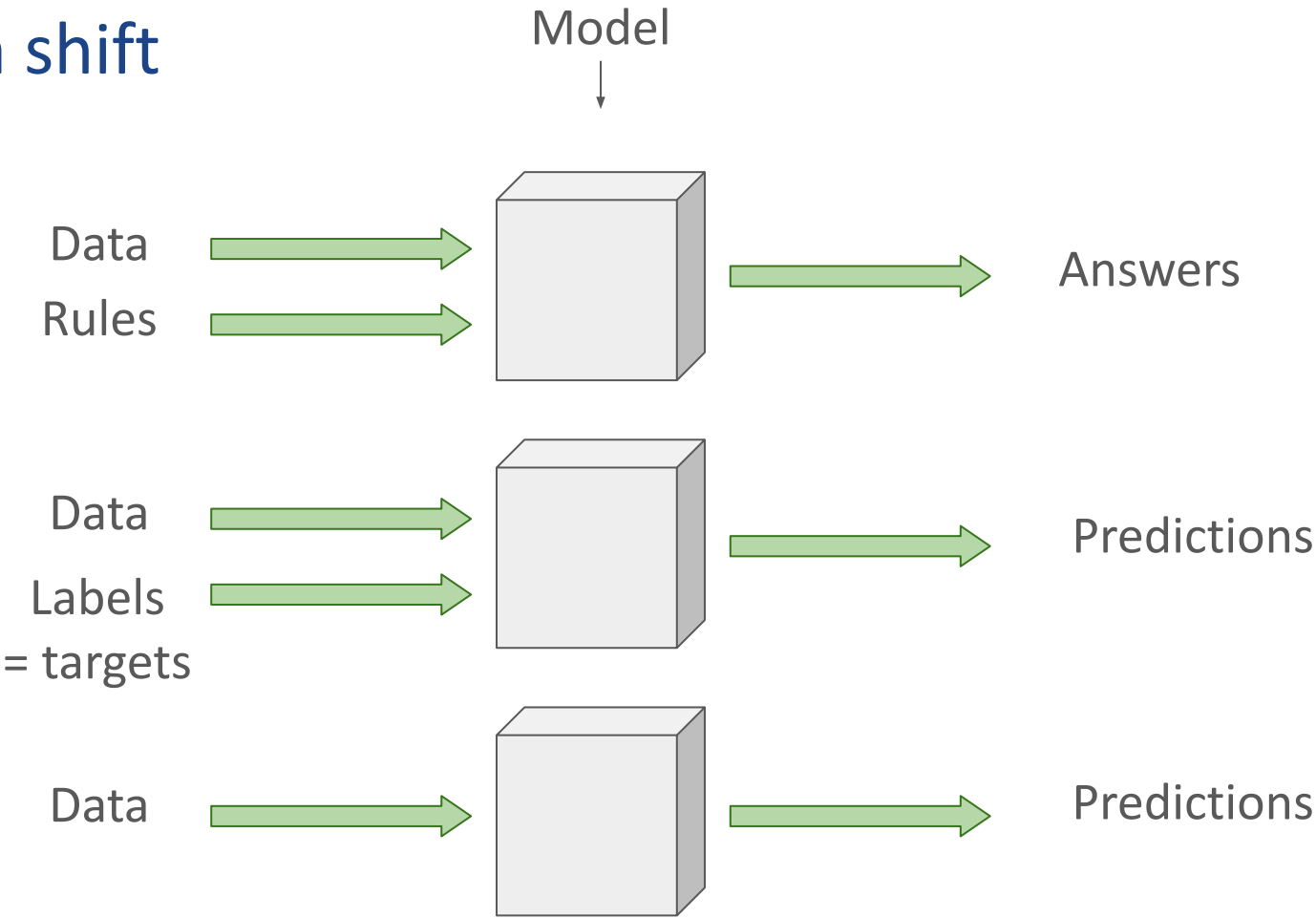
M  
L



# Paradigm shift

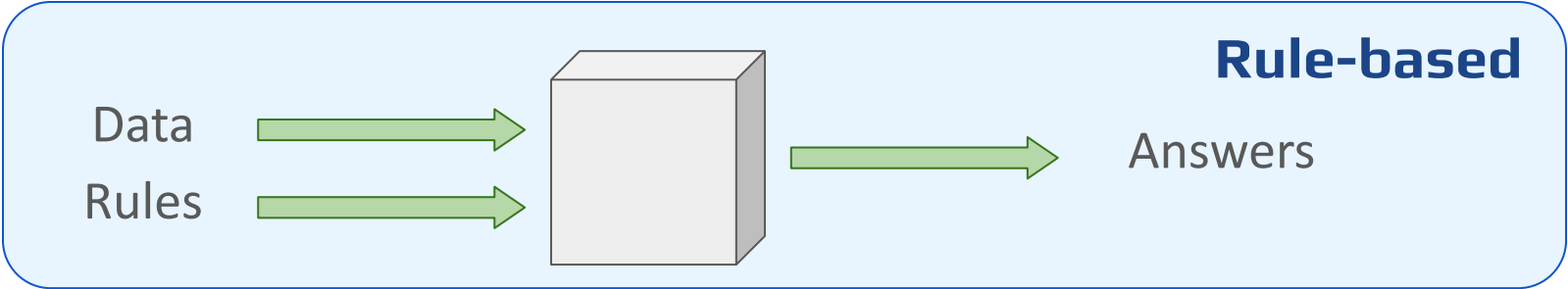
C  
L  
A  
S  
S  
I  
C

M  
L

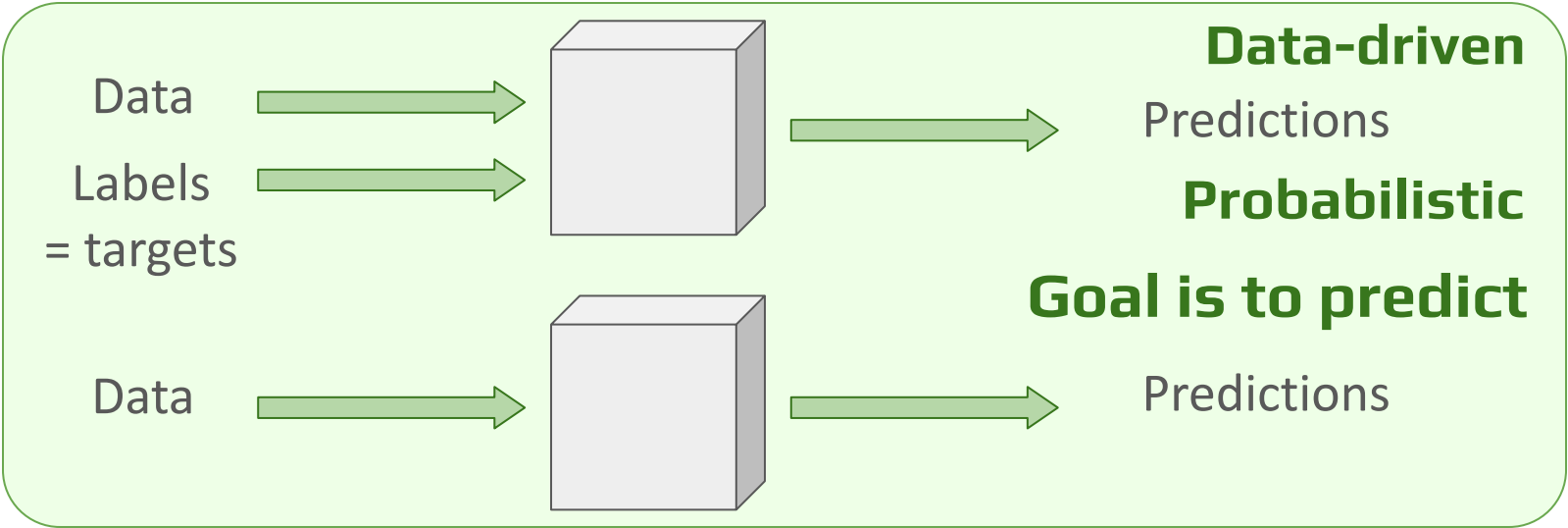


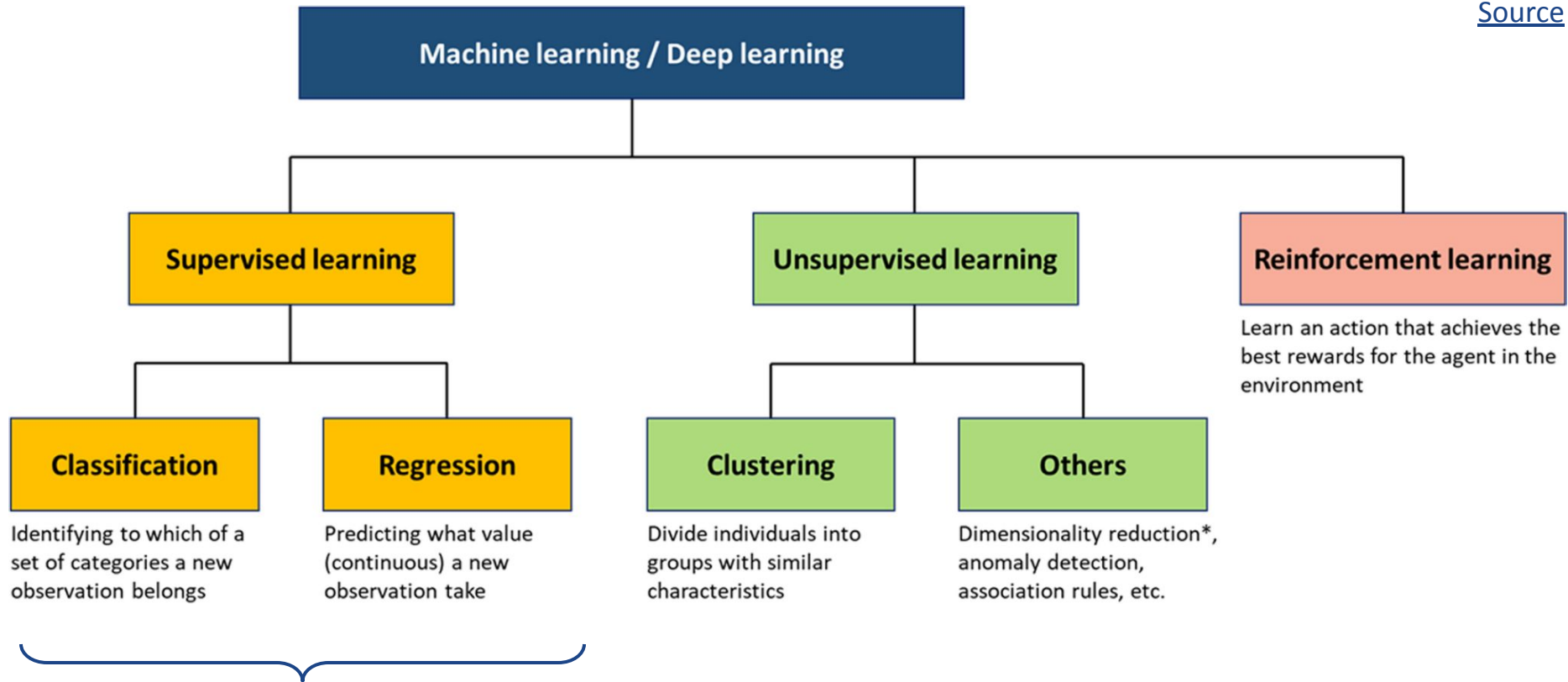
# Paradigm shift

C  
L  
A  
S  
S  
I  
C



M  
L





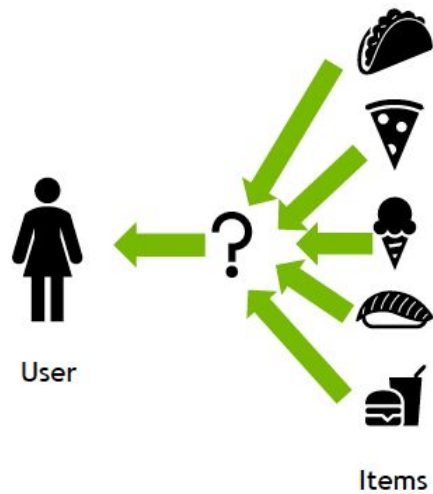
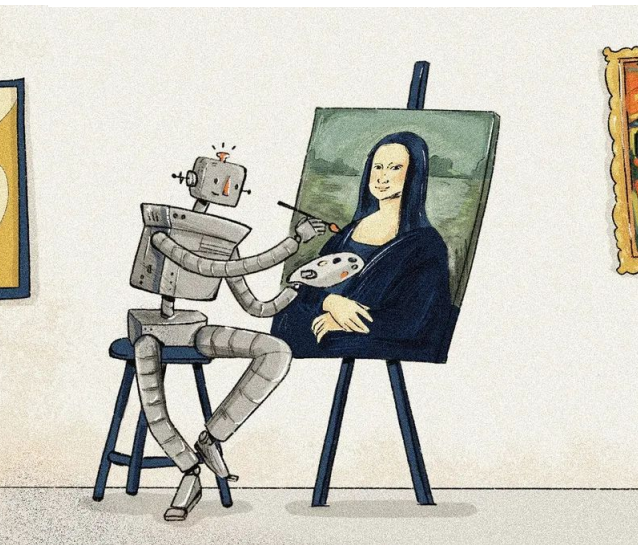
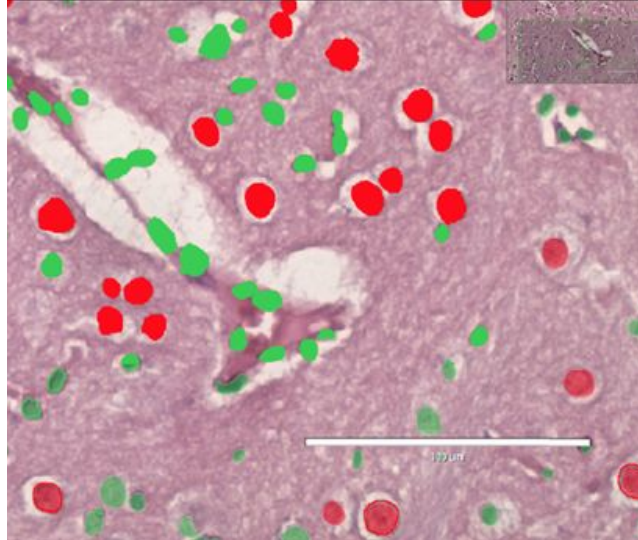
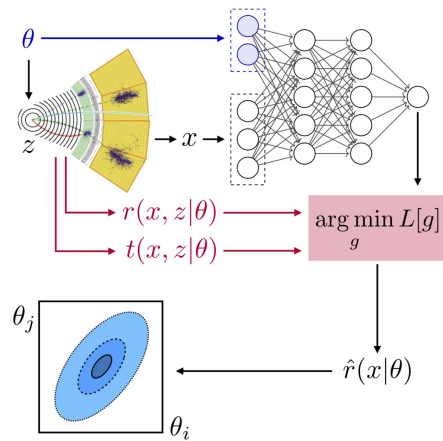
This week: understanding and ‘coding by hand’ the basic algorithms

# Machine Learning is a tool

# What uses of AI do you know?



# What uses of AI do you use?



# EASY-ML school

## Lectures

- 👉 Slides will be shared on Indico after each session
- 👉 Reading complement: I will share links on Google Classroom
- 👉 Ask any possible questions!

## Tutorials

- 👉 Tip: open an elog to track your new learning, debugging, python tricks
- 👉 Don't compare with your neighbours! Learn from anyone.
- 👉 Bored? Come talk to me, I will give you extra challenges

Always remember to...

... have fun!

