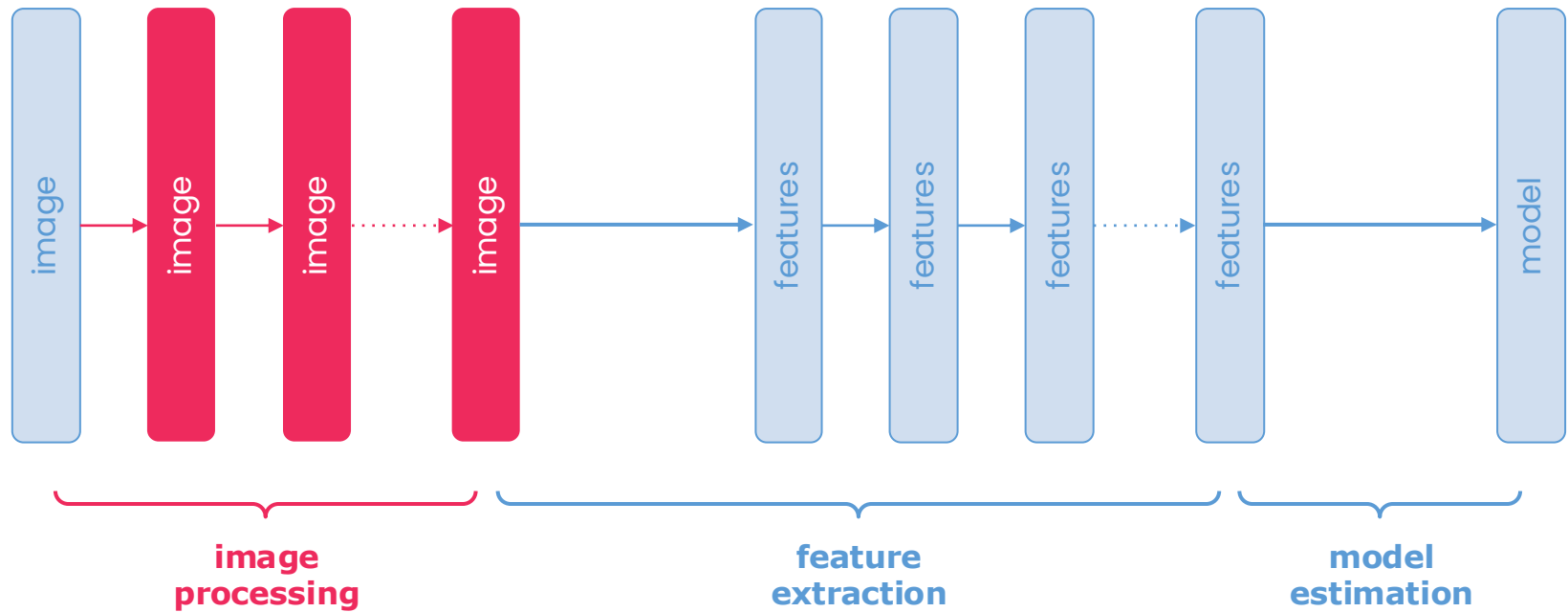


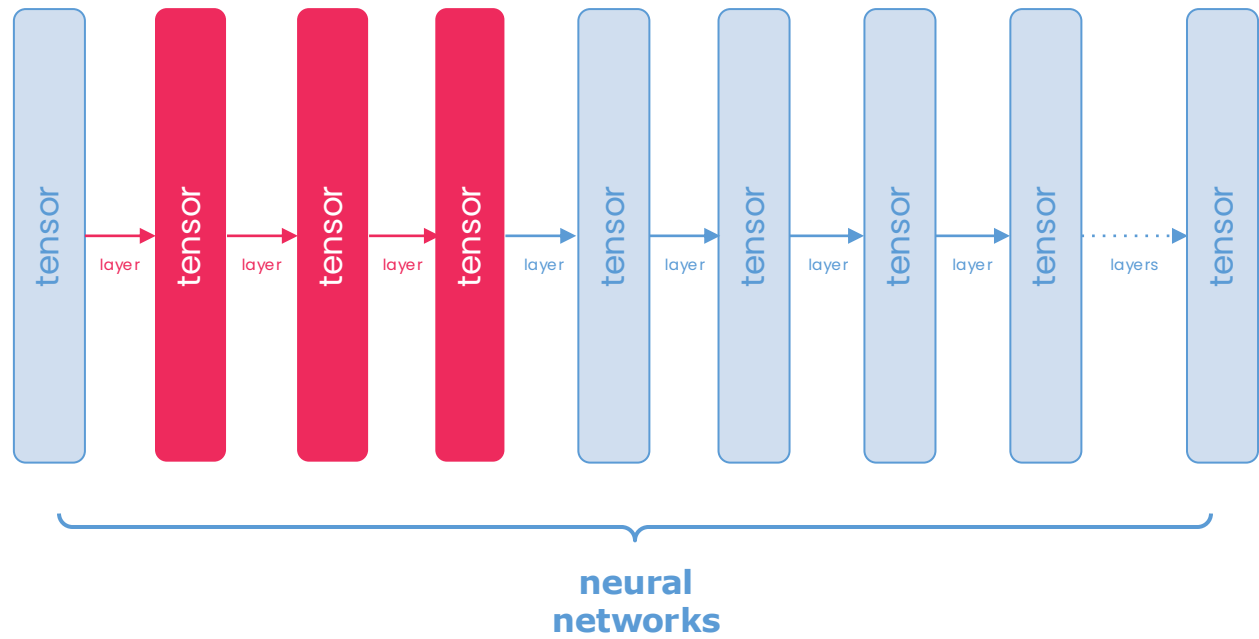
The background features several decorative curved lines in white and red, scattered across the dark gray field. Some lines are thin and white, while others are thicker and red, creating a modern, abstract aesthetic.

Insper

Computer Vision

Class 5: Slightly Less Basic Basics of Neural Networks





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?

Neural network basics

Neural network basics

- **Input:** the tensor that represents the received image.
- **Output:** the tensor that represents the returned model.

Neural network basics

- **Input:** the tensor that represents the received image.
- **Output:** the tensor that represents the returned model.
- **Hidden:** one or more intermediate tensors.

Neural network basics

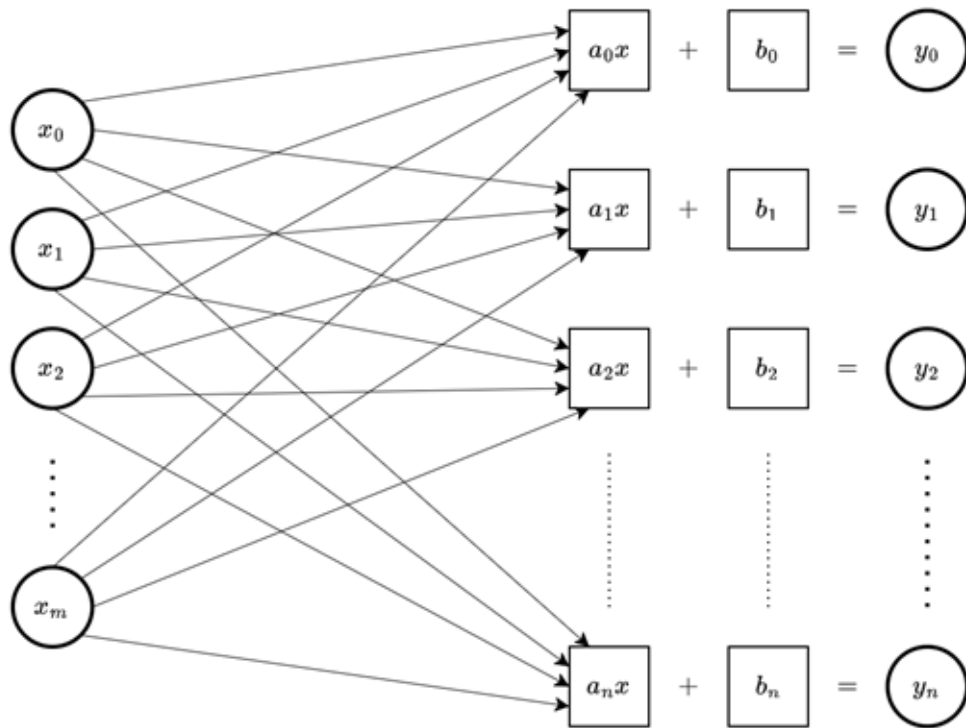
- **Input:** the tensor that represents the received image.
- **Output:** the tensor that represents the returned model.
- **Hidden:** one or more intermediate tensors.
 - Not easily interpretable in high-level terms.

Neural network basics

- **Input:** the tensor that represents the received image.
- **Output:** the tensor that represents the returned model.
- **Hidden:** one or more intermediate tensors.
 - Not easily interpretable in high-level terms.
 - Calculation defined by trainable parameters.

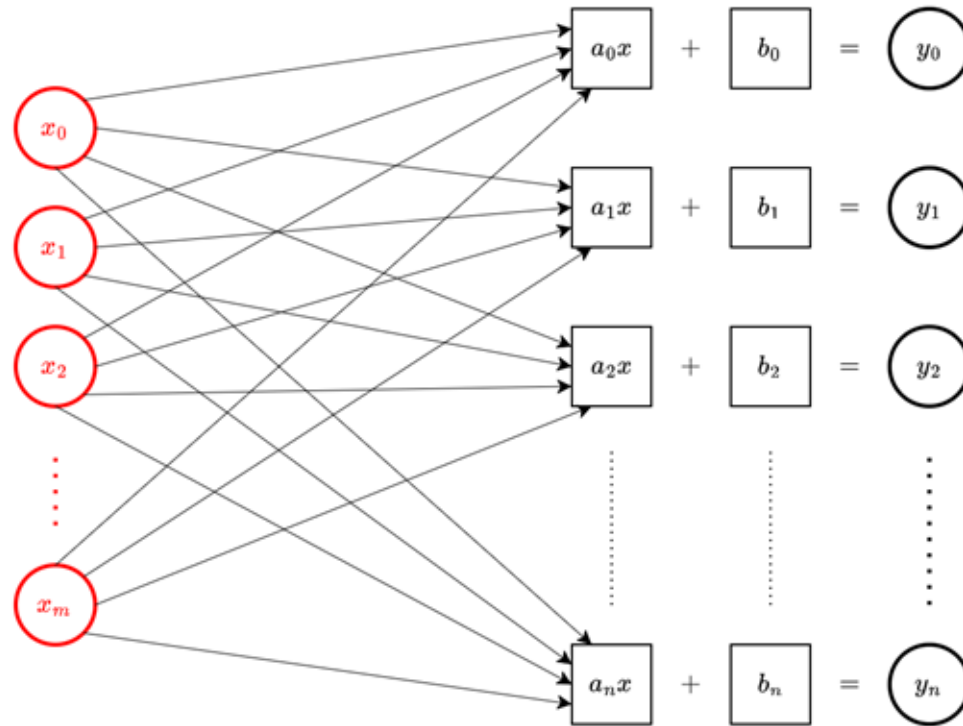
Neural network mysteries

- How can we separate a dataset in training data and testing data?
- ~~What is a hidden layer?~~
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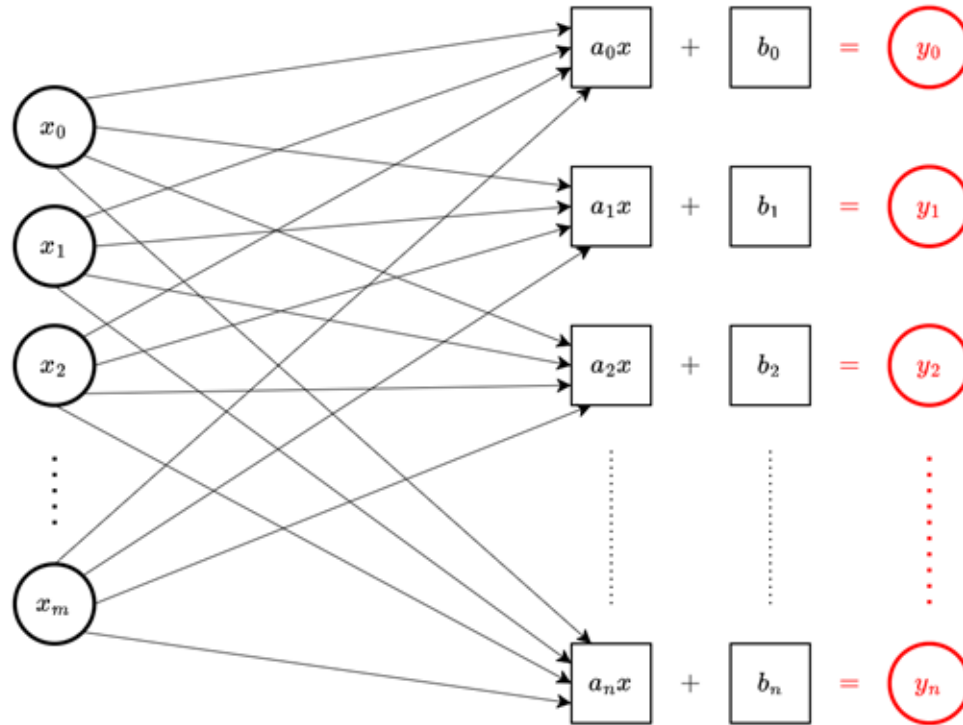
Input neurons:

data tensor



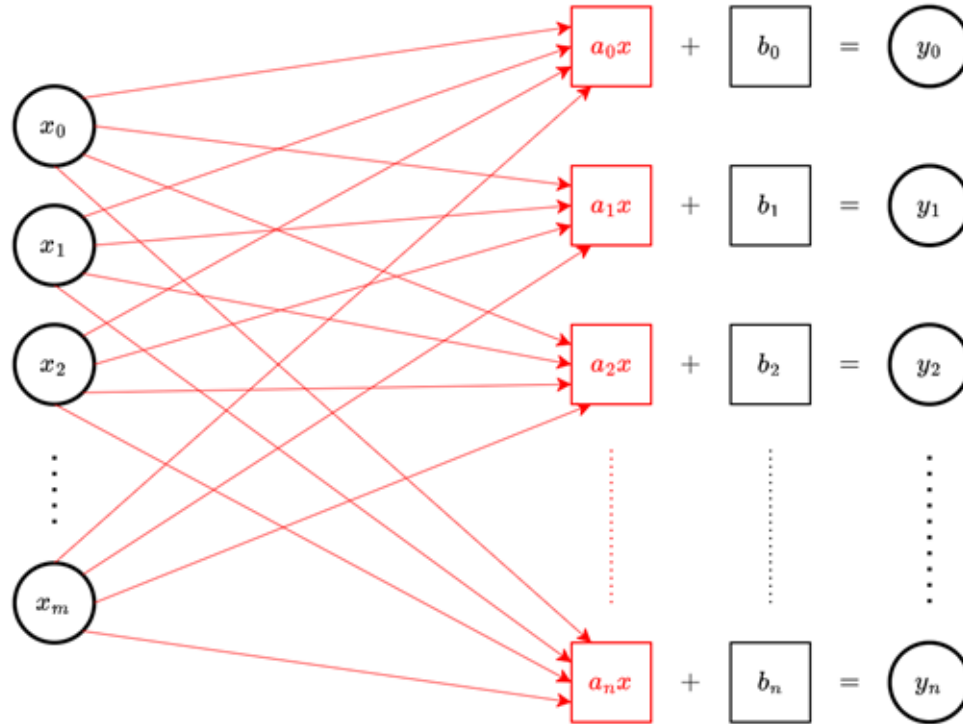
Output neurons:

data tensor



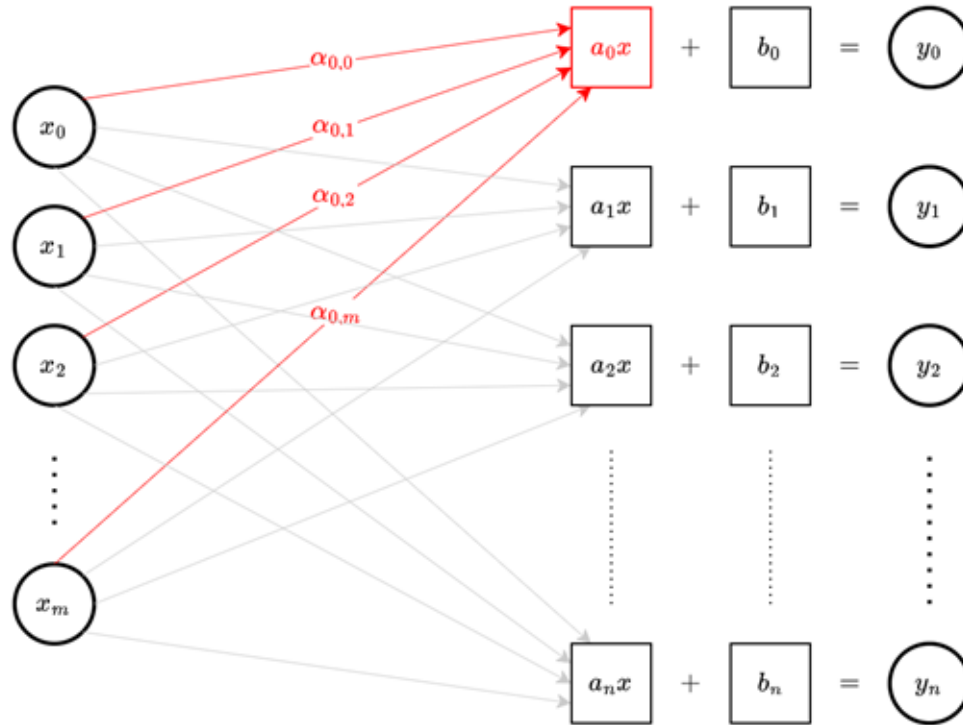
Weights:

multiplicative constants



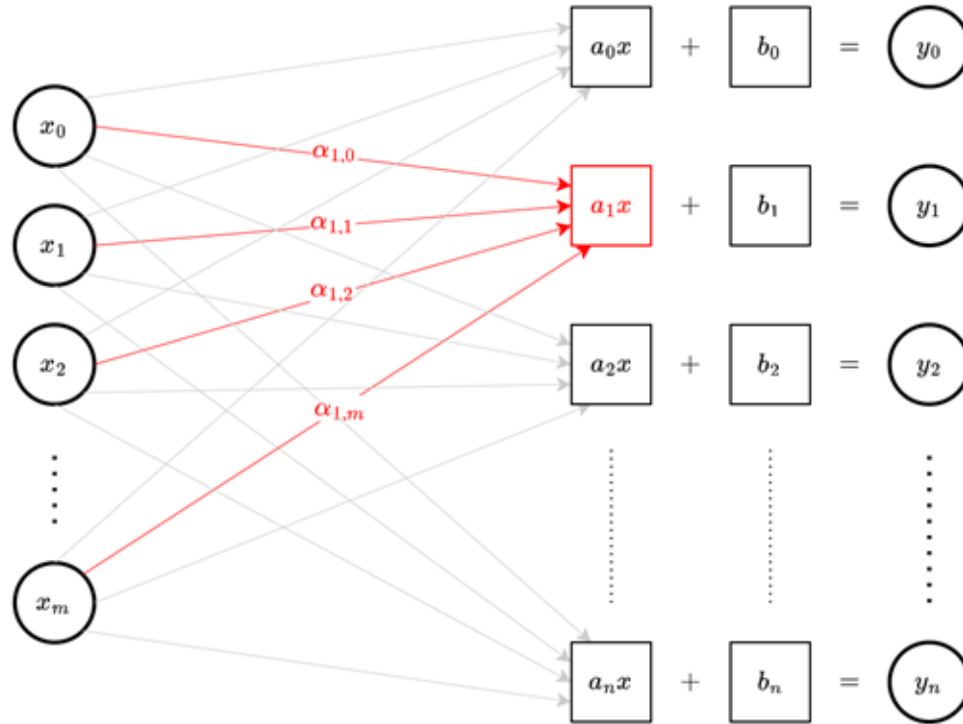
Weights:

multiplicative constants



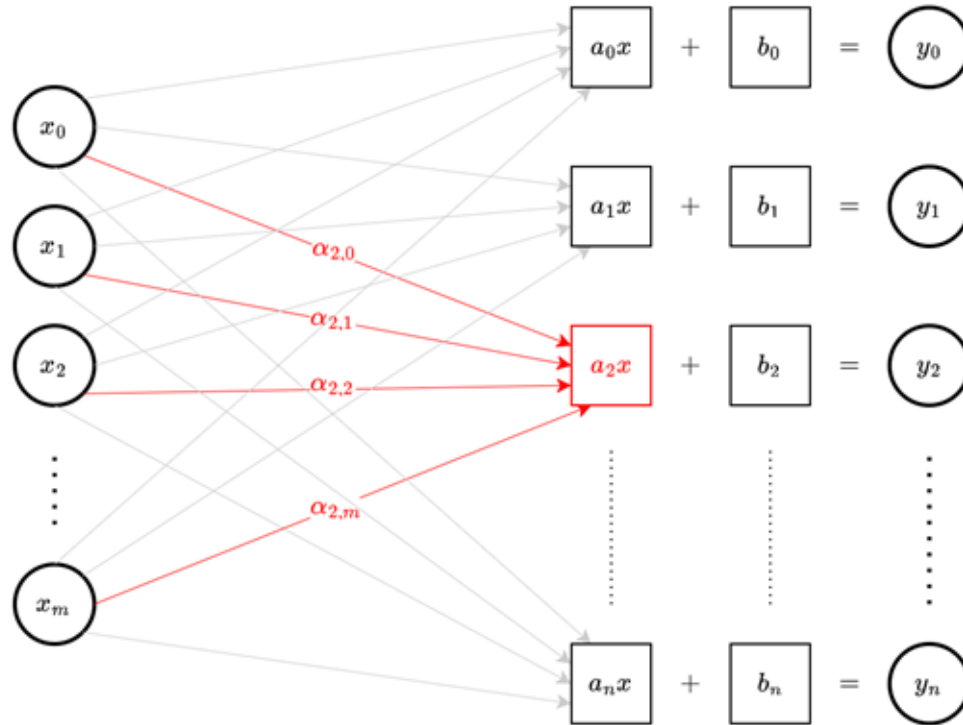
Weights:

multiplicative constants



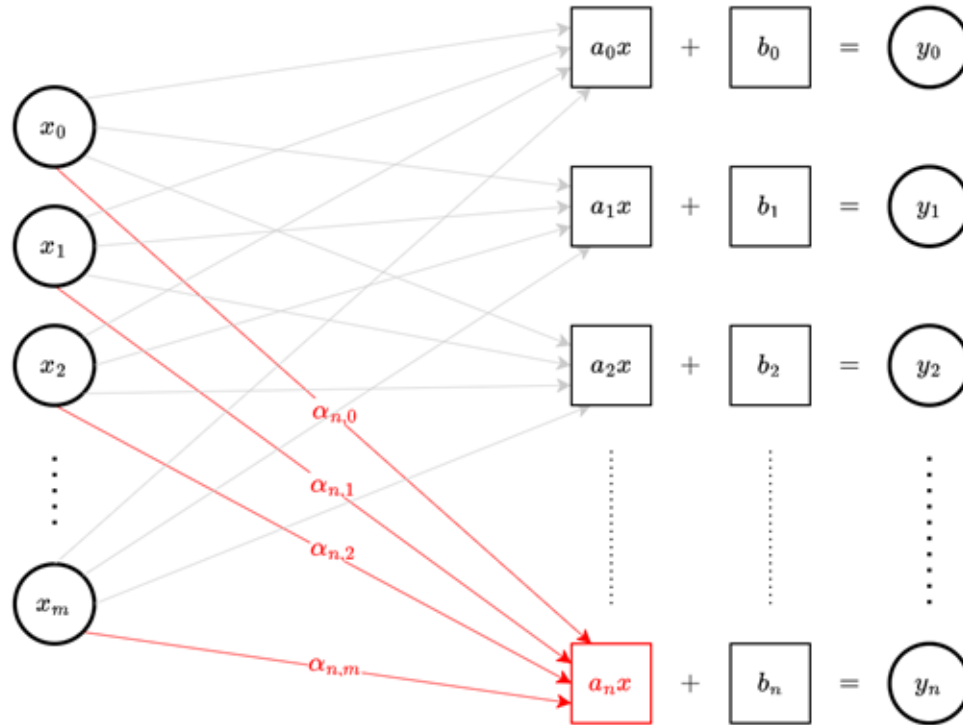
Weights:

multiplicative constants



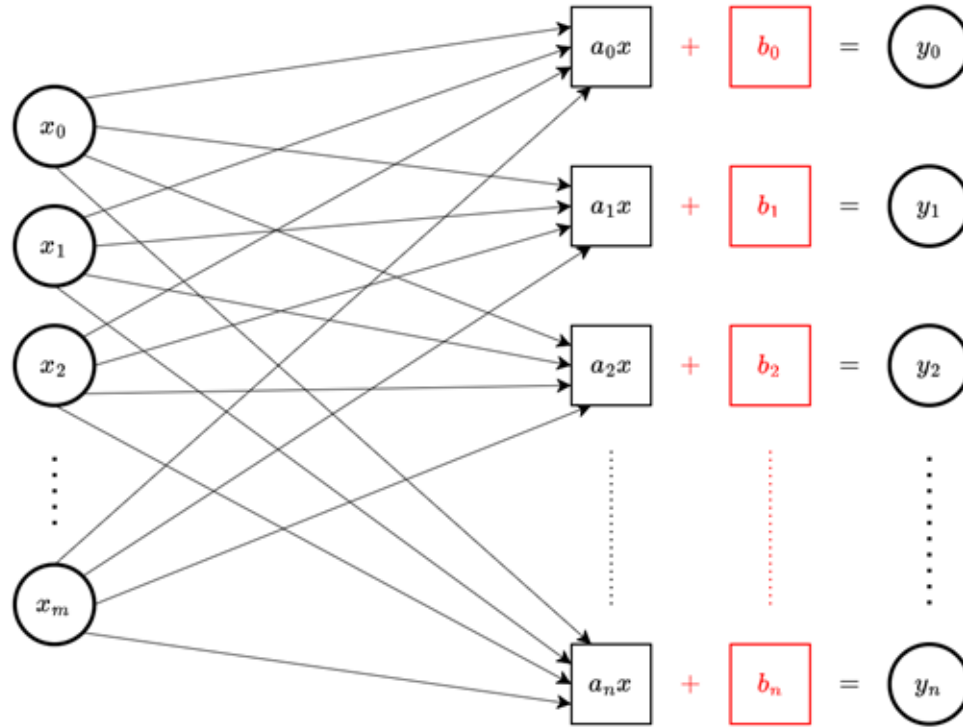
Weights:

multiplicative constants



Biases:

additive constants



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?
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- What exactly `activation='relu'` does?

Dense layer parameters

Dense layer parameters

- For m input neurons...

Dense layer parameters

- For m input neurons...
- ...and n output neurons...

Dense layer parameters

- For m input neurons...
- ...and n output neurons...
- ...we have mn weights...

Dense layer parameters

- For m input neurons...
- ...and n output neurons...
- ...we have mn weights...
- ...and n biases...

Dense layer parameters

- For m input neurons...
- ...and n output neurons...
- ...we have mn weights...
- ...and n biases...
- ...for a total of $mn+n$ parameters.

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?
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- What exactly activation='relu' does?



demonstration

Toolkit

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

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?
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- ~~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?
- Can classic vision algorithms be represented by dense layers?
- In a dense layer, are all the weights and biases always necessary?

The background of the slide consists of numerous horizontal, wavy lines in two shades of pink, creating a dynamic, flowing visual effect.

handout

Toolkit

- **Language:** Mathematics
- **Library:** None
- **Platform:** Pencil and Paper



Instructions

1. Organize in groups of 2 or 3 members. No more, no less.
1. Take a copy of the handout, read it, and do the activities.
1. Register the member names and return it to the professor.

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?
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- What exactly `activation='relu'` does?
- ~~Can classic vision algorithms be represented by dense layers?~~
- ~~In a dense layer, are all the weights and biases always necessary?~~

Next class:

- noise reduction.

Credits

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

- Fabio Miranda (fabiomiranda@insper.edu.br)
- Raul Ikeda (RaullGS@insper.edu.br)
- Fabio Ayres (FabioJA@insper.edu.br)
- Igor Montagner (IgorSMl@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.