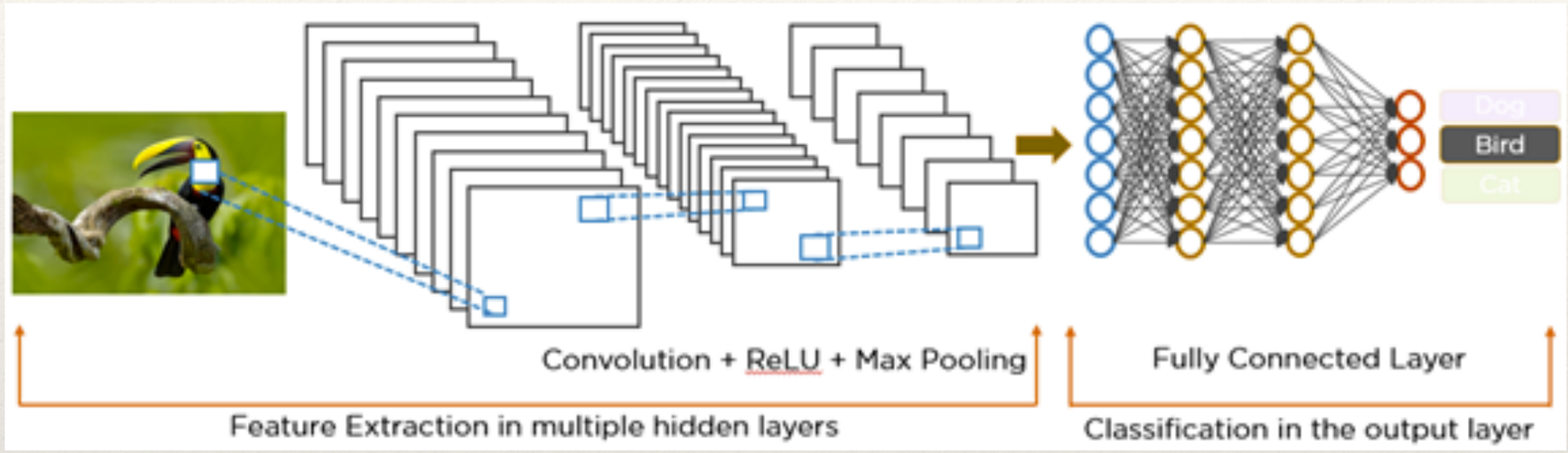
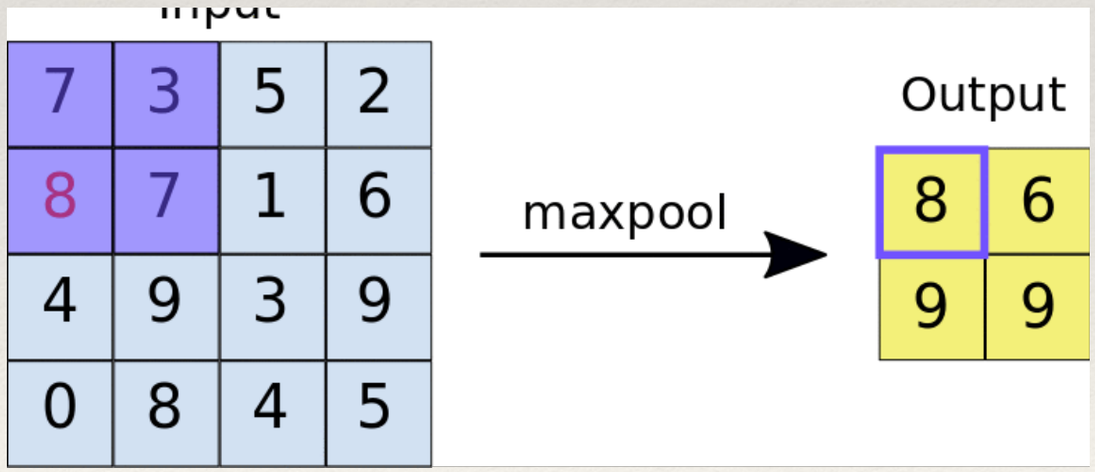
Deep Learning: Theory and Practice

Advanced Topics in Deep Learning

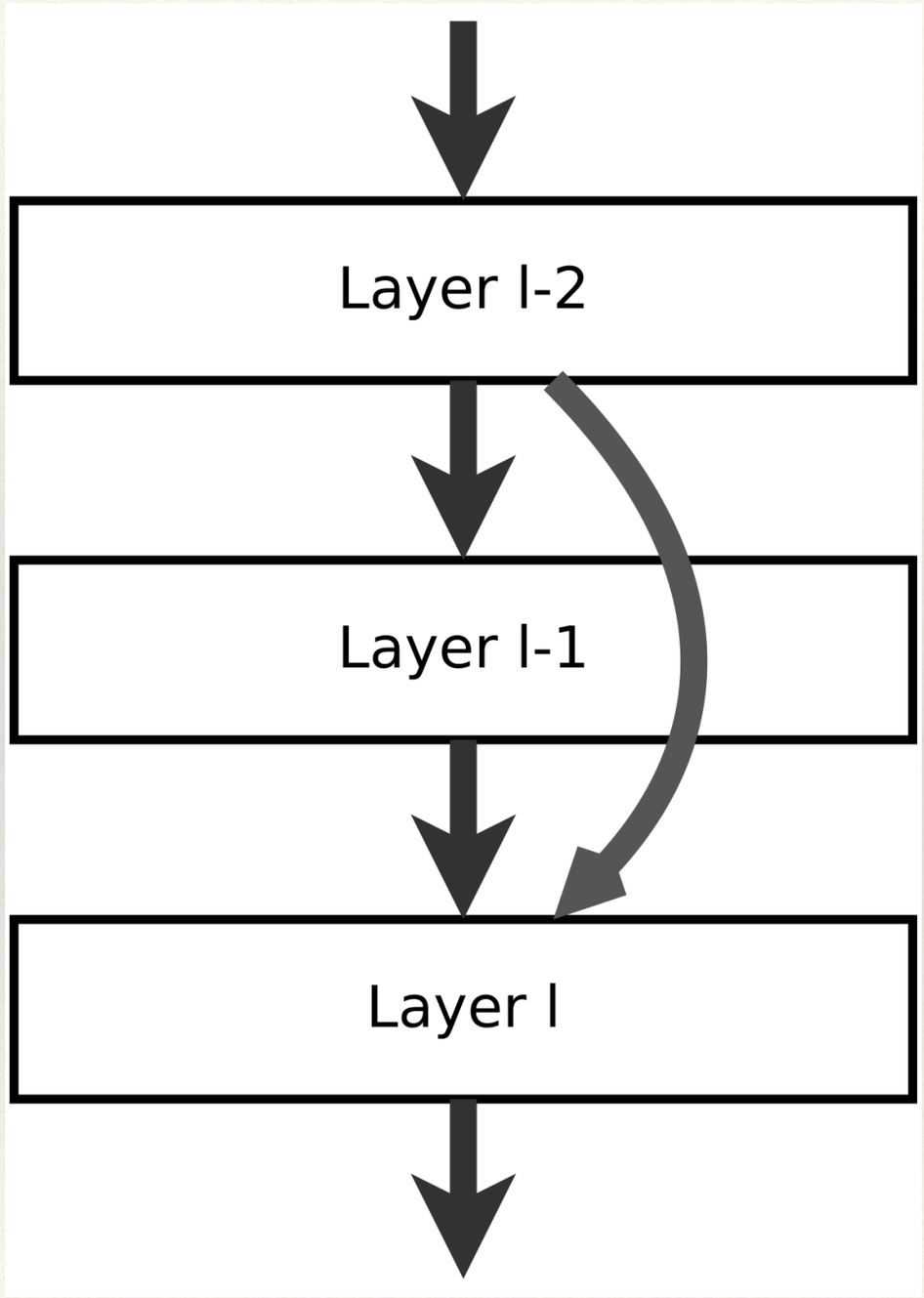
11-04-2019

Back propagation in Pooling Layers



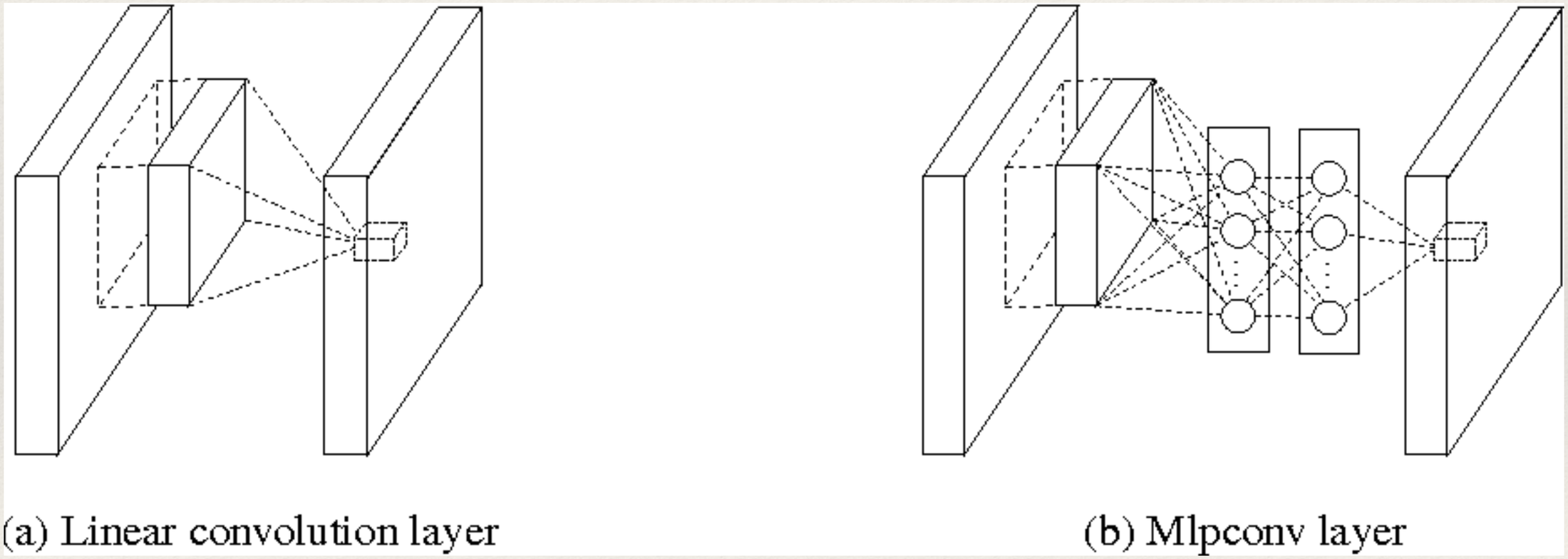


Resnet Architecture



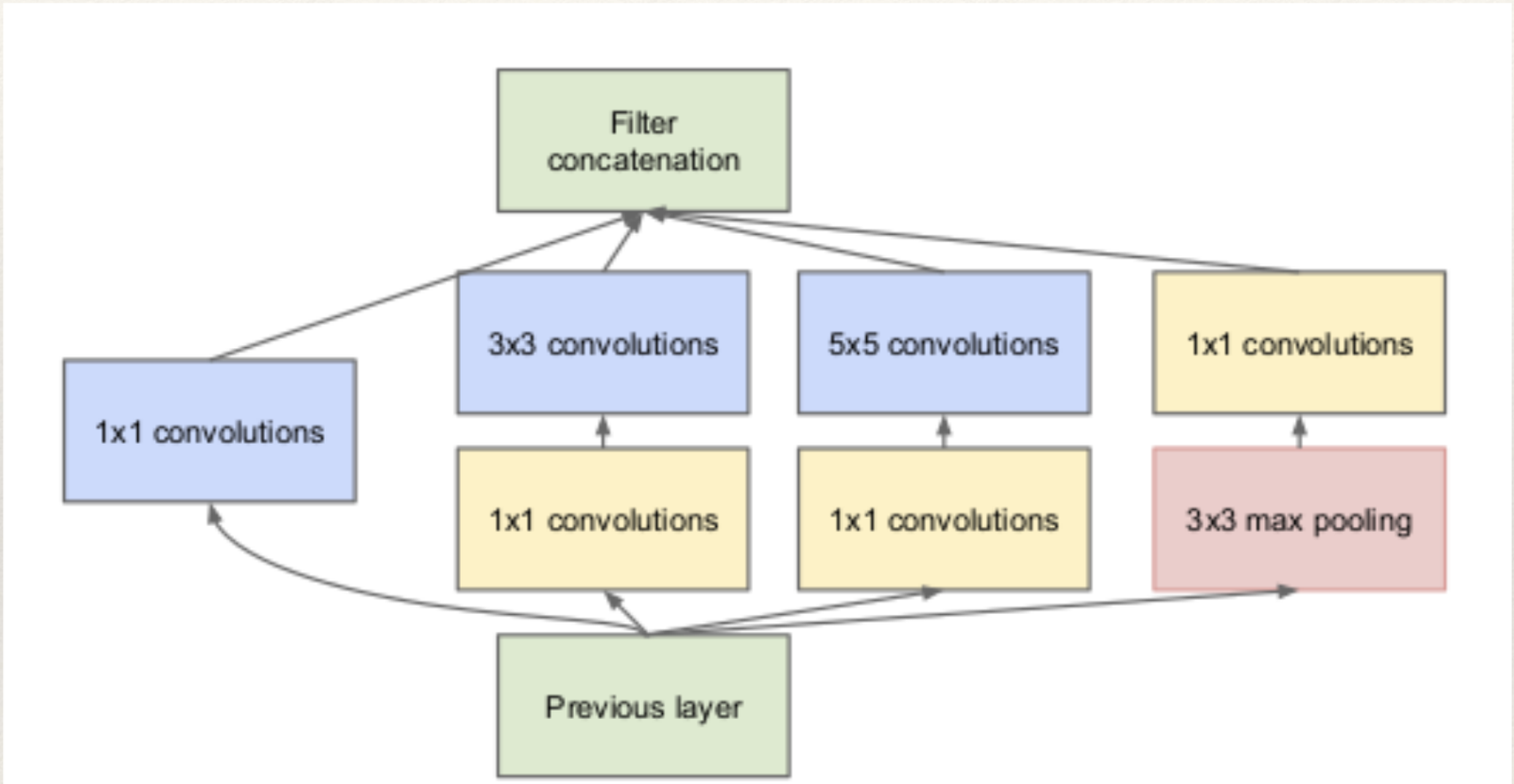
With skip connections

Network in Network



(a) Linear convolution layer (b) Mlpconv layer

Inception Network



"Deep Learning", Ian Goodfellow, Yoshua Bengio, Aaron Courville

Mixing Convolutional and LSTM networks

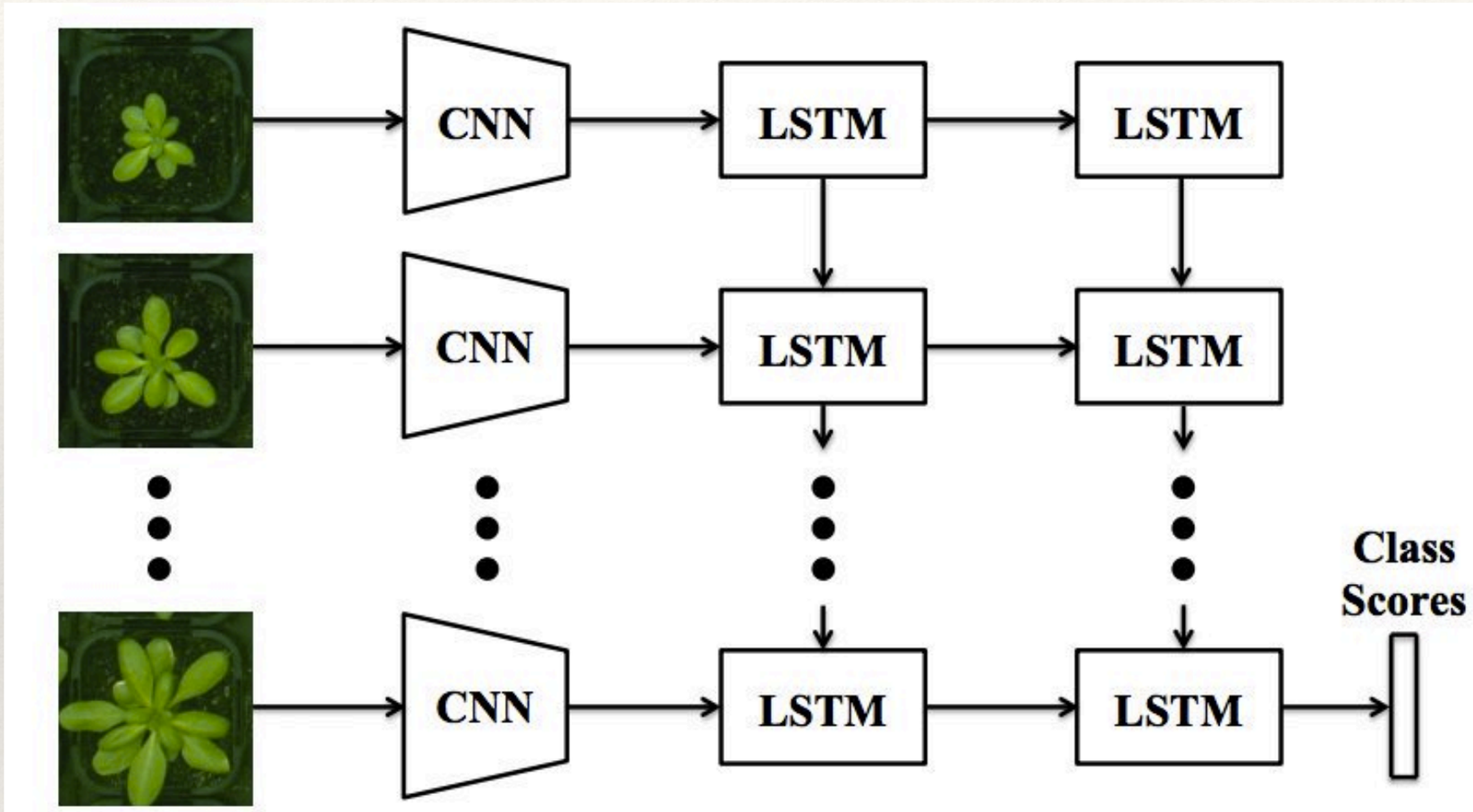


Figure 4: **The CNN-LSTM structure.** The CNNs extract deep features of the plant images and then, the growth pattern of the plant is modeled using LSTMs. Finally the genotype with highest class score is selected.

Deep Unsupervised Learning

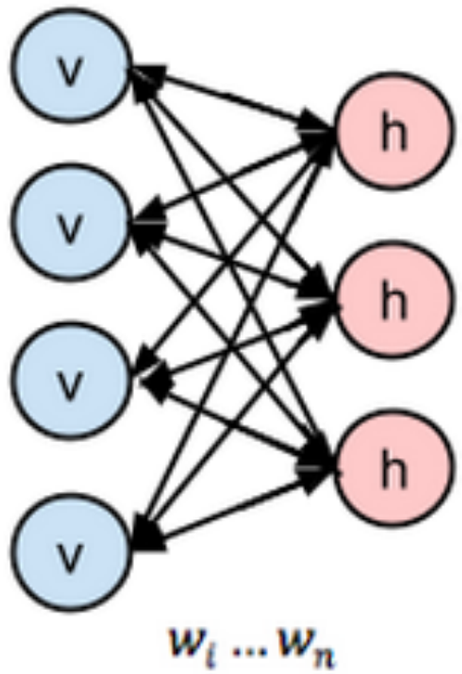
Restricted Boltzmann Machines

$$P(\mathbf{v} = \boldsymbol{v}, \mathbf{h} = \boldsymbol{h}) = \frac{1}{Z} \exp\left(-E(\boldsymbol{v}, \boldsymbol{h})\right)$$

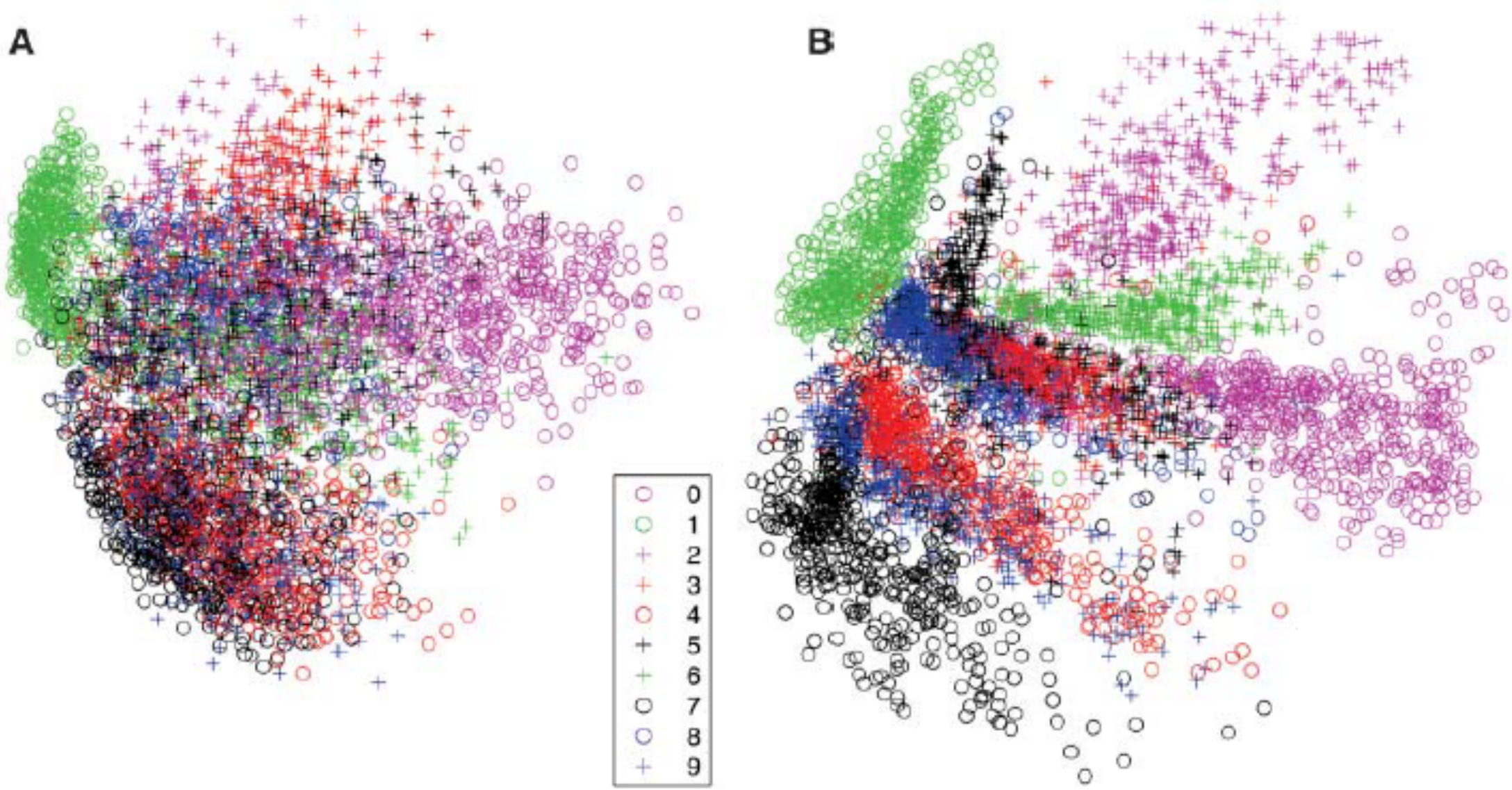
$$E(\boldsymbol{v}, \boldsymbol{h}) = -\boldsymbol{b}^\top \boldsymbol{v} - \boldsymbol{c}^\top \boldsymbol{h} - \boldsymbol{v}^\top \boldsymbol{W} \boldsymbol{h}$$

$$Z = \sum_{\boldsymbol{v}} \sum_{\boldsymbol{h}} \exp\left\{-E(\boldsymbol{v}, \boldsymbol{h})\right\}$$

A Symmetrical, Bipartite, Bidirectional Graph with Shared Weights



Restricted Boltzmann Machine

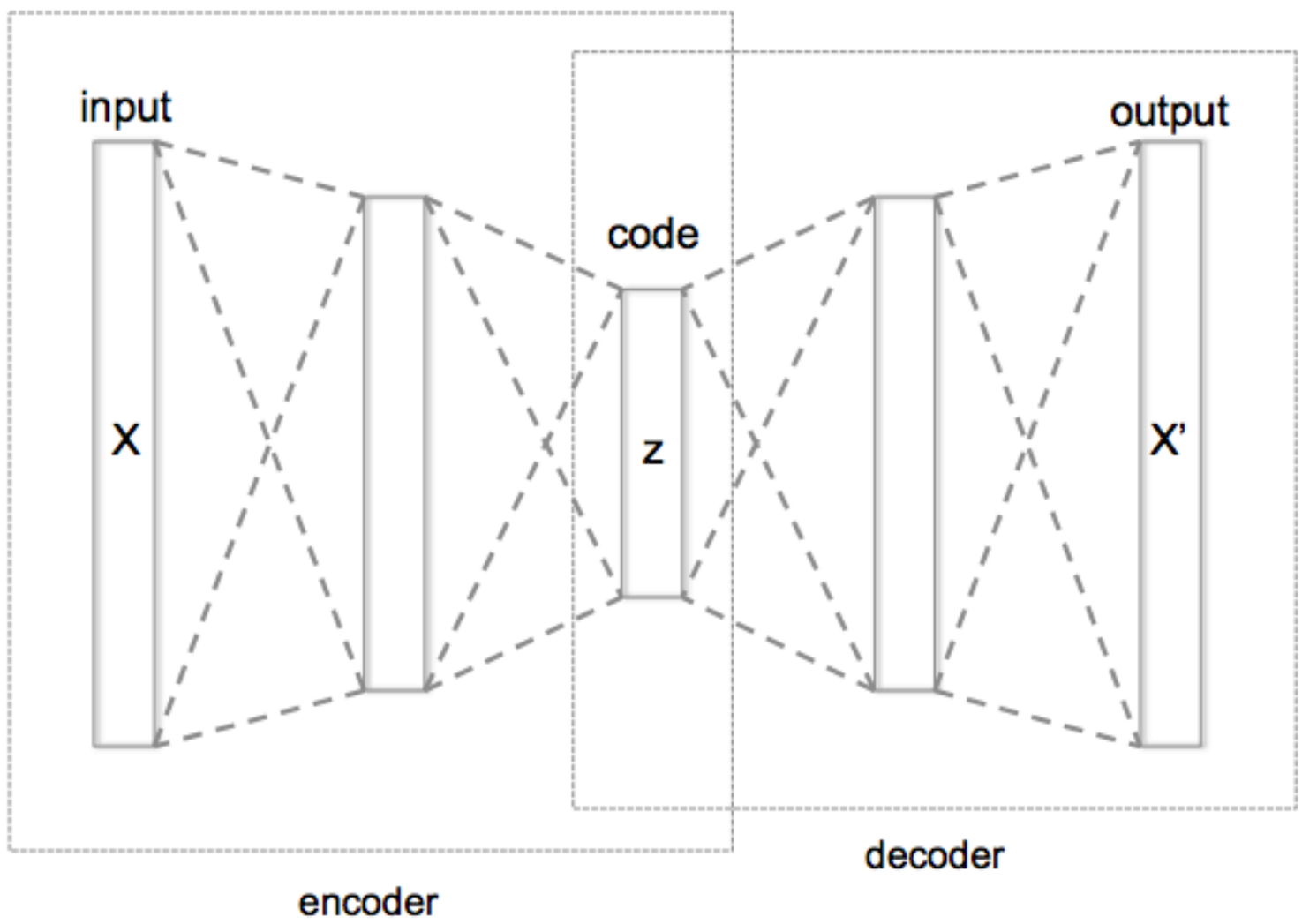


PCA **RBM**

Established 1911

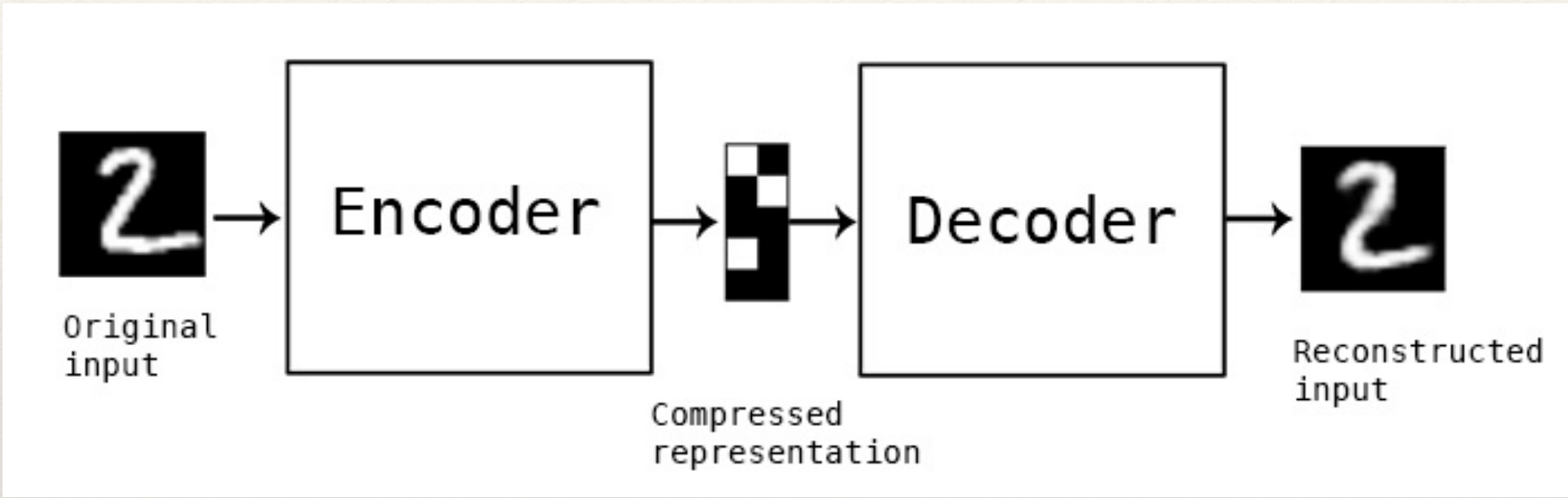
INDIAN INSTITUTE OF SCIENCE
भारतीय विज्ञान संस्थान

Autoencoders



Avoid Identity Mapping

Autoencoders



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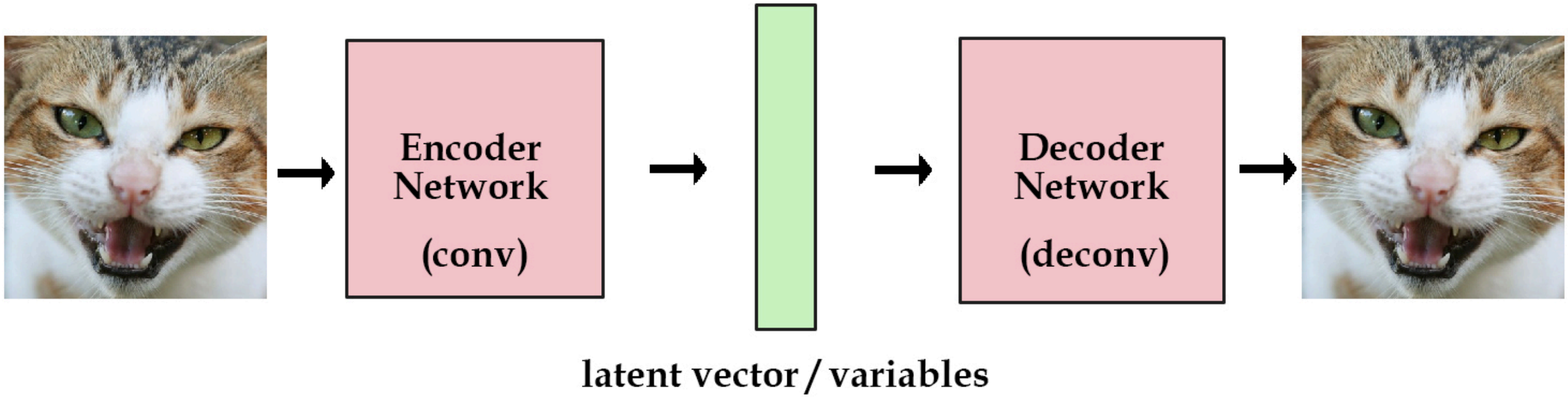
Convolutional Autoencoders

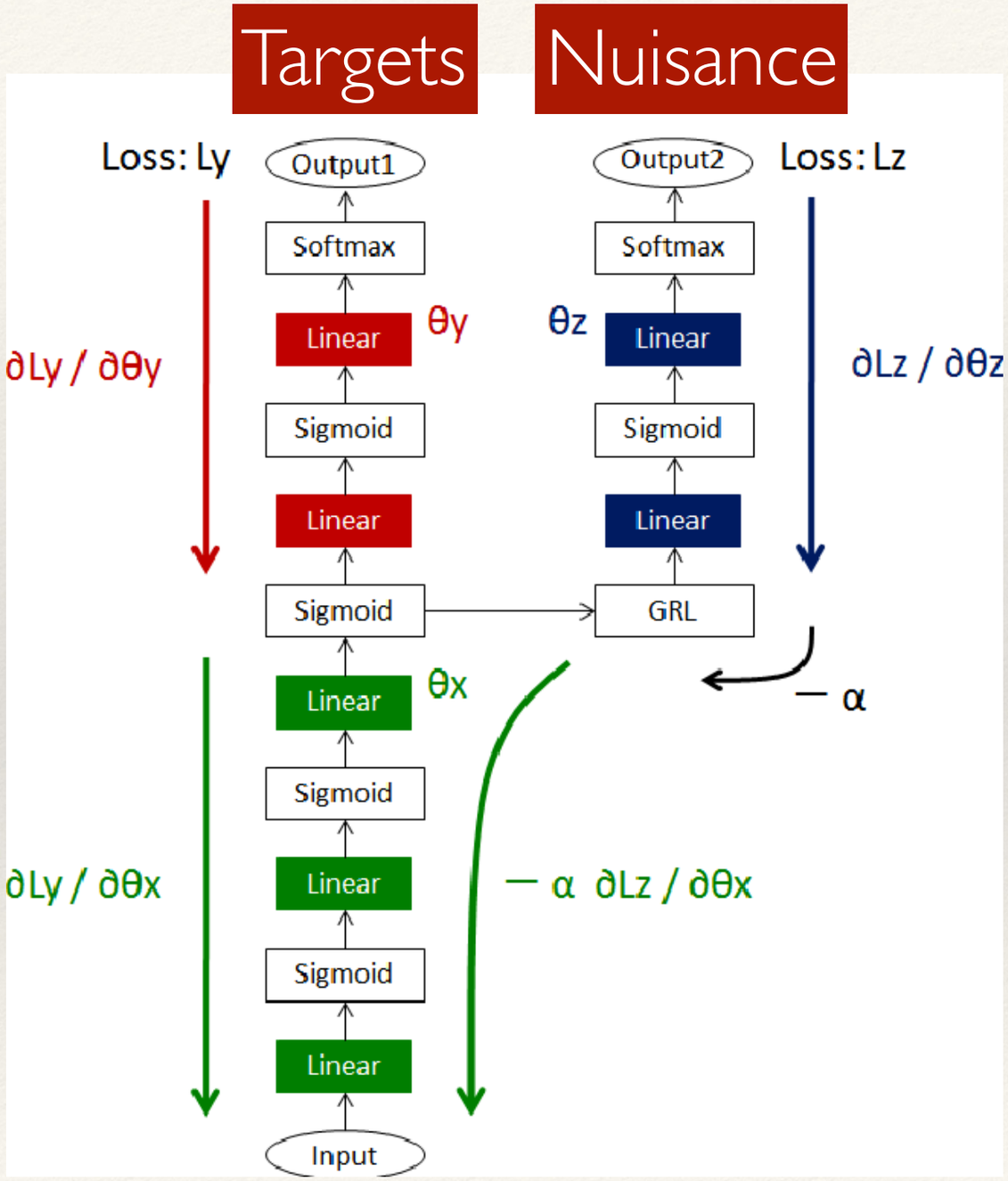


The latent vectors can form deep features for other supervised tasks.

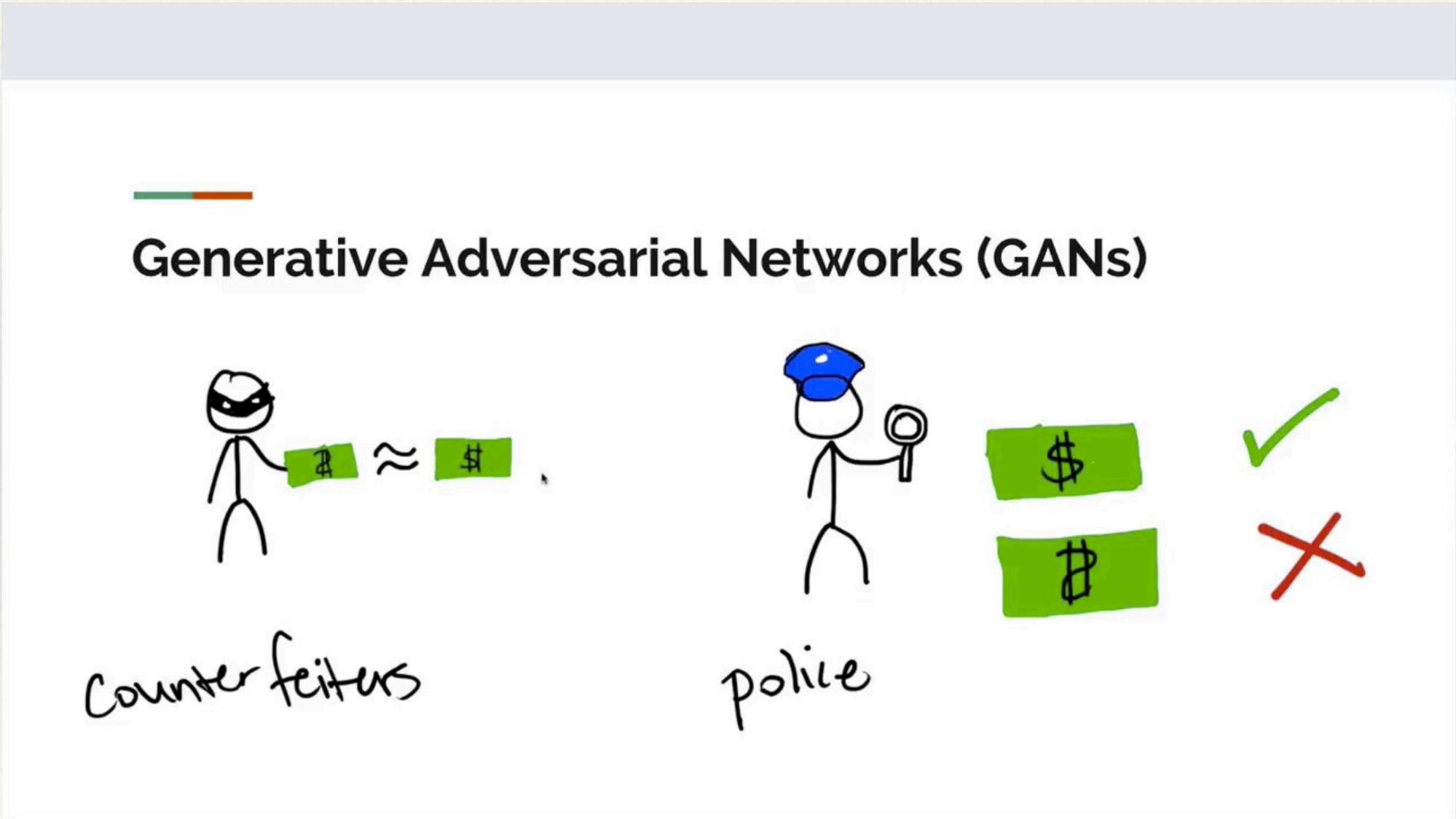
Adversarial Learning

- The target can be learned
  - using original gradient.
  - domain adversarial gradient.
- Model will learn to be domain invariant

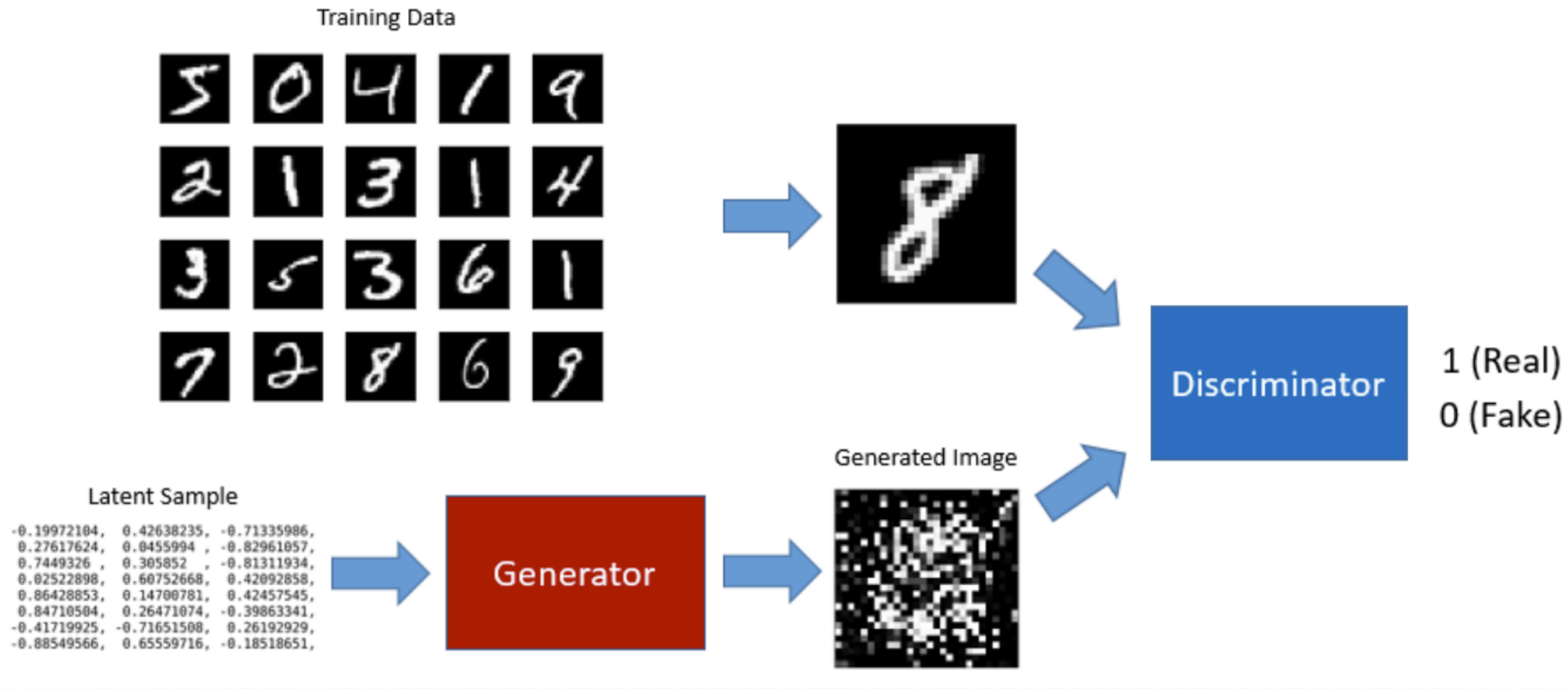
[Shinohara et al. 2017]



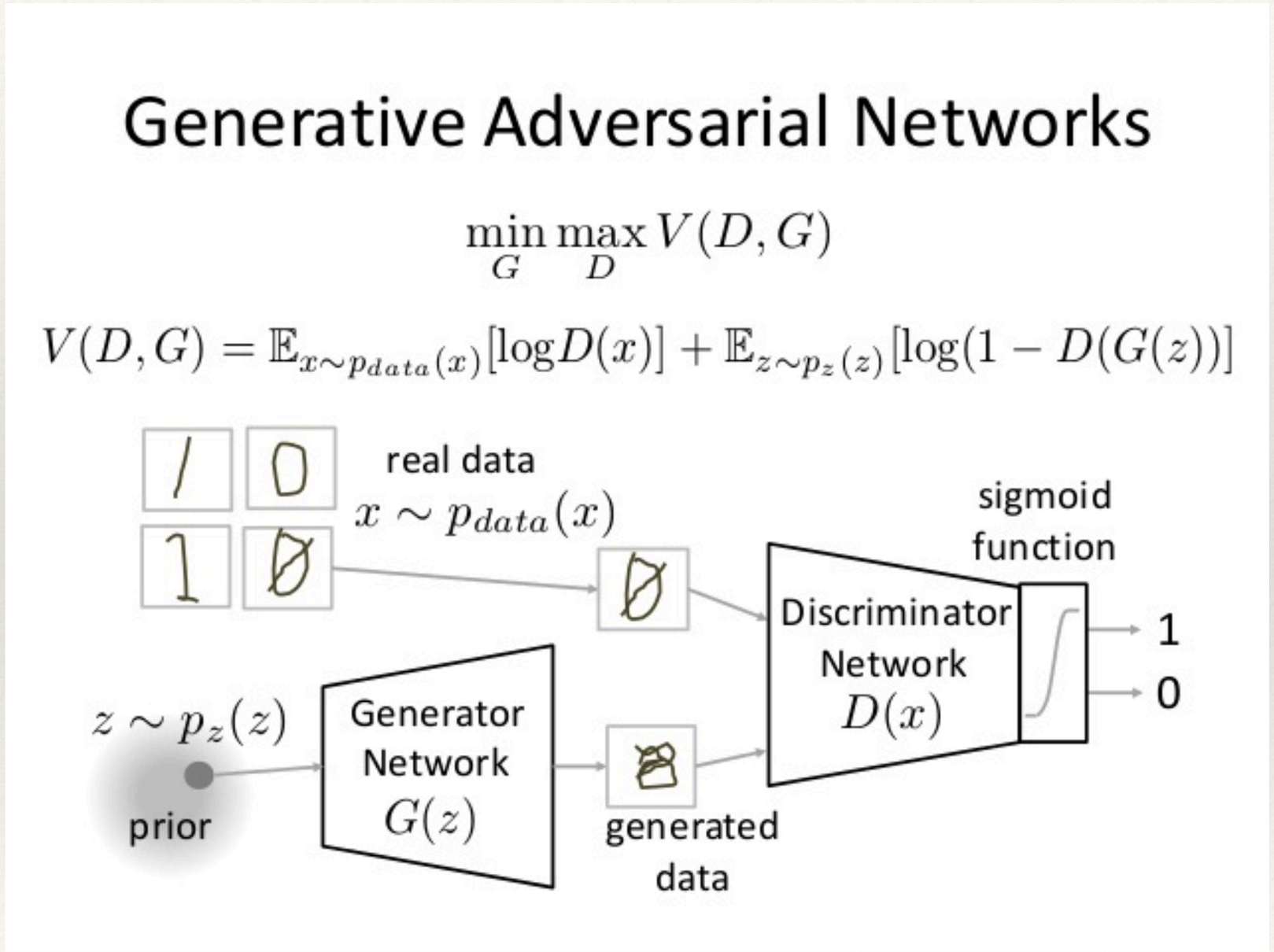
Generative Adversarial Networks



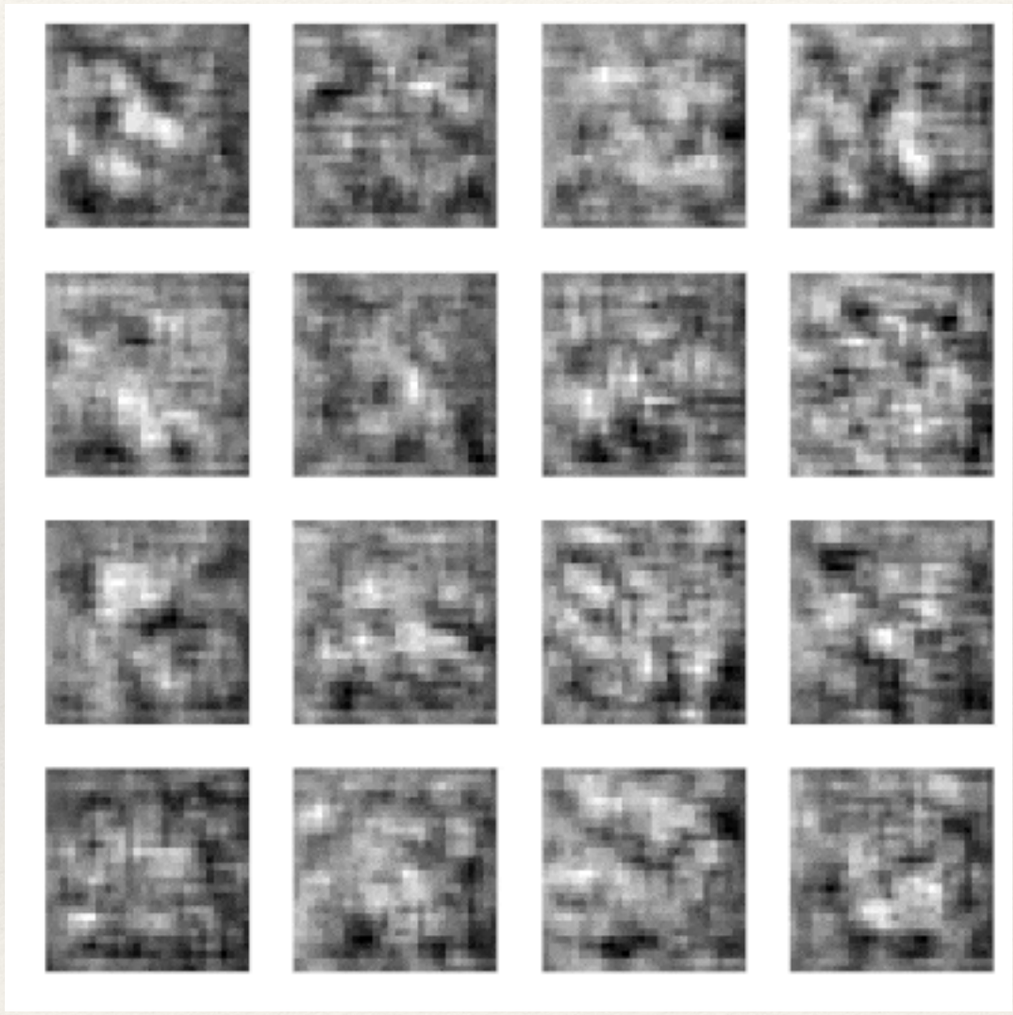
Generative Adversarial Networks



Generative Adversarial Networks

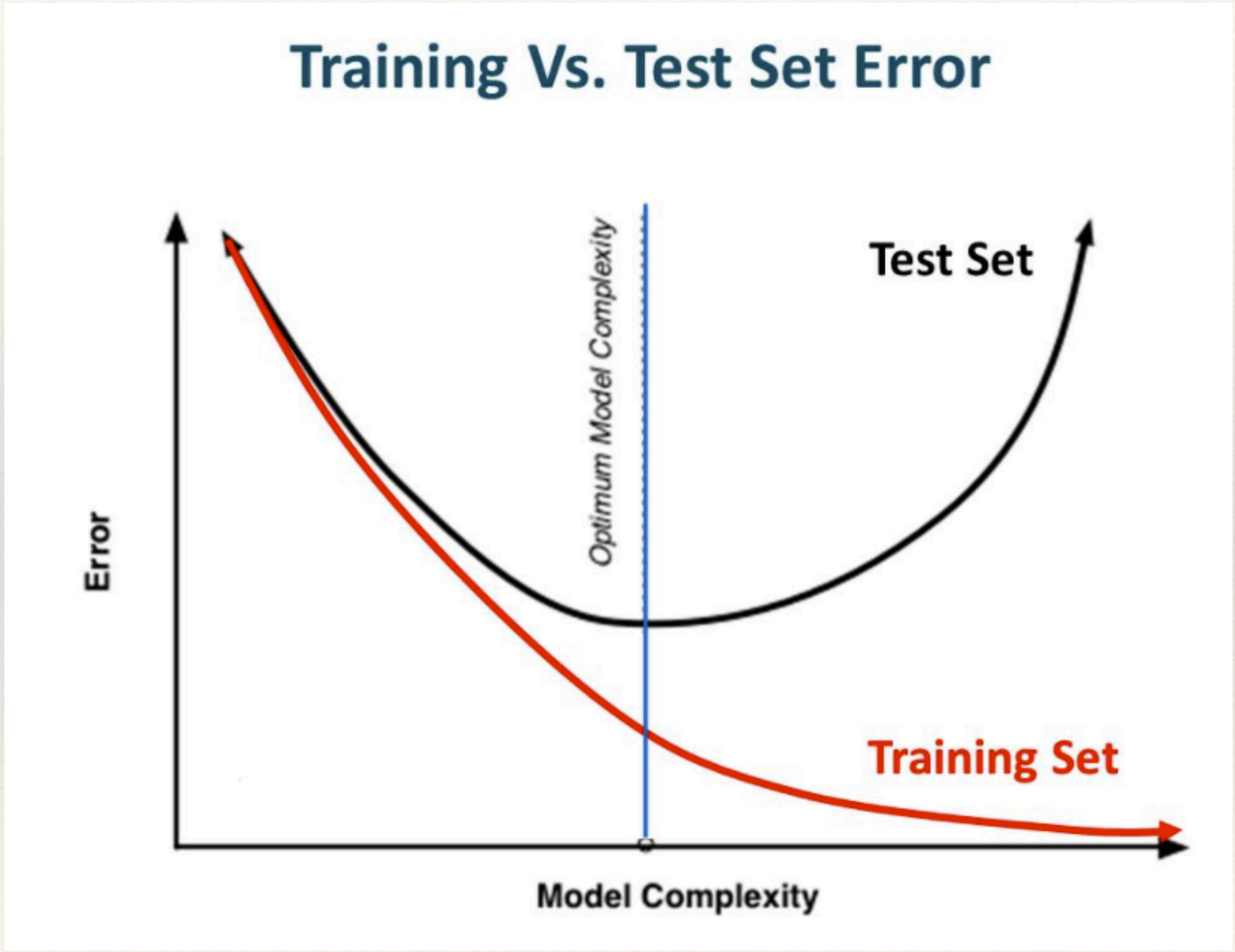


Generative Adversarial Networks

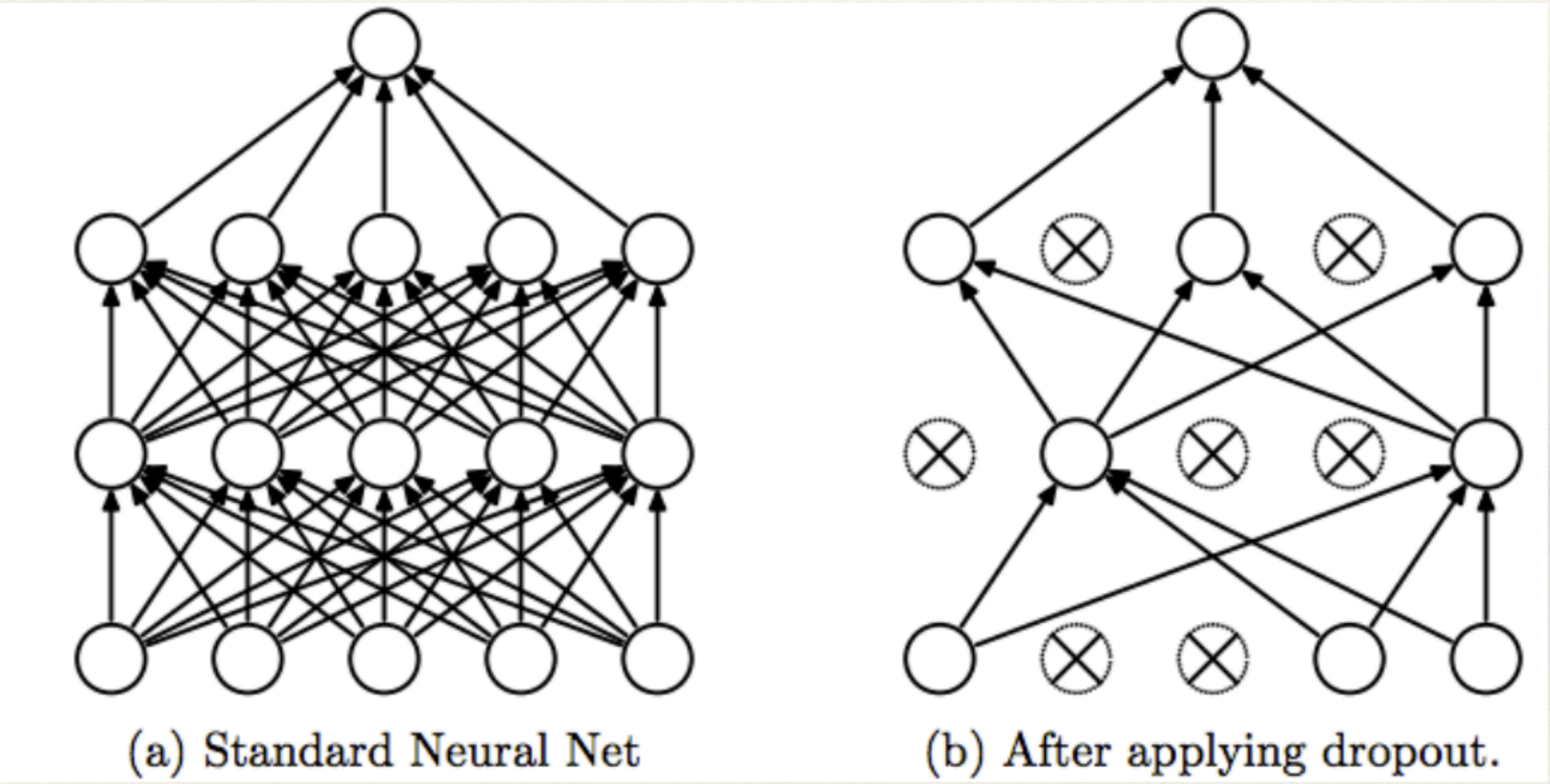


DCGANs

Regularization in Deep Learning



Dropout



(a) Standard Neural Net

(b) After applying dropout.