# ENGR 3321: Introduction to Deep Learning for Robotics

#### Summary





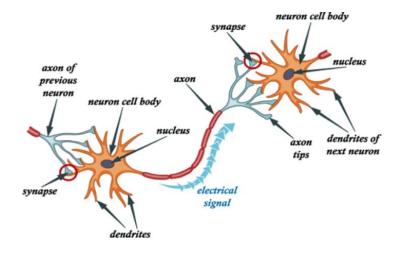
# Outline

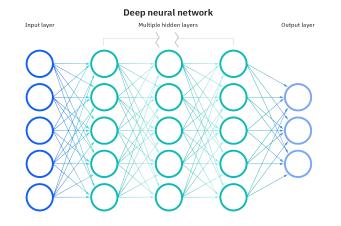
- Review
- Cool Projects
- Helpful Resources

#### Review

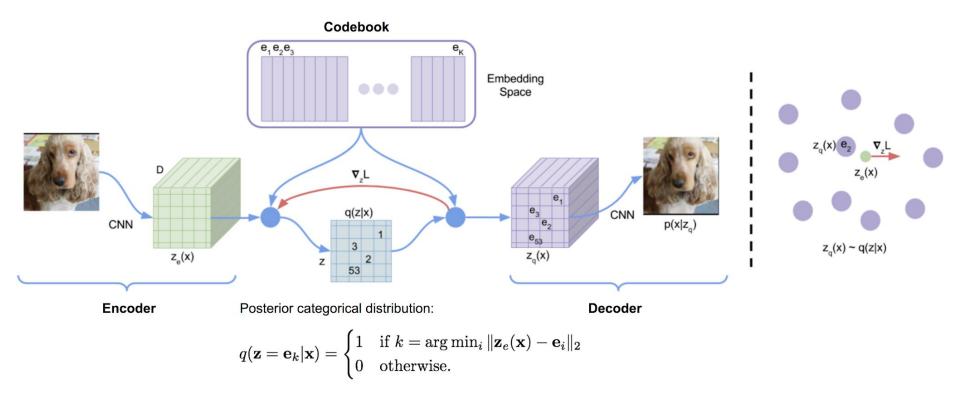
- Goal: Decision making (regression & classification).
- Linear & Logistic Regression.
- Multi-Layer perceptron network.
- Convolutional neural network.
- Forward pass & back-propagation.
- Activation functions, Datasets, NumPy, PyTorch, etc.

# Nature of Deep Learning

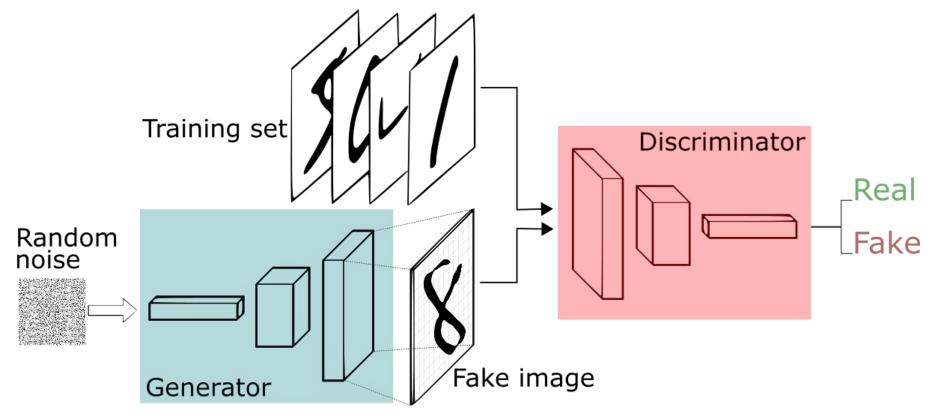




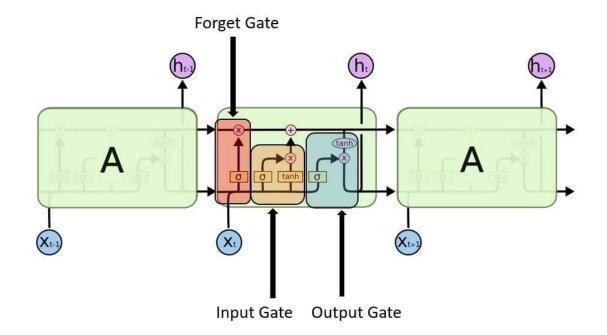
### Autoencoder



#### Generative Adversarial Network (GAN)



#### **Recurrent Neural Networks**



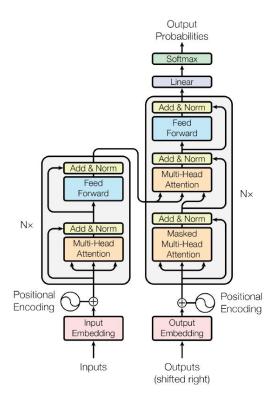
#### ChatGPT



how to merge dictionaries in python?



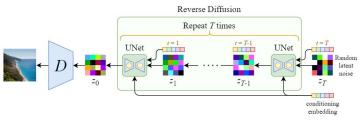
To merge two dictionaries in Python, you can use the `update()`



#### Transformer

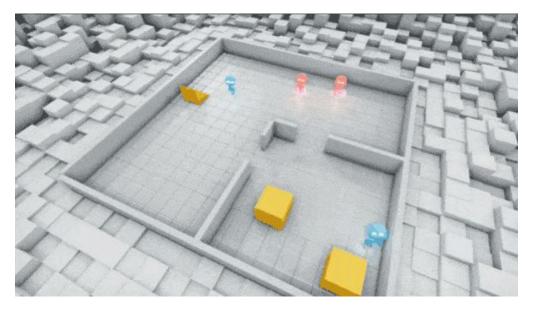
# Midjourney

	@м	lidjourney Bot 🏼	6	• *	<b>*</b> *	Search	Q	?	
<ul> <li>Friends</li> <li>Nitro</li> <li>DIRECT MESSAGES +</li> </ul>									
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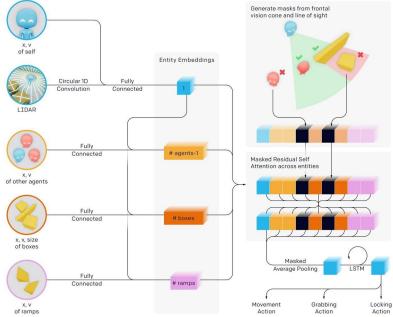


**Diffusion Model** 

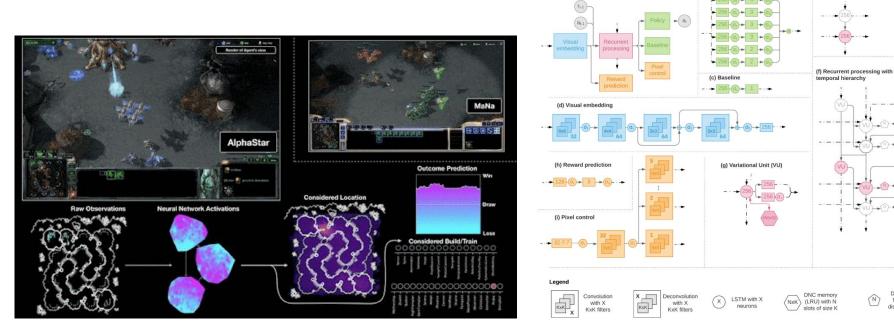
#### OpenAI: Hide-and-Seek



#### **Policy Architecture**



## Deepmind: AlphaStar



(a) Agent

Linear laver

with X neurons

Pointwise

addition

X

 $\oplus$ 

Linear laver with

X-Y-Z neurons

reshaped to 3D tensor

Outer product

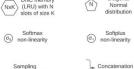
ReLU

(or) non-linearity

Module

Input/Output

(b) Policy



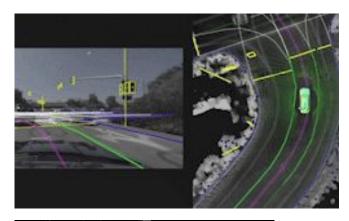
Sampling

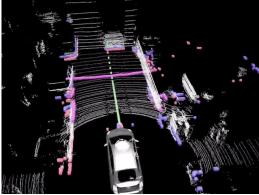
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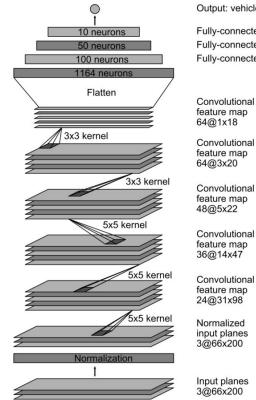
Diagonal

(e) Recurrent processing with LSTM

# Self-Driving





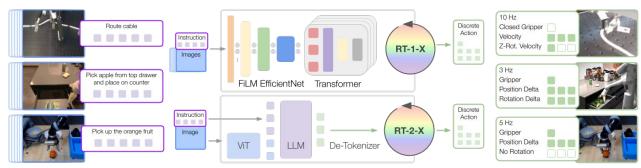


Output: vehicle control

Fully-connected layer Fully-connected layer Fully-connected layer

#### **Robotics Manipulation**





# Deep Learning Projects

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

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# Deep Learning in Robotics

- Object Detection
- <u>Autonomous Driving</u>
- Behavioral Clone
- <u>SLAM</u>
- <u>Self-Taught Learning</u>

# Learning Resources

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

# Practice Makes Perfect

- <u>PyTorch Tutorials</u>
- <u>TensorFlow Tutorials</u>
- HuggingFace Models, Datasets, Scripts, etc.
- Kaggle: Online AI Competitions
- Beginner's Guide to Python
- Learn NumPy

#### Good luck, have fun!