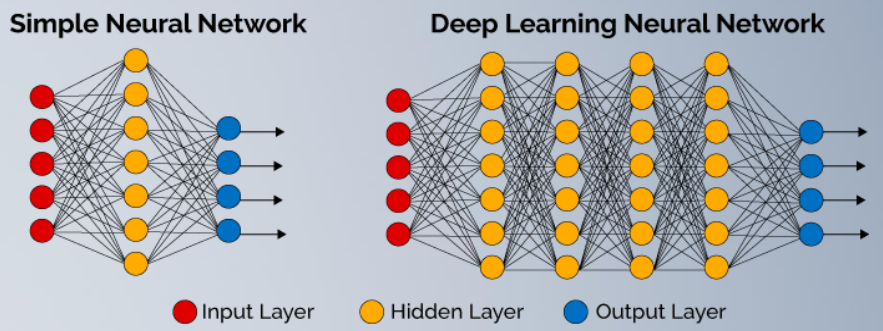
Neural Network Zoo

Alicia Gonzalez Cruz

ITAI 2376

Prof. Anna Devarakonda

Neural Networks

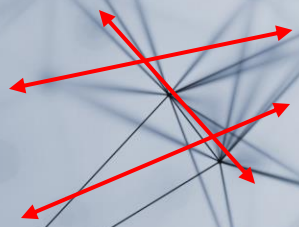


- Neural networks: a biologically-inspired programming paradigm that enables a computer to learn from observational data.

- Deep learning: a set of techniques for learning in neural networks

Neural networks and deep learning currently provide the best solutions to many problems in image recognition, speech recognition, and natural language processing.

Basic Neuron Structure
- Dendrites
- Cell Body
- Axon
- Axon Terminal



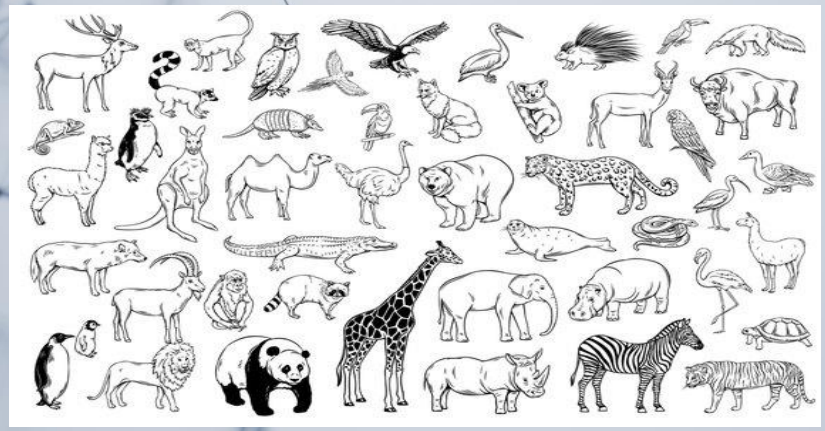
Neural Network Layers:
- Input Layer
- Hidden Layers
- Output Layers

Each neuron receives input, performs calculations, and produces an output that is passed on to other neurons. This layered structure allows the network to process information and make predictions, mimicking the way the brain functions

Neural Network Zoo Concept

- The **Neural Network Zoo** is a conceptual framework that illustrates the diverse types of neural networks by metaphorically representing each one as a unique "animal" based on its behavior, function, or structure.

- This approach simplifies learning for students and practitioners by visualizing abstract differences in a creative, memorable way.



Autoencoder – *The Hummingbird*

Transformer – *The Octopus*

Convolutional Neural Network (CNN) – *The Cheetah*

Self-Organizing Map (SOM) – *The Ant*

Recurrent Neural Network (RNN) – *The Raccoon*

Long Short-Term Memory (LSTM) – *The Lemur*

Generative Adversarial Network (GAN) – *The Owl and the Fox*

Radial Basis Function Network (RBFN) – ***The Crab***

Feedforward Neural Network (FNN) – *The Elephant*

Bayesian Neural Network (BNN) – *The Zebra*

Neural Network Animal

Transformer – The Octopus of the Neural Network Zoo

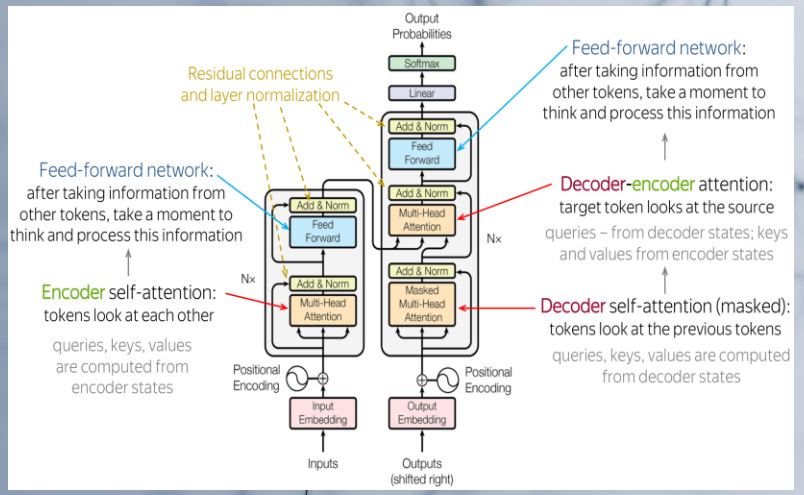
The Transformer is a deep learning architecture that processes sequences (like sentences or images) using a mechanism called attention. Unlike older networks like RNNs, it looks at all parts of the input at once, enabling fast, parallel processing and deep contextual understanding.

Encoder: Breaks down the input into meaningful representations.

Decoder: takes those representations and generates the output (like a translated sentence, or the next word).

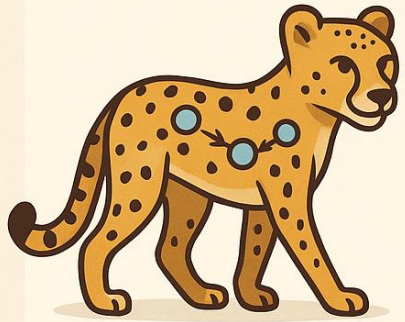
Typical Applications

- Language Modeling → ChatGPT, GPT-4
- Translation → English ↔ French
- Summarization → News → 1-paragraph
- Image Classification → Cat or Dog?
- Speech Recognition → Voice → Text



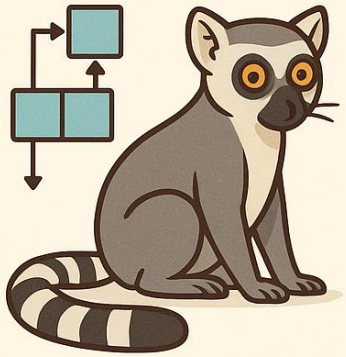
Neural Net Animal	Special Skill / Use Case	How It Works	Why That Animal?
🐆 **CNN Cheetah**	Great at **images** and **spatial tasks**	Uses filters to detect shapes, edges, textures	Cheetah is fast and focused — like how CNNs zoom in on image features
🦝 **RNN Raccoon**	Good for **sequences**, like **text** or **time series**	Remembers past steps and passes that info forward	Raccoons are curious and remember steps — like RNNs remembering what came before
🐿️ **LSTM Lemur**	Best for **long sequences**(like long sentences or speech)	Has memory cells to keep info longer than RNNs	Lemurs have better memory — they don't forget quickly like regular RNNs
🦉 **Transformer Owl**	Best for **language understanding** and **translation**	Looks at all parts of the data at once (attention)	Owls are wise and aware of the big picture — like Transformers paying attention to everything

NEURAL NETWORK ZOO

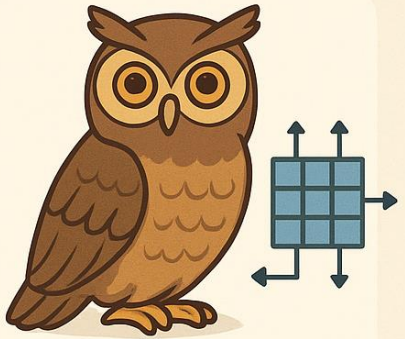


CONVOLUTIONAL
NEURAL NENTROK

RNN
RACCOON



LSTM
LONG-SHOT-TRM



TRANSFORMER

Citations

Alammar, J. (2018, June 27). *The Illustrated Transformer*. Jalammar.github.io. https://jalammar.github.io/illustrated-transformer/

Ankit, U. (2022, June 28). *Transformer Neural Networks: A Step-by-Step Breakdown | Built In*. Builtin.com. https://builtin.com/artificial-intelligence/transformer-neural-network

Karpathy, A. (2012). *CS231n Convolutional Neural Networks for Visual Recognition*. Github.io. https://cs231n.github.io/convolutional-networks/

Nielsen, M. A. (2018). *Neural Networks and Deep Learning*. Neuralnetworksanddeeplearning.com; Determination Press. http://neuralnetworksanddeeplearning.com/

The Neural Network Zoo - The Asimov Institute. (2016, September 14). The Asimov Institute. https://www.asimovinstitute.org/neural-network-zoo/