

Introdução à Machine Learning

Visão geral e conceitos introdutórios

Agenda

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do curso

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O que é IA,
ML e DL?

03

A importância
dos dados

04

Dilemas e
problemáticas

05

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tarefas em ML

06

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revisão

01

Apresentação do curso

Um pouco sobre a Iris

Existe **desde 2019**.

Busca promover a comunidade de **IA, Machine Learning e Data Science** na Unicamp.

Os integrantes são da **Computação**, majoritariamente, e de **outros cursos**.

Equipe do curso: por volta de **7 pessoas**.

Temos conteúdo no **nossa canal do YouTube!**



Como será o curso?

Formas de participar: presencial (IC300 / CC00) e online (Google Meet).

Horários: 14h00 até às 17h00 (3 horas de duração).

Canal de comunicação: grupo de WhatsApp.

Aulas gravadas serão disponibilizadas no YouTube da Iris.

As aulas terão partes **expositivas e práticas**.

Pré-requisitos:

- Obrigatórios:
 - Python, NumPy, Pandas e Matplotlib;
 - Álgebra linear básica (operações com matrizes).
- Opcionais:
 - Seaborn;
 - Cálculo (noções de derivada, derivada parcial e vetor gradiente) e outros conceitos de álgebra linear.

Cronograma



Aula 1 (18/05):

Introdução à Machine Learning



Aula 2 (01/06):

Aprendizado superv. e Reg. Linear



Aula 3 (22/06):

Otimização da função de custo



Aula 4 (29/06):

Avaliação de modelos e Reg. Logística



Aula 5 (13/07):

Árvores de decisão e *random forest*



Aula 6 (27/07):

Aprendizado não-superv. e clusterização



Aula 7 (10/08):

Redução de dimensionalidade



Aula 8 (24/08):

Introdução à Redes Neurais

As datas poderão (e provavelmente vão) sofrer alterações.

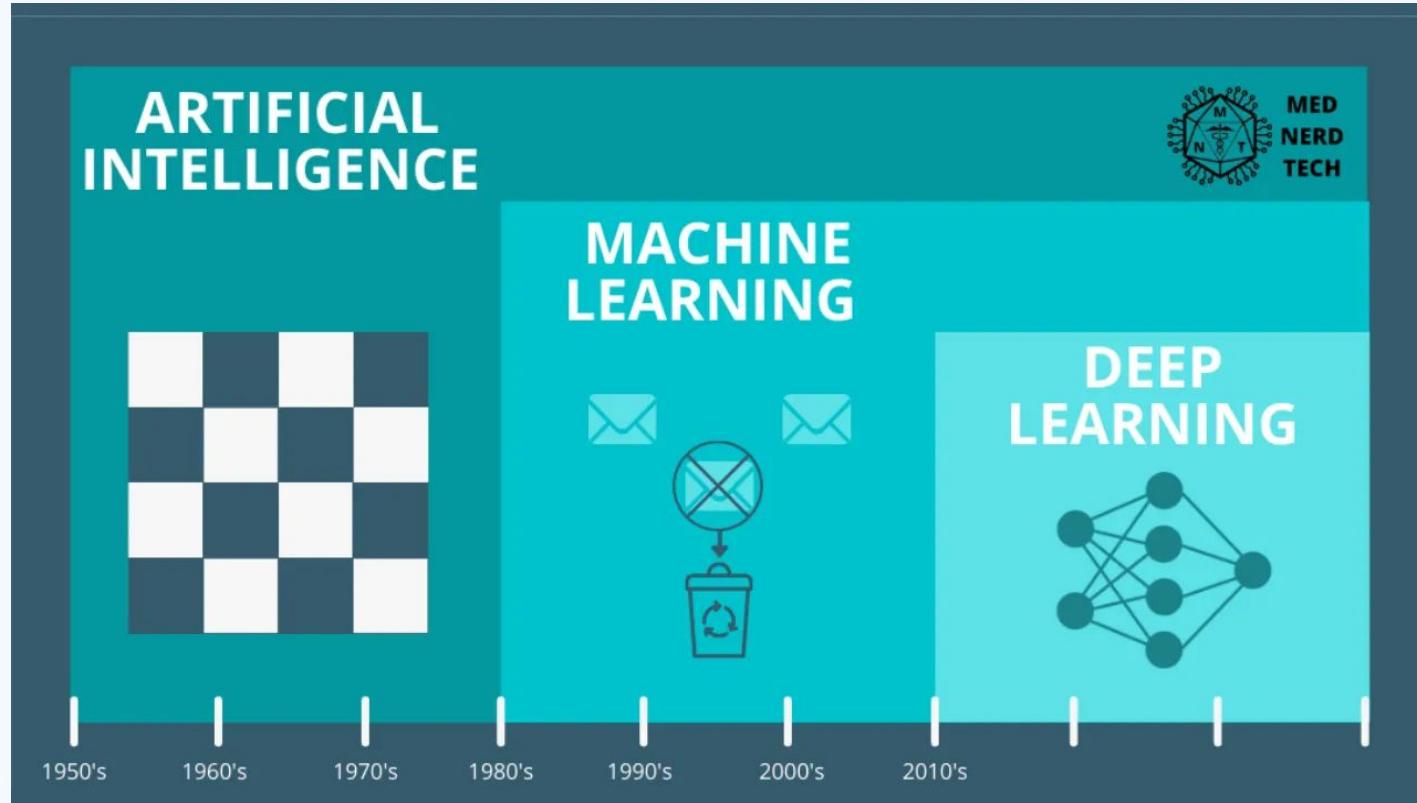
Talvez seja necessário adicionar uma aula a mais, caso o conteúdo atrasse.



02

O que é IA, ML e DL?





Retirado de: <https://medium.com/mednerdtech/ia-x-ml-x-dl-e320867333c1>

O que é Inteligência Artificial?

"A ciência e a engenharia de **fazer máquinas inteligentes**"

– John McCarthy (1955)

"A capacidade de um sistema de **interpretar corretamente dados externos**,
aprender com esses dados e usar esses aprendizados para **alcançar
objetivos e tarefas específicas por meio de adaptação flexível.**"

– Kaplan e Haenlein (2019)



O que é Inteligência Artificial?

Inteligência artificial restrita (Narrow AI):

Refere-se à capacidade de um sistema de computador realizar uma tarefa de forma mais precisa e eficiente do que um humano, **dentro de um escopo bem definido**.

Inteligência artificial geral (AGI):

Em teoria, capaz de resolver **problemas profundamente complexos**, aplicar **julgamento em situações incertas** e incorporar conhecimentos anteriores em seu raciocínio atual, **de criatividade e imaginação equivalentes às dos humanos** e poderia assumir uma gama muito mais ampla de tarefas do que a IA restrita.

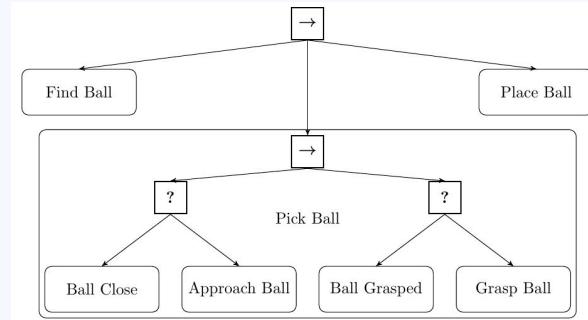
É o tipo de IA que você vê em filmes onde robôs têm pensamentos conscientes e agem com base em seus próprios motivos.

Fonte:

<https://azure.microsoft.com/en-us/resources/cloud-computing-dictionary/what-is-artificial-intelligence#self-driving-cars>

IA antes de Machine Learning

```
Welcome to      EEEEEE LL   IIII ZZZZZZ AAAAAA  
EE   LL   III ZZZZ AA  AA  
EEEEE LL   II  ZZ  AAAAAAA  
EE   LL   II  ZZ  AA  AA  
EEEEE LLLLLL IIII ZZZZZZ AA  AA  
  
Eliza is a mock Rogerian psychotherapist.  
The original program was described by Joseph Weizenbaum in 1966.  
This implementation by Norbert Landsteiner 2005.  
  
ELIZA: Is something troubling you ?  
YOU: Men are all alike.  
ELIZA: What is the connection, do you suppose ?  
YOU: They're always bugging us about something or other.  
ELIZA: Can you think of a specific example ?  
YOU: Well, my boyfriend made me come here.  
ELIZA: Is it important to you that your boyfriend made you come here ?  
YOU: He says I'm depressed much of the time.  
ELIZA: I'm sorry to hear that you are depressed.  
YOU: It's true. I am unhappy.  
ELIZA: Can you explain what made you unhappy ?  
YOU:
```



Agentes inteligentes baseados em regras:

- Busca de estados
- Min-max
- Behavior Tree
- ...

Exemplos:

- Xadrez, damas, ...
- NPCs em outros tipos de jogos
- Chatbot rudimentares

Retirado de:

<https://en.wikipedia.org/wiki/ELIZA>, <https://www.regencychess.com/blog/artificial-intelligence-and-chess-an-evolving-landscape/>, <https://engineering.nordeus.com/learning-of-behavior-trees-for-autonomous-agents/>

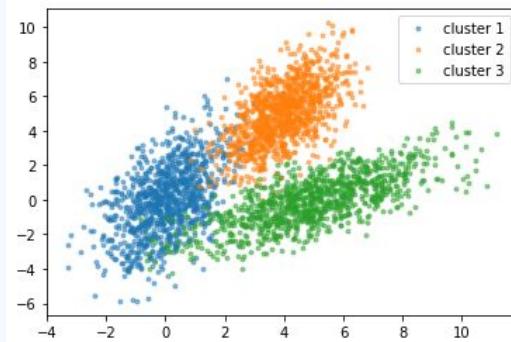
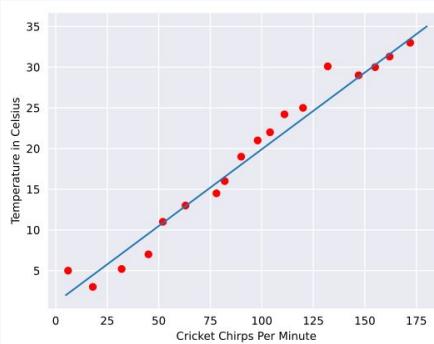
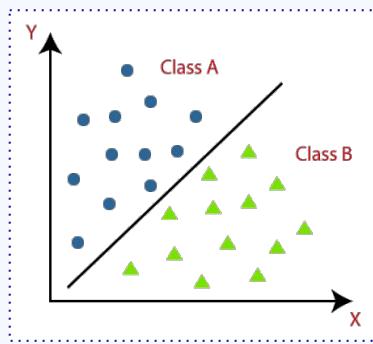
O que é Machine Learning?

“Um programa de computador **aprende a partir de uma experiência E** com respeito a uma **classe de tarefas T** e uma **métrica de performance P**, se a **sua performance em tarefas de T, quando medida por P, melhora com a experiência E.**”

– Tom Mitchell (1997)



O que é Machine Learning?



**Modelos que se
ajustam aos dados:**

- Regressão linear
- Regressão logística
- Algoritmos de Clusterização
- ...

Exemplos:

- Classificadores simples
- Sistemas preditivos
- Sistemas de recomendação
- ...

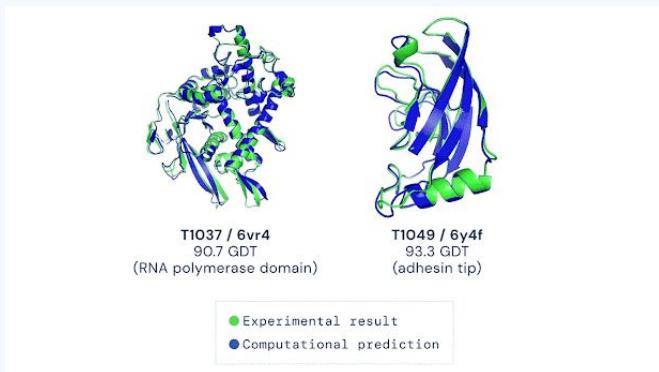
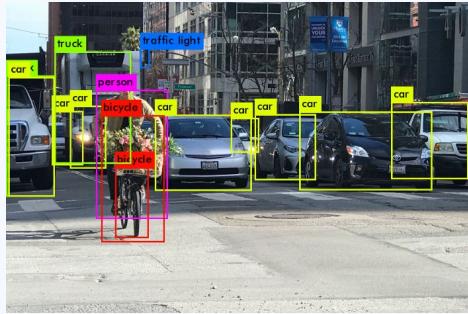
O que é Deep Learning?

“A aprendizagem profunda é uma forma de aprendizagem de máquina que permite aos computadores aprender com a experiência e **compreender o mundo em termos de uma hierarquia de conceitos**. Como o computador adquire conhecimento a partir da experiência, **não é necessário que um operador de computador humano especifique formalmente todo o conhecimento que o computador precisa**. A hierarquia de conceitos permite que o computador **aprenda conceitos complicados construindo-os a partir de conceitos mais simples.**”

– Goodfellow et al. (2016)



O que é Deep Learning?



Retirado de:
<https://exame.com/inteligencia-artificial/o-que-e-chatgpt-como-usar-a-ia-em-portugues-no-seu-dia-a-dia/>
<https://medium.com/analytics-vidhya/yolo-explained-5b6f4564f31>,
<https://deepmind.google/discover/blog/alphafold-a-solution-to-a-50-year-old-grand-challenge-in-biology/>

Sistemas que descobrem, aprendem e combinam padrões aprendidos:

- CNNs
- RNNs e LSTMs
- Transformers
- ...

Exemplos:

- Sistemas de visão computacional
- Chatbots modernos
- IA generativa
- ...

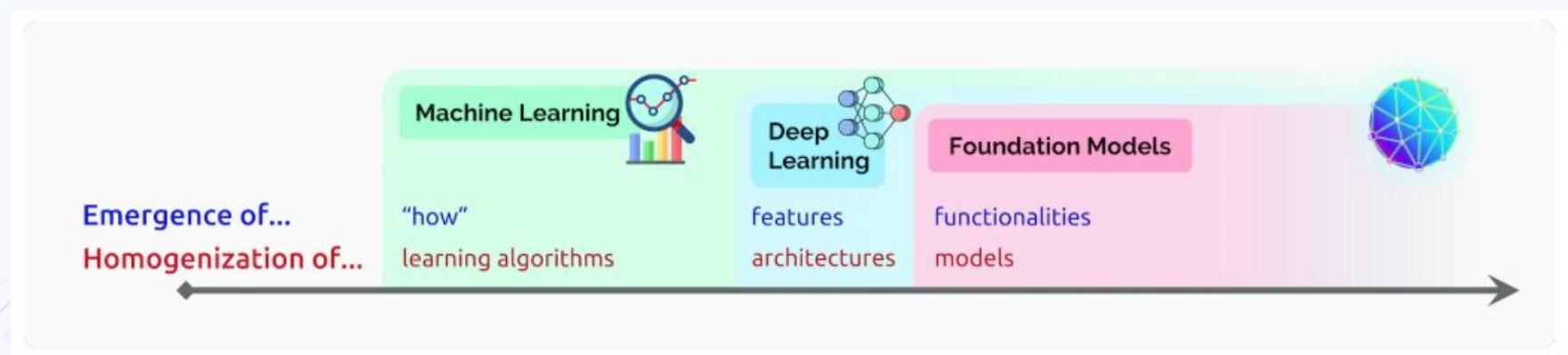
Emergência e homogeneização

Emergência

Surgimento de novos comportamentos.
“Soma das partes não é igual ao todo”.

Homogeneização

Uso de uma mesma técnica em várias áreas.



Emergência e homogeneização

Machine Learning

Emergência

Sistemas passam a ter a capacidade de descobrirem como resolver uma tarefa a partir de dados.

Homogeneização

Diversas aplicações passaram a poder se basear em um algoritmo genérico de aprendizado com base em dados.

Deep Learning

Emergência

Aprendizagem de conceitos abstratos sem a especificação explícita. A escala enorme de modelos trouxe características como *in-context learning*.

Homogeneização

As mesmas arquiteturas de modelos passaram a ser aplicáveis para diversos tipos de aplicações.

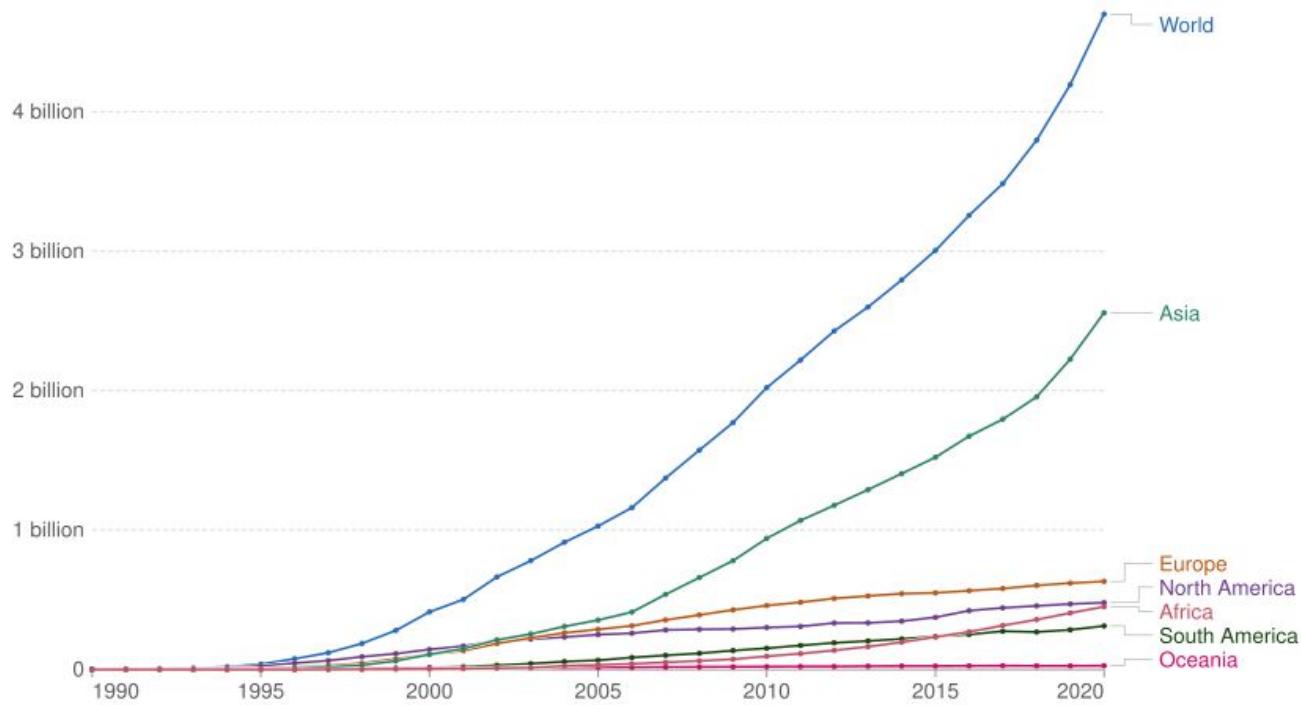
03

A importância dos dados



Number of people using the Internet

Number of people who used the Internet in the last three months.



Data source: OWID based on International Telecommunication Union (via World Bank) and UN (2022)

[OurWorldInData.org/internet](https://ourworldindata.org/internet) | CC BY

Leaders | Regulating the internet giants

The world's most valuable resource is no longer oil, but data

The data economy demands a new approach to antitrust rules



May 6th 2017

Share

ANTONIO GARCÍA MARTÍNEZ

IDEAS FEB 26, 2019 7:08 AM

No, Data Is Not the New Oil

Proposals to "pay" users for the value of their data don't reflect how internet giants like Facebook and Google really operate.



David Parkins

May 6th 2017

Share

A NEW commodity spawns a lucrative, fast-growing industry, prompting antitrust regulators to step in to restrain those who control its flow. A century ago, the resource in question was oil. Now similar concerns are being raised by the giants that deal in data, the oil of the digital era. These titans—Alphabet (Google's parent

ImageNET

14.197.122 de imagens



Retirado de:

<https://rubikscode.net/2021/07/19/top-23-best-public-datasets-for-practicing-machine-learning/>

MegaFace (V2)

672 mil pessoas e 4 milhões de fotos

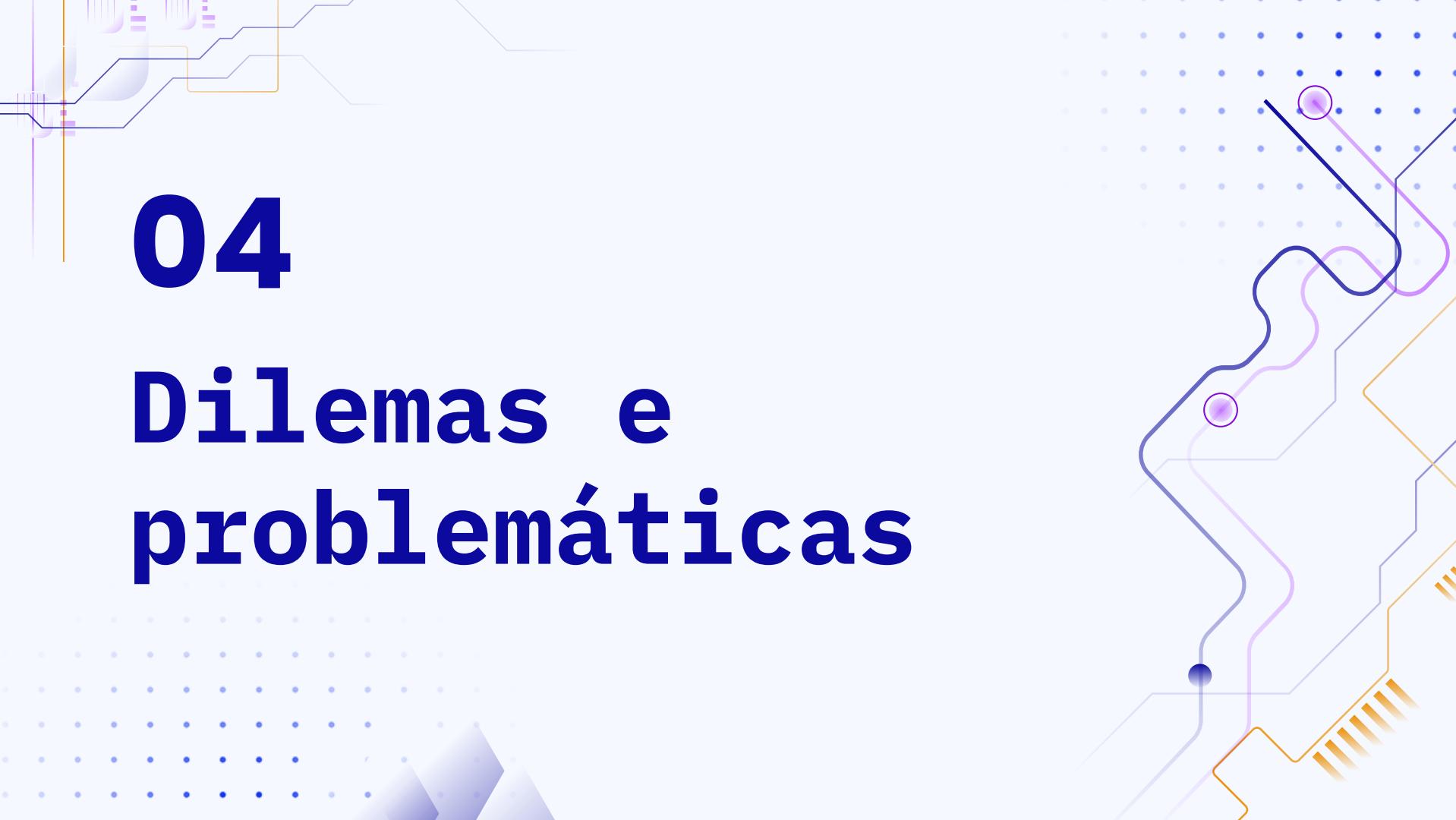


Retirado de:

<https://www.biometricupdate.com/201910/megaface-facial-recognition-dataset-origin-raises-privacy-and-liability-concerns>

04

Dilemas e problemáticas

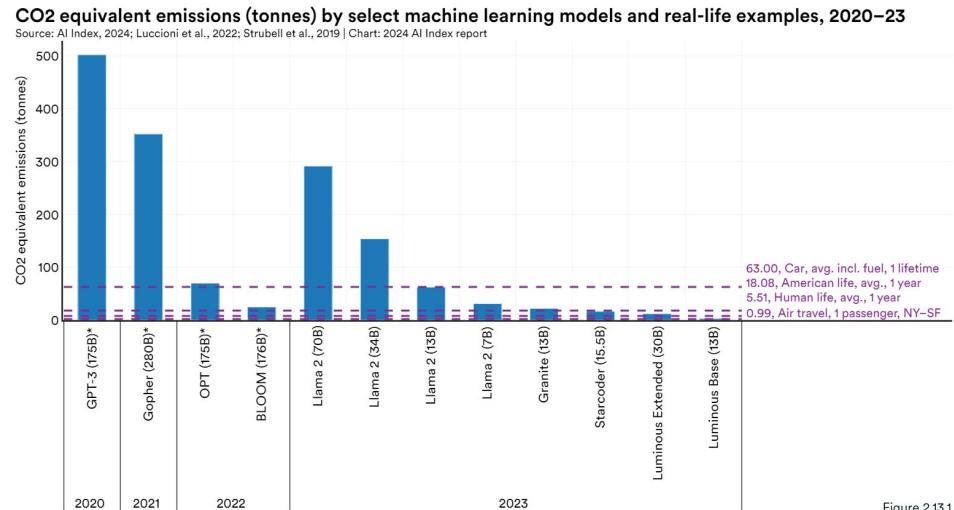


Problemáticas

Custo energético e implicações ambientais.

Usos indevidos e indiscriminados.

Vieses sociais, culturais e políticos.



Retirado de:
<https://aiindex.stanford.edu/report/>

Figure 2.13.1

Problemáticas

Custo energético e implicações ambientais.

Usos indevidos e indiscriminados.

Vieses sociais, culturais e políticos.



Retirado de:
<https://noticias.uol.com.br/cotidiano/ultimas-noticias/2024/04/28/reconhecimento-facial-erros-falta-de-transparencia.htm>

Problemáticas

Custo energético e implicações ambientais.

Usos indevidos e indiscriminados.

Vieses sociais, culturais e políticos.



renatasouzario • Seguir
Rio de Janeiro, Rio de Janeiro

renatasouzario • Racismo algorítmico!

Ao criar uma arte inspirada nos pôsteres da Disney, me deparei com uma imagem gerada a partir de Inteligência Artificial que me retratava como uma mulher negra com uma arma na mão. A descrição pedida era de uma mulher negra, de cabelos afro, com roupas de estampa africana num cenário de favela. E essa foi a imagem gerada. Não pode uma mulher negra, cair da favela, estar num espaço que não da violência? O que leva essa "desinteligência artificial" a associar o meu corpo, a minha identidade, com uma arma?

Em um mundo forjado pela branquitude, que tem o domínio

4.613 curtidas
HÁ 2 HORAS

Entrar para curtir ou comentar.

Retirado de:

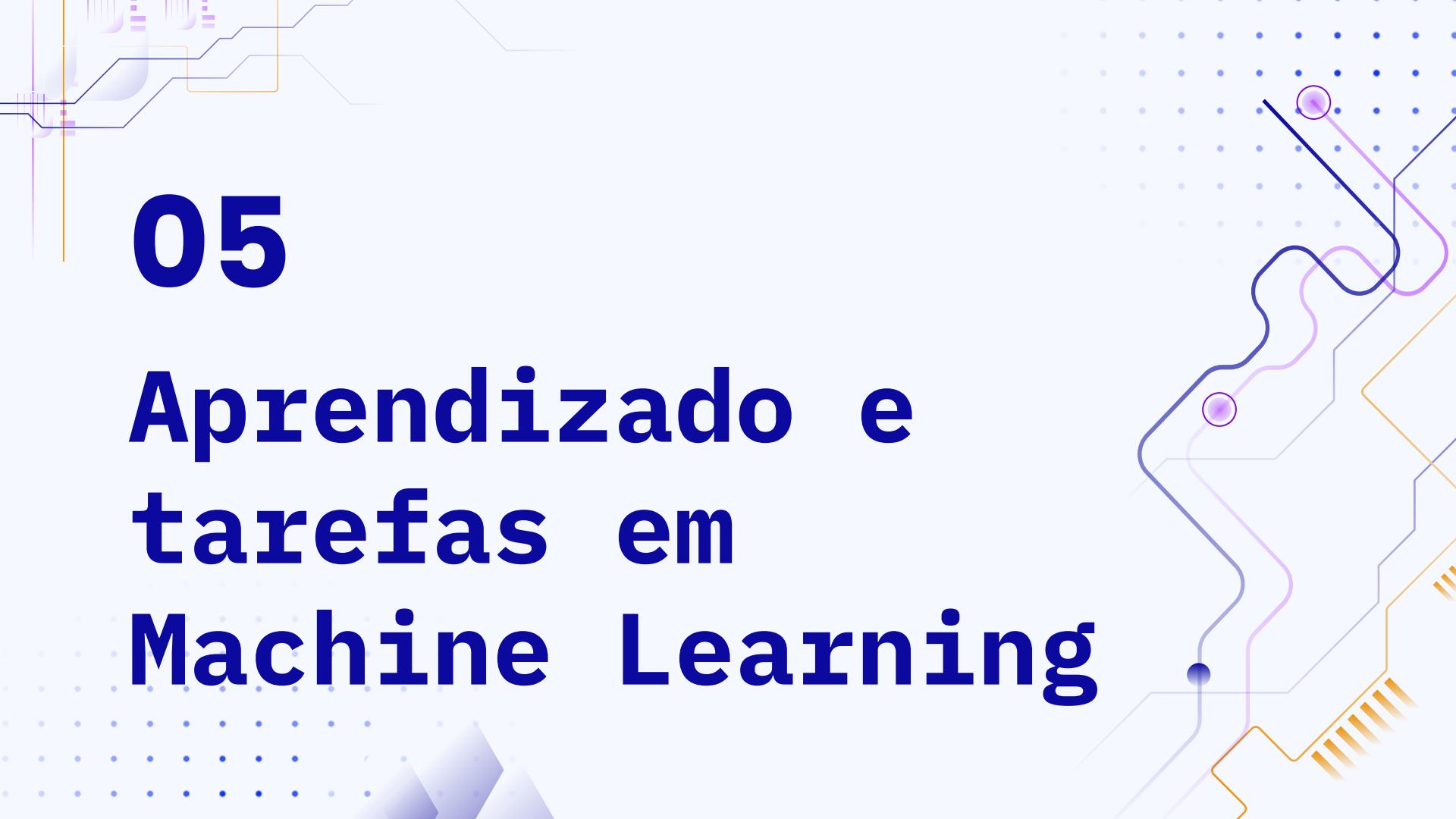
<https://g1.globo.com/ri/rio-de-janeiro/noticia/2023/11/09/apos-denuncia-de-racismo-em-ferramenta-de-inteligencia-artificial-deputada-foi-chamada-de-macaca-em-redes-sociais.ghtml>



AI, Ain't I A Woman? de Joy Buolamwini

05

Aprendizado e tarefas em Machine Learning

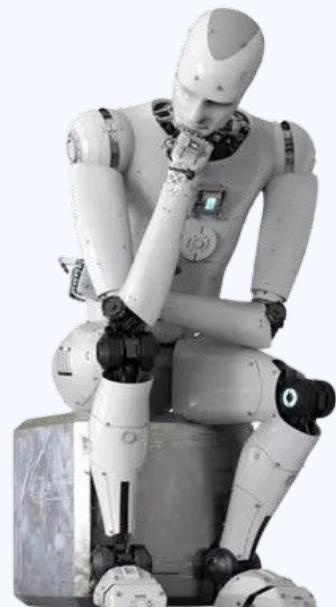


O aprendizado de máquina

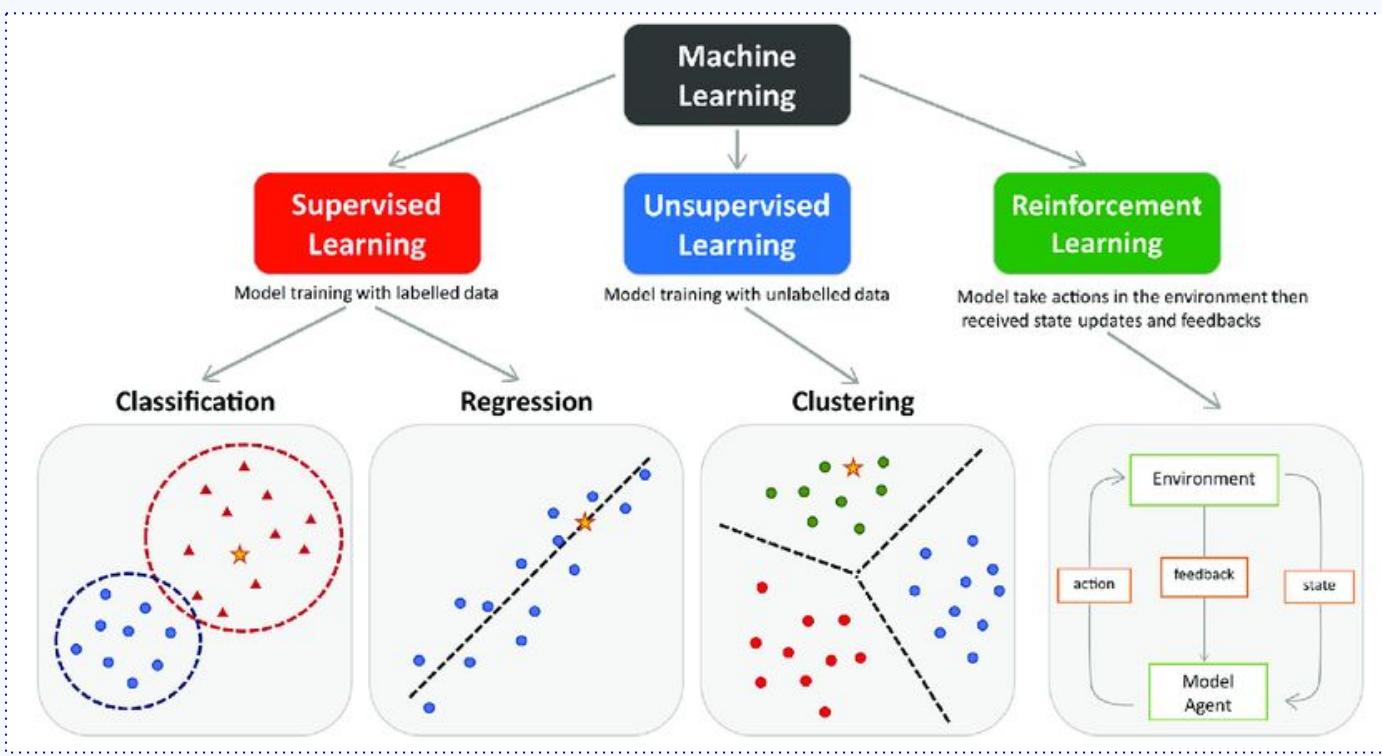
Programação tradicional:



Aprendizado de máquina:



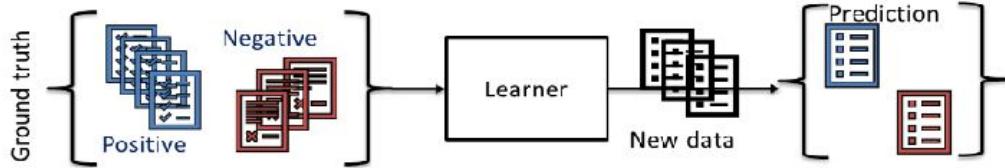
Paradigmas de aprendizado



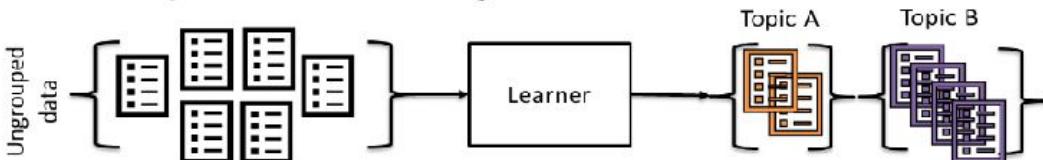
Retirado de: https://www.researchgate.net/figure/The-main-types-of-machine-learning-Main-approaches-include-classification-and_fig1_354960266

Paradigmas de aprendizado

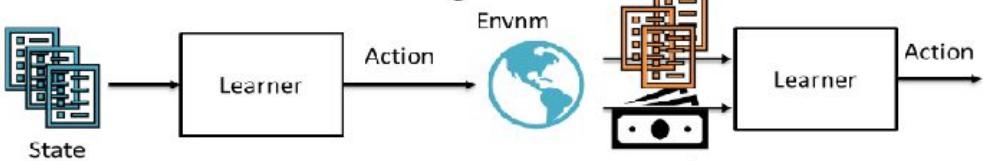
❖ Supervised Learning



❖ Unsupervised Learning



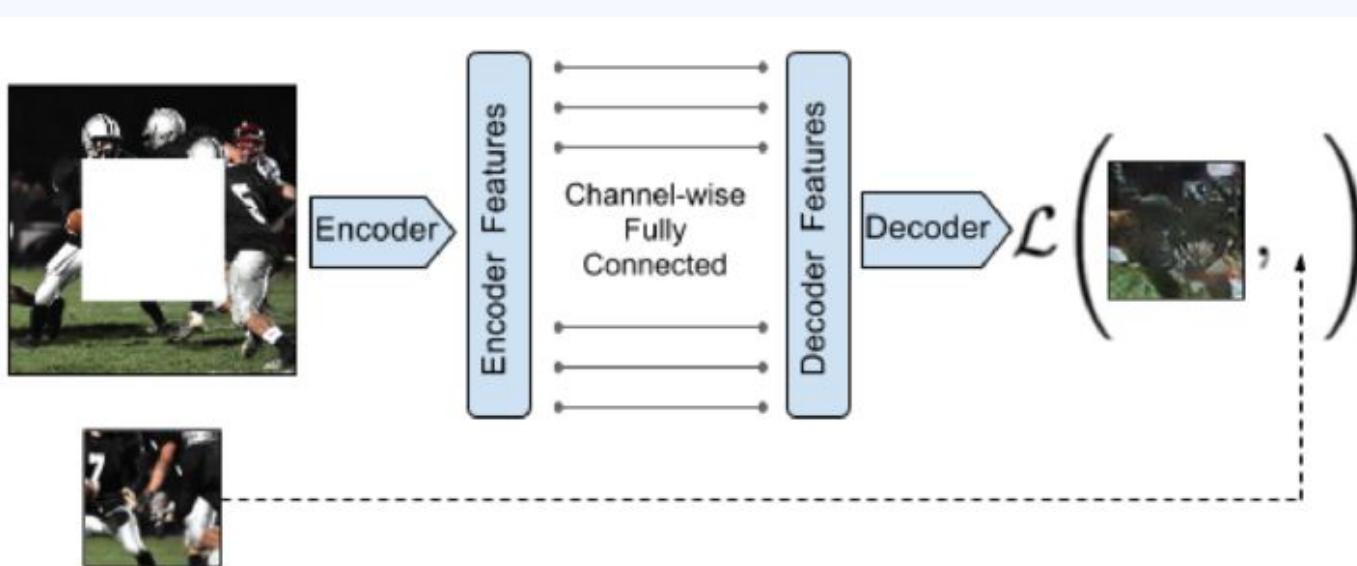
❖ Reinforcement Learning



Paradigmas de aprendizado

Importante mencionar um paradigma, usado para treinamento de sistemas de Deep Learning, que surgiu última década...

Aprendizado Auto-supervisionado



Paradigmas de aprendizado

Aprendizado supervisionado:



O objetivo é “**predizer**” uma saída esperada/alvo.



Saída esperada /alvo é **conhecida**.

Aprendizado Não-supervisionado:



O objetivo é **encontrar padrões** na estrutura dos dados.



Não há uma saída esperada /alvo **conhecida**.

Aprendizado Auto-supervisionado:

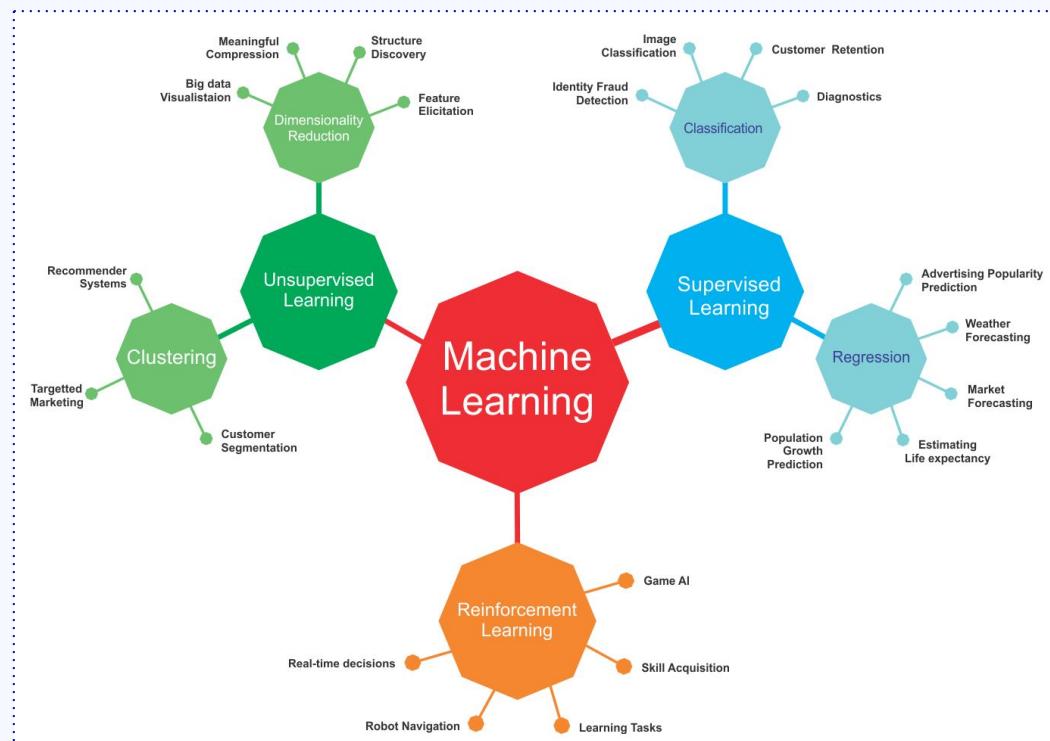


O objetivo é extrair e **capturar os padrões** nos dados.



A saída esperada /alvo **faz parte dos dados de entrada**.

Tarefas (ou “problemas”)



Retirado de: <https://subscription.packtpub.com/book/data/9781789345070/1/ch01lv1sec04/ml-tasks>

06

Exercícios de revisão



Revisão e atividade prática

Ambiente de desenvolvimento: Google Colab.

Atividade de revisão:

- Python;
- Manipulação de dados;
- Análise de dados;
- Operação com matrizes.



Referências

Parte do material foi inspirado nos slides da Prof^a. Sandra Avila e do Prof. Anderson Rocha.

Livros utilizados:

- *Deep Learning* (2016)
- *An Introduction to Statistical Learning* (2023)
- *Pattern Recognition and Machine Learning* (2006)
- *Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow* (2017)

Obrigado pessoal!

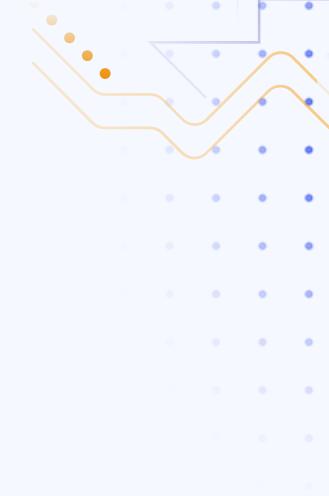
Até próxima aula :)



Iris Data Science UNICAMP



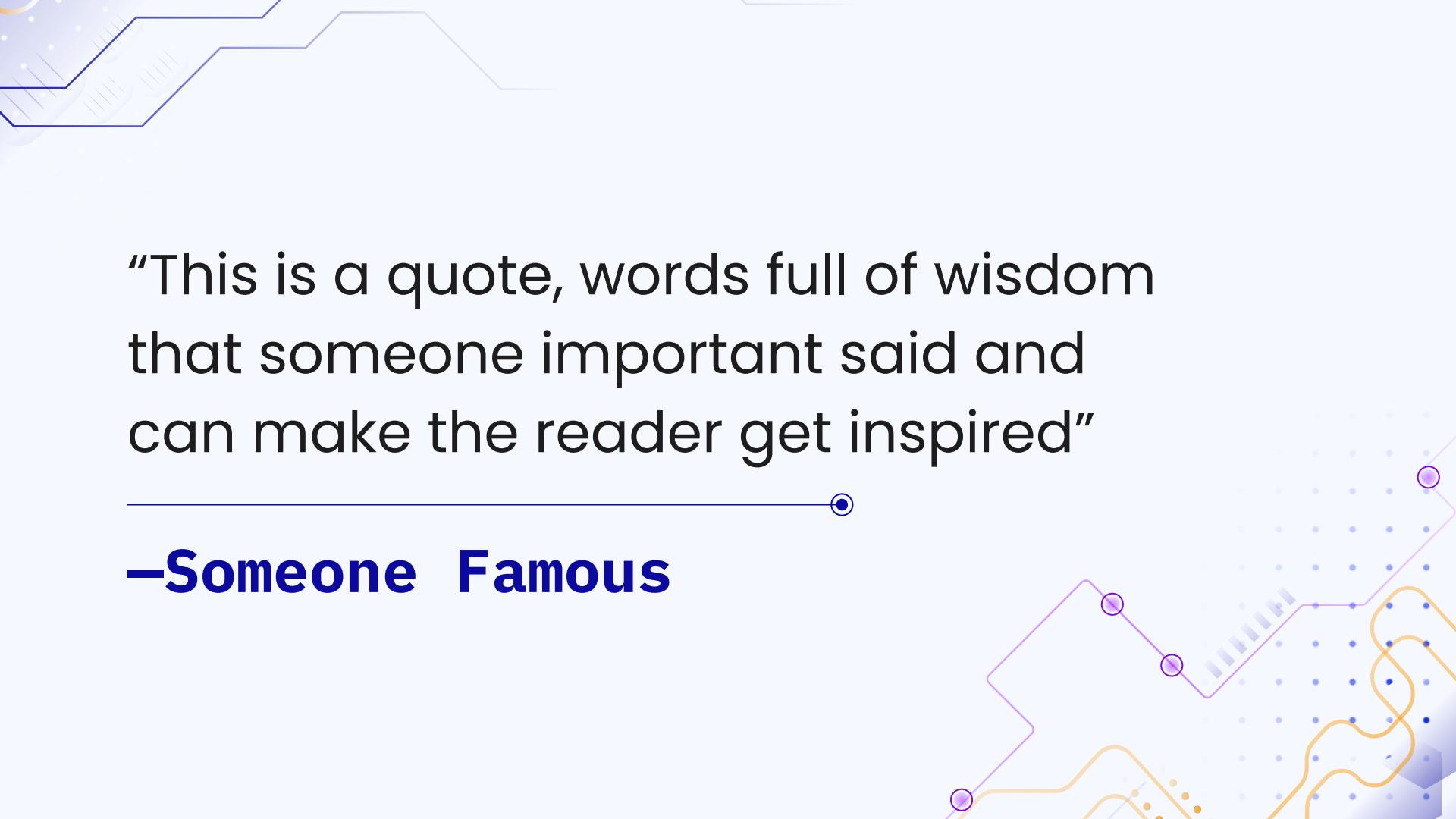
@irisdatascienceunicamp



Introduction

Mercury is the closest planet to the Sun and the smallest one in the entire Solar System. **This planet's name has nothing to do with the liquid metal**, since Mercury was named after the Roman messenger god. Mercury's surface is filled with craters

Mercury takes a little more than 58 days to complete its rotation, so try to imagine how long days must be there! **Since the temperatures are so extreme, albeit not as extreme** as on Venus, Mercury has been deemed to be non-habitable for humans



“This is a quote, words full of wisdom
that someone important said and
can make the reader get inspired”

—Someone Famous

Concepts



Mercury

Mercury is the closest planet to the Sun and **the smallest one** in the Solar System—it's only a bit larger than the Moon



Venus

Venus has a beautiful name and is the **second planet from the Sun**. It's hot and has a poisonous atmosphere

What is this topic about?



Mercury

It's the closest planet to the Sun and the **smallest** in the Solar System



Venus

Venus has a beautiful name and is the second planet from the Sun



Mars

Despite being red, Mars is actually a **cold place**. It's full of iron oxide dust

Features of the topic

Mars

Despite **being red**,
Mars is very cold

Neptune

It's the farthest
planet from the Sun

Jupiter

Jupiter is the biggest
planet of them all

Saturn

Saturn is a **gas giant**
and has several rings

Examples



Mercury

It's the closest planet to the Sun and the **smallest** in the Solar System



Venus

Venus has a beautiful name and is the second planet from the Sun



Mars

Despite being red, Mars is actually a **cold place**. It's full of iron oxide dust

Recommendations



Mars

Despite being red,
Mars is very cold



Mercury

Mercury is the closest
planet to the Sun



Venus

Venus is the second
planet from the Sun



Saturn

Saturn is a gas giant
and has several rings



Neptune

Neptune is the farthest
planet from the Sun



Jupiter

Jupiter is the biggest
planet of them all

Image always reinforce the concept

You can give a brief description of the topic you want to talk about here. For example, if you want to talk about Mercury, you can say that it's the smallest planet in the entire Solar System



4,498,300,000

Big numbers catch your audience's attention

9h 55m 23s

Jupiter's rotation period

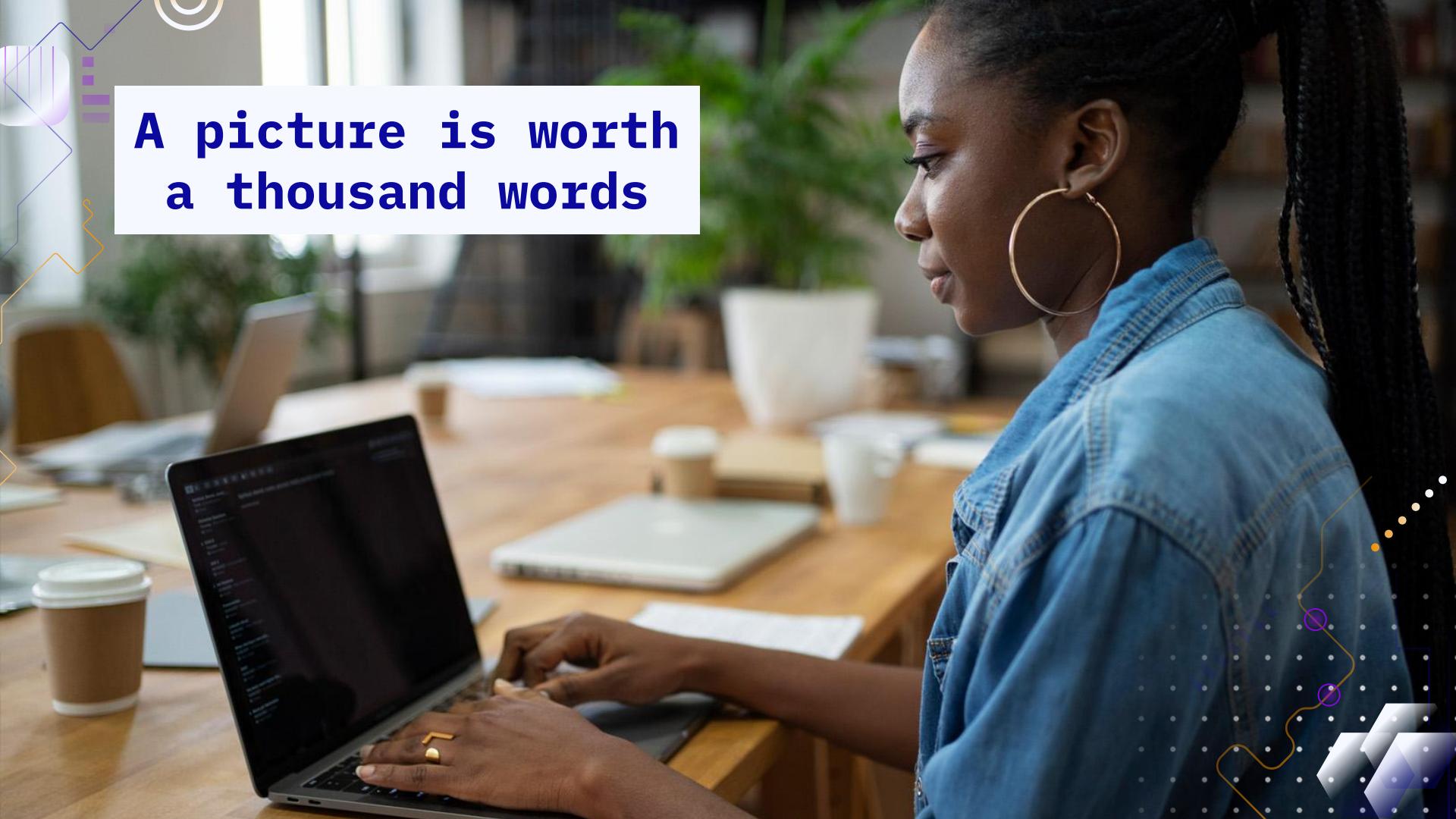
333,000

The Sun's mass compared to Earth's

386,000 km

Distance between the Earth and the Moon

Awesome words



A picture is worth
a thousand words

Practical exercise - calculator

Objective:

Introduce participants to basic coding concepts by building a **simple calculator**

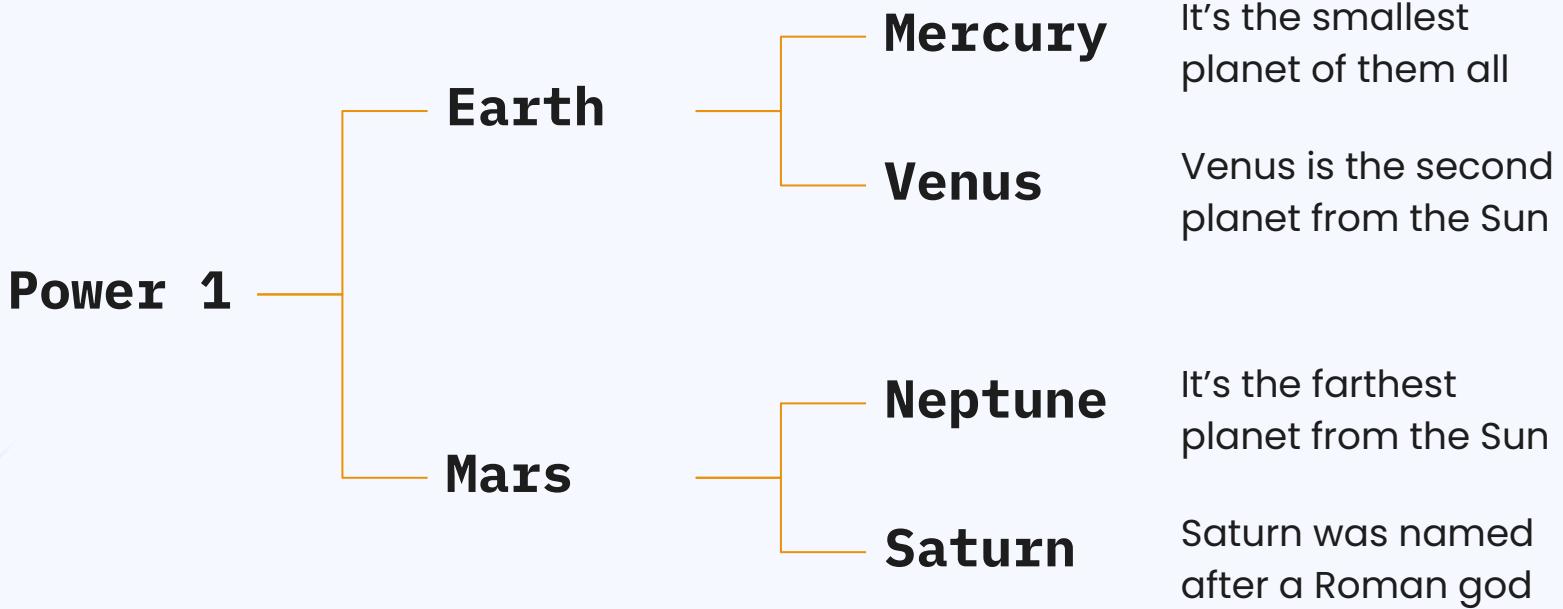
Instructions:

1. Open a Python development environment and write the following code:

```
# Simple Calculator  
num1 = int(input("Enter the first number: "))  
num2 = int(input("Enter the second number: "))  
print("Sum:", num1 + num2)  
print("Difference:", num1 - num2)  
print("Product:", num1 * num2)  
print("Quotient:", num1 / num2)
```

2. Run the program and experiment with different numbers
3. Observe the output

Brainstorm and idea generation



Main topic and details

Mars

Despite being red,
Mars is **very cold**

Jupiter

Jupiter is the biggest
planet of them all

Neptune

It's the farthest
planet from the Sun

Saturn

It's a gas giant and
has **several rings**



Popular programming languages

01

Neptune

Mercury is the closest planet to the Sun and the **smallest** of them all

02

Venus

Venus has a beautiful name and is the **second planet from the Sun**

03

Earth

Earth is the third planet from the Sun and the only one that harbors life in the Solar System

04

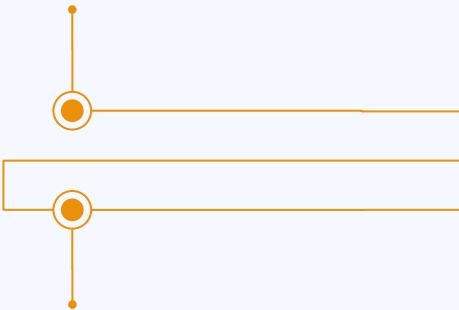
Saturn

Saturn is a gas giant and has several rings. It's composed mostly of hydrogen and helium

Sequences

Saturn is composed of
hydrogen and helium

First

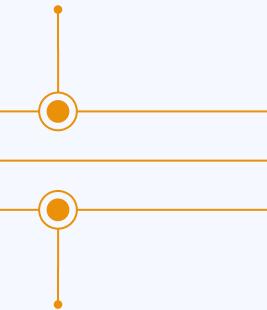


Next

Despite being red,
Mars is **very cold**

Mercury is the **closest**
planet to the Sun

Next



Next

Earth is the third
planet from the Sun



Jupiter was named
after a Roman god

Next



Last

Venus has extremely
high temperatures

Classification

Mars	Venus	Mercury	Jupiter
<ul style="list-style-type: none">• Small• Red• Cold• Rocky	<ul style="list-style-type: none">• Small• Hot• Dry• Volcanic	<ul style="list-style-type: none">• Small• Hot• Rocky• Cratered	<ul style="list-style-type: none">• Large• Cold• Gassy• Striped
Mars is full of iron oxide dust	Venus has high temperatures	Mercury is quite a small planet	Jupiter is a huge gas giant

Cause and effect

Problem

Mars

Despite being red,
Mars is very cold

Venus

Venus is the second
planet from the Sun

Solution

Mercury

Mercury is the closest
planet to the Sun

Saturn

Saturn is a gas giant
and has several rings

Question and answer

Question

Is Mercury the closest planet to the Sun and the smallest one in the Solar System? **Note that it's a bit larger than the Moon**

Answer

Venus has a beautiful name and is **the second planet from the Sun**. It's hot and has a poisonous atmosphere

Step-by-step coding

01



Earth

It's the only planet known to **harbor life**

02



Mercury

Mercury is the closest planet to the Sun

03



Jupiter

Jupiter is the **biggest** planet of them all

04



Saturn

Saturn was named after a Roman god

Parts and whole

The whole objective

Mercury is the closest planet to the Sun and the smallest one in the entire Solar System

Parts of the object

- Mercury
- Jupiter
- Venus
- Mars
- Earth
- Saturn
- Mercury

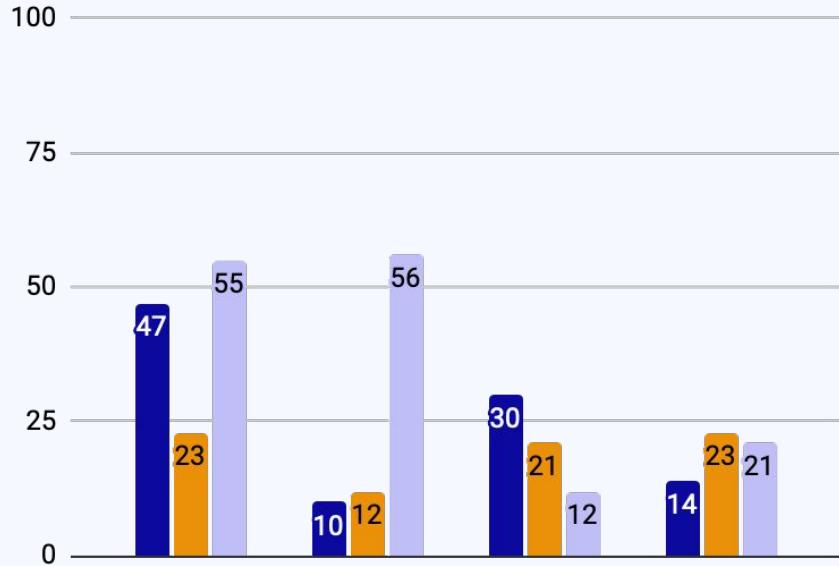
What happens if the parts are missing?

Earth is the third planet from the Sun and the **only one that harbors life in the Solar System**

What's the function of the parts?

Jupiter is a gas giant and the biggest planet in the Solar System

You can use this graph



Follow the link in the graph to modify its data and then paste the new one here. [For more info, click here](#)



Mercury

Mercury is the closest planet to the Sun



Jupiter

Jupiter is the biggest planet of them all



Saturn

Saturn was named after a Roman god

This is a map

USA

Despite being red, Mars is **very cold**

India

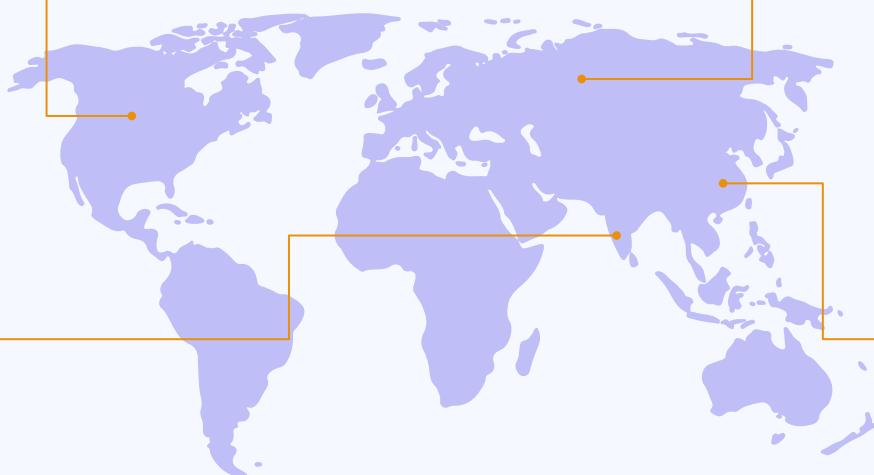
Jupiter is the biggest planet of them all

Russia

Neptune is the farthest planet from the Sun

China

Saturn is **a gas giant** and has several rings



Mockups

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Do you have any questions?

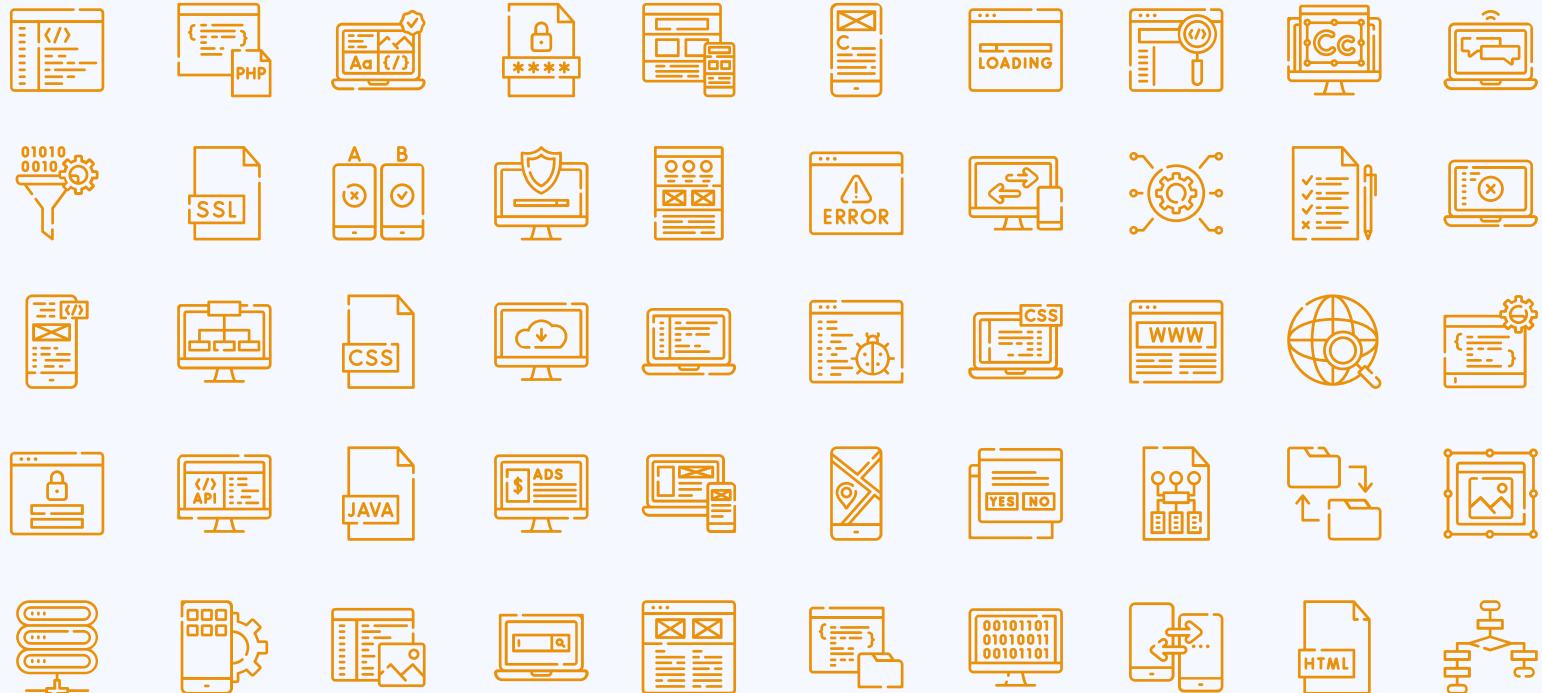
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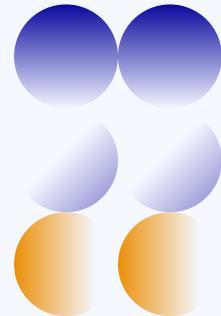
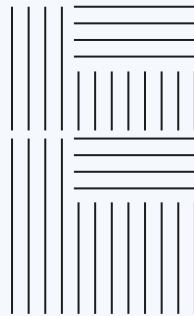


Icon pack



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Agenda

01

Apresentação do curso

You can describe the topic
of the section here

03

Tips

You can describe the topic
of the section here

02

O que é IA, ML e DL?

You can describe the topic
of the section here

04

Problemáticas atuais

You can describe the topic
of the section here

Contents of this template

You can delete this slide when you're done editing the presentation

<u>Fonts</u>	To view this template correctly in PowerPoint, download and install the fonts we used
<u>Used and alternative resources</u>	An assortment of graphic resources that are suitable for use in this presentation
<u>Thanks slide</u>	You must keep it so that proper credits for our design are given
<u>Colors</u>	All the colors used in this presentation
<u>Icons and infographic resources</u>	These can be used in the template, and their size and color can be edited
<u>Editable presentation theme</u>	You can edit the master slides easily. For more info, click here

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#0c0a9e

#8208d5

#1d1d1d

#eb9109

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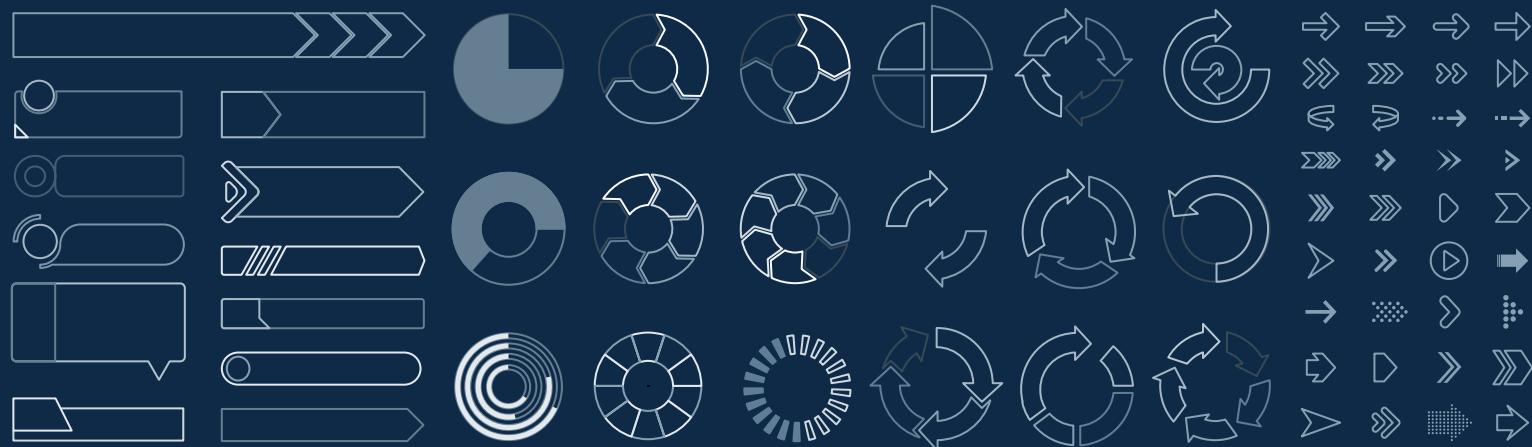
Rafiki



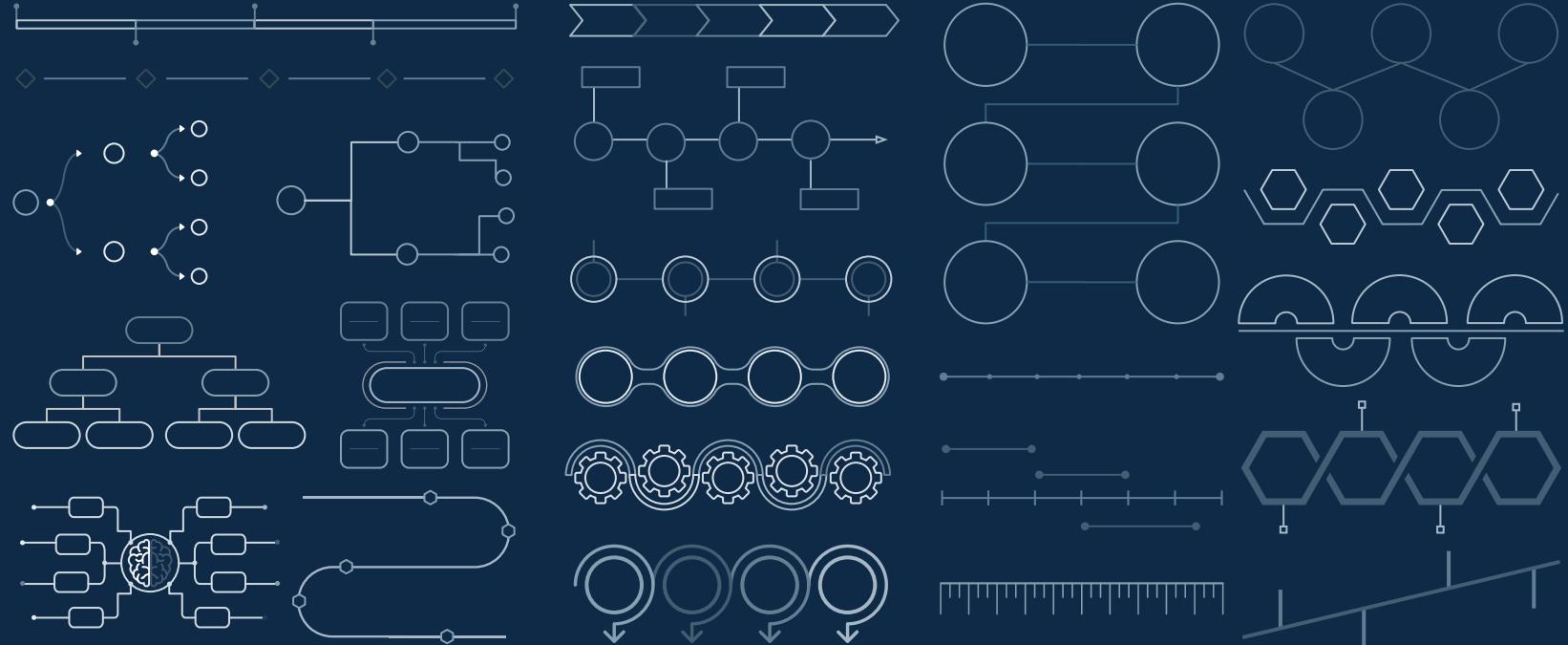
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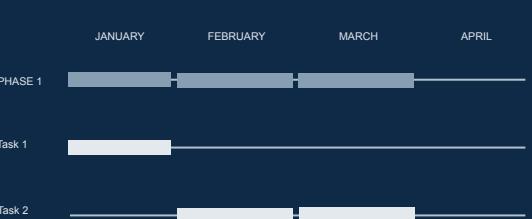
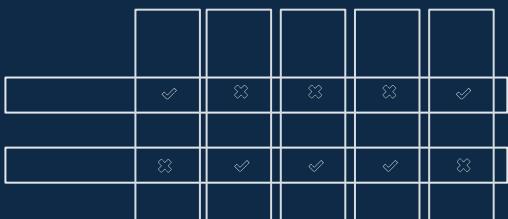
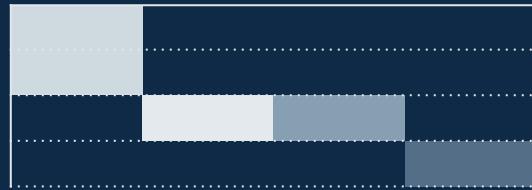
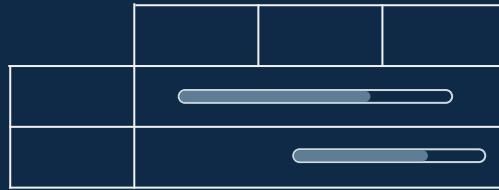
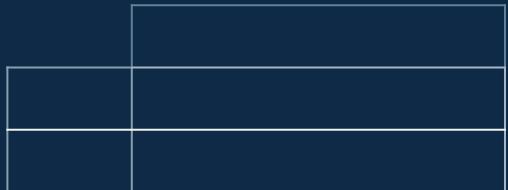
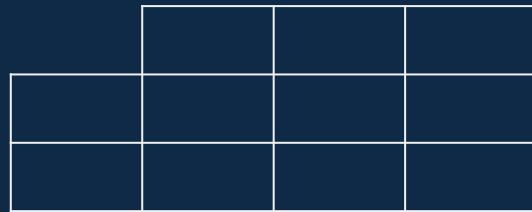
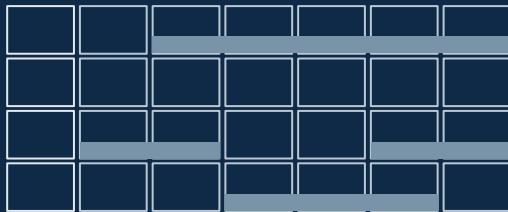
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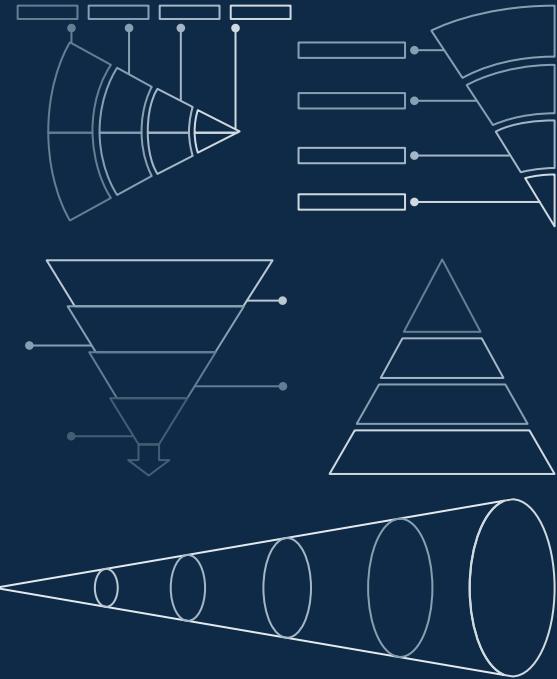
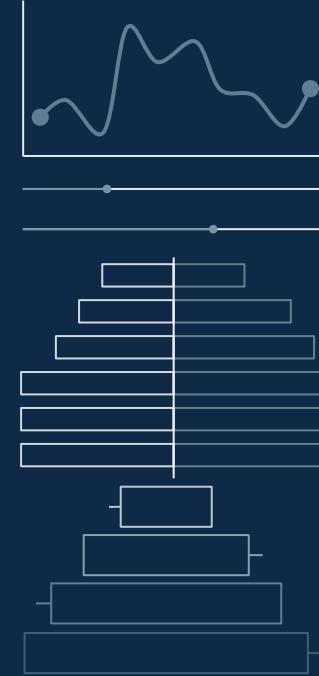
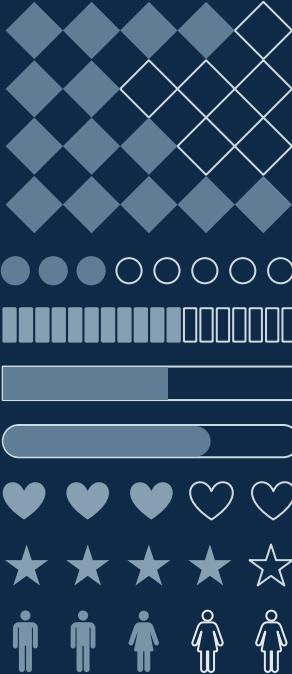
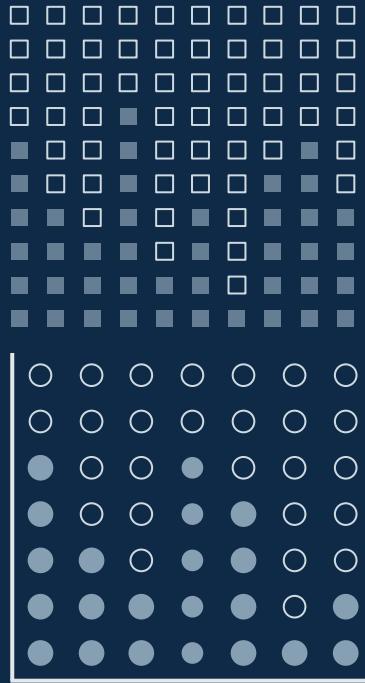












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