Insper

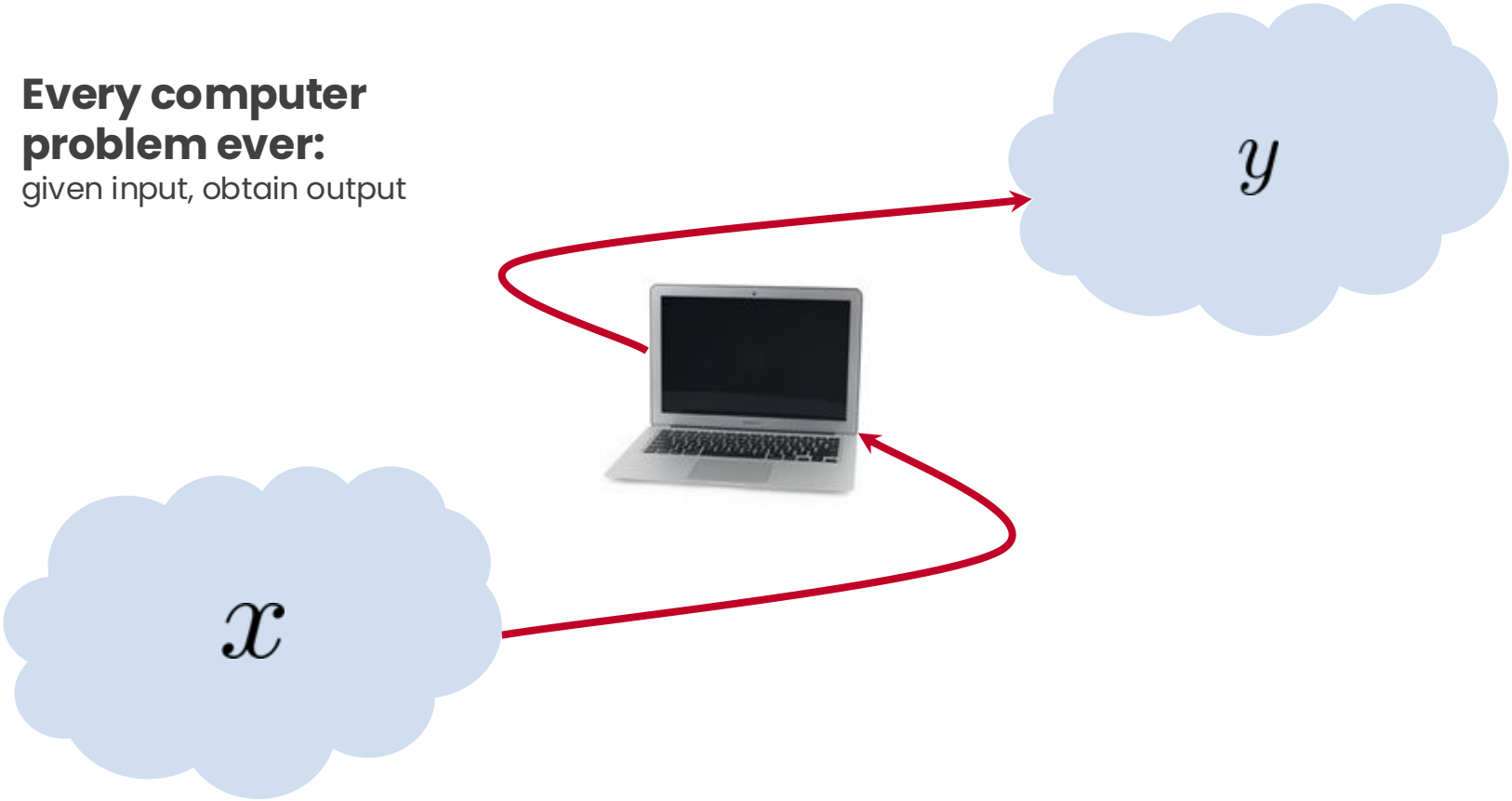
Computer Vision

Class 2: The Very Basic Basics of Neural Networks

Computer vision:
camera captures image and algorithms extract information

This is a panoramic view of the two Insper buildings under daylight. You can also see other buildings, nearby streets, and surrounding trees. The sky is slightly clouded. Some of the windows are lit, but others are not...

Every computer problem ever:
given input, obtain output



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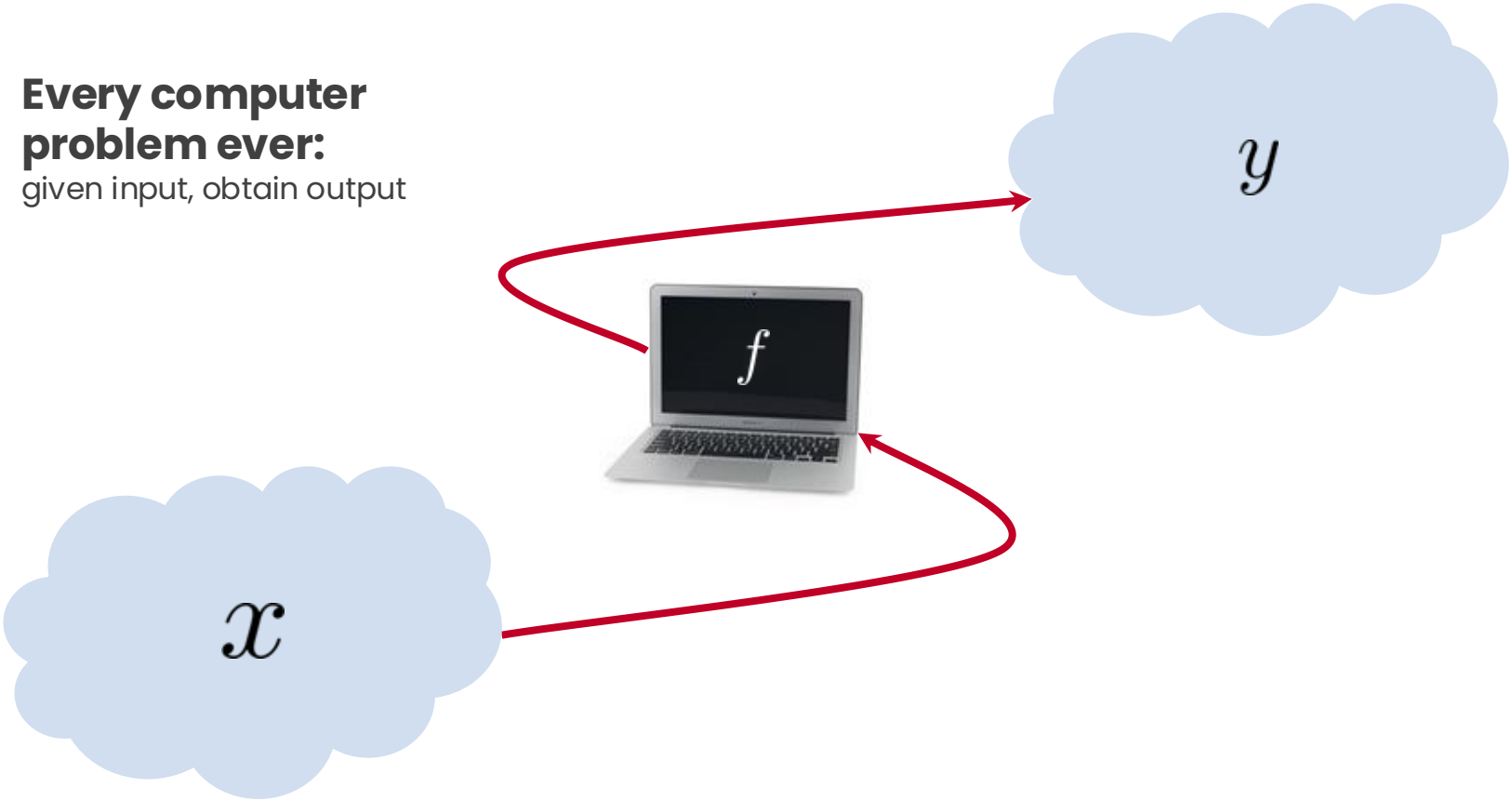

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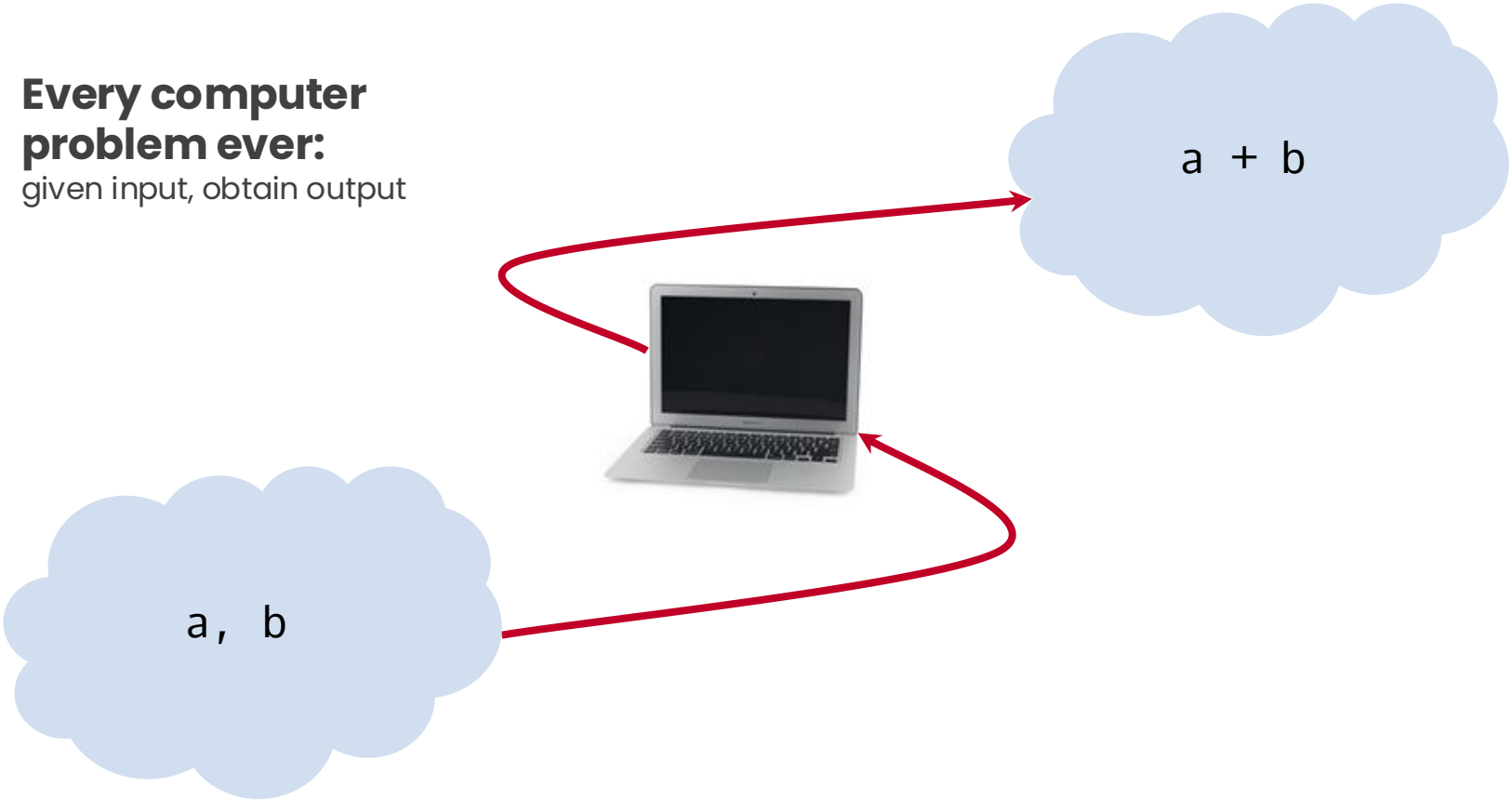

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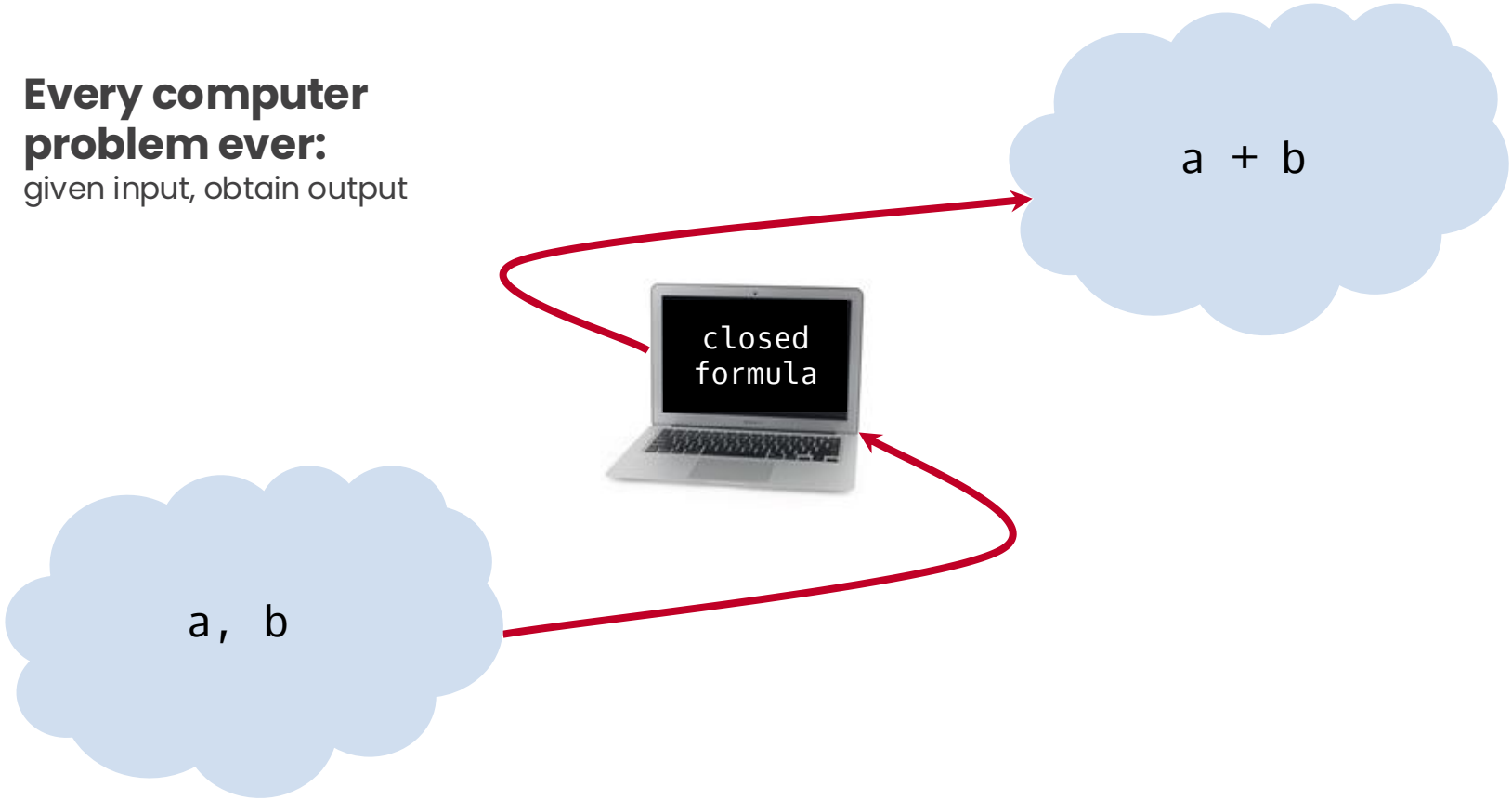

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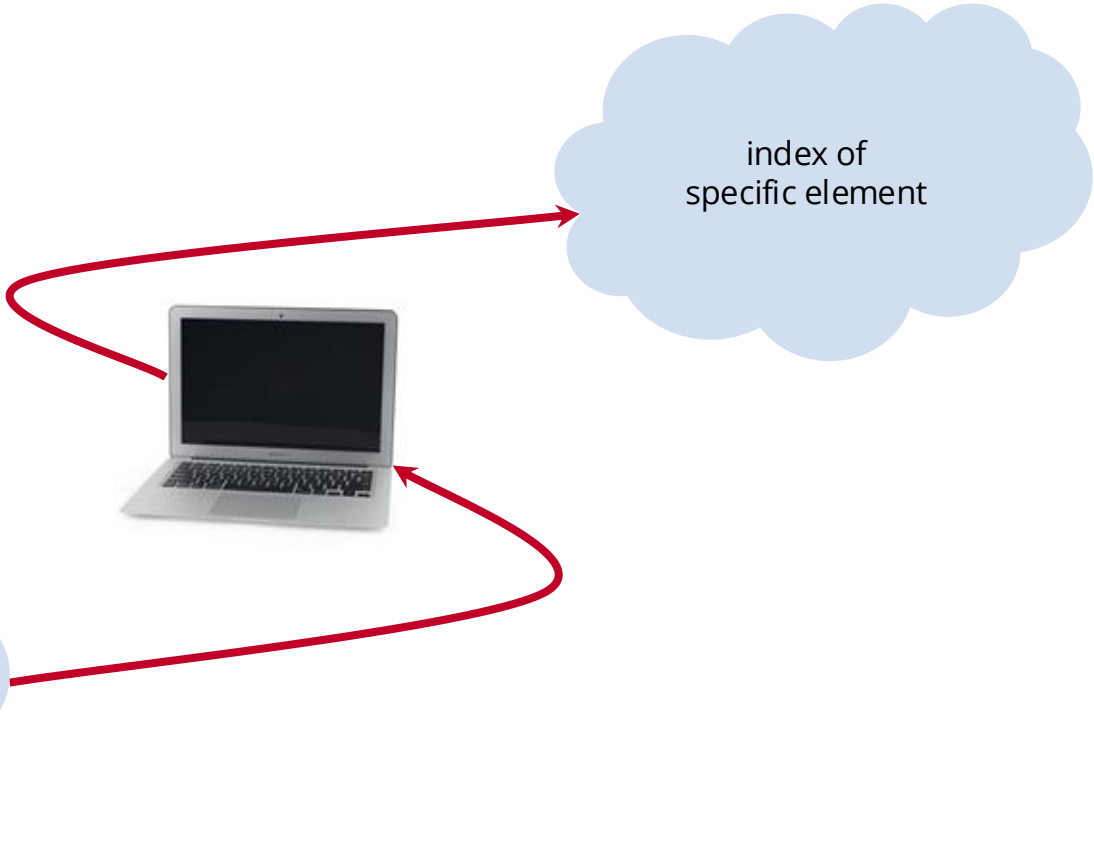

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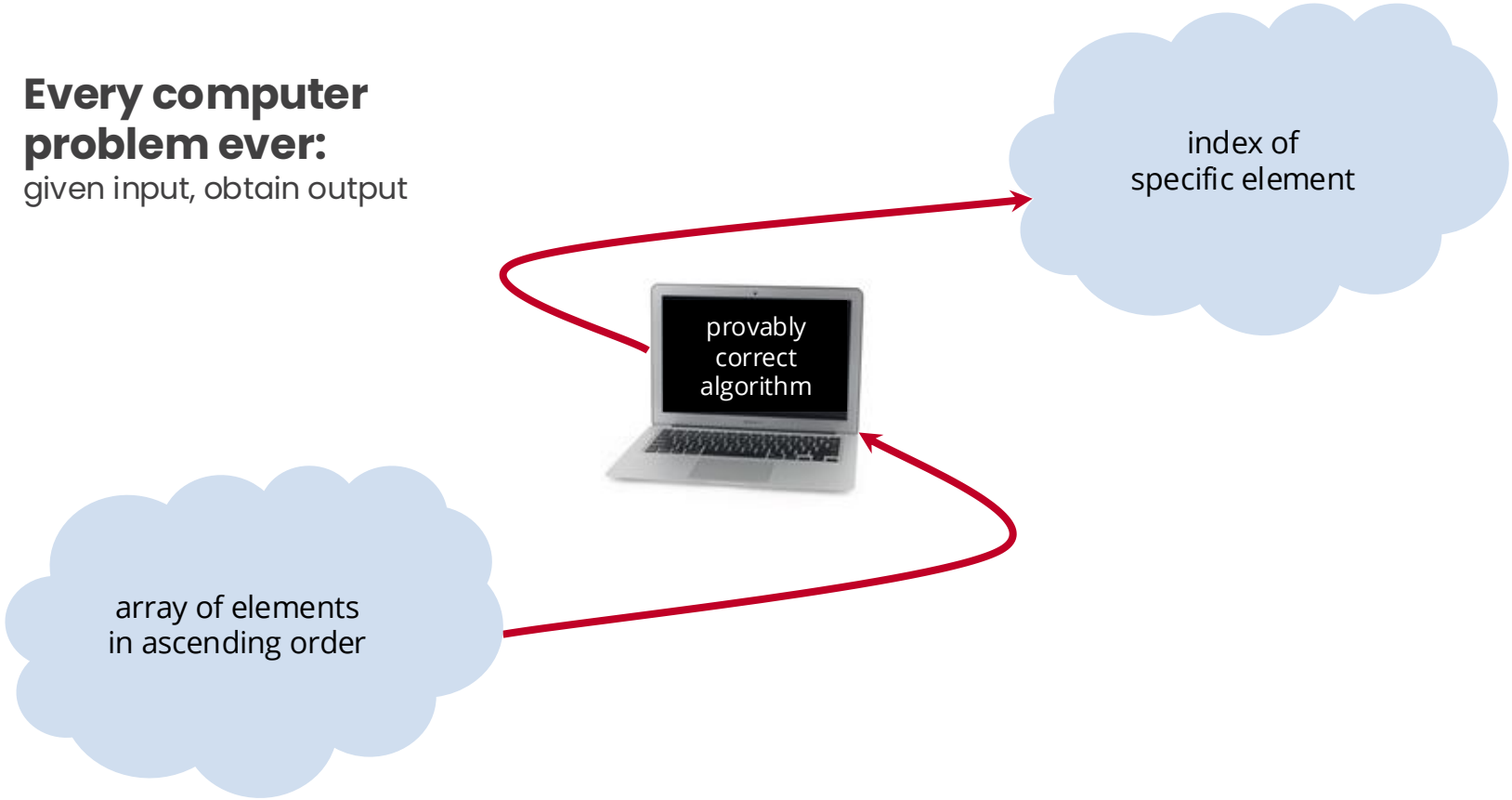

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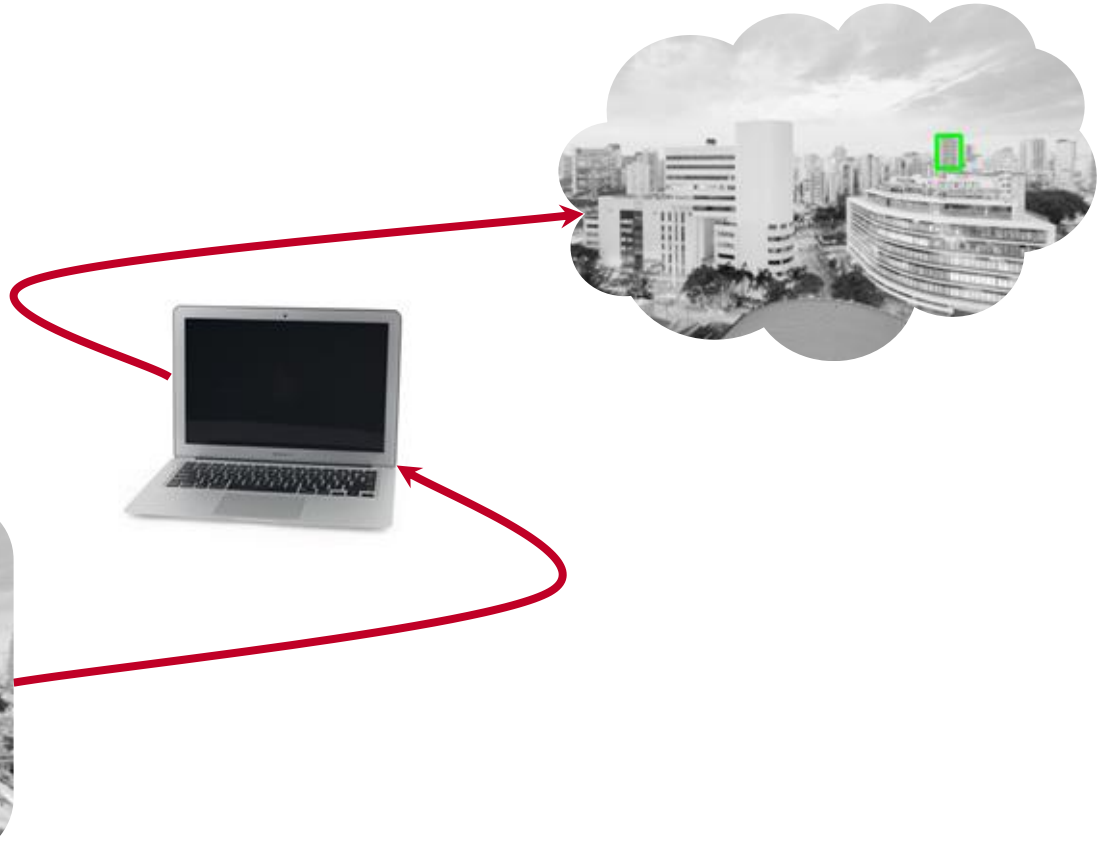

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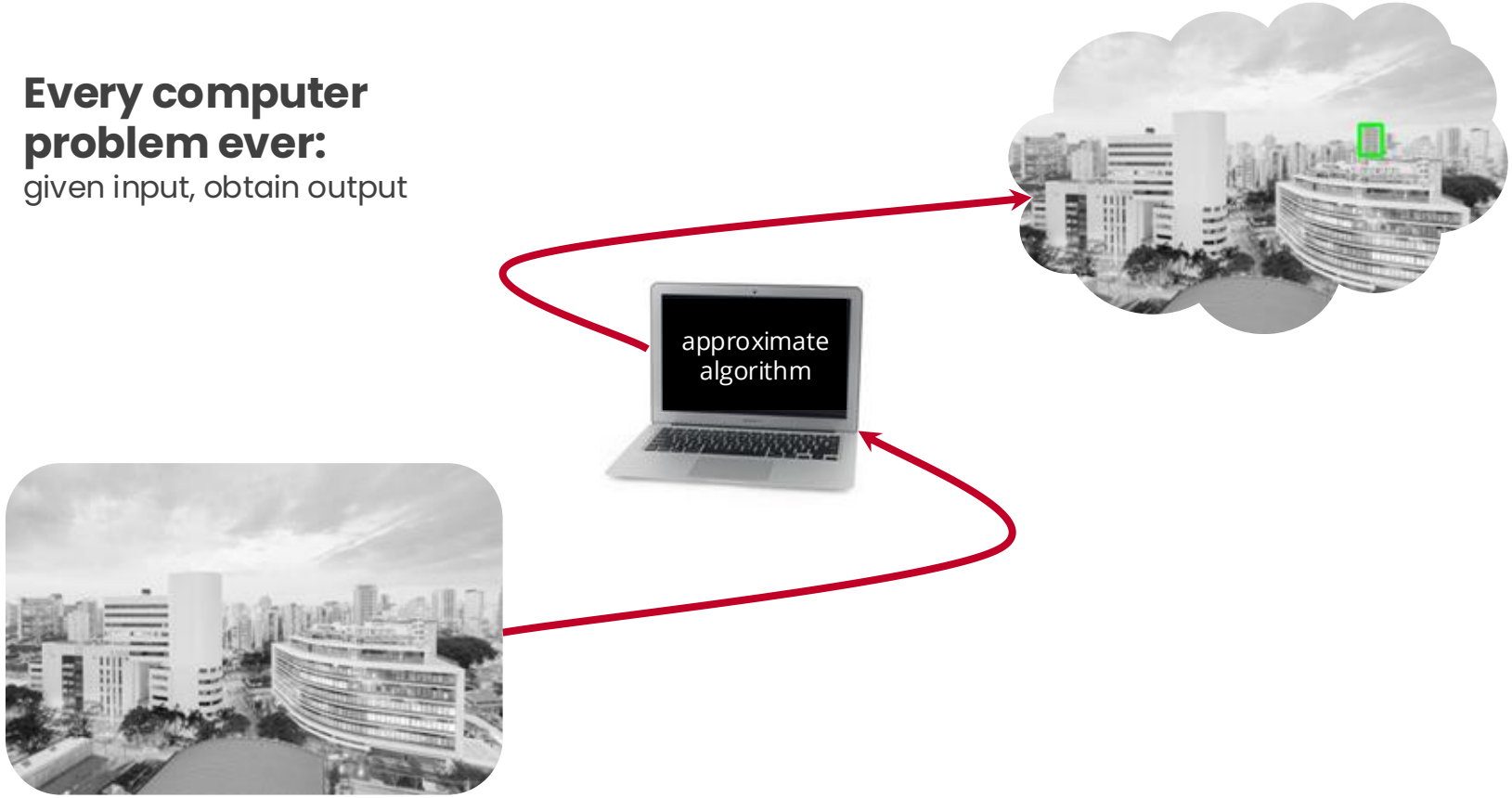

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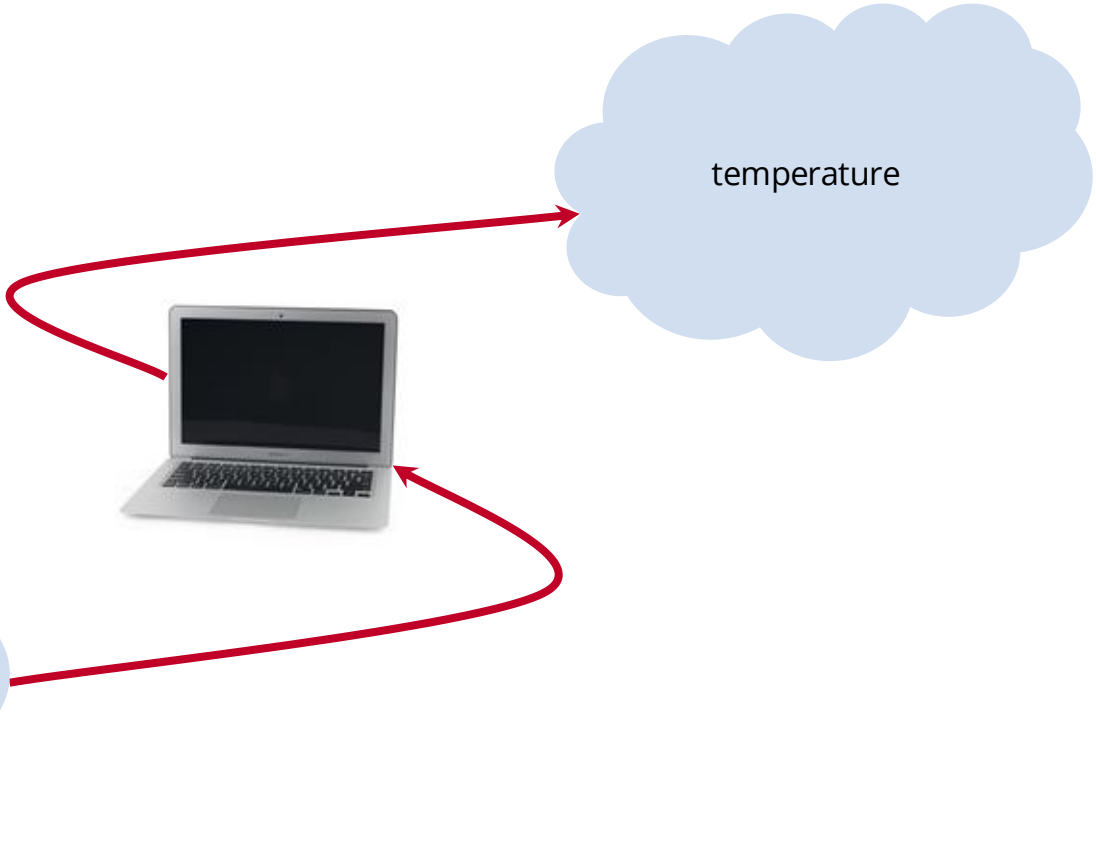

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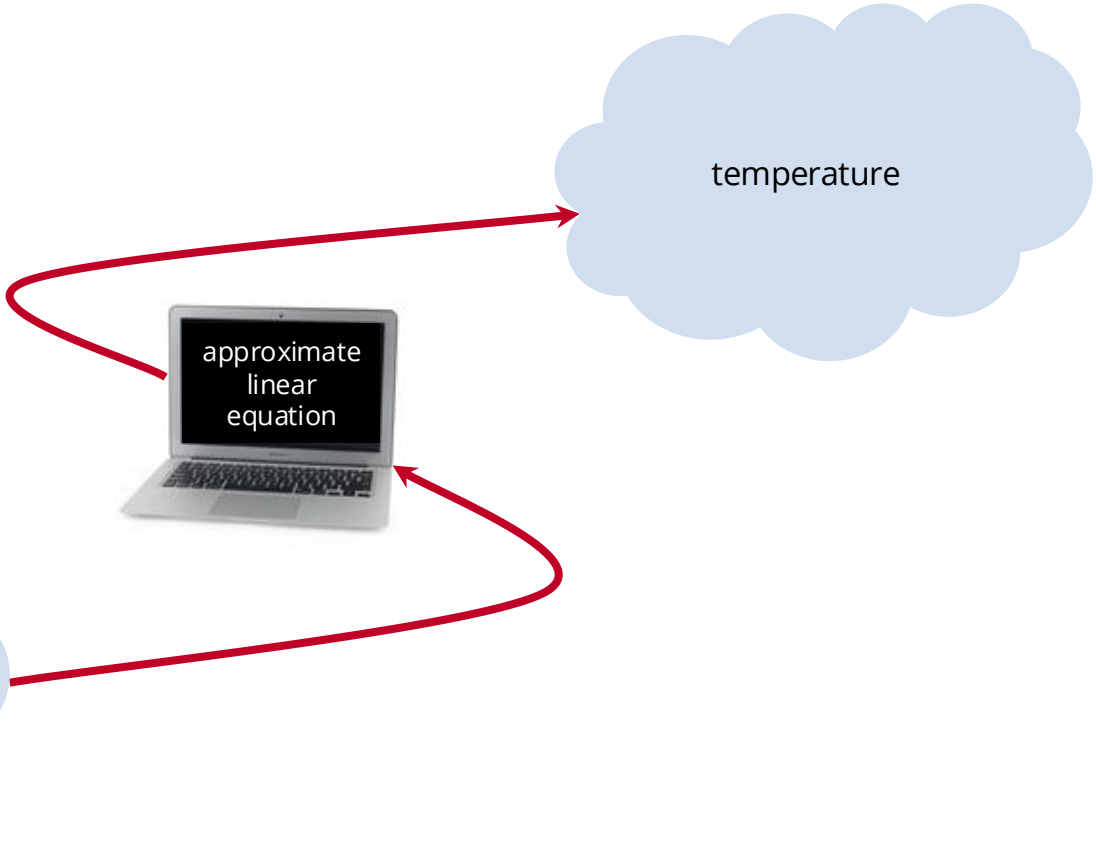

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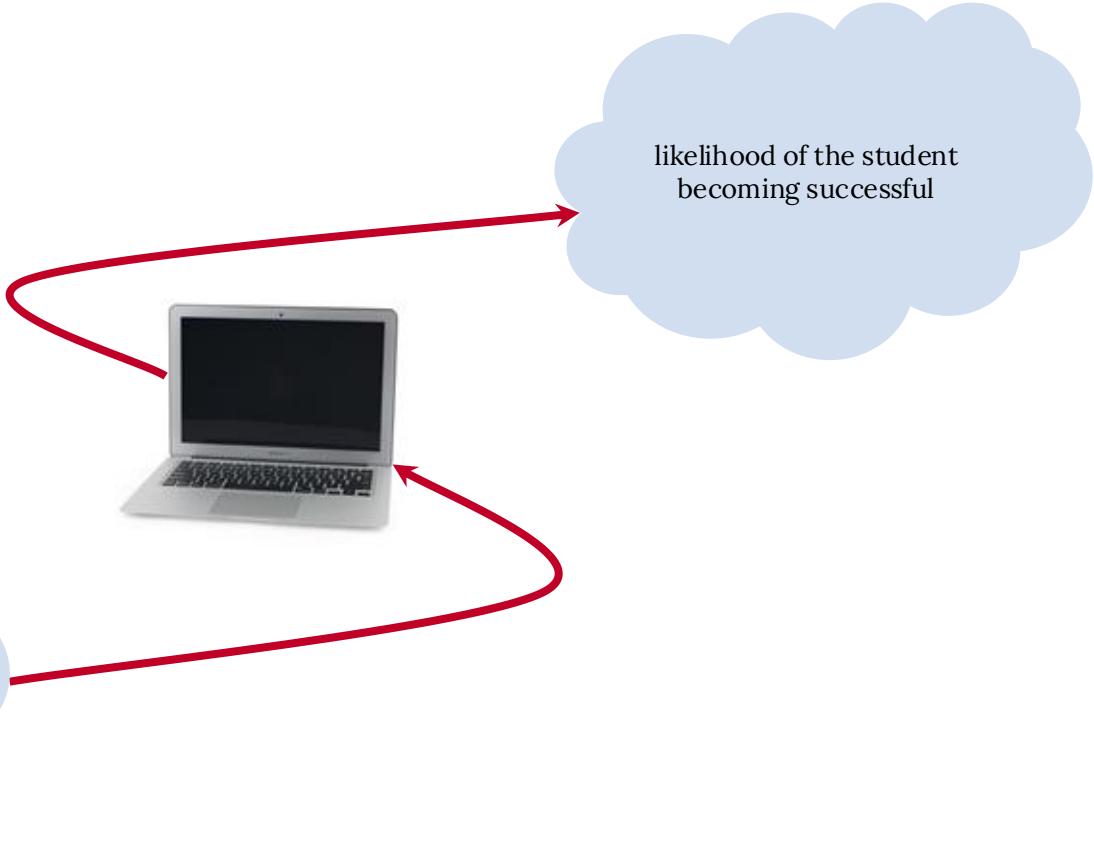

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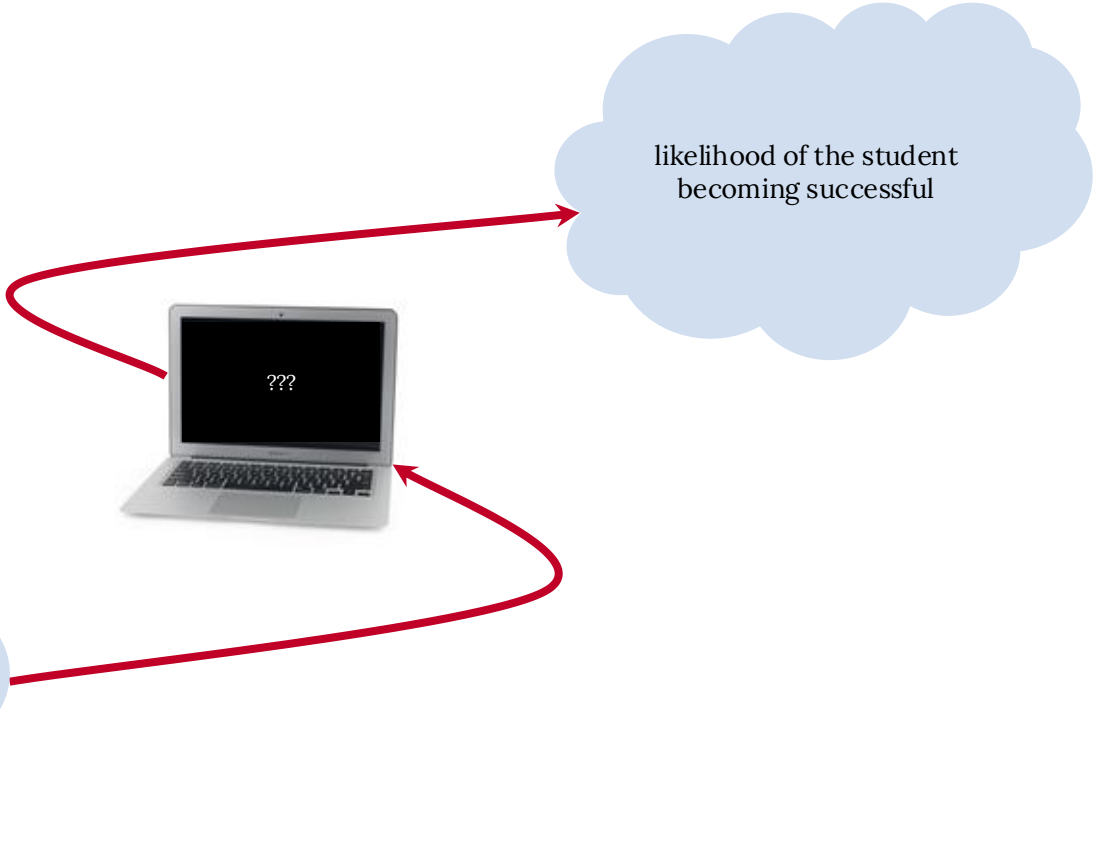

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- ...there is only training data. *(ex: traits and success)*

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- ...there is an adequate model *(ex: linear equation)* and training data *(ex: voltage and temperature pairs)* to approximate the parameters (ex: angular and linear coefficients) of this model.
- ...there is only training data. *(ex: modern vision)*

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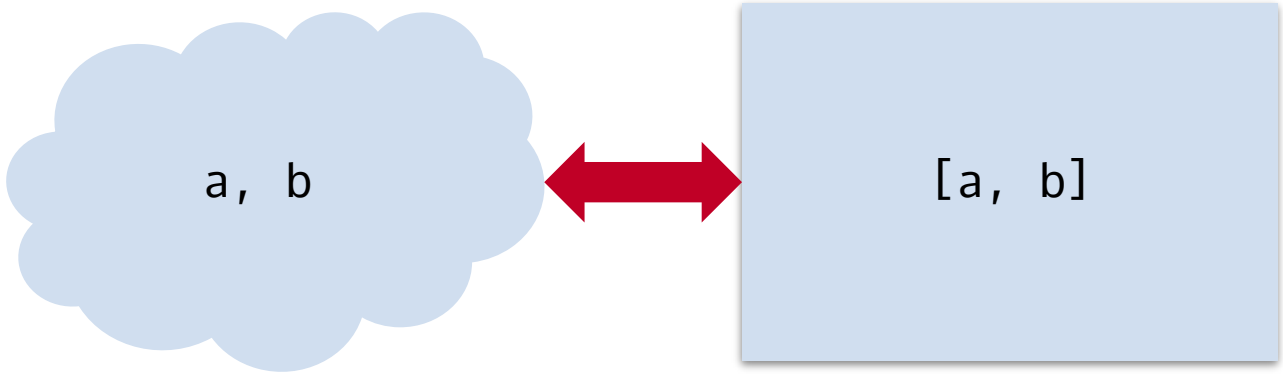
1. set the model hyperparameters; *(configuration of the learning process that will not be inferred from training data)*

1. use the training data to estimate the fine-grained parameters.

How can one model work for so many different problems?

Data tensor:
a multidimensional array that represents an input or output



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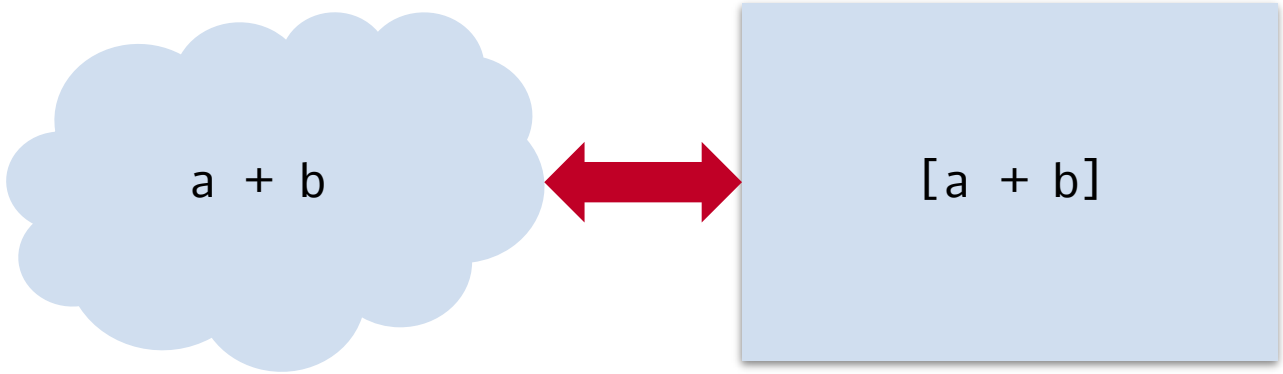

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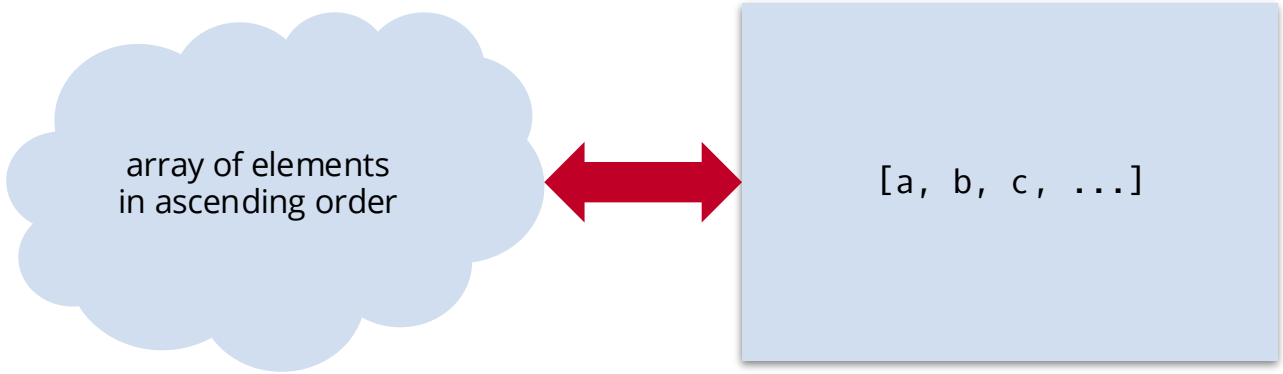

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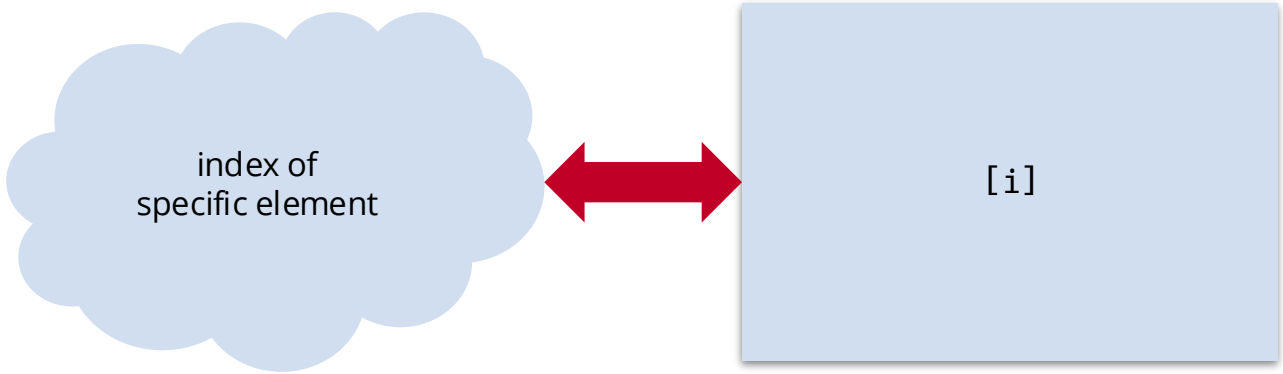

Data tensor:

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  ...,
 [182, 182, 179, ...,  67,  61,  66],
 [187, 187, 181, ...,  80,  76,  76],
 [187, 186, 183, ...,  91,  94,  97]]
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Data tensor:

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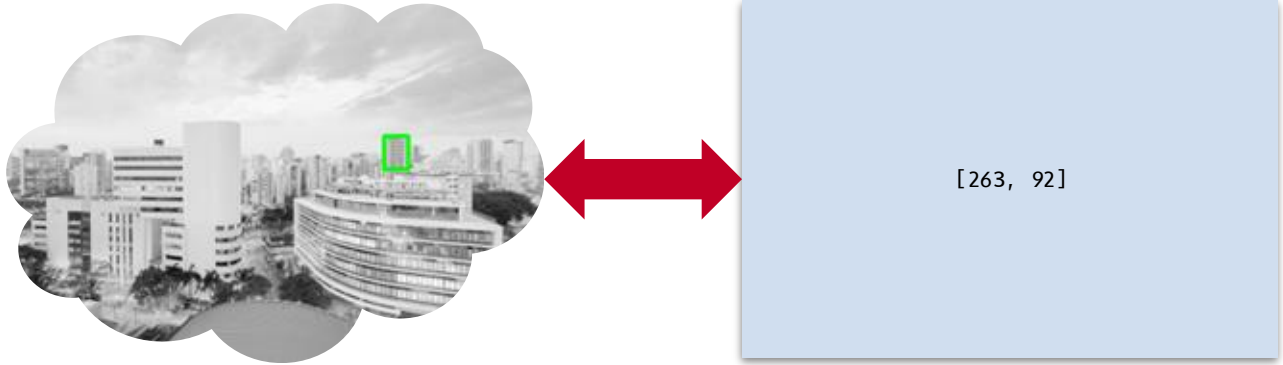
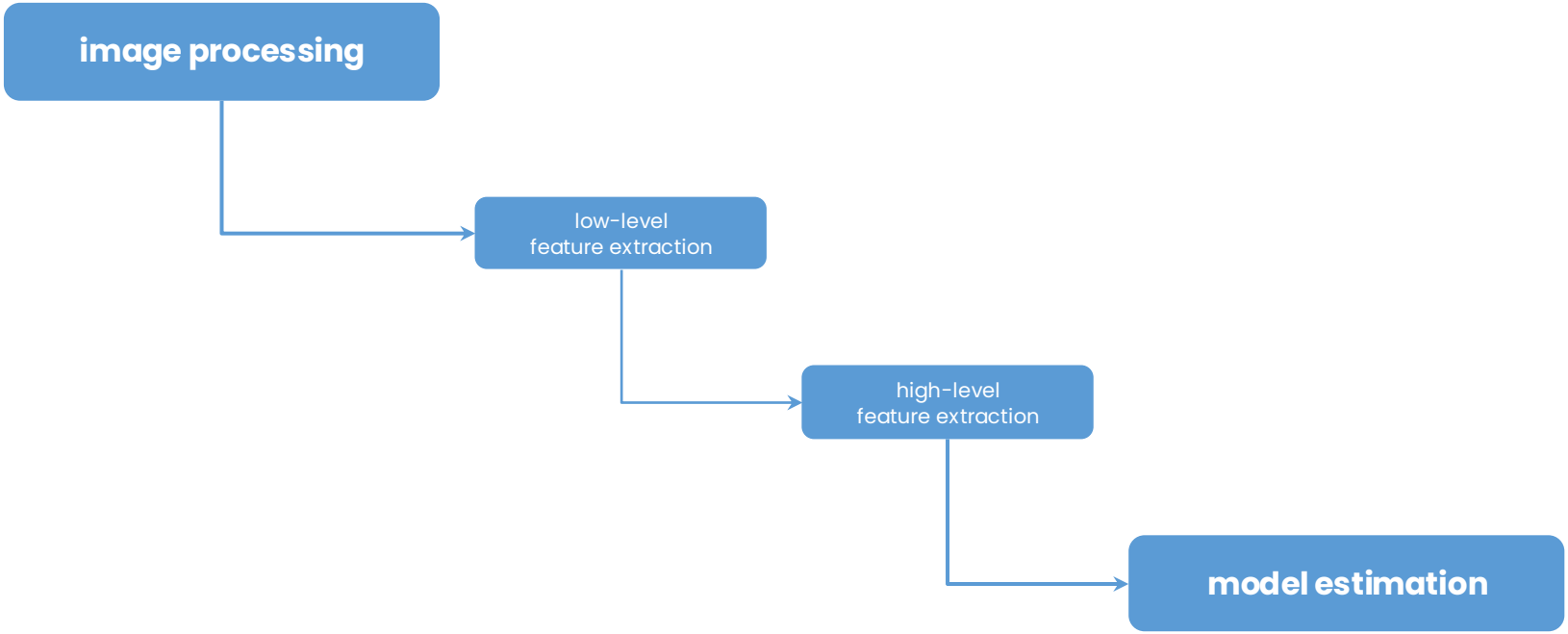
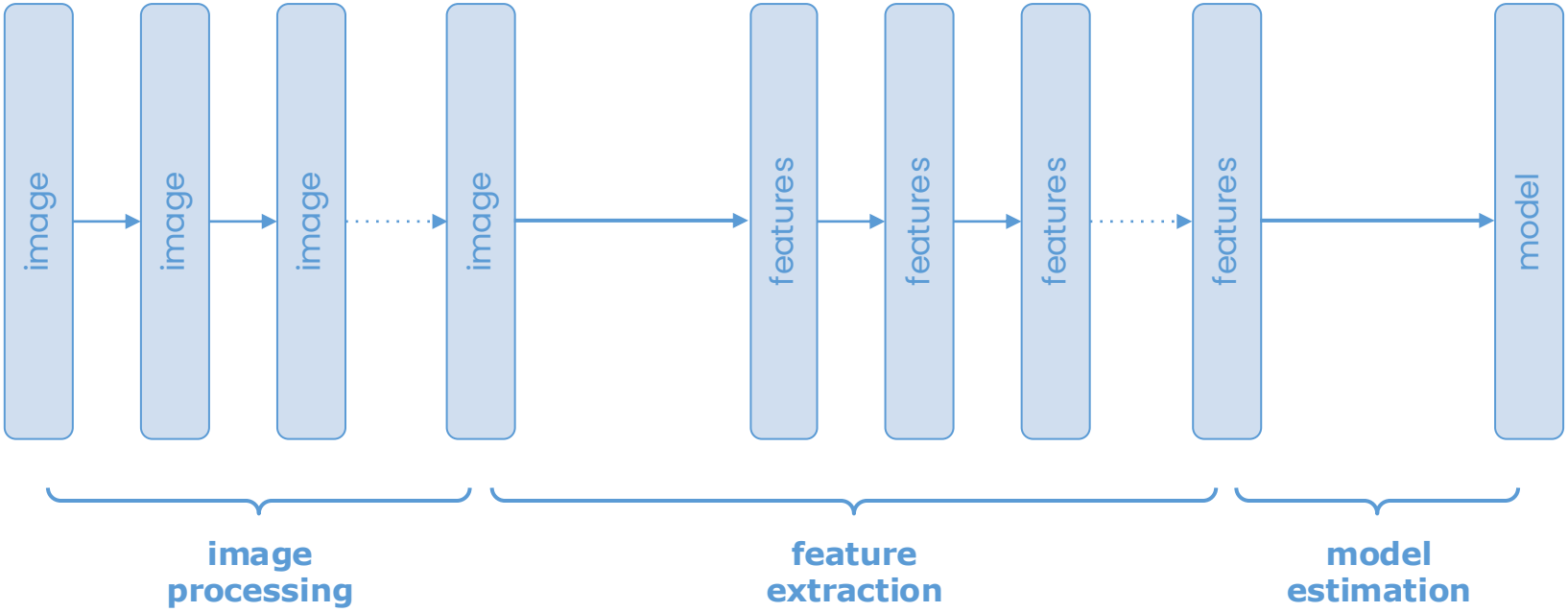


The computer vision pipeline

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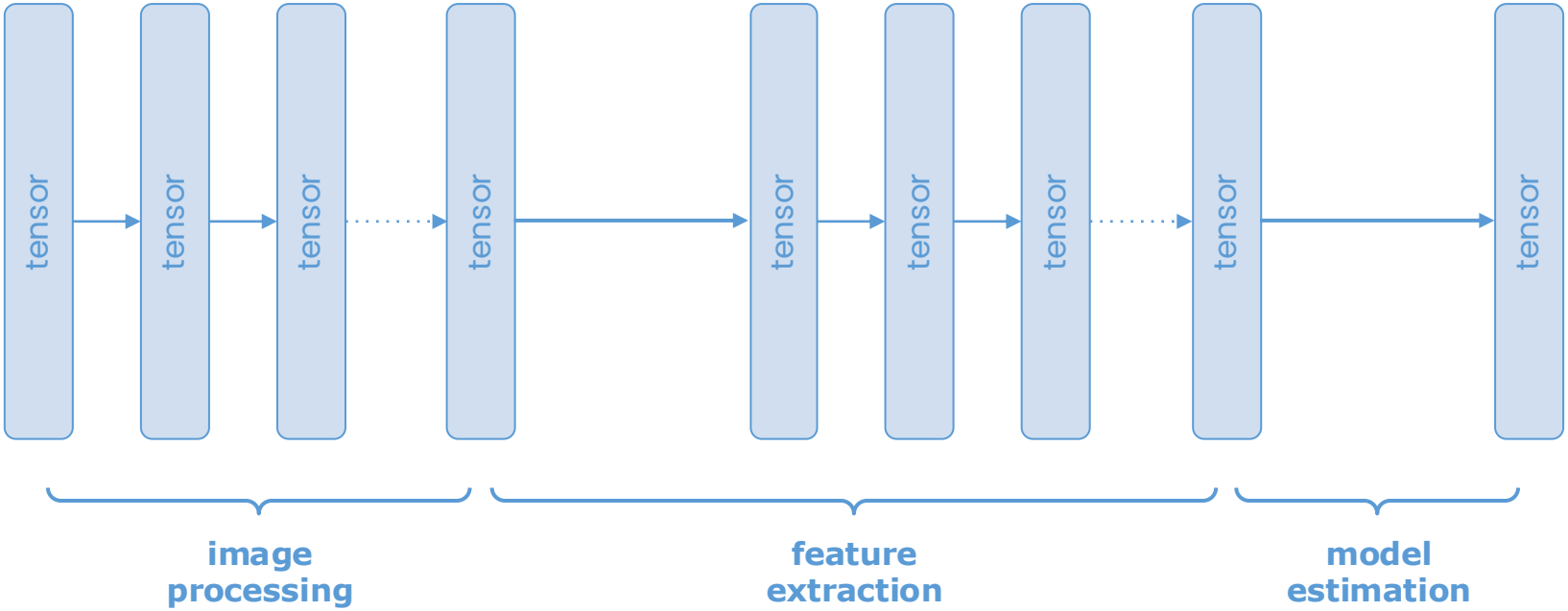
feature extraction
model estimation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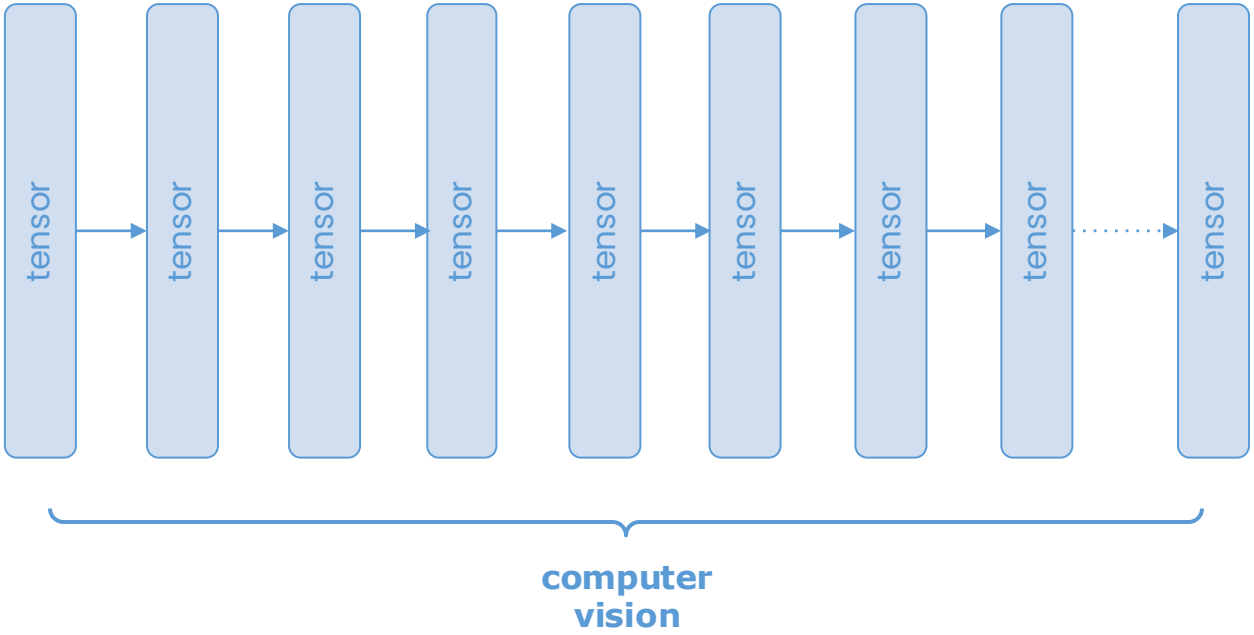
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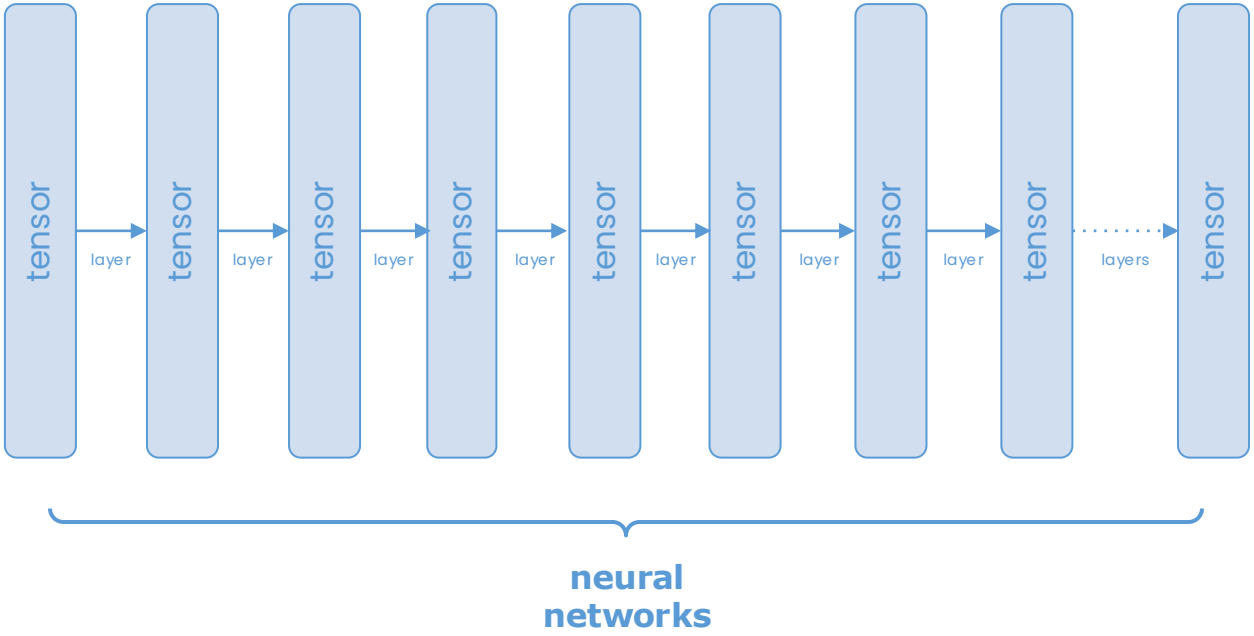
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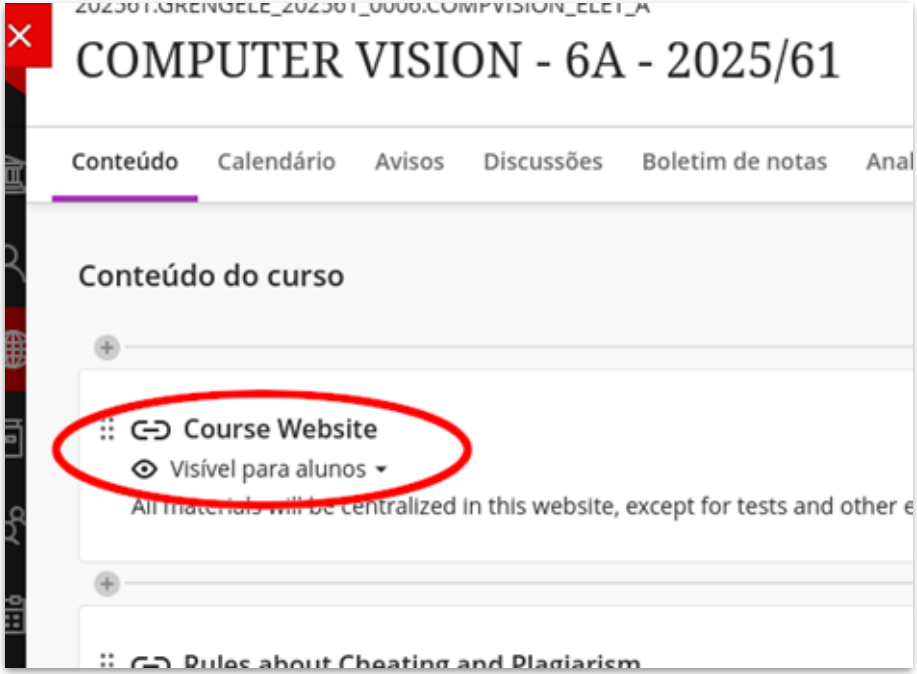
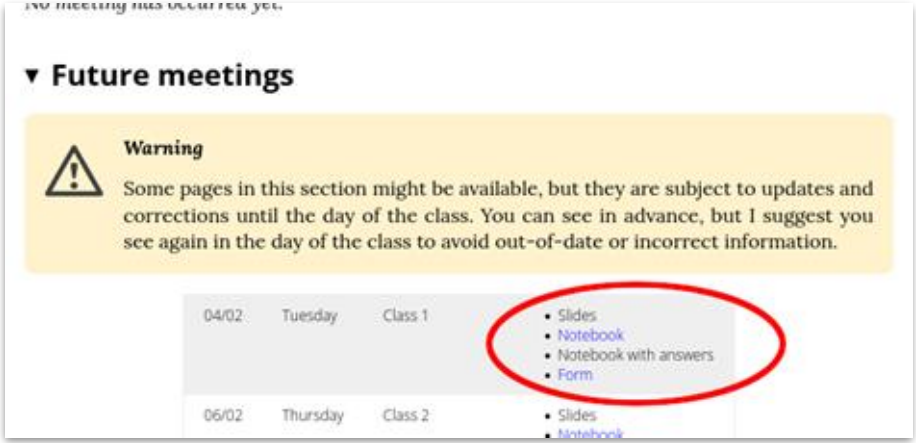
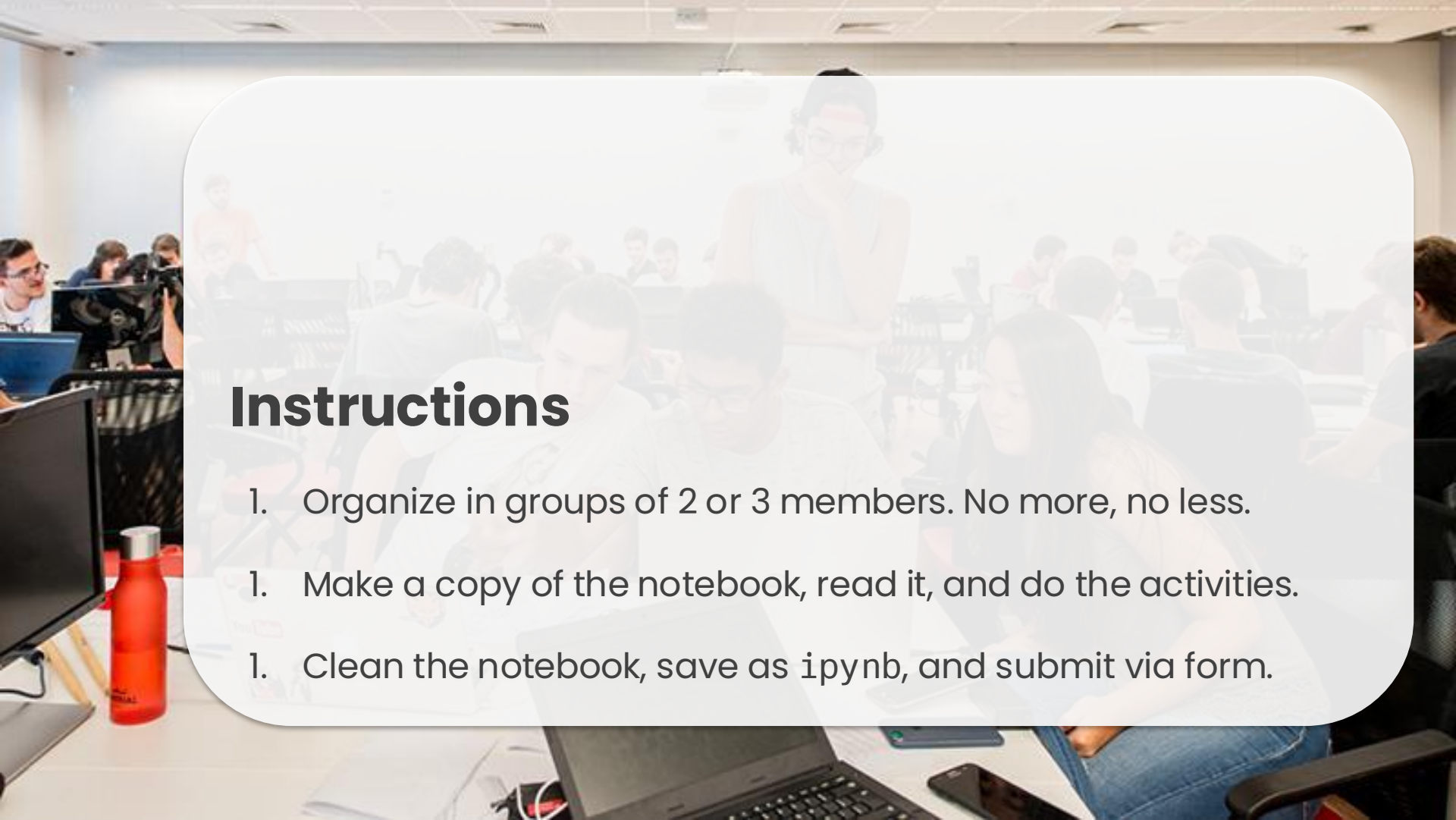

COMPUTER VISION - 6A - 2025/61
Conteúdo
Calendário
Avisos
Discussões
Boletim de notas
Conteúdo do curso
Course Website
Visível para alunos


No meeting has occurred yet.
▼ Future meetings
Warning
Some pages in this section might be available, but they are subject to updates and corrections until the day of the class. You can see in advance, but I suggest you see again in the day of the class to avoid out-of-date or incorrect information.
04/02 Tuesday Class 1
Slides
Notebook
Notebook with answers
Form
06/02 Thursday Class 2
Slides

Toolkit

- **Language:** Python
- **Library:** Keras
- **Platform:** Google Colab



Instructions

1. Organize in groups of 2 or 3 members. No more, no less.
1. Make a copy of the notebook, read it, and do the activities.
1. Clean the notebook, save as `ipynb`, and submit via form.

Neural Network Mysteries

- How can we separate a dataset in training data and testing data?
- What is a hidden layer?
- Does it matter if the input tensors are 3D, 2D, or 1D?
- What is a dense layer?
- How do we calculate the number of parameters in a dense layer?
- How do we calculate the number of steps in a training process?
- How do we calculate the number of steps in a testing process?
- Does the number of layers matter?
- Does the size of a dense layer matter?
- What exactly `activation='relu'` does?

Even basic coarse-tuning of neural networks requires some knowledge.

Classic computer vision can help providing some of this knowledge.

Next class:

- colors as numbers.

Credits

This material was based on the work of other professors, listed below.

- Fabio Miranda (fabiomiranda@insper.edu.br)
- Raul Ikeda (RaulIGS@insper.edu.br)
- Fabio Ayres (FabioJA@insper.edu.br)
- Igor Montagner (IgorSM1@insper.edu.br)
- Andrew Kurauchi (AndrewTNK@insper.edu.br)
- Luciano Silva (LucianoS4@insper.edu.br)
- Tiago Sanches (tiagoss4@insper.edu.br)

Well, except for the errors. Any errors you might find are probably my fault.

Images

https://www.insper.edu.br/campus/
https://en.wikipedia.org/wiki/Laptop