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➤ Neural networks: Technical jargon

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➤ Outline

- What is jargon
- Neurons, units, filters, dimensions...?
- Names for types of layers
- Latent space, encoder, decoder



➤ Jargon = confusing terminology

- Multiple sub-communities, using different terminology
- Different ways of viewing/formalizing *same thing*
 - Layers vs Modules
 - Units vs Filters vs Neurons
 - Fully connected layers, convolutional layers...?



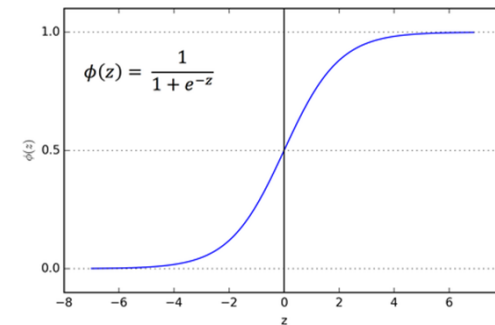
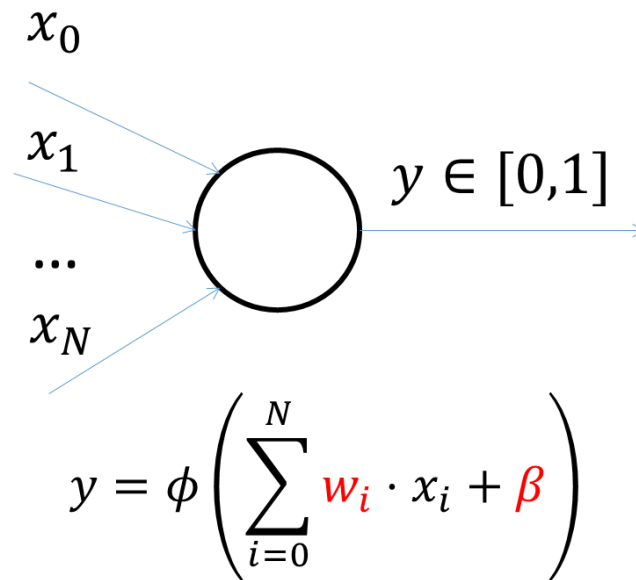
➤ Neurons, units, filters, dimensions...?

- All terms describe **shape of tensors** in output to a module
- One **tensor dimension** depends on <term>
- Fundamental idea: **unitary operation**
 - The operation can be repeated several times by different units
 - Each unit will produce a new dimension in the output tensor



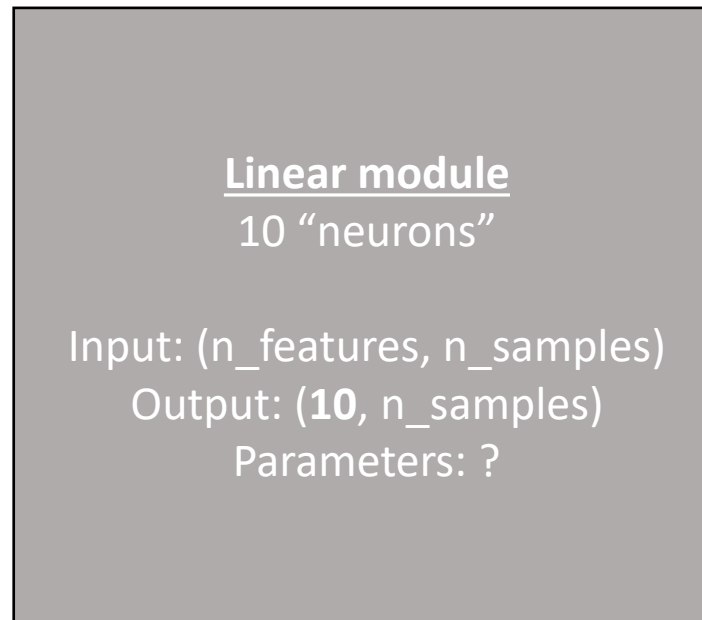
➤ Neurons, units, filters, dimensions...?

- “Neurons”
 - One neuron outputs **one value**, two neurons, two values, etc.
 - **Number of neurons** -> Output tensor dimension



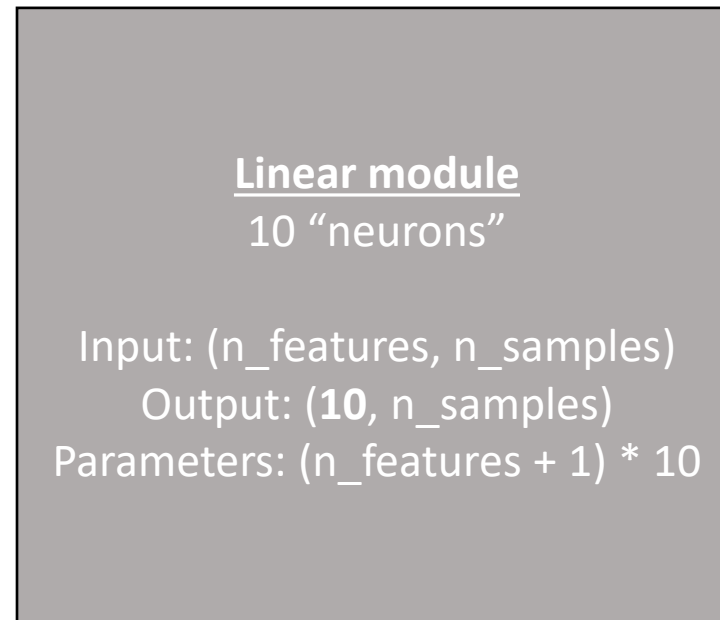
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➤ Linear module + activation

- Structure often found in NNs of all kinds
- pytorch encodes it as a **linear module** followed by **activation**
- More “historical” names found in literature
 - Fully-connected (FC) layer
 - Multi-layer perceptron (MLP)
 - Feed-forward module (maybe more general)
- Only Linear modules and activations: **feed-forward NN**

➤ Neurons, units, filters, dimensions...?

- “Filters” in CNNs
 - Each “filter” corresponds to a set of weights in a convolution
 - Each filter outputs the result of a single convolution
 - Terminology: number of channels == number of filters
- Output shape
 - Imagine an input tensor of one image (1, c, h, w)
 - Conv. module: padding=1, stride=1, kernel=3, out_channels=64
 - Size of the output tensor?

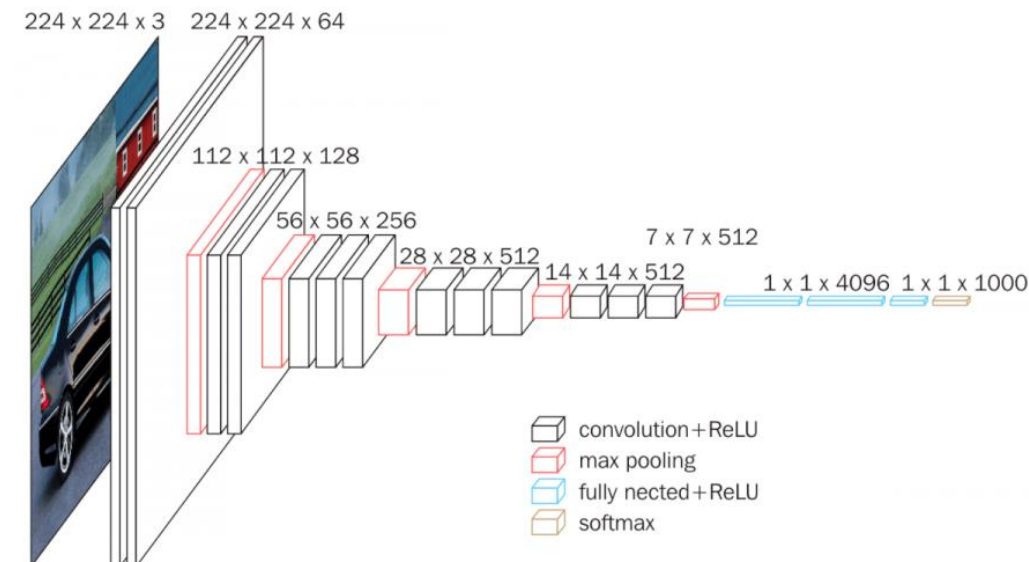
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 - Shape of the output tensor: (1, **64**, h, w)



➤ Convolutional layer

- *Imprecise*, but generally a structure like
 - Convolutional module
 - Activation
 - Downscaling (MaxPooling, or AvgPooling)
- Sometimes it can be more complex
 - Convolutional module
 - Activation
 - Convolutional module
 - Activation
 - Downscaling



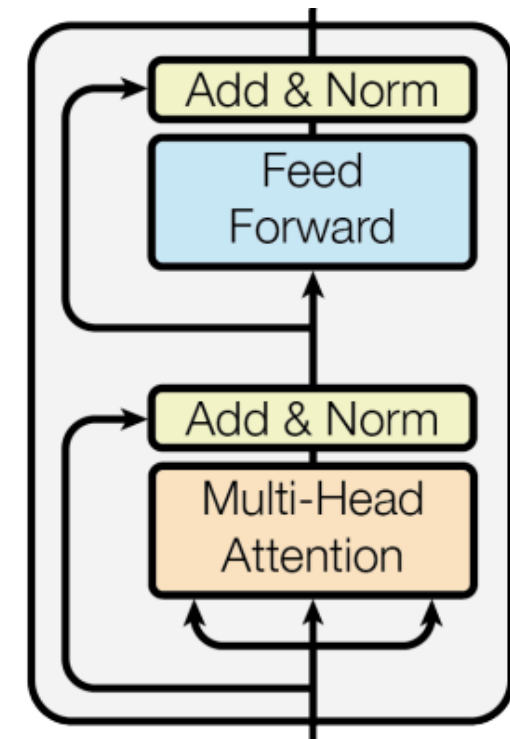
➤ Neurons, units, filters, dimensions...?

- “Units” in RNNs
 - Each “unit” corresponds to a set of weights
 - Size of the hidden state tensor == number of units
 - Output shape depends on number of units



➤ Transformer module/block

- Typical composition
 - Attention module
 - Addition and normalization
 - Linear module
 - Activation
 - Normalization



➤ Prediction, inference, forward pass...

- Used as synonyms
 - Forward pass: matrix multiplication from input to output
 - Inference: distinguish it from learning
 - Prediction: get outputs for values of one input sample

➤ Latent space, encoding, decoding

- Terminology from embeddings
- Encoder
 - Part of a NN which goes from high to low tensor dimensionality
 - Very often, from **relational data** to a **vectorial space** (1D tensor)
- Decoder
 - Part of NN which performs the opposite operation
- Latent space/bottleneck
 - Output tensors of the lowest-dimensionality point in the NN
 - Typically it's an embedding with some sort of semantics



The INRAE logo is displayed in a bold, teal, sans-serif font.The logo for université PARIS-SACLAY features the word "université" in a purple, serif font with a dot above the 'i', and "PARIS-SACLAY" in a purple, sans-serif font below it.

Questions?

Bibliography

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