ENGR 3321: Introduction to Deep Learning for Robotics

Summary

12/04/2023

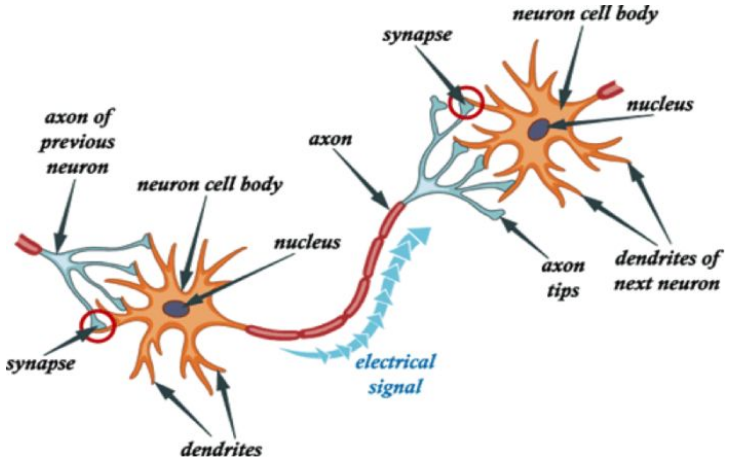
Outline

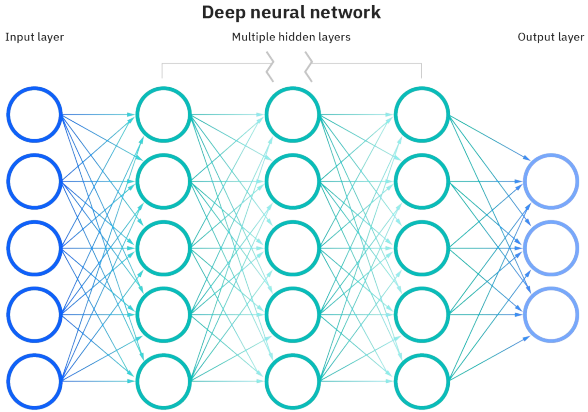
- Review
- Cool Projects
- Helpful Resources

Review

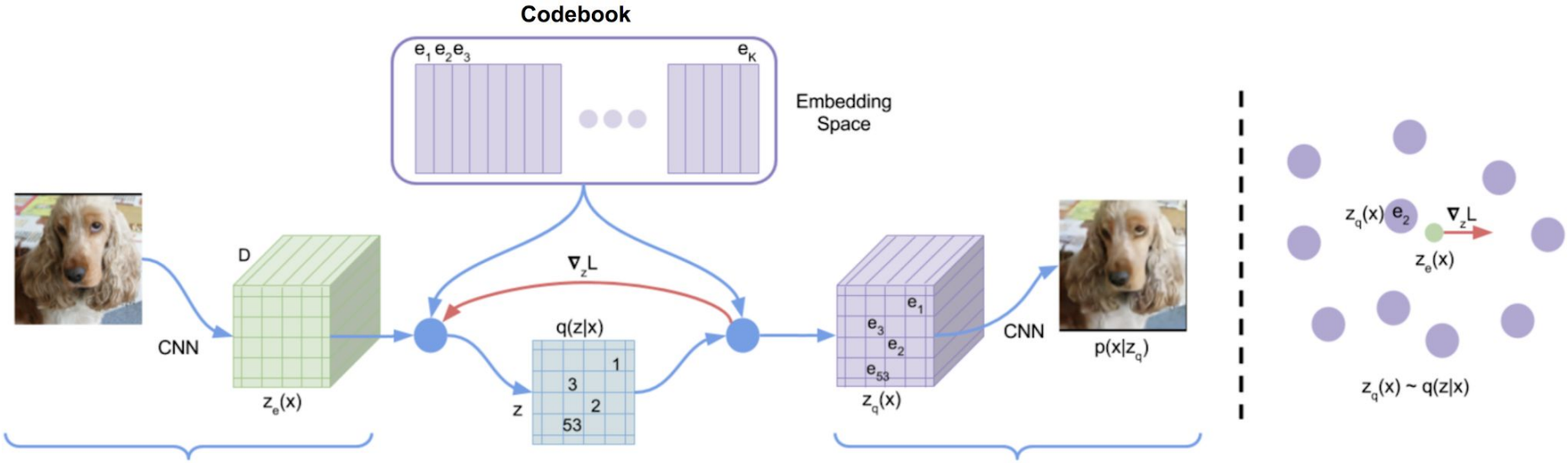
- Goal: Decision making (regression & classification).
- Linear & Logistic Regression.
- Multi-Layer perceptron network.
- Convolutional neural network.
- Forward pass & back-propagation.
- Activation functions, Datasets, NumPy, PyTorch, etc.

Nature of Deep Learning





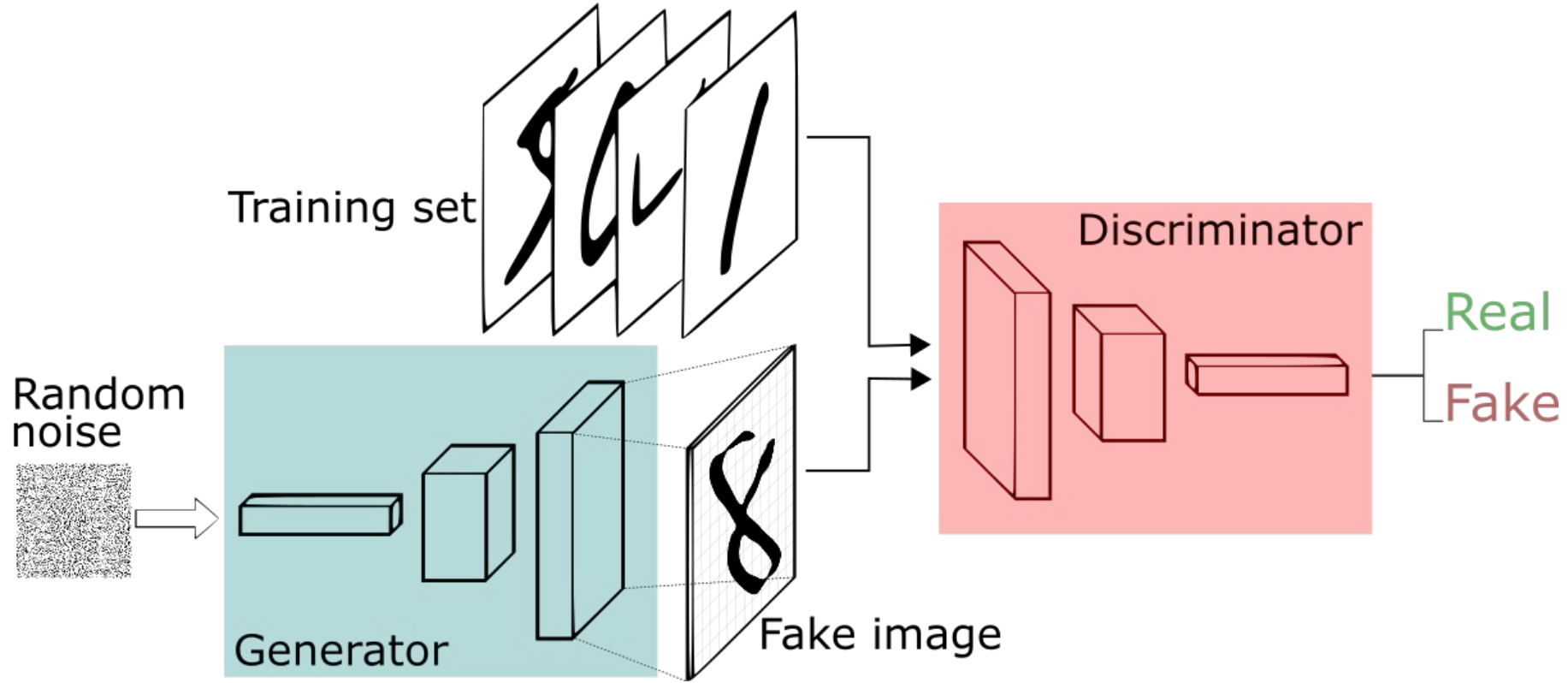
Autoencoder



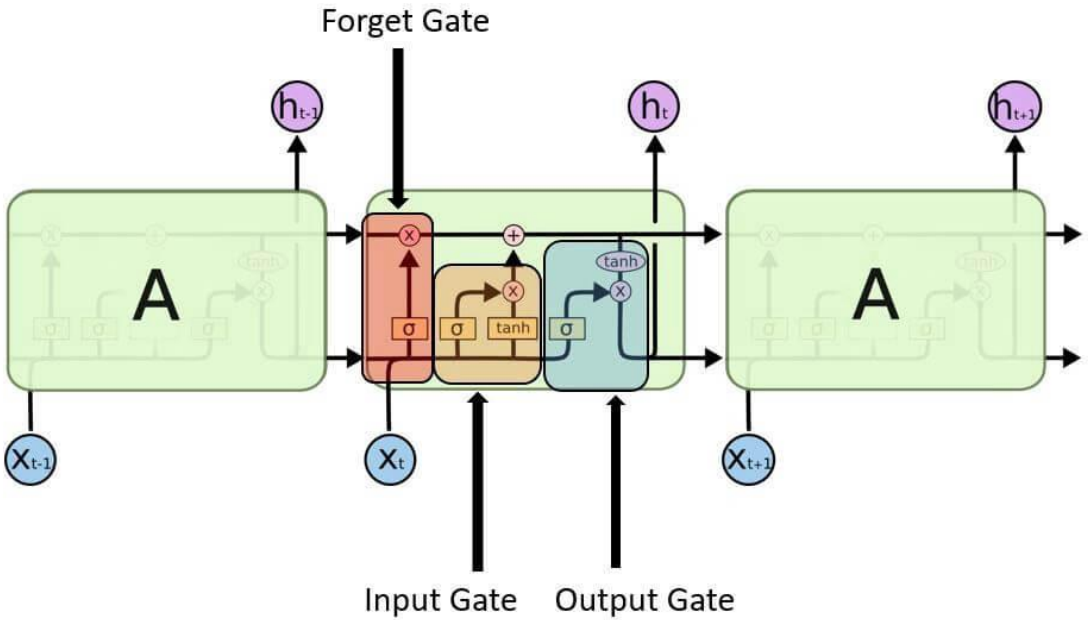
Posterior categorical distribution:

$$q(\mathbf{z} = \mathbf{e}_k|\mathbf{x}) = \begin{cases} 1 & \text{if } k = \arg\min_i \|\mathbf{z}_e(\mathbf{x}) - \mathbf{e}_i\|_2 \\ 0 & \text{otherwise.} \end{cases}$$

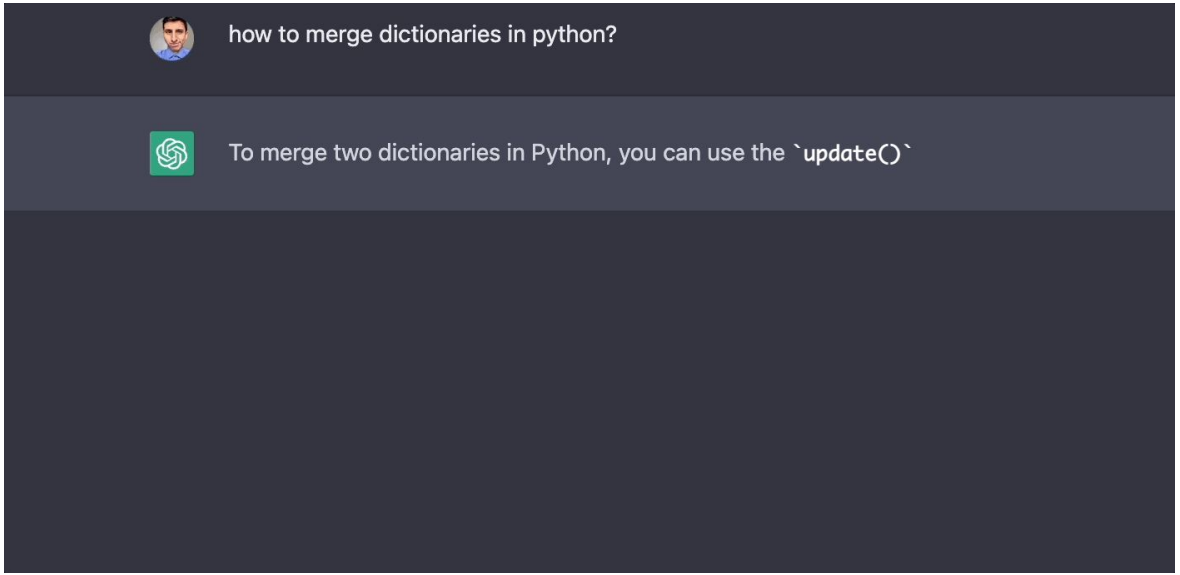
Generative Adversarial Network (GAN)

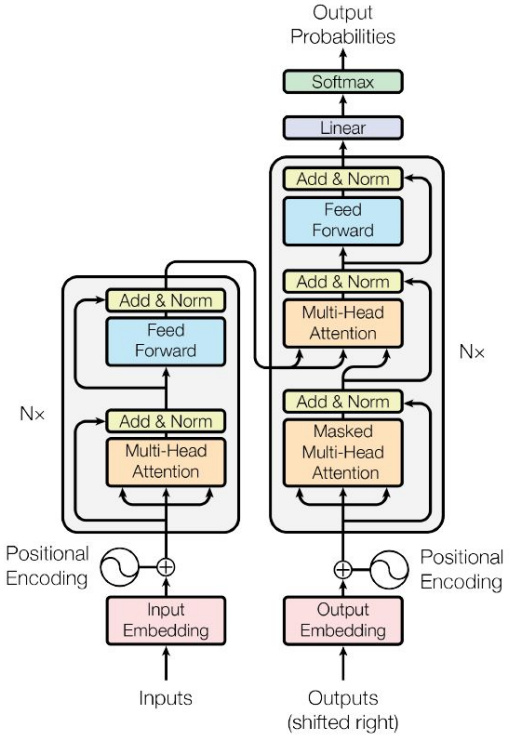


Recurrent Neural Networks



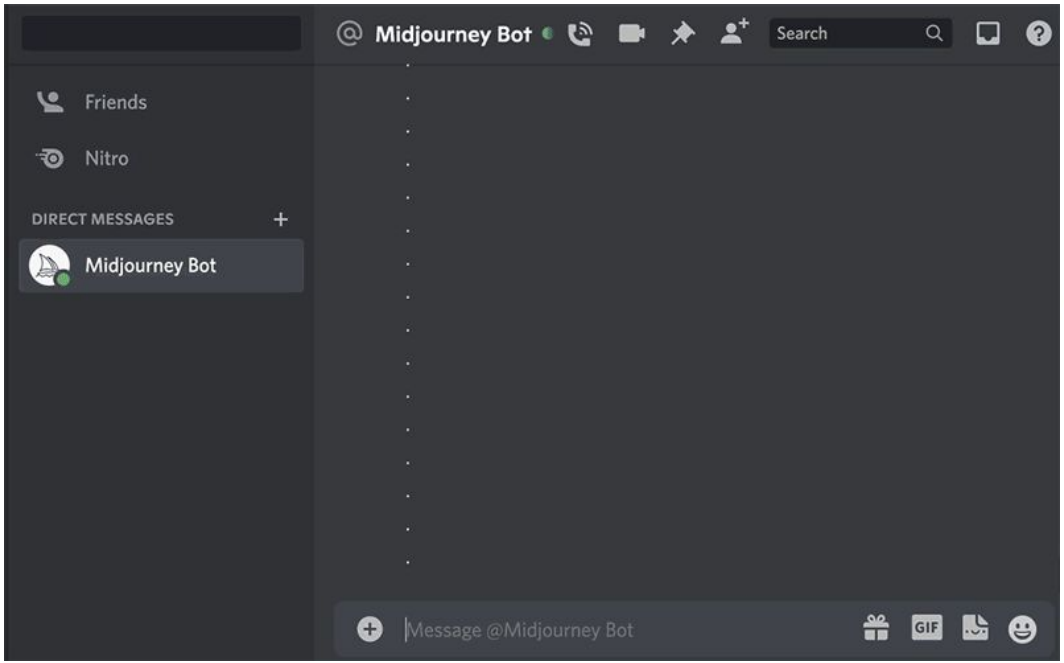
ChatGPT

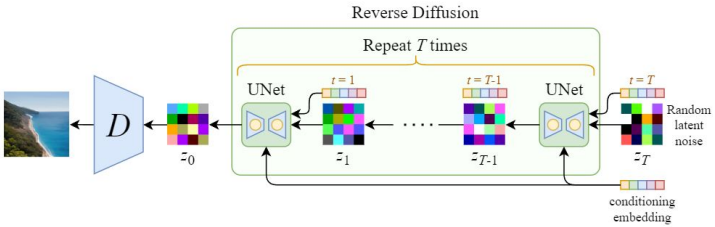




Transformer

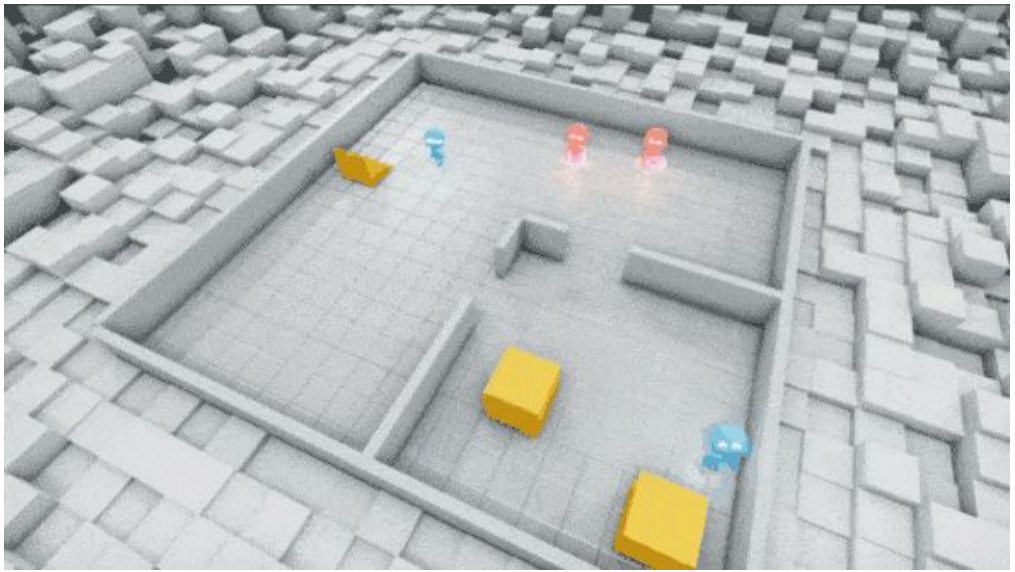
Midjourney

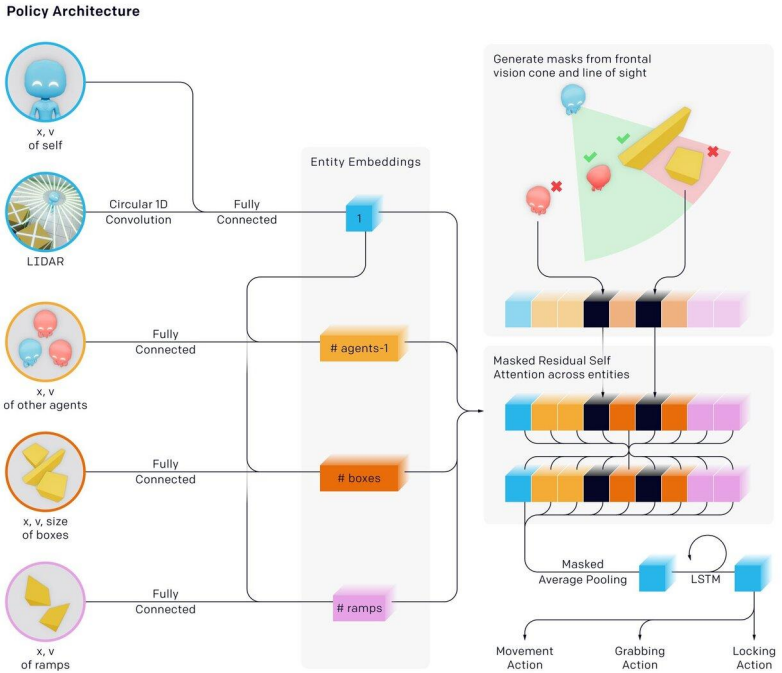




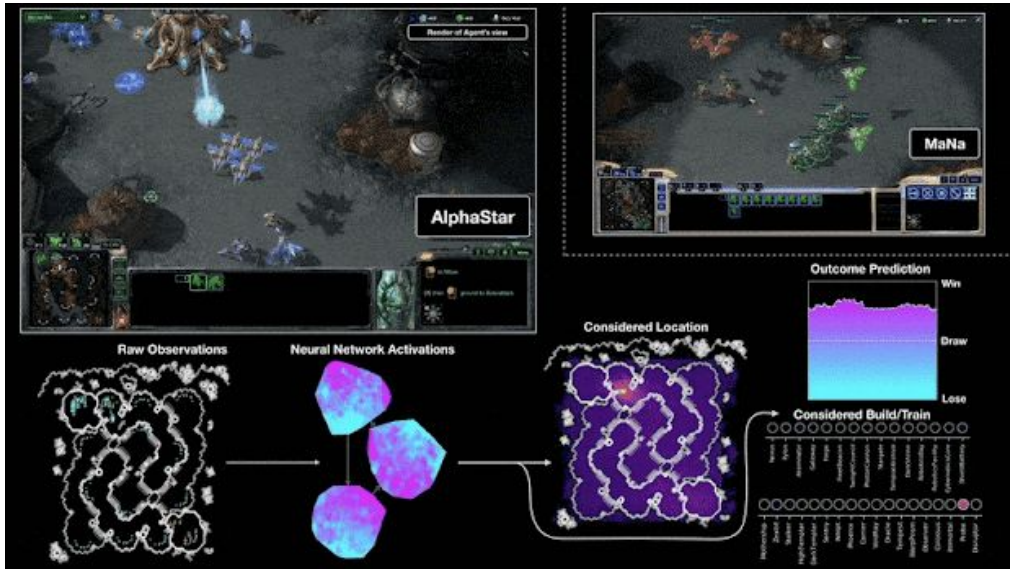
Diffusion Model

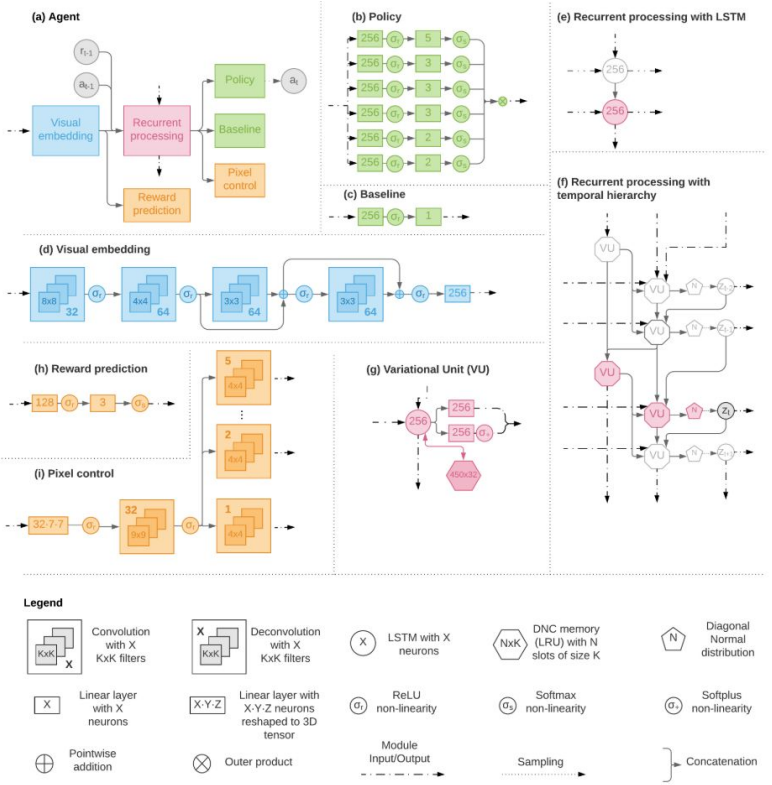
OpenAI: Hide-and-Seek



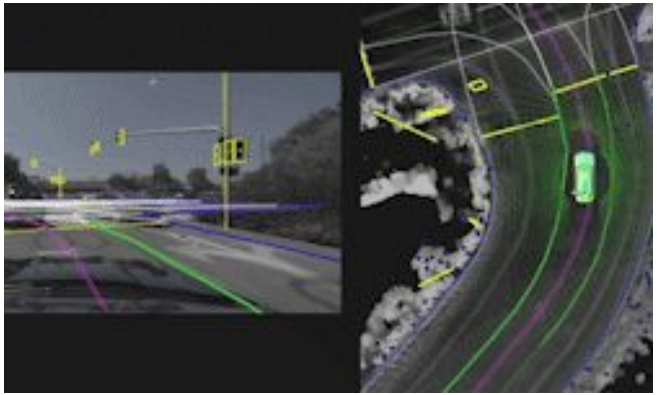


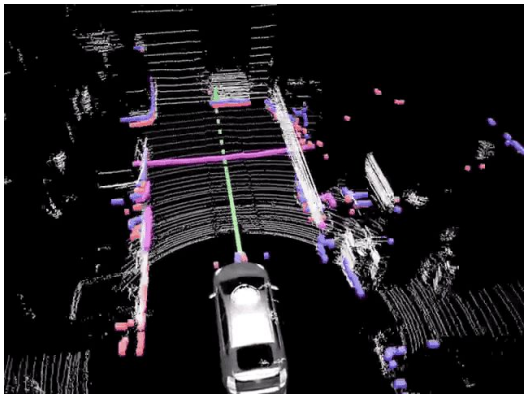
Deepmind: AlphaStar

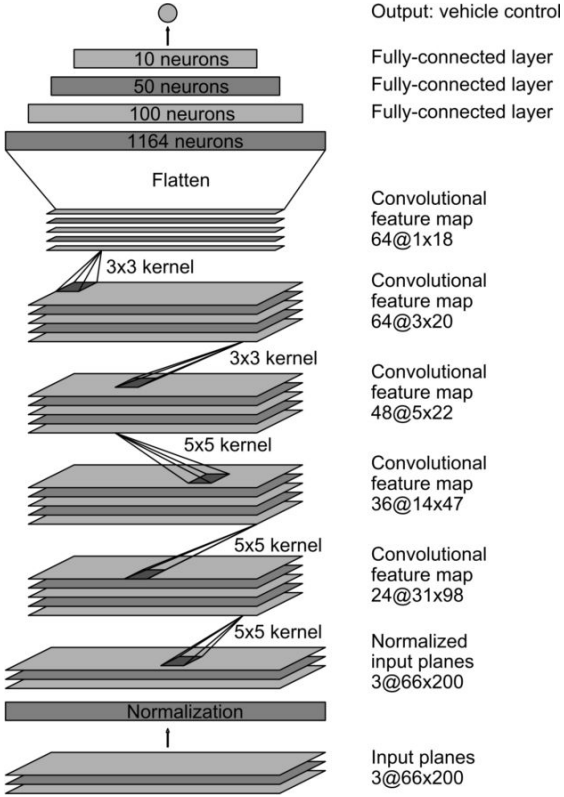




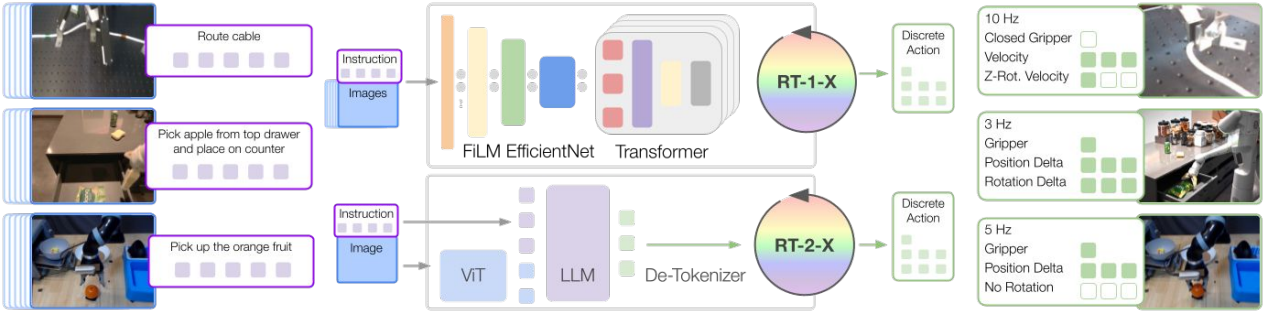
Self-Driving







Robotics Manipulation



Deep Learning Projects

- Chating
- Facial Recognition
- Object Detection
- 3D Model Reconstruction
- Translation
- Speech to Text / Text to Speech
- Compose Novel / Image / Music
- Medical and Pharmaceutical
- Investment
- Gaming

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Deep Learning in Robotics

- Object Detection
- Autonomous Driving
- Behavioral Clone
- SLAM
- Self-Taught Learning

Learning Resources

- CS231n: Deep Learning for Computer Vision (Stanford University)
- deeplearning.ai
- Berkeley Artificial Intelligence Research Blog
- Lil'Log
- Machine Learning Concepts/Papers Explained
- Data Science Concepts Explained

Practice Makes Perfect

- PyTorch Tutorials
- TensorFlow Tutorials
- HuggingFace Models, Datasets, Scripts, etc.
- Kaggle: Online AI Competitions
- Beginner’s Guide to Python
- Learn NumPy

Good luck, have fun!