INTRODUCTION TO DEEP LEARNING

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ENG- MAYAR SWILAM

Artificial Intelligence

Machine Learning

Deep Learning

MLP

CNN

GAN

RBFN

RNN

LSTM

Autoencoders

Rule Based Systems

Support Vector Machines

Gaussian Process Regression

Random Forest

Linear Regression

Logistic Regression

K-Means Clustering

Cognitive Modeling

Planning

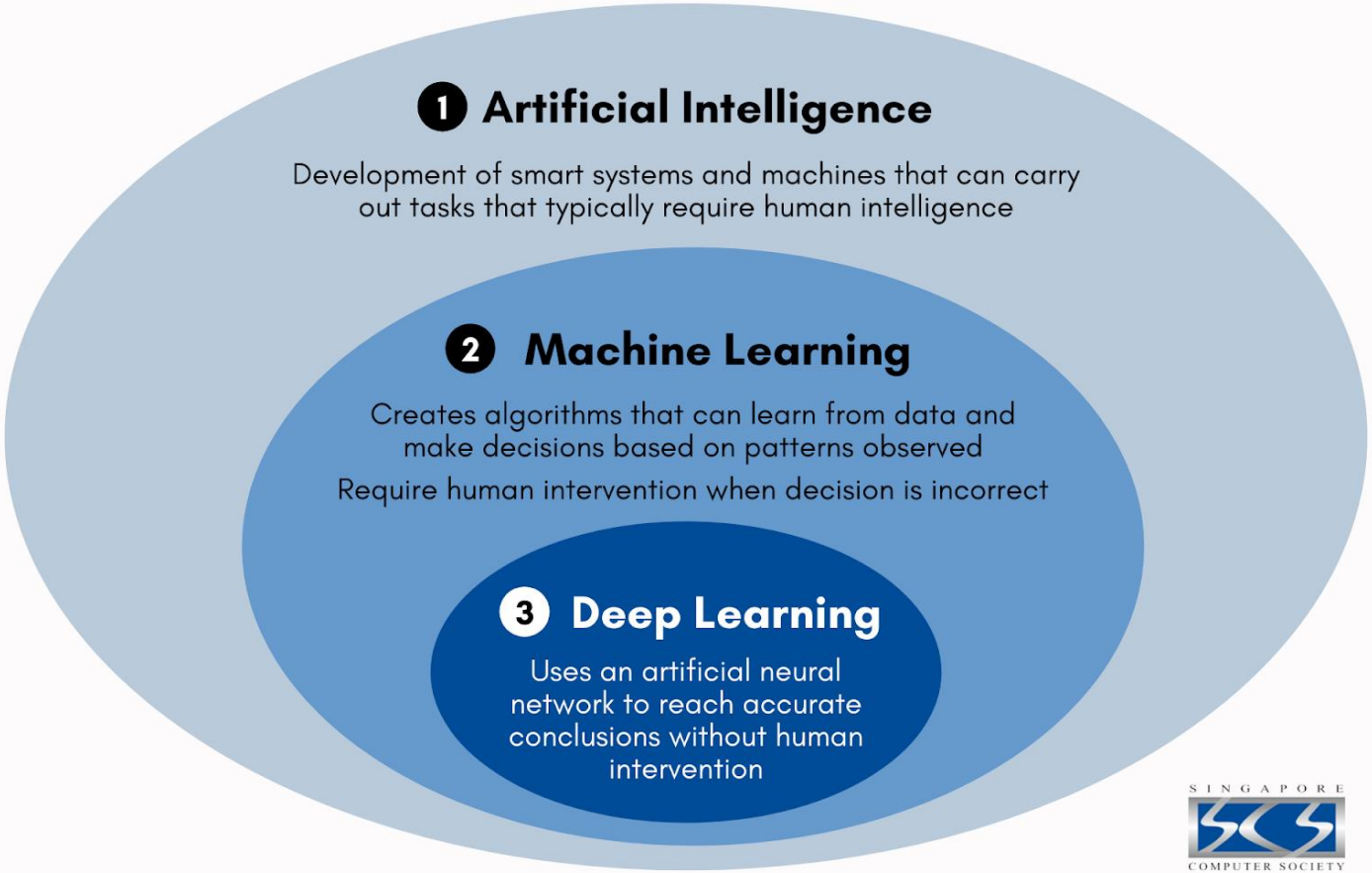
Game Playing

Search Algorithms

Knowledge Representation and Reasoning

Propositional Calculus

ARTIFICIAL INTELLIGENCE VS **MACHINE LEARNING** VS **DEEP LEARNING**

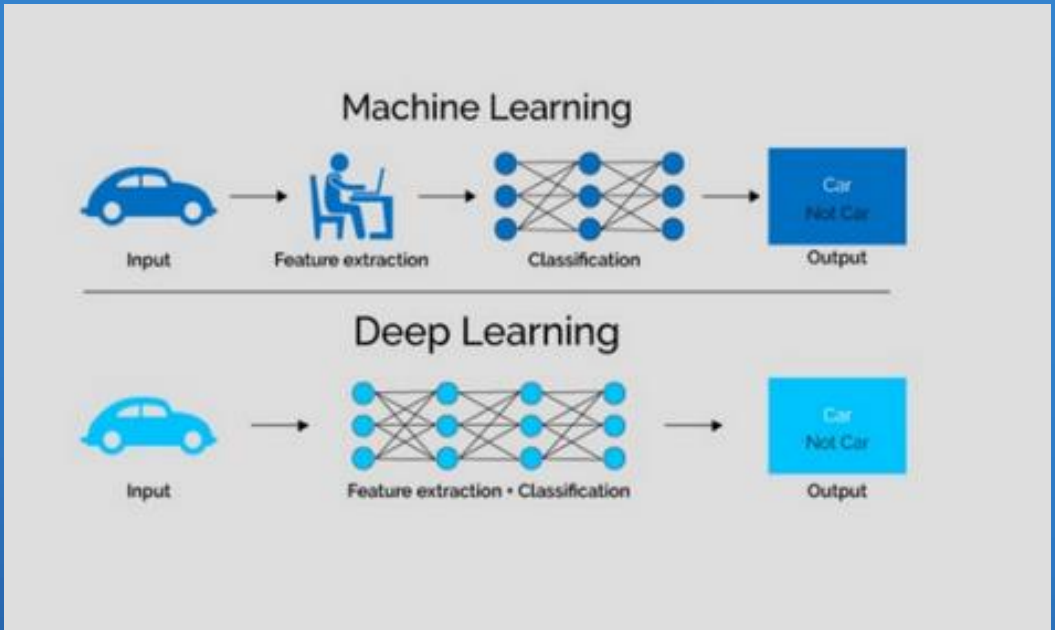


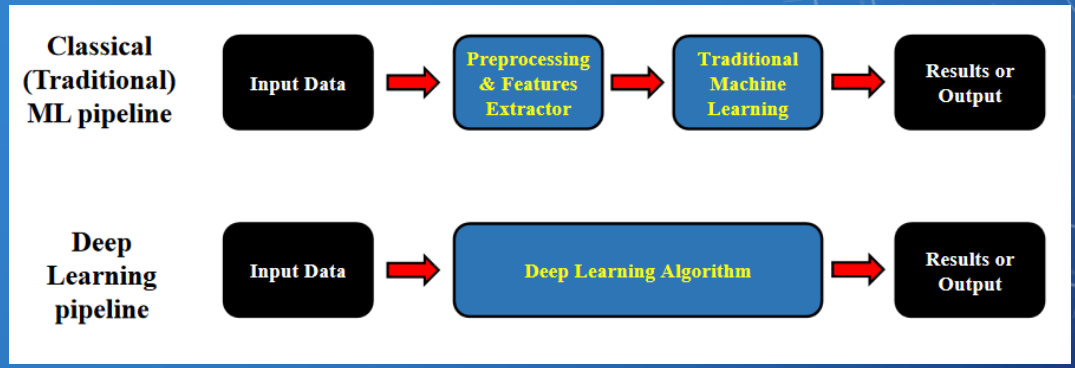
SINGAPORE COMPUTER SOCIETY

WHAT IS DEEP LEARNING ?

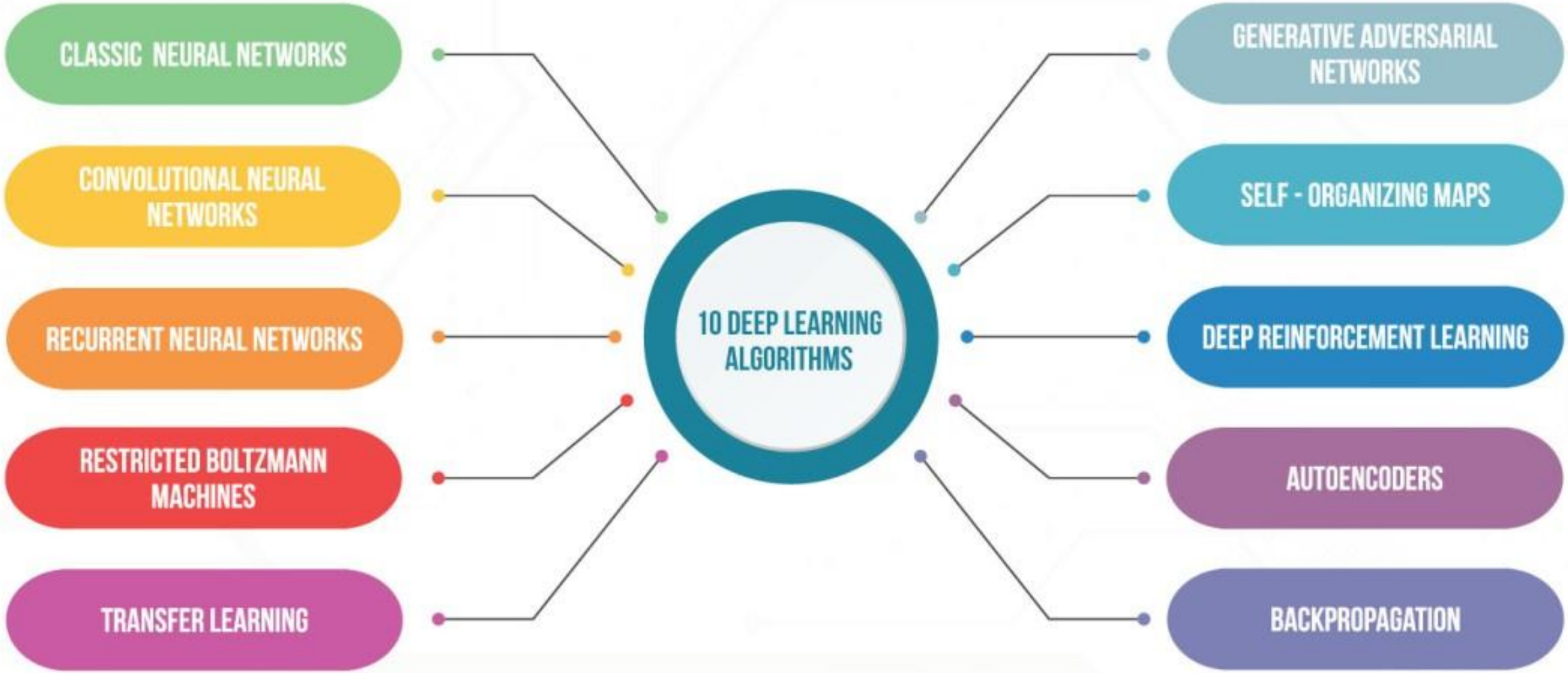
- **Deep learning** is a subset of machine learning that focuses on using ARTIFICIAL NEURAL NETWORKS **(ANN)** to model and solve complex patterns and representations in data.

- It involves training neural networks with multiple layers (hence the term "deep") to automatically learn hierarchical features from raw data.





CLASSICAL ML VS. DL



SOURCE: SHUTTERSTOCK

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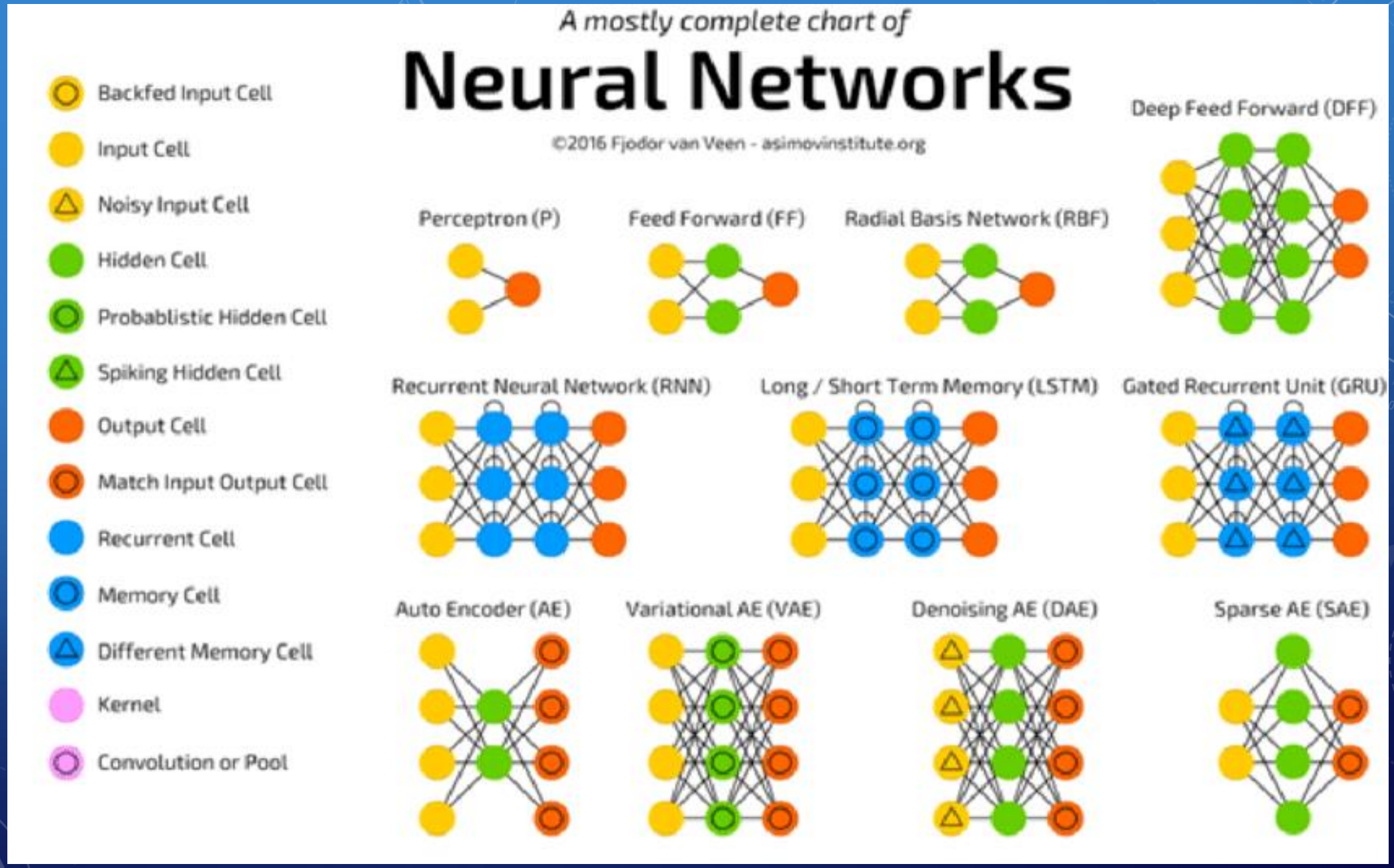
NEIL SAHOTA


A mostly complete chart of
Neural Networks
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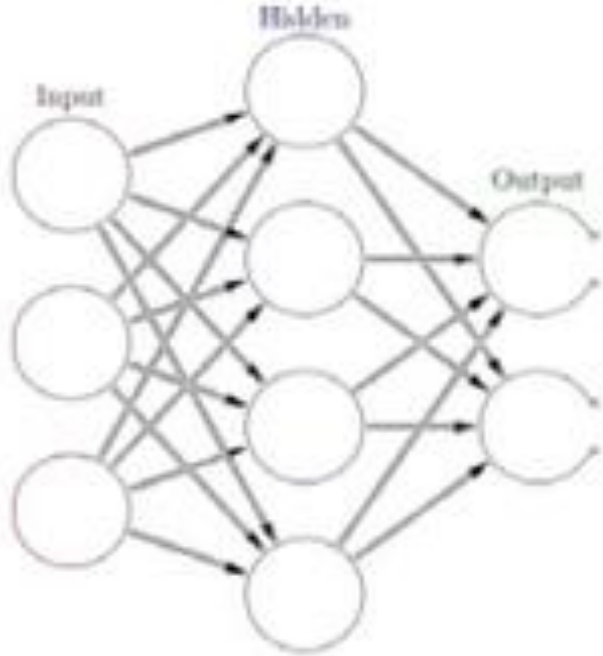
Backfed Input Cell
Input Cell
Noisy Input Cell
Hidden Cell
Probablistic Hidden Cell
Spiking Hidden Cell
Output Cell
Match Input Output Cell
Recurrent Cell
Memory Cell
Different Memory Cell
Kernel
Convolution or Pool
Perceptron (P)
Feed Forward (FF)
Radial Basis Network (RBF)
Deep Feed Forward (DFF)
Recurrent Neural Network (RNN)
Long / Short Term Memory (LSTM)
Gated Recurrent Unit (GRU)
Auto Encoder (AE)
Variational AE (VAE)
Denoising AE (DAE)
Sparse AE (SAE)

Data Processing

Navigation



Text Processing

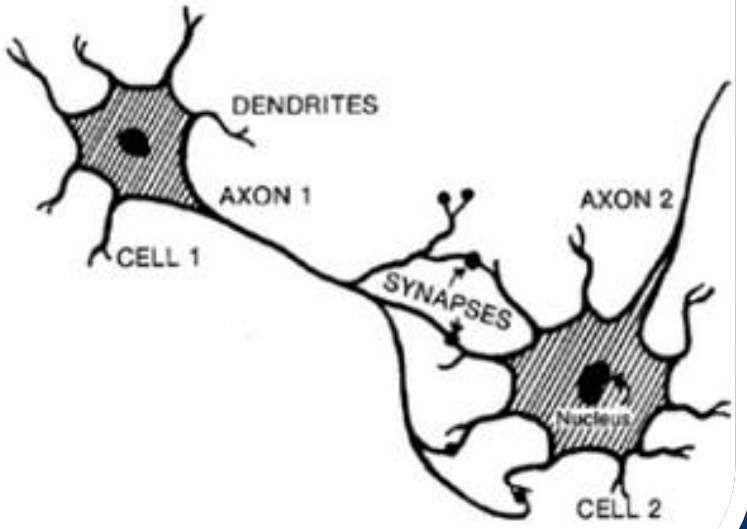
Computer Vision

Speech Understanding

INSPIRATION

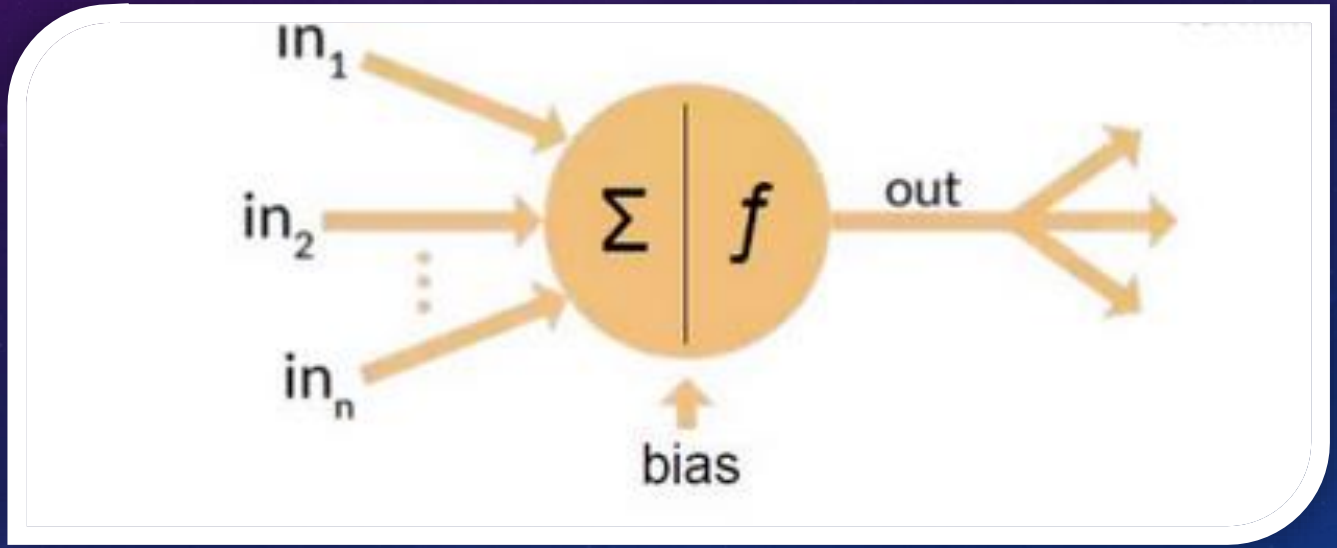
Biological Neural Network

- Dendrites accept inputs from other neurons
- Axon transmist impulses to other neurons
- Synapses are structures where impulses are transfered from one neuron to another

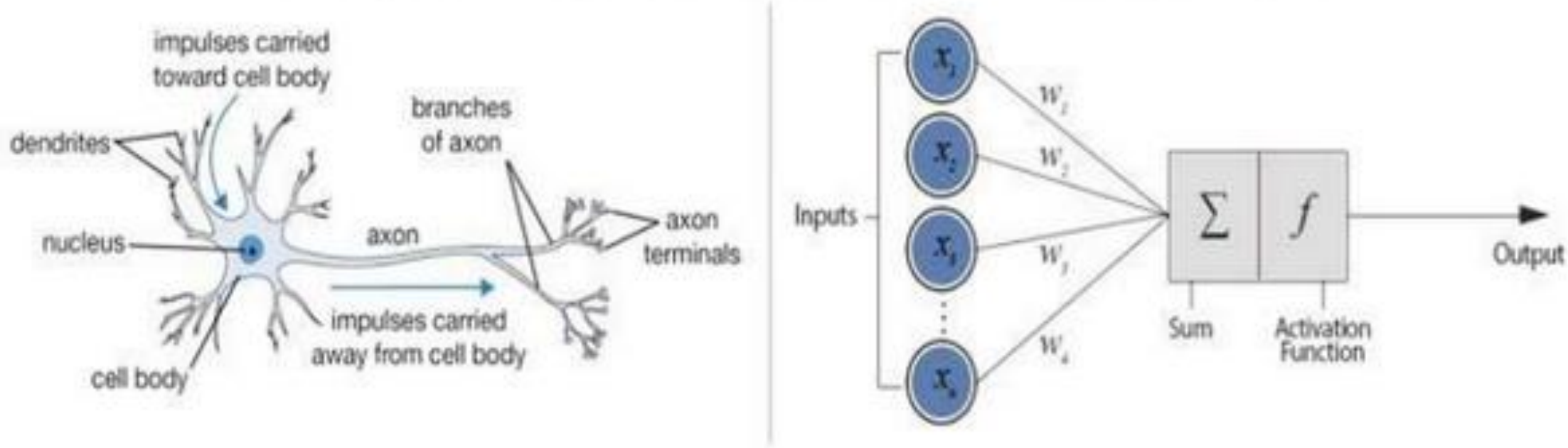


INSPIRATION (CONT.)

Artificial Neural Network



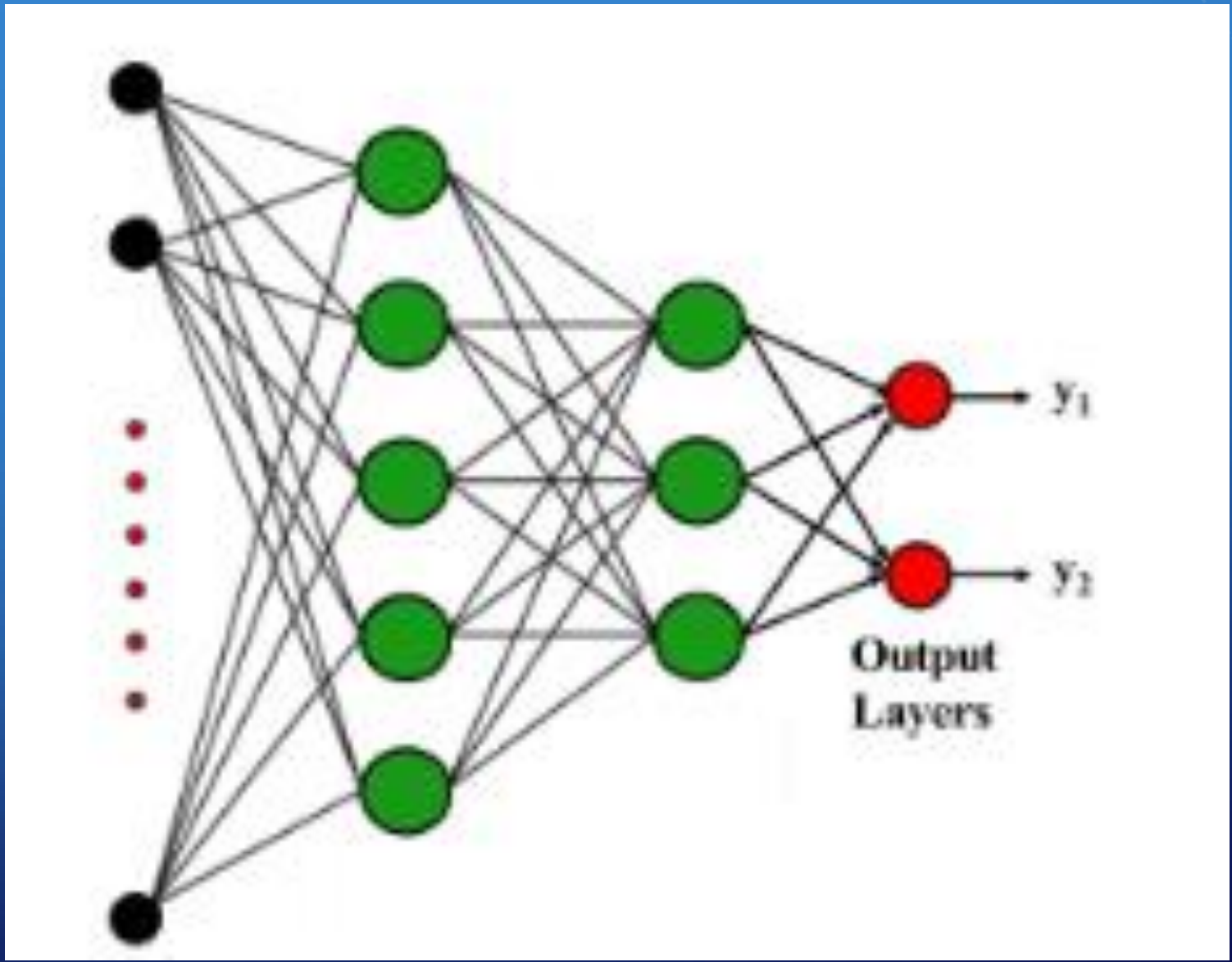
Biological Neuron versus Artificial Neural Network



THE BEGINNING: ANN

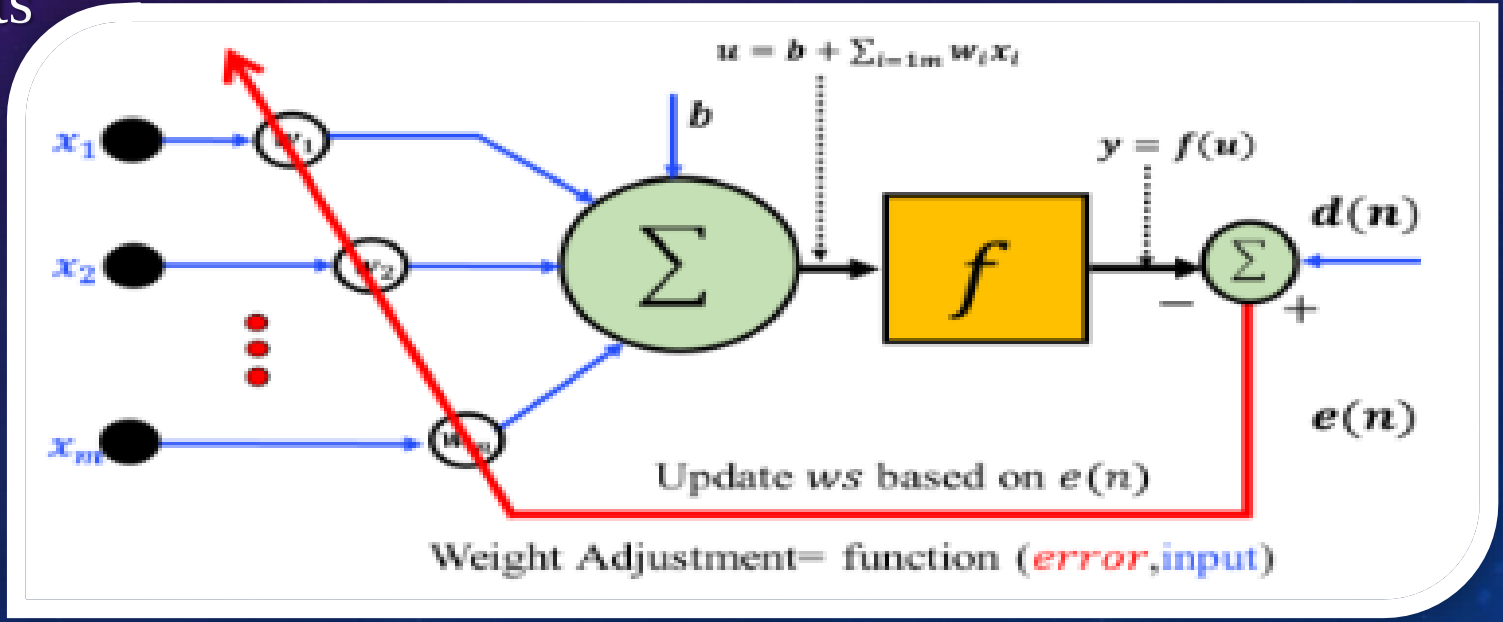
- **Neural networks** are collections of thousands (or millions) of these simple processing units (neurons) that together perform useful computations.

- ANNs can be represented using oriented graphs

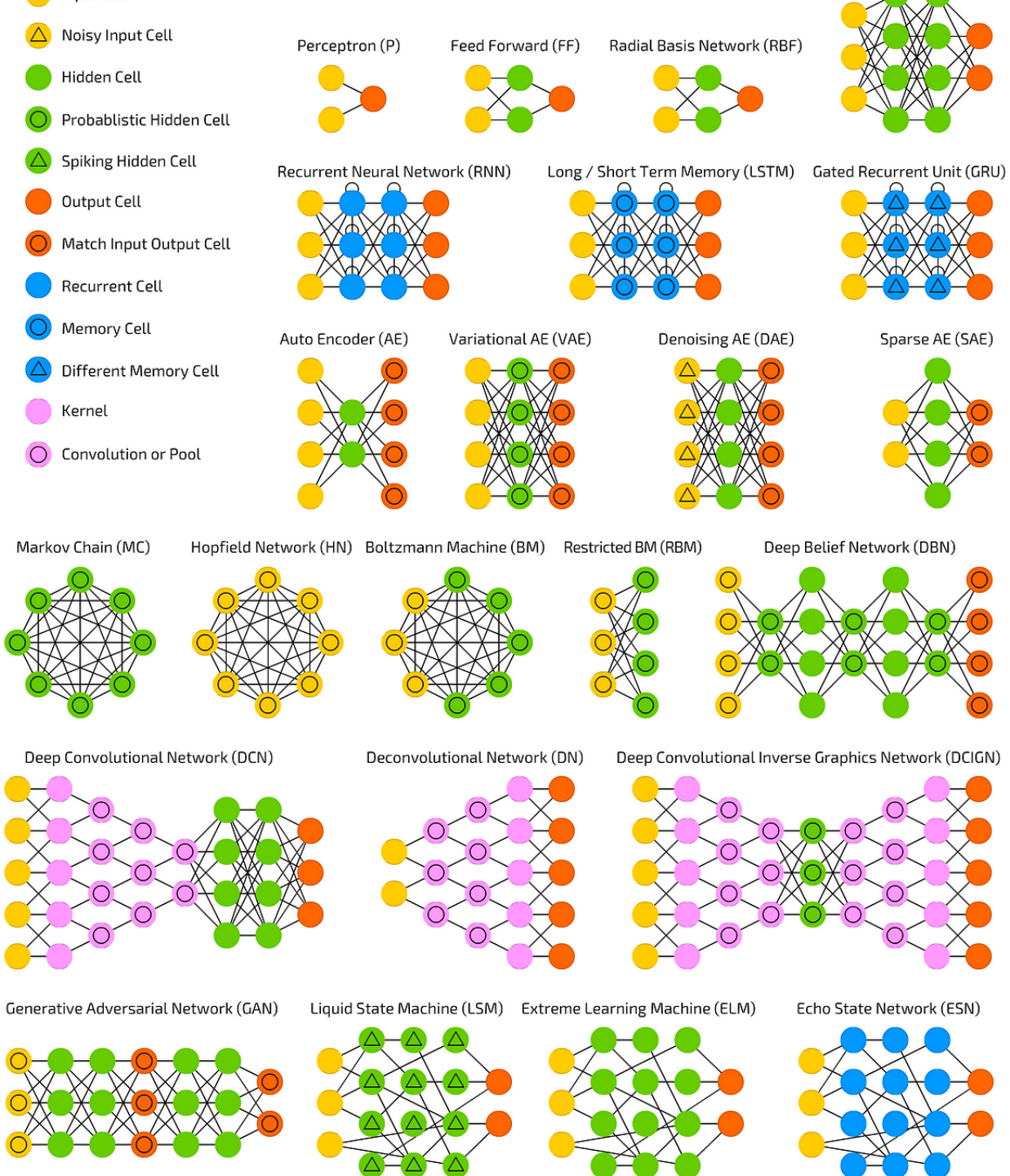

y_1
y_2
Output
Layers

THE BEGINNING: ANN (CONT.)

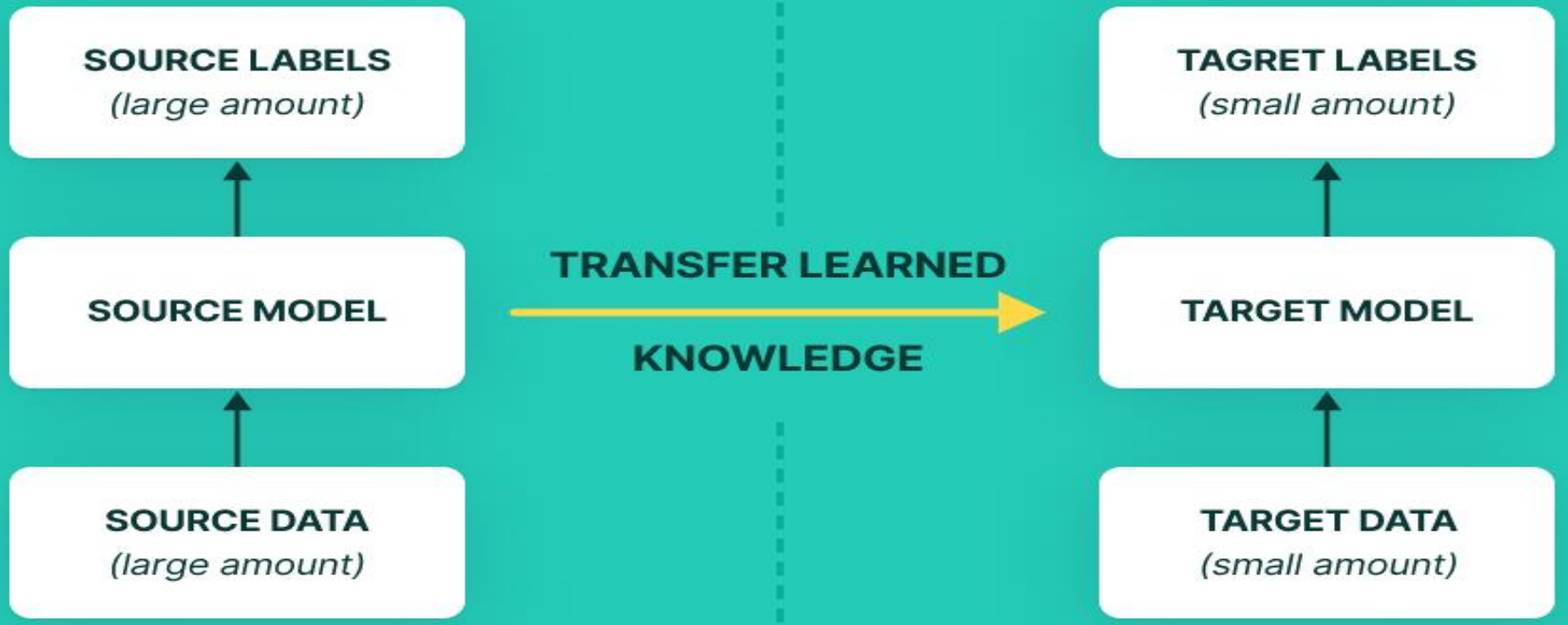
- **Neural network** are parallel processing using highly nonlinear prediction functions
- Neurons are nodes and they are **activated** based on the **weighted** sum of their inputs



ARCHITECTURES

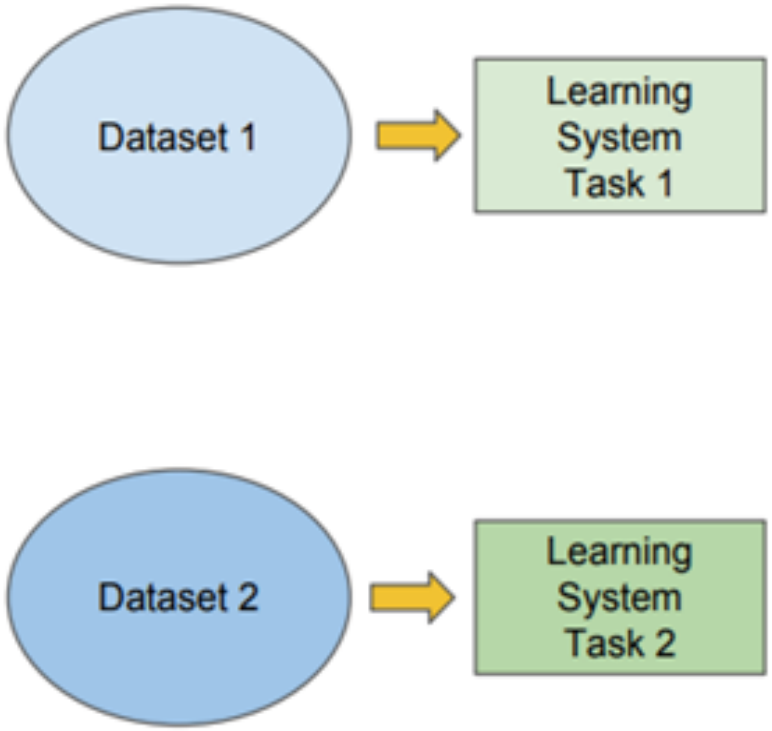


MANY ARCHITECTURES

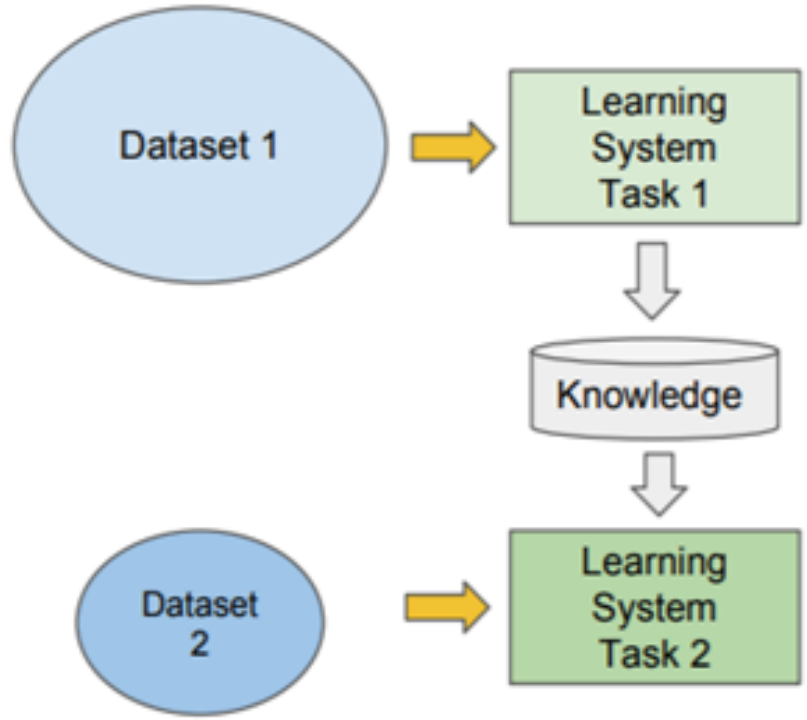

SOURCE LABELS
(large amount)
SOURCE MODEL
SOURCE DATA
(large amount)
TRANSFER LEARNED
KNOWLEDGE
TAGRET LABELS
(small amount)
TARGET MODEL
TARGET DATA
(small amount)

Traditional ML vs Transfer Learning

- Isolated, single task learning:
  - Knowledge is not retained or accumulated. Learning is performed w.o. considering past learned knowledge in other tasks



- Learning of a new tasks relies on the previous learned tasks:
  - Learning process can be faster, more accurate and/or need less training data



GENERATIVE AI

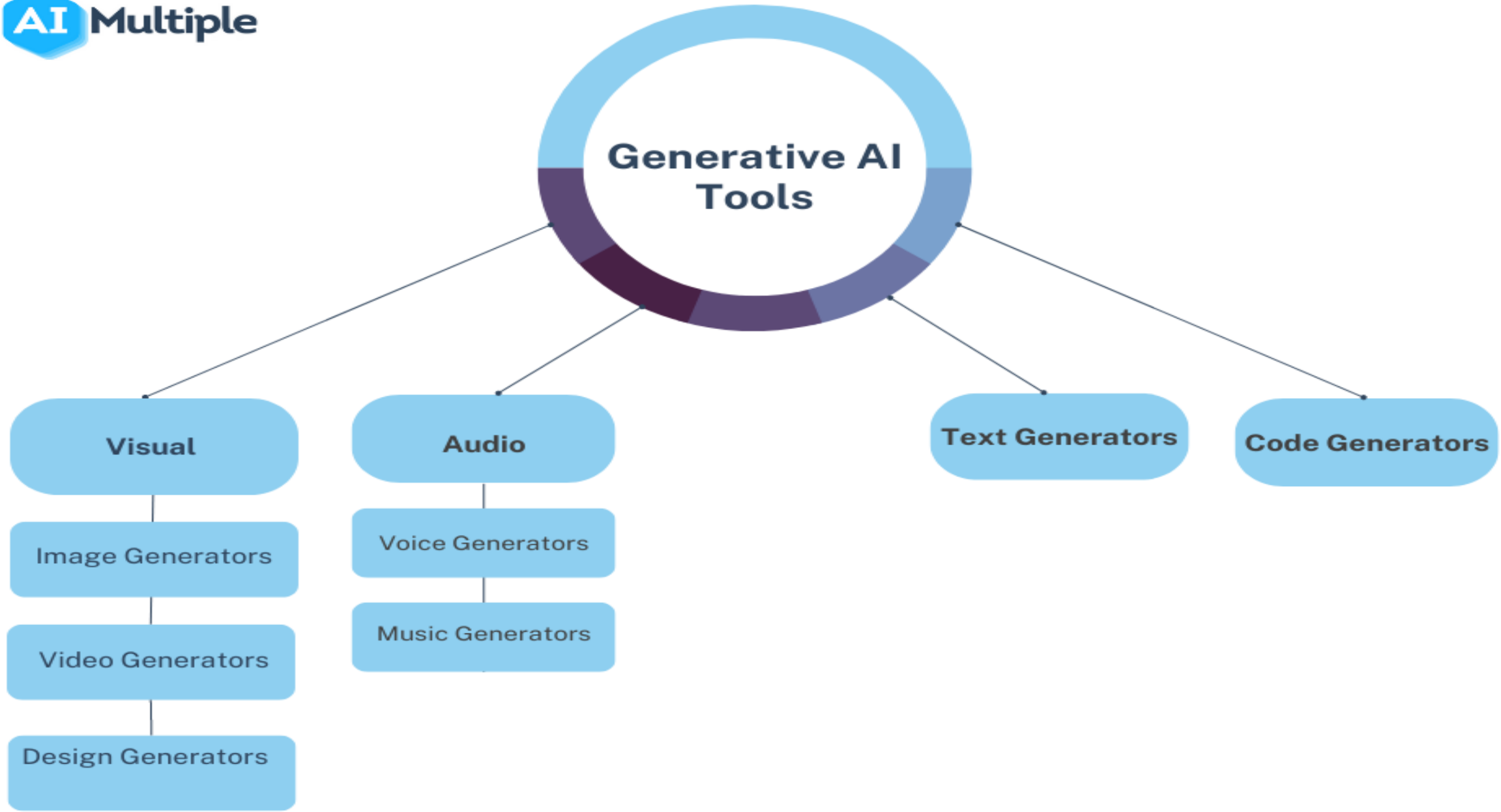
WHAT IS GENERATIVE AI ?

- **Generative AI**, short for **Generative Artificial Intelligence**, refers to a field of artificial intelligence that focuses on creating models and algorithms capable of generating new, original data that resembles a given input dataset.

- These models aim to capture and replicate patterns, styles, and characteristics present in the training data to produce new data samples that are similar in nature.

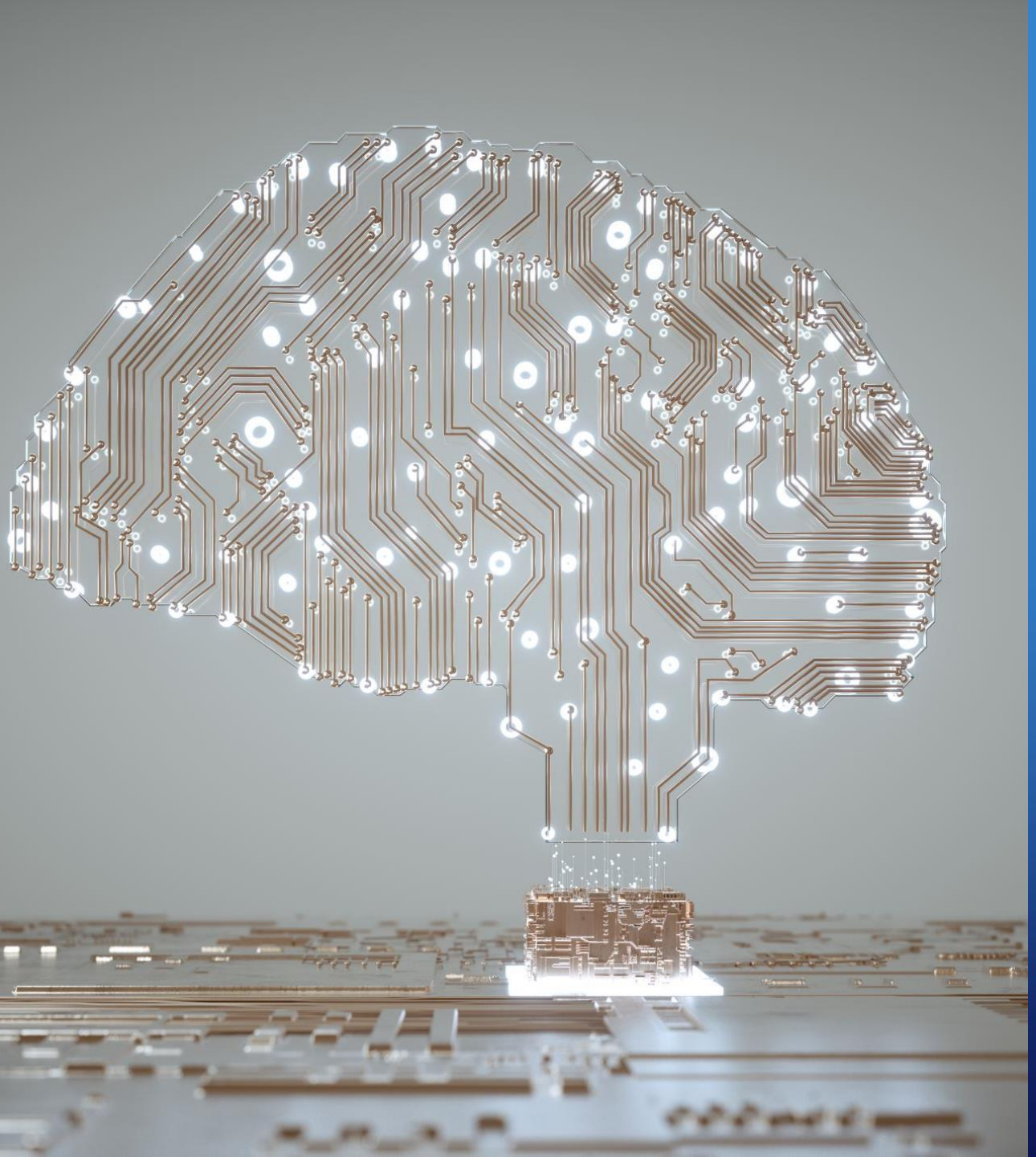
- They were introduced by Ian Goodfellow and his colleagues in 2014. GANs consist of two neural networks, the generator, and the discriminator, which are trained simultaneously through adversarial training.

AI Multiple


Generative AI Tools
Visual
Image Generators
Video Generators
Design Generators
Audio
Voice Generators
Music Generators
Text Generators
Code Generators

The Generative AI Application Landscape

	TEXT	CODE	IMAGE	SPEECH	VIDEO	3D	OTHER
APPLICATION LAYER	Marketing (content) Sales (email) Support (chat / email) General writing Note taking Other	Code generation Code documentation Text to SQL Web app builders	Image generation Consumer / Social Media / Advertising Design	Voice Synthesis	Video editing / generation	3D models / scenes	Gaming RPA Music Audio Biology & chemistry
MODEL LAYER	OpenAI GPT-3 DeepMind Gopher Facebook OPT Hugging Face Bloom Cohere Anthropic AI2 Alibaba, Yandex, etc.	OpenAI GPT-3 Tabnine Stability.ai	OpenAI Dall-E 2 Stable Diffusion Craiyon	OpenAI	Microsoft X-CLIP Meta Make-A-Video	DreamFusion NVIDIA GET3D MDM	TBD



AI IS THE FUTURE

QUESTIONS

THANK YOU