Unsupervised learning:
AIs don’t need no education?

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Let’s leave the AIs alone...

Supervised dataset (i.e. labeled)
Example: cats versus dogs

Unsupervised dataset (i.e. no labels)
Traditional use cases of unsupervised learning

- Association (market/basket analysis)
- Probability density estimation
- …
Can unlabeled data help to solve better/faster the supervised problems?

**Manifold assumption:** real data is high dimensional, but lie close to a low-dimensional manifold

Example: images

https://onlineimagetools.com/generate-random-image

Example: text

http://randomtextgenerator.com/

Style too own civil out along. Perfectly offending attempted add arranging age gentleman concluded. Get who uncommonly our expression ten increasing considered occasional travelling.

Up maids me an ample stood given. Certainty say suffering his him collected intention promotion. Hill sold ham men made lose case.

In the common parlance, randomness is the apparent lack of pattern or predictability in events.[1][2] A random sequence of events, symbols or steps often has no order and does not follow an intelligible pattern or combination.

Natural-language generation (NLG) is a software process that transforms structured data into natural language. It can be used to produce long form...
Yes, they cat can

Effective low-dimensional representations (i.e. the manifold) can be learned from unsupervised data.
Self-supervised learning

• When used to learn effective representations to bootstrap/improve supervised learning, unsupervised learning is (often) referred to as self-supervised learning.
• “Self-supervised learning is a subset of unsupervised learning methods [...] in which [neural networks] are explicitly trained with automatically generated labels (pseudo-labels).”

Let’s go back in the classroom...

Semi-supervised dataset

Cat
Cat
Cat
Cat
Dog
Dog
Dog
Dog
?
**Auto-encoders**

The simplest pretext task is the **autoencoder**: reconstruct the input data. We usually categorize them according to how the task is made difficult:

- **Autoencoder**: an information bottleneck whose dimensionality is smaller than the input data (auto-encoder)

- **Denoising auto-encoder**: the bottleneck is smaller, and the input is distorted

- **Sparse auto-encoder**: the bottleneck is larger than the input, but we require sparse activations

Self-supervision from (spatial) context

Figure 1. Our task for learning patch representations involves randomly sampling a patch (blue) and then one of eight possible neighbors (red). Can you guess the spatial configuration for the two pairs of patches? Note that the task is much easier once you have recognized the object!

Self-supervision by contrastive learning

State-of-the-art self-supervised methods are closing the gap with respect to the supervised counterpart in some tasks.

Domain adaptation
A personal example: «Real-time comprehensive scene understanding» (CVPR 2020)

Learning of multiple related tasks by self-supervision and proxy labels

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