

Introduction to AI

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01

AI Overview

What is AI?

- Artificial Intelligence (AI) is a field of science concerned with building machines that can reason, learn, and act in such a way that would normally require human intelligence or that involves data whose scale exceeds what humans can analyze.
- AI enables computers and machines to simulate human learning, comprehension, problem solving, decision making, and creativity.

Benefits of AI:

- Automation - factory robots, inspecting products for defects, reduce human error
- Extremely fast, infinitely available, pattern recognition

Different Types of AI

Currently Exists:

Reactive Machines

A limited AI that reacts to different stimuli based on preprogrammed rules. Cannot learn new data, predicts based on given data - ex: [Netflix Recommendation Engine](#)



Limited Memory

Uses Deep Learning algorithms to monitor specific situations over time. Data is not saved to memory, but AI is programmed from actions of past and present data - ex: [Self-driving cars](#)



Does Not Yet Exist:

Theory of Mind

Potentially can understand the world and how other entities have thoughts and emotions. Understand intentions and predict behavior.



Self Aware

A step above theory of mind, gaining a sense of self and understanding emotions, their state of being, and predicting others' feelings.



Training Models of AI



Supervised Learning

"**Inputs and outputs**" - Simplest form of ML, consists of using labeled data sets to train algorithms to further classify data or predict outcomes accurately.



Unsupervised Learning

"**Without human intervention**" - Automate data extraction from large, unlabeled and unstructured data sets to then make their own predictions about what the data represents.



Reinforcement Learning

"**Learn by doing**" - performs a task through trial and error until desired response. Once desired response is given, agent receives positive reinforcement. If task is done poorly then would receive negative reinforcement.

Evolution of AI

1950's

❖ Artificial intelligence (AI)

Human intelligence exhibited by machines

1980's

⌚ Machine learning

AI systems that learn from historical data

2010's

🧠 Deep learning

Machine learning models that mimic human brain function

2020's

AIT Generative AI (Gen AI)

Deep learning models (foundation models) that create original content

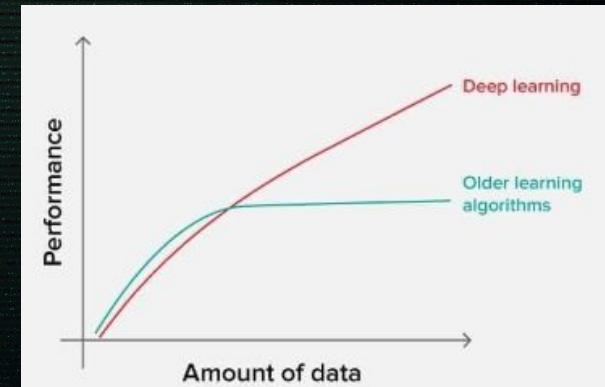
Machine Learning vs. Deep Learning

Machine Learning

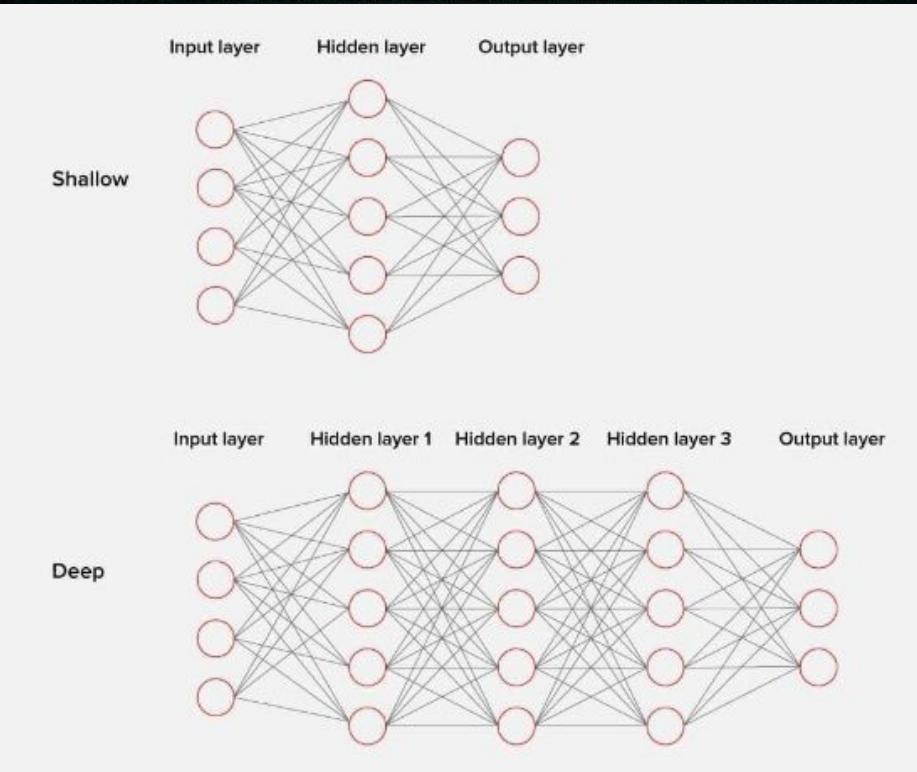
- Umbrella Term
- Make Optimized Predictions
 - Training Data
- Reinforcement training
- Supervised vs. Unsupervised

Deep Learning

- Subset of ML
- Large Data Sets
- Scalable
- Neural Networks
- Black Box process



Neural Network Diagram



History of AI

Inception

Alan Turing's describes his Turing Machine in 1935.

Major Improvement

Multi-layered Neural Networks massively increased accuracy.
(1980s)

1st Created

Christopher Strachey creates "Checkers" program in 1951.

Major Improvement

Natural Language processing with IBM Watson, Hanson's Sophia, and assistants Siri and Alexa. (2011-2016)

Major Improvement

IPL, LISP, and PROLOG languages designed with AI in mind (1960-1973).

Modern Day

OpenAI releases ChatGPT and DALL-E for generative text and images. (2020s)



Modern Uses

General Public

- Digital Assistants
- Spelling and grammar checks
 - Advertising
- Online Shopping recommendations
 - Video Games
 - Search Engines

Google what does ai do

All Images Videos News Shopping Forums Web More Tools

Researcher Specialist Engineer Scientist Product Manager Step-by-step A

AI Overview

Artificial intelligence (AI) is a collection of technologies that enable machines to perform tasks that mimic human intelligence. AI can:

- **Analyze data:** AI can process large amounts of data to identify patterns and relationships that humans might overlook.
- **Make recommendations:** AI can use data analysis to make recommendations.
- **Understand language:** AI can understand and translate spoken and written language.
- **See:** AI can use cameras and other sensors to perceive its environment.
- **Learn:** AI can learn from experience and adjust to new inputs.

Specialized Use

- Medicinal Design (ARCH)
- Inorganic Crystal Discovery (GNoME)
 - Protein Structure (AlphaFold)
- Planned Vera C. Rubin Observatory

RESEARCH

Millions of new materials discovered with deep learning

29 NOVEMBER 2023

Amil Merchant and Ekin Dogus Cubuk

Share

A collage of four images illustrating the use of AI in materials science: a close-up of a solar panel, a green crystal structure, a colorful grid pattern, and a purple crystal specimen.

Ethics in AI

Unethical

- Deepfakes
- Generative AI as Actual Work
- Incorrect Information
- Biases in Training Data



Dilemmas

- Lethal Autonomous Weapons
- Copyright Uncertainty
- AI & Jobs
- Self Driving Cars

What should the self-driving car do?

The diagram illustrates a classic moral dilemma for autonomous vehicles. A blue car is heading towards five people tied to the road. The driver must choose between two options: steering the car into a barrier to stop it, which would kill the driver, or steering it towards one person tied to the road, which would save the other four. Two "Show Description" buttons are at the bottom of each panel.

Show Description

Show Description

Morality Machine <http://moralmachine.mit.edu/>

Example Ethical Dilemma

You run a popular YouTube channel where you review movies and TV shows. One day, you come across an online deepfake tool that allows you to create realistic videos of actors saying anything you'd like. Thinking it would be a fun way to preview an upcoming movie, you create a deepfake video of a beloved actor giving a glowing, exclusive interview about how excited they are for the movie.

In the deepfake, the actor praises the film, even though you haven't seen it yet. You publish the video, clearly labeling it as a "leaked interview," and it goes viral. Viewers are thrilled by the actor's excitement and start eagerly anticipating the movie based on the fake comments. However, a week later, the actual movie releases, and it turns out to be a disappointment. Fans feel misled by your video, thinking the real actor gave a false endorsement.

What should you do next?

- A. Take the video down and apologize
- B. Edit the video description to clarify that it's a deepfake
- C. Leave the video online as is
- D. Create more deepfake content

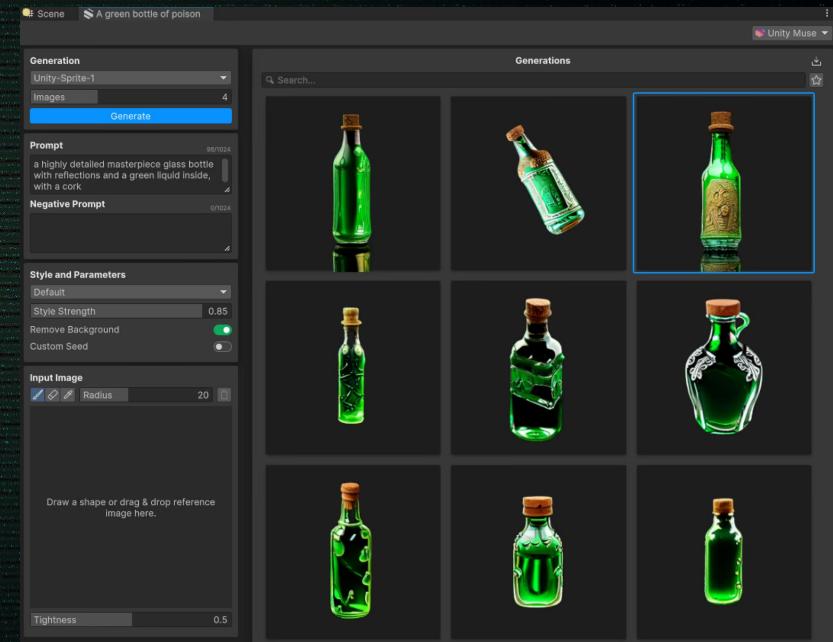
02

Types of AI in Unity

Unity Muse

Built-in generative AI

- Textures
- 2D Sprites
- Animations
- Behaviors
- Problem Solving



Unity Sentis

Package to implement other AI models into Unity

Example use cases:

- Object Identification
- Handwriting Detection
- AI Enemy Difficulties
- AI NPC Dialogue

Pathfinding

Built-in pathfinding - NavMesh

- Easy to use
- Very simple
- Can't do some things

A* Pathfinding Package

- Tilemap
- Node based
- Much more complex



03

Demo Modes

Game Demos

- A short presentation to show off selected features of a game
- They can involve interactive or visual representations of the game
- Can be playable or non-playable

Playable Demos

- What?
 - A playable version of the game
 - Usually a small/limited version of the game
 - Requires enough development to be completed
- Why?
 - Most engaging / interactive form of a demo
 - More information about the game can be collected
 - Bugs
 - Server Issues

Non-Playable Demos

- What?
 - A video or some other visual presentation of the game
 - Shows off features and/or narrative elements
- Why?
 - Can be done early or late in development
 - Helpful marketing tool
 - Can be used to show progress in development



04

Static/Dynamic Binding Intro

Static Binding

What is static binding?

- Computer determining everything at compile-time
- Deciding what types will be used, methods, etc
- It is also called early binding

Where does static binding shine? I.E What are the best uses for it?

- It improves performance because everything is assigned before running your program.
- Easier to debug (don't have to wait until the code is running to see errors)
- If your program will know the type of your object or the methods it contains

How does static binding differ from dynamic binding?

- Dynamic binding is called late binding
- Bound at run-time, types are not assigned beforehand
- Slower
- Keyword "virtual" for methods
- Allows for more flexibility

Example of Static Binding

Where could you potentially replace static binding with dynamic binding?

Enemy: have a general attack method for an enemy class, allow different subclasses of enemies to override that Attack method with their own unique attacks. Can use keywords "virtual" and "override" for your method

Basic example for static binding: here all enemies, regardless of subclass, would be using the same attack method when it's called. The WaterEnemy could not have its own, unique Attack Method.

```
using UnityEngine;
2 references
public class Enemy : MonoBehaviour{

    0 references
    int basicspeed= 12f;
    1 reference
    public static void Attack(){
        Debug.Log("Enemy begins attacking");
    }
}
0 references
public class WaterEnemy : Enemy{
    0 references
    int waterspeed = 10f;
}
```

How to use Dynamic Binding

- Two classes required for Dynamic binding: A superclass and subclass

- EX: Grandpa and Father.
-
-
-
-
-
-
- Static Type
- Dynamic Type

```
Grandpa func1 = new Father();
```

```
public partial class Grandpa {  
    public virtual void DoDynamic() { GD.Print($"Dynamic Grandpa"); }  
    public void DoStatic() { GD.Print($"Static Grandpa"); }  
}  
  
public partial class Father : Grandpa {  
    public override void DoDynamic() { GD.Print($"Dynamic Father"); }  
    public void DoStatic() { GD.Print($"Static Father"); }  
}
```

- To define a dynamically bound function, you must use the keyword “Virtual” this can be paired with the keyword “Override” to define when and what you would like bound dynamically.
- Dynamic binding is performed at run time, making it slower than static binding



05

Dynamic Binding Examples

```
using Godot;
using System;

public partial class Sprite2d : Sprite2D {
    public override void _Process(double delta) {
        SuperClass func1 = new SubClass(); // Dynamic binding
        SubClass func2 = new SubClass(); // Static Binding
        if (Input.IsActionJustPressed("move")) {
            func1.DoDynamic();
            func1.DoStatic();
            func2.DoDynamic();
            func2.DoStatic();
        }
    }
}

public partial class SuperClass : Sprite2D {
    public virtual void DoDynamic() { GD.Print($"SuperClass dynamic function"); }
    public void DoStatic() { GD.Print($"SuperClass static function"); }
}

public partial class SubClass : SuperClass {
    public override void DoDynamic() { GD.Print($"SubClass dynamic Function"); }
    public void DoStatic() { GD.Print($"SubClass static function"); }
}
```

What Will the
outputs be?

Outputs

```
using Godot;
using System;

public partial class Sprite2d : Sprite2D {
    public override void _Process(double delta) {
        SuperClass func1 = new SubClass(); // Dynamic binding
        SubClass func2 = new SubClass(); // Static Binding
        if (Input.IsActionJustPressed("move")) {
            func1.DoDynamic();
            func1.DoStatic();
            func2.DoDynamic();
            func2.DoStatic();
        }
    }

    public partial class SuperClass : Sprite2D {
        public virtual void DoDynamic() { GD.Print($"SuperClass dynamic function"); }
        public void DoStatic() { GD.Print($"SuperClass static function"); }
    }

    public partial class SubClass : SuperClass {
        public override void DoDynamic() { GD.Print($"SubClass dynamic Function"); }
        public void DoStatic() { GD.Print($"SubClass static function"); }
    }
}
```

SubClass dynamic Function
SuperClass static function
SubClass dynamic Function
SubClass static function

Grandpa Father son explanation

```
#include <iostream>
using namespace std;

class Grandpa
{
public:
    virtual void DoDynamic() {cout << "      Dynamic Grandpa" << endl;}
    void DoStatic(){cout << "      Static Grandpa" << endl;}
    void DoPartial() {cout << "      Partial Grandpa" << endl;}
};

class Father: public Grandpa
{
public:
    void DoDynamic(){ cout << "      Dynamic Father" << endl; }
    void DoStatic(){cout << "      Static Father" << endl;}
    virtual void DoPartial() {cout << "      Partial Father" << endl;}
};

class Son: public Father
{
public:
    void DoDynamic(){ cout << "      Dynamic Son" << endl; }
    void DoStatic(){cout << "      Static Son" << endl;}
    void DoPartial() {cout << "      Partial Son" << endl;}
};
```

```
int main() // On each blank line write the output produced by that line
{
    // As static Grandpa dynamic Grandpa
    Grandpa * pGrandpa1 = new Grandpa();
    pGrandpa1->DoDynamic();
    pGrandpa1->DoStatic();
    pGrandpa1->DoPartial();

    // As static Grandpa dynamic Father
    Grandpa * pGrandpa2 = new Father();
    pGrandpa2->DoDynamic();
    pGrandpa2->DoStatic();
    pGrandpa2->DoPartial();

    // As static Grandpa dynamic Son
    Grandpa * pGrandpa3 = new Son();
    pGrandpa3->DoDynamic();
    pGrandpa3->DoStatic();
    pGrandpa3->DoPartial();

    // As static Father dynamic Father
    Father * pFather1 = new Father();
    pFather1->DoDynamic();
    pFather1->DoStatic();
    pFather1->DoPartial();

    // As static Father dynamic Son
    Father * pFather2 = new Son();
    pFather2->DoDynamic();
    pFather2->DoStatic();
    pFather2->DoPartial();
}
```

Grandpa, Father, Son Answers

1. Dynamic Grandpa
2. Static Grandpa
3. Partial Grandpa
4. Dynamic Father
5. Static Grandpa
6. Partial Grandpa
7. Dynamic Son
8. Static Grandpa
9. Partial Grandpa
10. Dynamic Father
11. Static Father
12. Partial Father
13. Dynamic Son
14. Static Father
15. Partial Son

```
int main() // On each blank line write the output produced by that line
{
    // As static Grandpa dynamic Grandpa
    Grandpa * pGrandpa1 = new Grandpa();
    pGrandpa1->DoDynamic();
    pGrandpa1->DoStatic();
    pGrandpa1->DoPartial();

    // As static Grandpa dynamic Father
    Grandpa * pGrandpa2 = new Father();
    pGrandpa2->DoDynamic();
    pGrandpa2->DoStatic();
    pGrandpa2->DoPartial();

    // As static Grandpa dynamic Son
    Grandpa * pGrandpa3 = new Son();
    pGrandpa3->DoDynamic();
    pGrandpa3->DoStatic();
    pGrandpa3->DoPartial();

    // As static Father dynamic Father
    Father * pFather1 = new Father();
    pFather1->DoDynamic();
    pFather1->DoStatic();
    pFather1->DoPartial();

    // As static Father dynamic Son
    Father * pFather2 = new Son();
    pFather2->DoDynamic();
    pFather2->DoStatic();
    pFather2->DoPartial();
}
```

Unity Demo

Zachary Squires - Teal Team 6

What Do I Need For the Oral Exam?

Wow I'm so glad you asked, here is a video

[DynamicBindingShadowNew.mp4](#)



06

DEADLINES

Timeline

10/24: TL4 Weekly Status Report



11/10-15 ORAL EXAM WEEK

Be prepared with all team
lead deliverables!

10/29: TL6 Presentation

10/31: TL5 Weekly Status Report
and TL5 Deliverables due

11/07 TL6 Weekly Status Report

Thanks

Do you have any questions?

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