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TECH FOR JOBS

Support Session 10

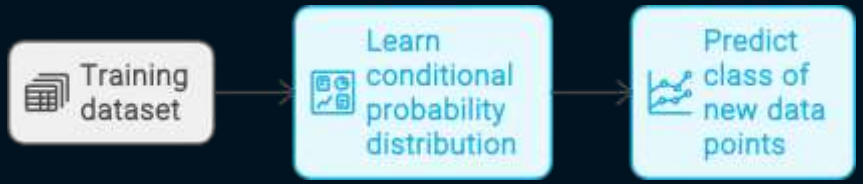
Ahmad Albaqsami

Agenda

- Introduction to GenAI
- Portfolio Project - Generative AI Asynchronous Lesson

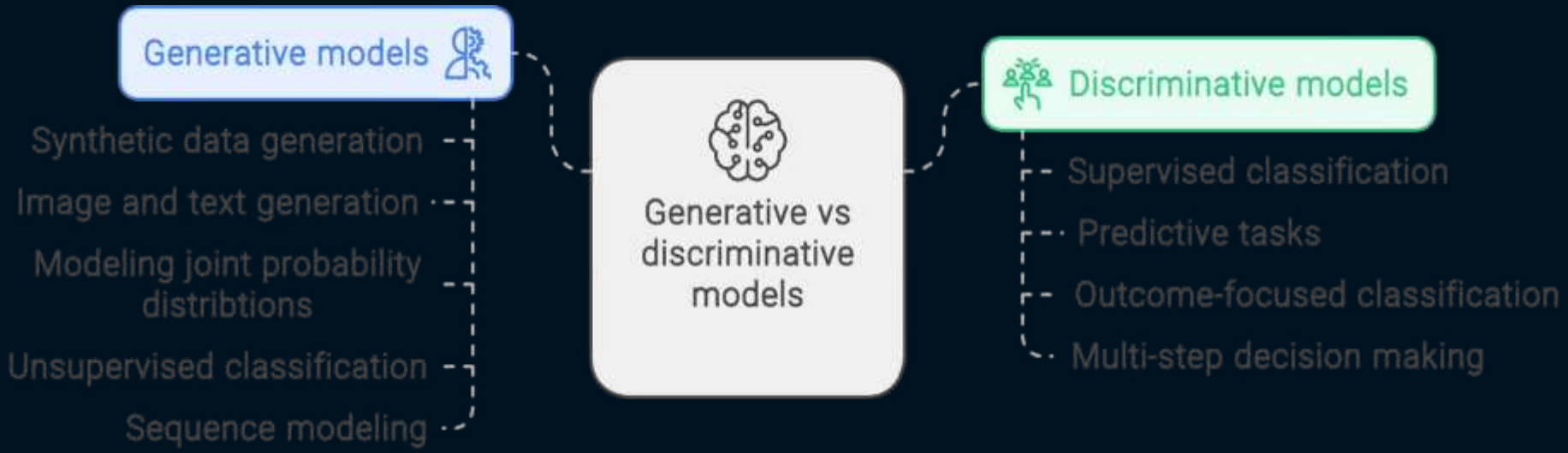
Discriminative vs. Generative Models

- **Discriminative Models:** Classify input data into categories.



- **Generative Models:** Generate new data instances resembling the training data.

Discriminative vs. Generative Models



Machine Learning

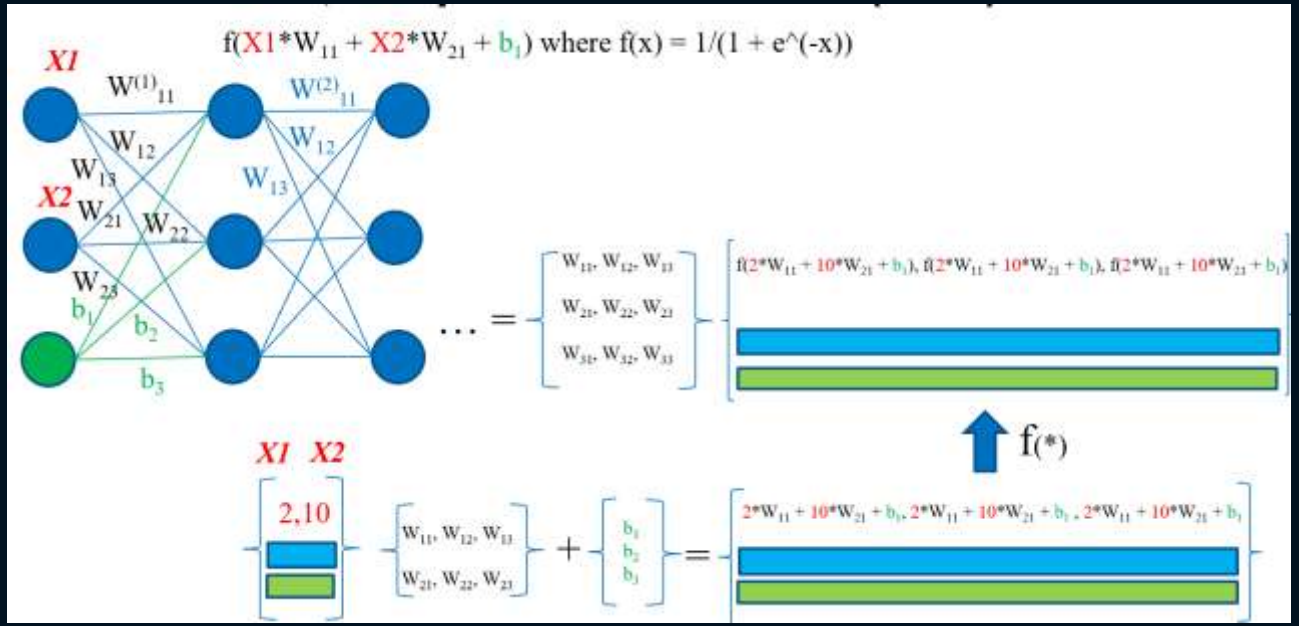
- “Machine learning is the field of study that gives computer the ability to learn without being explicitly programmed” – Arthur Samuel
- It is about **automating** the **automation**; We provide the data to the machine learning algorithm, and it figures out the rules!

Traditional Programming

- We write **programs** to do tasks, instead of us doing them manually.
- We come up with the **rules** and we set those rules in the program

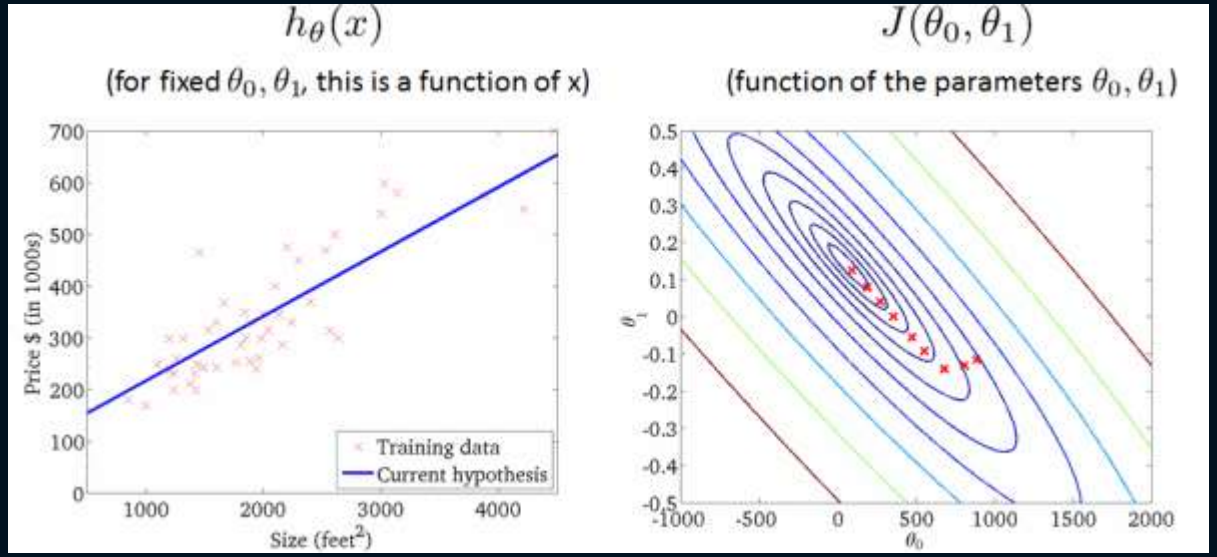
Deep Learning Fundamentals

- A class of **Machine learning** that uses **Neural Networks, Deep Neural Networks (DNN)**



Deep learning Steps

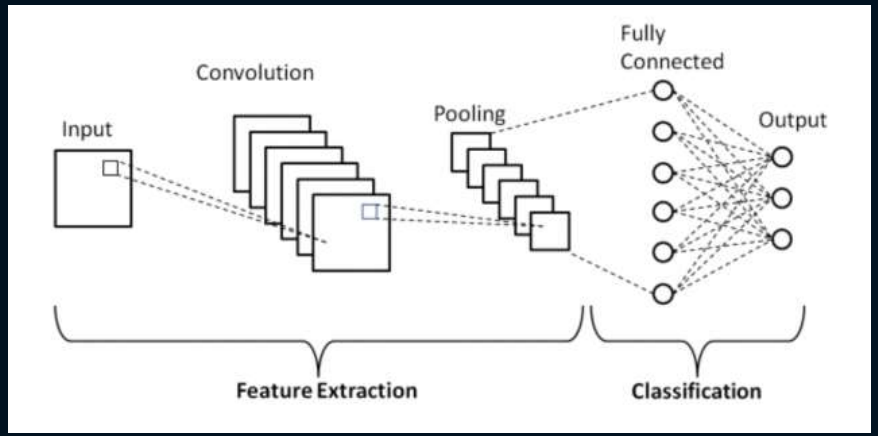
- Why is training Compute Intensive..?
- Updates require **Mathematical Optimization**



Convolutional Neural Networks

- Optimized for grid-like data such as images

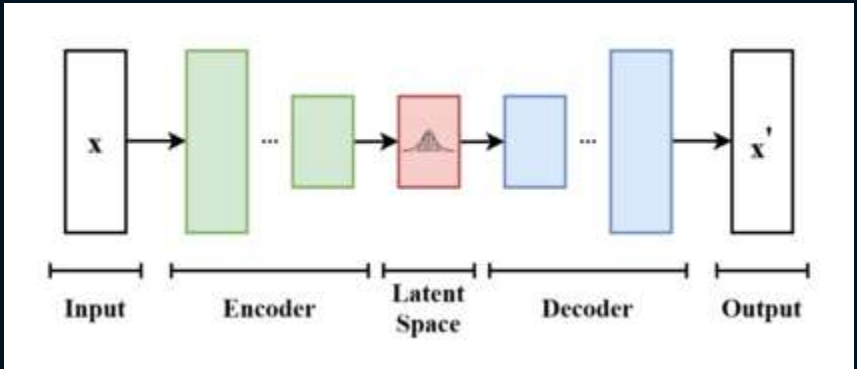
- Key Layers:
  - Convolutional layer (feature extraction).
  - Pooling layer (dimensionality reduction).
  - Fully connected layer (classification).



Variational Autoencoders (VAEs)

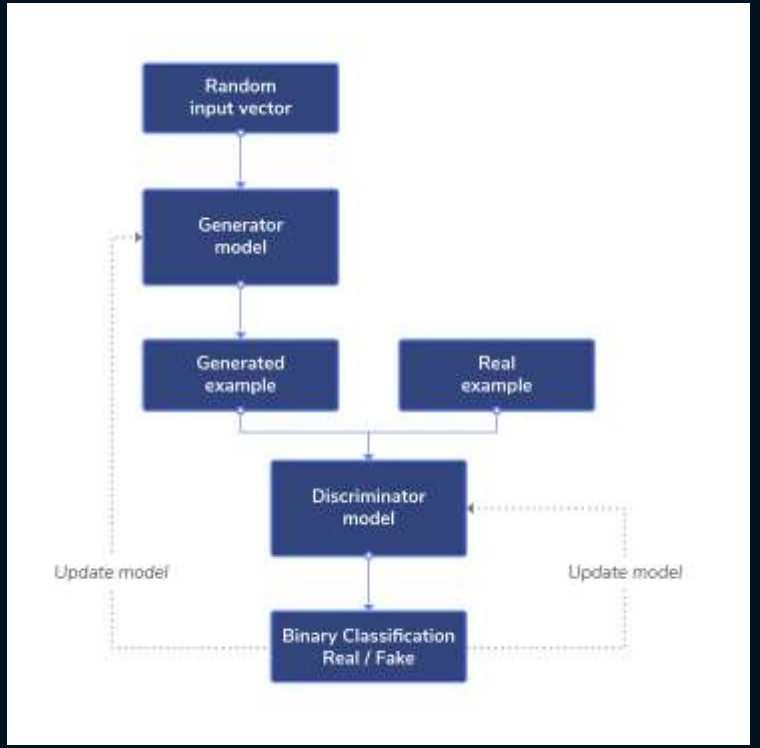
- Encode input data into a latent space and decode it to reconstruct the input.

- Architecture:
  - Encoder: Converts data to latent space.
  - Latent Space: Compressed representation.
  - Decoder: Reconstructs the original input.



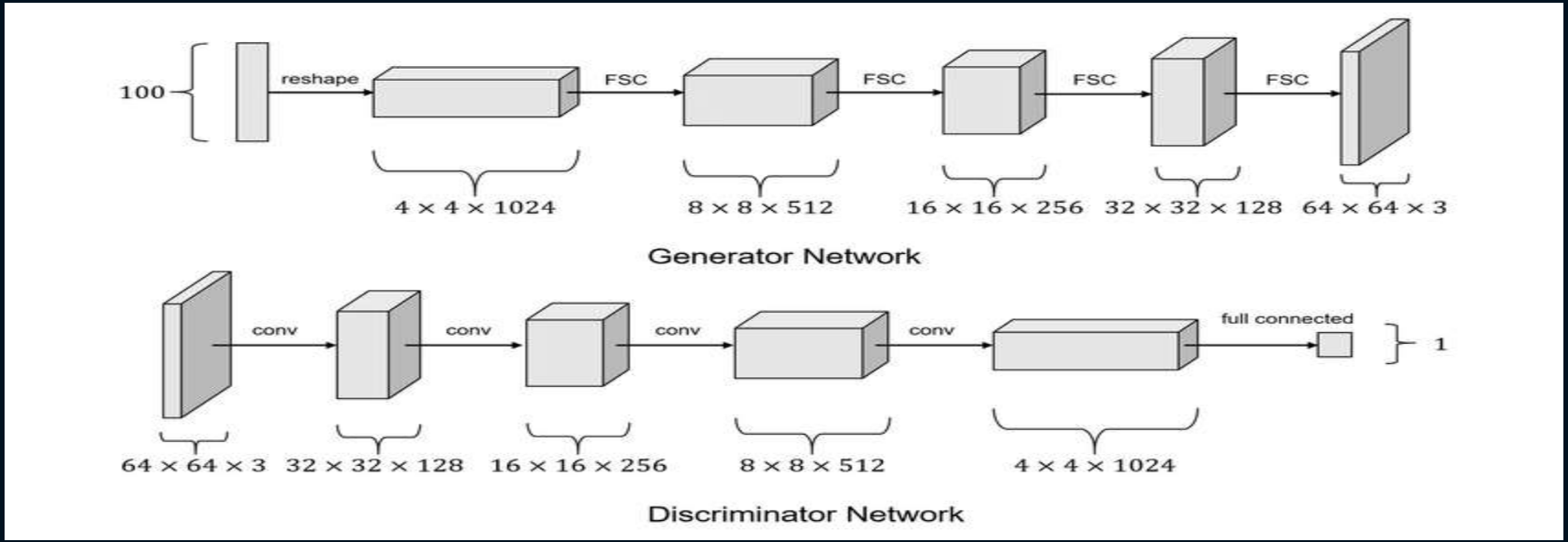
Generative Adversarial Networks (GANs)

- Consists of a generator and a discriminator.
- **Generator**: Produces synthetic data.
- **Discriminator**: Classifies real vs. fake data.
- **Training:** Both models improve by competing against each other.



Deep Convolutional GANs (DCGANs)

- An improved GAN that uses CNN layers for both the generator and discriminator.



Advanced Generative Techniques

- **StyleGAN:** Known for generating realistic and stylized images.
- **CycleGAN:** Performs style transfer between two image sets (e.g., horses to zebras).
- **BigGAN:** Extends GANs to generate high-resolution images.

Auto-Regressive Models

- Predict the next element in a sequence based on previous elements

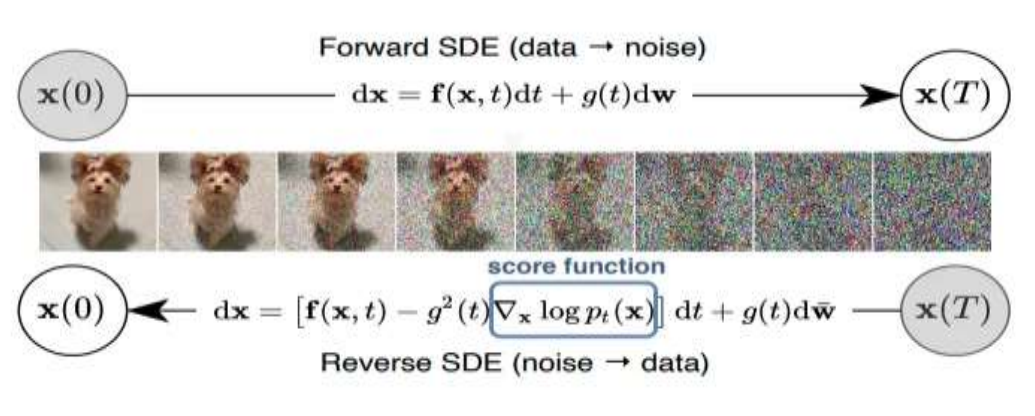
Key Models:

- **RNN:** Processes sequential data with feedback loops.
- **LSTM:** An advanced RNN that solves the problem of long-term dependencies.
- **PixelCNN:** Generates images pixel-by-pixel.

Diffusion Models

- **Mechanism:** Reverse the diffusion process that gradually adds noise to data.

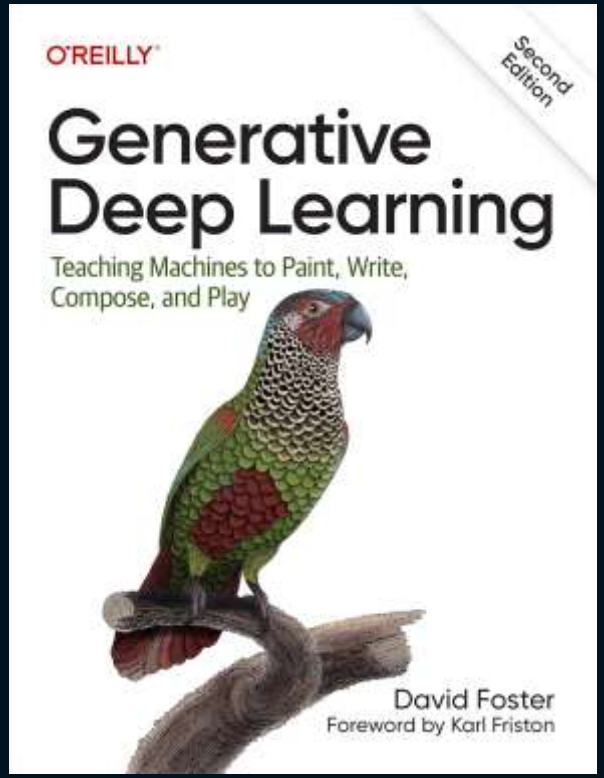
- Process:
  - Start with random noise.
  - Iteratively denoise to generate data.



Transformers and GPT

- **Self-Attention Mechanism**: Each word in the input attends to every other word, assigning importance weights.
- **Key Steps:**
  - Compute Query, Key, and Value vectors for each token.
  - Calculate attention scores and weights.
  - Weighted sum of values generates context-aware representations.
- **Multi-Head Attention:** Multiple attention heads capture different relationships in parallel.
- **Transformer Layers:** Alternating layers of attention and feed-forward neural networks.
- **Application:** Used in natural language generation (e.g., GPT).

Book Recommendation



Prompt Engineering

- A SURVEY OF PROMPT ENGINEERING METHODS IN LARGE LANGUAGE MODELS FOR DIFFERENT NLP TASKS

- https://arxiv.org/abs/2407.12994

- “In total, we read and present a survey of 44 research papers which talk about 39 different prompting methods on 29 different NLP tasks of which most of them have been published in the last two years.”