

Welcome

# ENGR 3321: Introduction to Deep Learning for Robotics

Introduction

08/26/2024



# Outline

- Course related information
- A Brief Introduction on Deep Learning

# Course Information

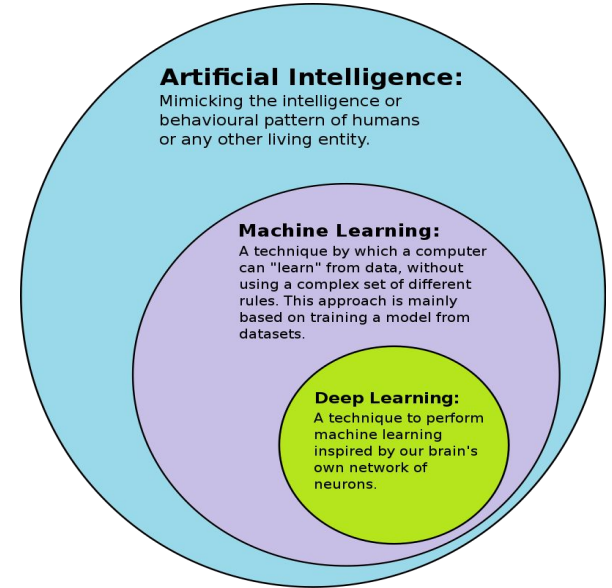
- Classes: 01:00 PM - 02:15 PM, M/W @ CCCS111
- Office Hour: 10:00 AM - 12:00 PM, Monday @ LSC110
- Slides & Assignments: [https://linzhanguca.github.io/deep\\_learning-2024](https://linzhanguca.github.io/deep_learning-2024)
- Announcements & Grades: Blackboard
- Homework: Github Classroom

# Introduction to Deep Learning

# What is Deep Learning

- Definition: Deep learning is a subset of machine learning that uses neural networks with many layers (hence "deep") to model complex patterns in data.
- Examples: object detection, chatbot, video generating, autonomous driving, etc..
  - [Yolo](#)
  - [Claude](#)
  - [Sora](#)
  - [Waymo One](#)

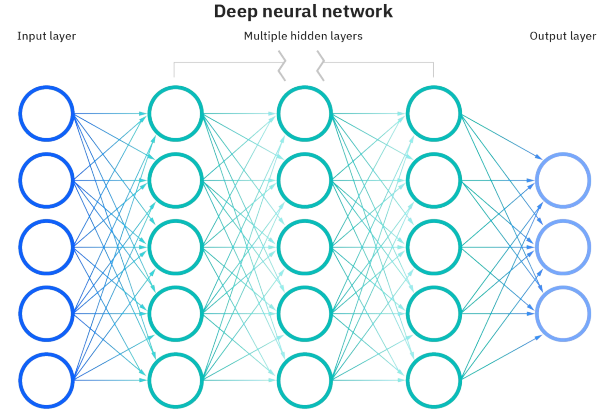
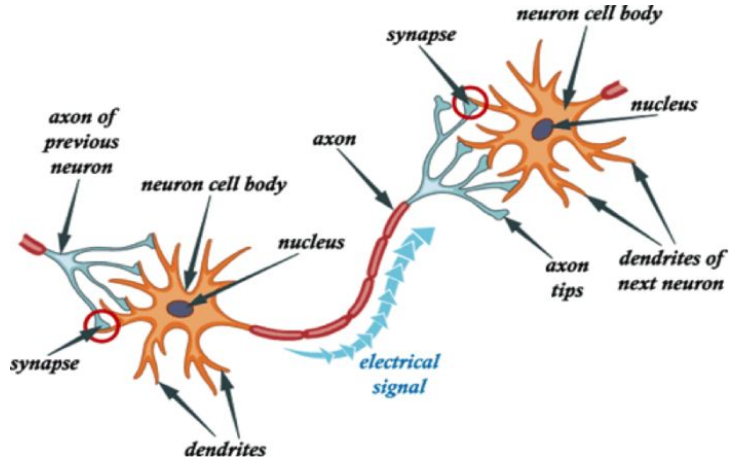
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# Why Deep Learning

- Large datasets
- More complex patterns
- Automatically extract features without manual intervention
- Successfully helped industries like healthcare (e.g., diagnosing diseases from medical images), finance (e.g., fraud detection), and entertainment (e.g., recommendation systems).

# How Deep Learning Works





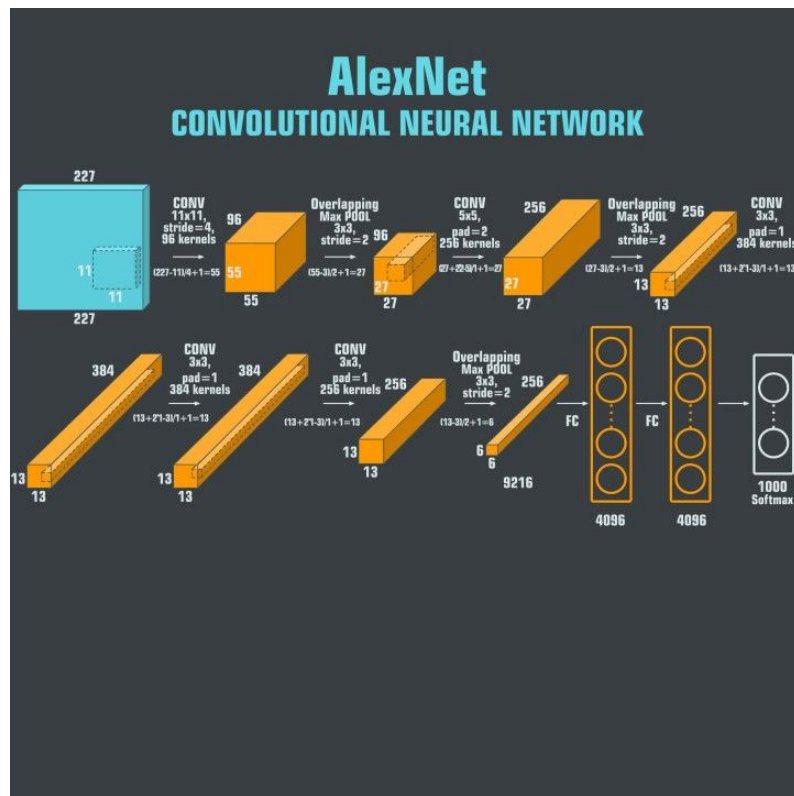
# Perceptron

- Neural Network Concepts: In 1943 American neurophysiologist and cybernetician of the University of Illinois at Chicago Warren [McCulloch](#) and self-taught logician and cognitive psychologist [Walter Pitts](#) published “A Logical Calculus of the ideas Imminent in Nervous Activity”.
- Perceptron: In 1958 a research psychologist and project engineer at the Cornell Aeronautical Laboratory in Buffalo, New York, [Frank Rosenblatt](#) introduced the perceptron. It was one of the earliest neural network models, designed for binary classification tasks.

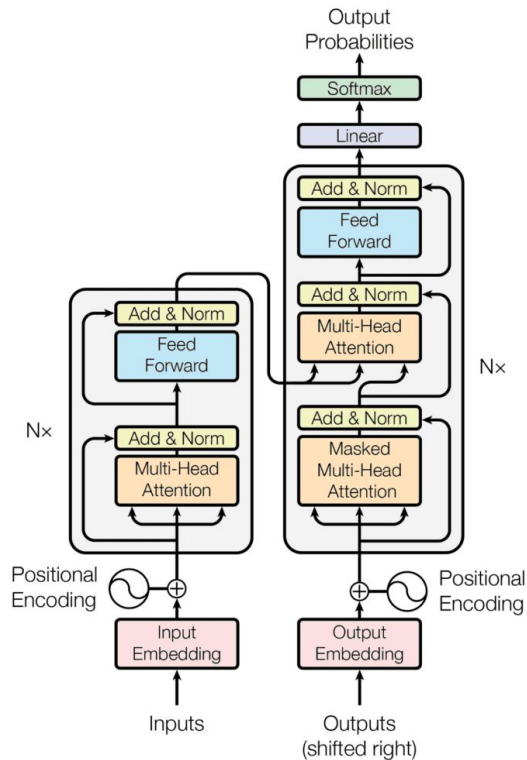
# Winter of AI

- Challenges: Early neural networks faced significant limitations, such as the inability to solve non-linear problems, leading to decreased interest and funding in 1970s. This period is often referred to as the "AI Winter."
- Backpropagation: Geoffrey Hinton, David Rumelhart, and Ronald J. Williams published "Learning representations by back-propagating errors" in 1986. The backpropagation algorithm allowed for the training of multi-layer neural networks, revitalizing interest in neural networks.

# Emergence of Deep Learning



# Modern Era of Deep Learning



# Deep Learning in Robotics

- [Object Detection](#)
- [Autonomous Driving](#)
- [Behavioral Clone](#)
- [SLAM](#)
- [Self-Taught Learning](#)

# Pros

- Solves a lot of problems.
- End-to-End process.
- Growing community and rich resources.
- Well-paid jobs.

# Cons

- Resources requirement
- Uncertainty
- Nasty data
- Explainability
- Ethics