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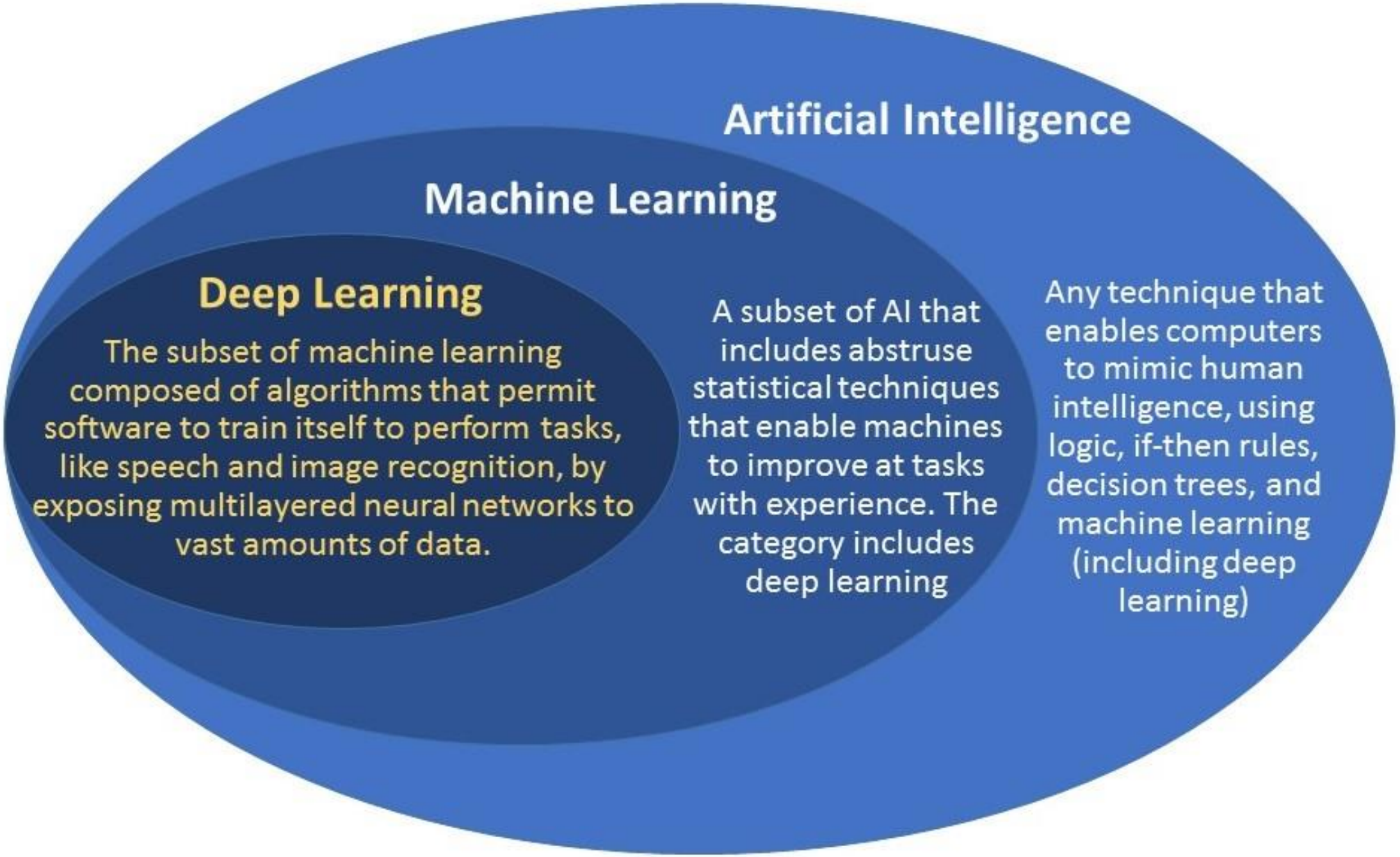
ANN – Part 3
Deep Learning



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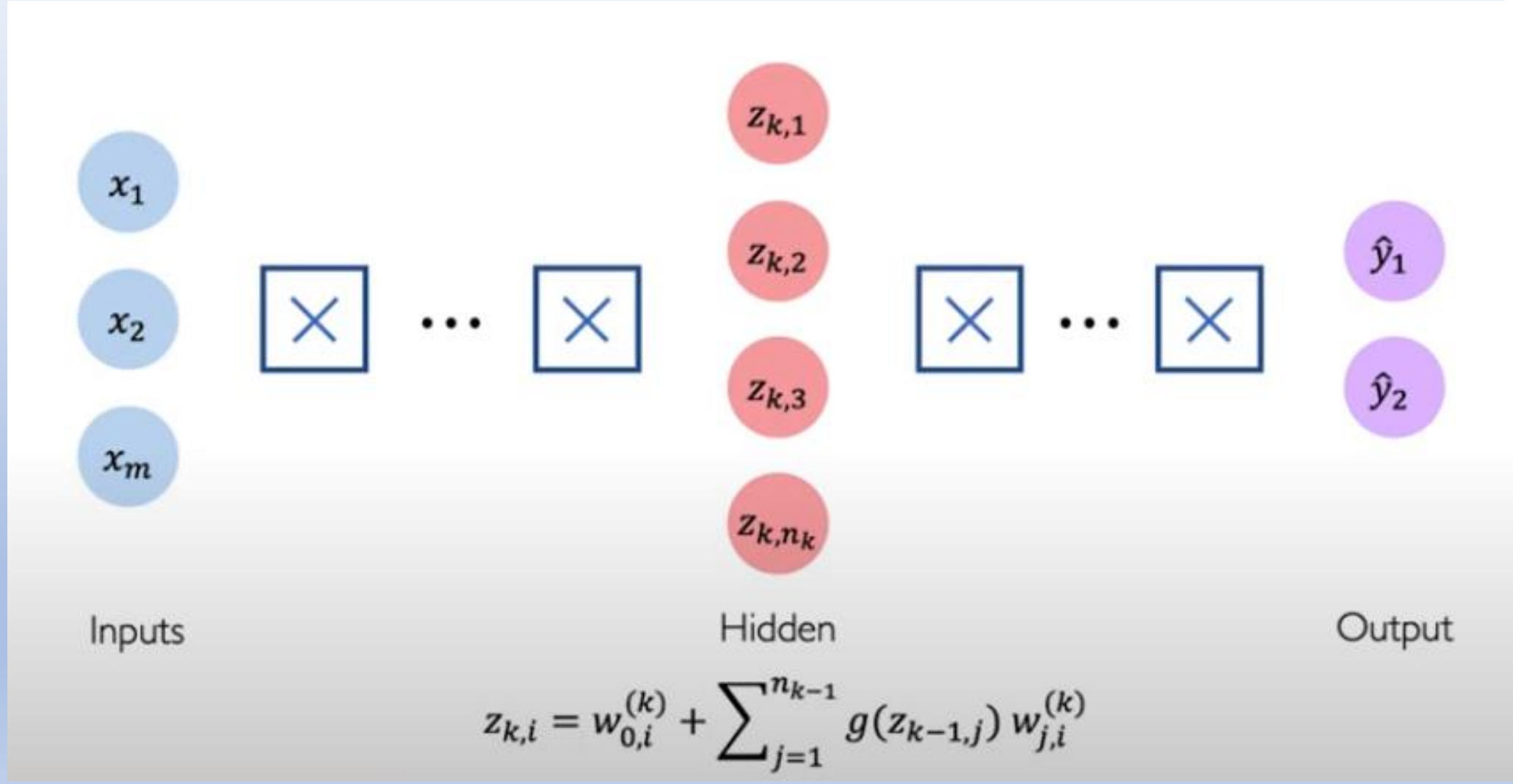
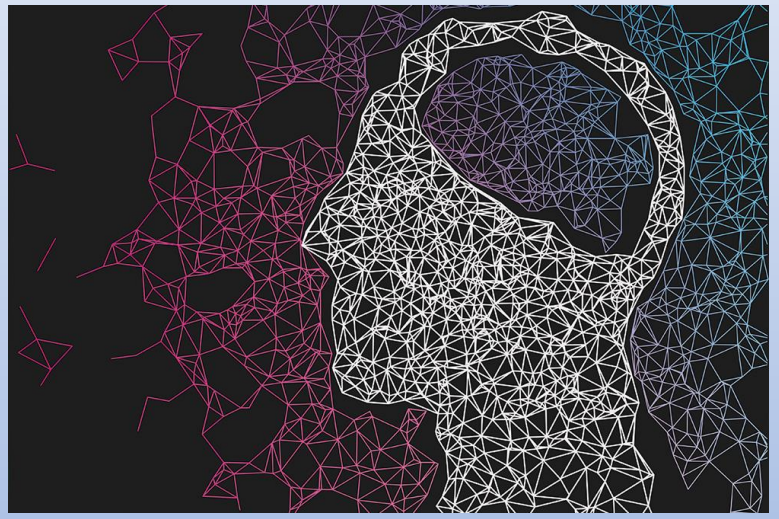
Revisit: Multi-layers ANN or Deep Neural networks



$$z_{k,i} = w_{0,i}^{(k)} + \sum_{j=1}^{n_{k-1}} g(z_{k-1,j})\, w_{j,i}^{(k)}$$

Brief history about Deep Learning

When was deep learning introduce? The term *Deep Learning* was introduced to the machine learning community by Rina Dechter in 1986(R,Dechter, 1986),and to artificial neural networks by Igor Aizenberg and colleagues in 2000, in the context of Boolean threshold neurons.



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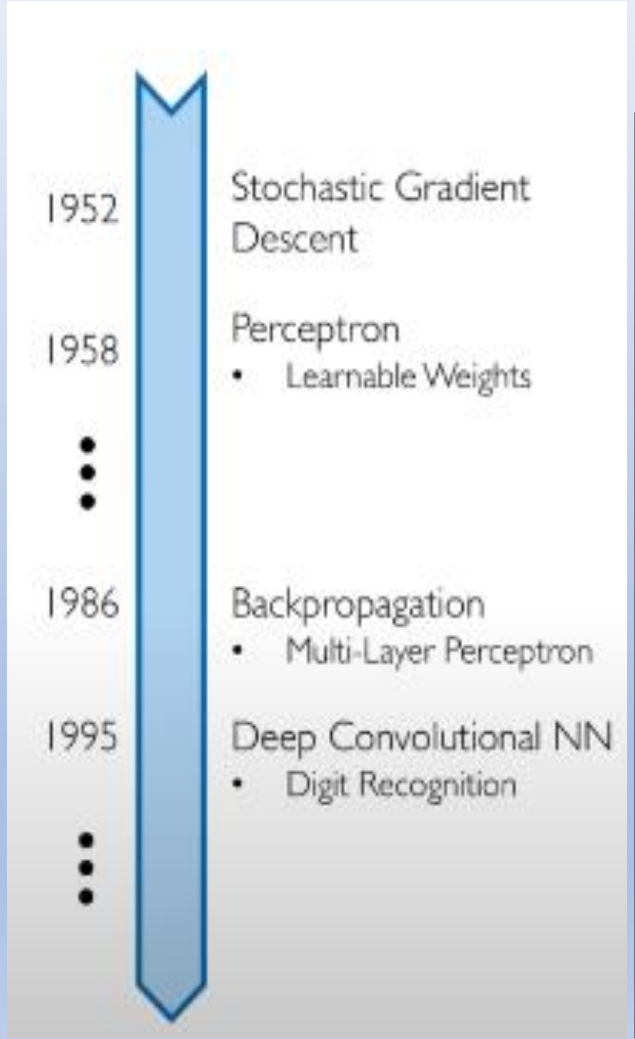
https://en.wikipedia.org/wiki/Deep_learning

Why now?

Neural Networks date back decades, so why the resurgence now?



1. Big Data

- Larger Datasets
- Easier Collection & Storage

2. Hardware

- Graphics Processing Units (GPUs)
- Massively Parallelizable

3. Algorithms

- Improved Techniques
- New Models
- Toolboxes

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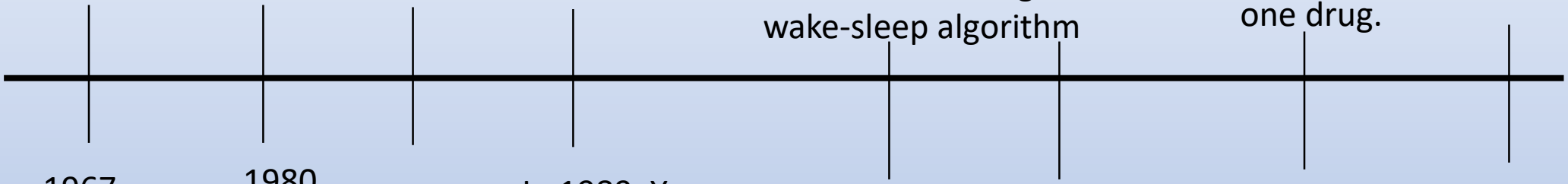
Deep learning revolution



1967

First General working algorithm was published by Alexey Ivakhnenko and Lapa.

1980

Other deep learning working architectures began with the Neocognitron introduced by Kunihiko Fukushima

The term Deep Learning was introduced to the machine learning community by Rina Dechter in 1986

In 1989, Yann LeCun et al. applied the standard backpropagation algorithm to a deep neural network with the purpose of recognizing handwritten ZIP codes on mail.

In 1995, Brendan Frey demonstrated that it was possible to train a network containing six fully connected layers and several hundred hidden units using the wake-sleep algorithm

In 2000, deep learning was introduced to artificial neural networks community by Igor Aizenberg and colleagues.

In 2012, a team led by George E. Dahl won the "Merck Molecular Activity Challenge" using multi-task deep neural networks to predict the biomolecular target of one drug.

In 2013 and 2014, the error rate on the ImageNet task using deep learning was further reduced. Image classification was then extended to the more challenging task of generating descriptions for images, often as a combination of CNNs and LSTMs.

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https://en.wikipedia.org/wiki/Deep_learning

Deep Learning Methods

Deep learning allows computational models that are composed of multiple processing layers to learn representations of data with multiple levels of abstraction.

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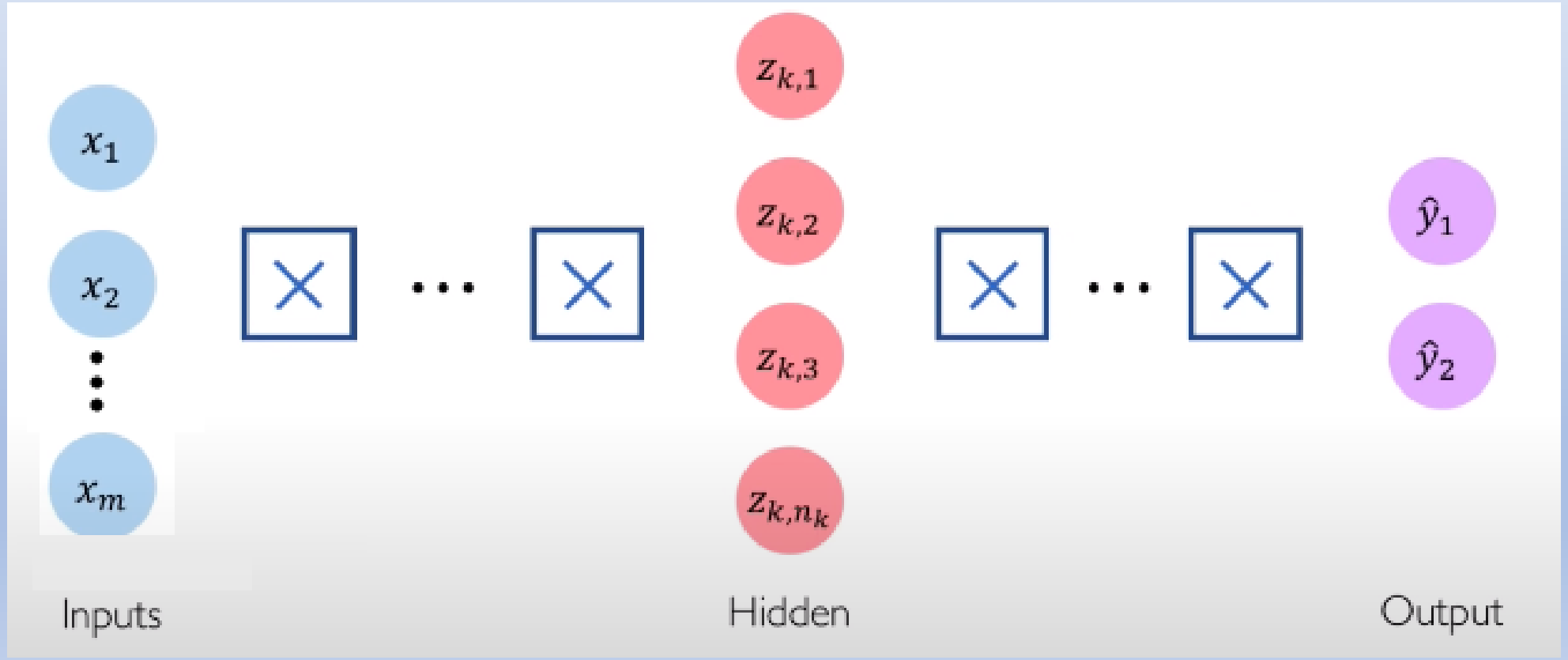
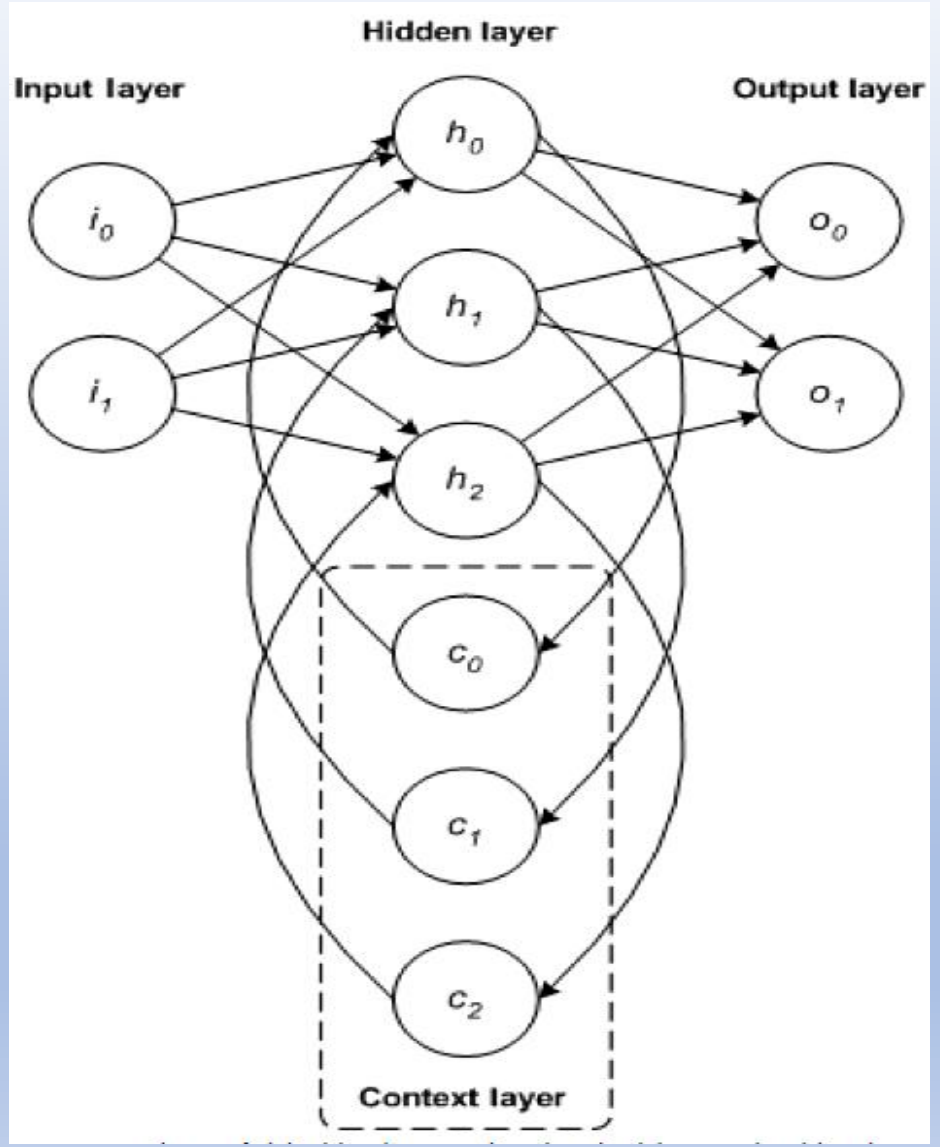
Five Main Deep Learning Methods

1. Fully Connected Neural Networks (good for general classification)
2. Convolutional Neural Networks (good for image recognition)
3. Recurrent Neural Network (speech recognition and handwriting recognition)
4. Generative Adversarial Networks
5. Deep Reinforcement Learning
6. LSTM network (good for speech recognition)

Deep Neural Network

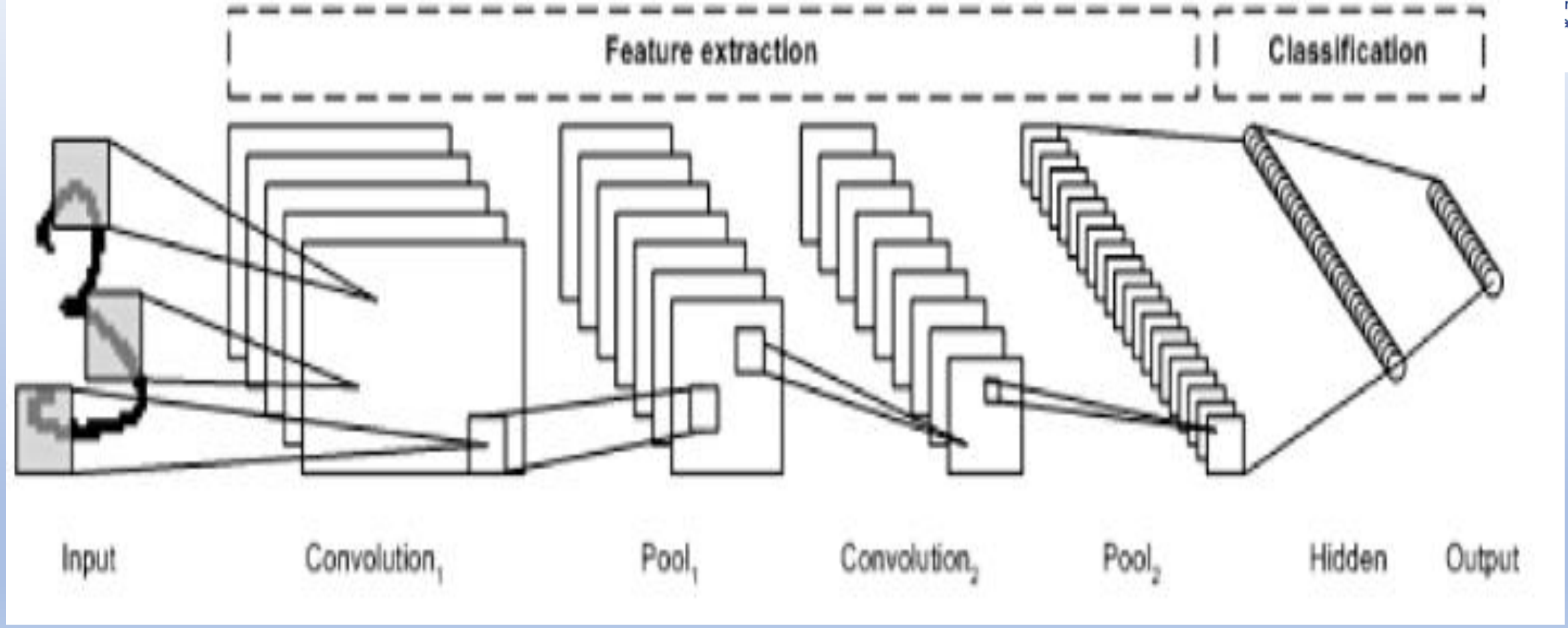


Recurrent neural networks (RNN)



https://developer.ibm.com/technologies/artificial-intelligence/articles/cc-machine-learning-deep-learning-architectures/

Convolutional neural networks (CNN)



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Reference

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2. https://en.wikipedia.org/wiki/Deep_learning

3. https://doi.org/10.1017/atsip.2013.9 A tutorial survey of architectures, algorithms, and applications for deep learning – Li Deng

Thank you for your attention