Artificial Intelligence

2024-2025

Subject: Artificial Intelligence

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Course: 2024 / 2025

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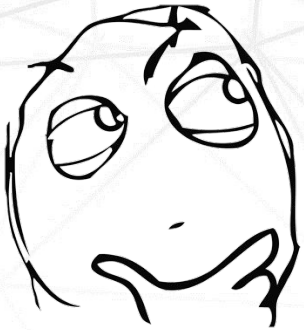
Be careful, don't send the emails with your questions to our old student email. Remember to check the correct email.

https://github.com/EjbejaranosAI/AI4VJ

Before starting… a brief quiz

Scan the code and go to mentimeter : 4171 8375

Introduction



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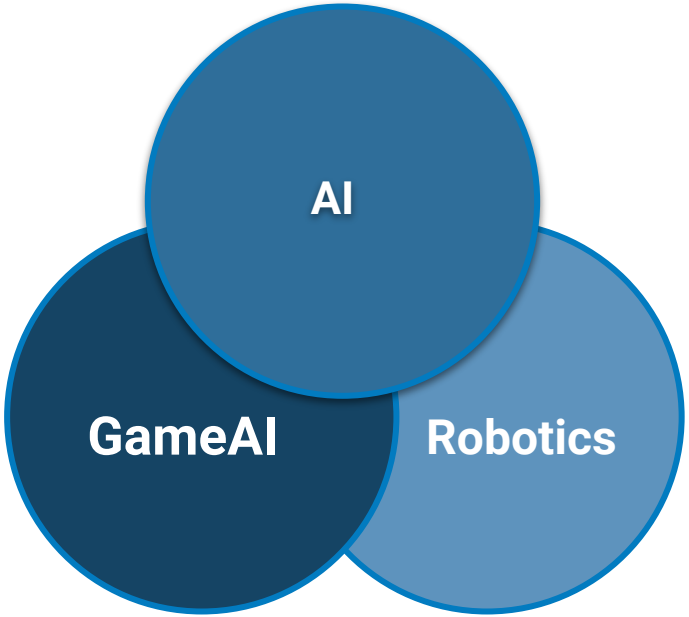
Context



Intelligence

- **Definitions**
  - Intelligence is the ability to generate complex thoughts, reason logically, plan ahead, store and retrieve information, learn from experiences, and recognize patterns. In essence, it's a set of cognitive tools that enable us to interact effectively and adaptively with our environment.

Intelligence

Artificial Intelligence

- **Definitions**
  - AI will be such a program which in an arbitrary world will cope not worse than a human.[Dimiter Dobrev-2004]

  - From a technological perspective, AI can be defined as "a collection of technologies that combine data, algorithms and computing power". This definition focuses on the technical components that enable AI systems.

  - From a capabilities perspective, AI is often defined as technology that enables machines to imitate various complex human skills. This views AI in terms of its ability to replicate human-like intelligence and behaviors.

Artificial Intelligence

- **Definitions**
  - From a functional perspective, AI can be defined as systems that "can sense their environment, comprehend the collected information, learn, and derive actions based on that information". This emphasizes AI's ability to perceive, reason, and act.
  - From a cognitive science perspective, AI is sometimes defined as "computer systems that reproduce human cognition using data which is accessed from a variety of different sources/systems to take decisions and/or facilitate actions". This links AI to replicating human cognitive processes.
- **Examples**
  - Play chess
  - Reading license plates
  - Weather forecasting

Impact of AI in Video Games

Impact of AI in Video Games

Artificial Intelligence

AI involves techniques that equip computers to emulate human behavior, enabling them to learn, make decisions, recognize patterns, and solve complex problems in a manner akin to human intelligence.

Machine Learning

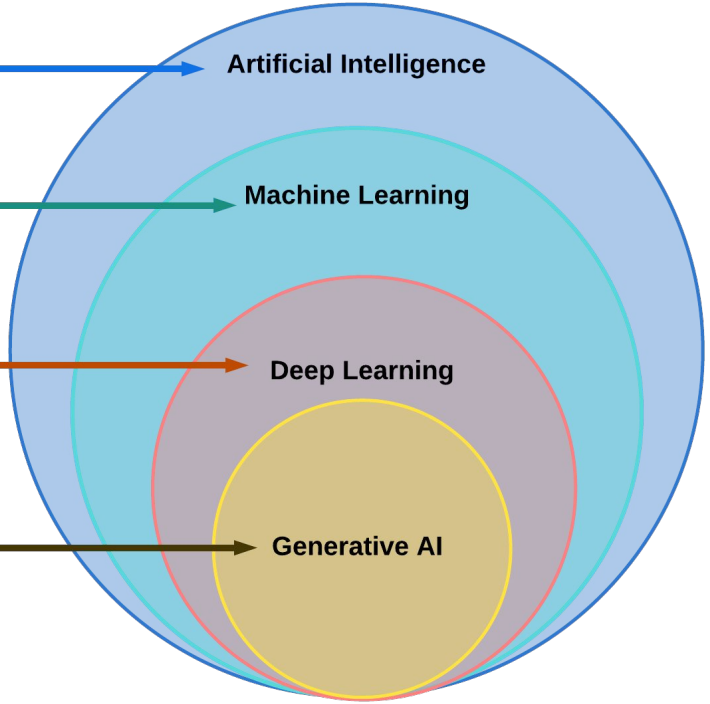
ML is a subset of AI, uses advanced algorithms to detect patterns in large data sets, allowing machines to learn and adapt. ML algorithms use supervised or unsupervised learning methods.

Deep Learning

DL is a subset of ML which uses neural networks for in-depth data processing and analytical tasks. DL leverages multiple layers of artificial neural networks to extract high-level features from raw input data, simulating the way human brains perceive and understand the world.

Generative AI

Generative AI is a subset of DL models that generates content like text, images, or code based on provided input. Trained on vast data sets, these models detect patterns and create outputs without explicit instruction, using a mix of supervised and unsupervised learning.

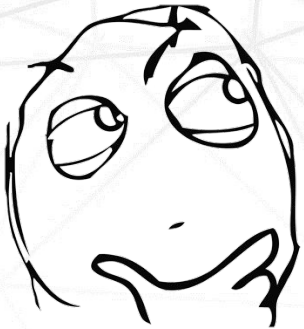


Unraveling AI Complexity - A Comparative View of AI, Machine Learning, Deep Learning, and Generative AI.

(Created by Dr. Lily Popova Zhuhadar, 07, 29, 2023)

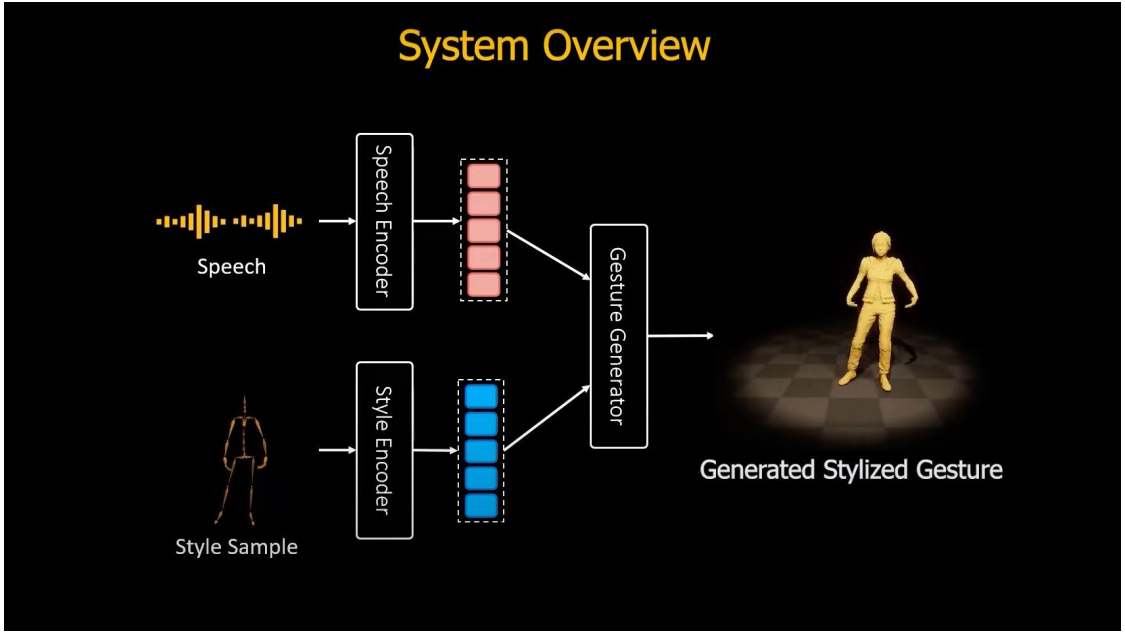
Overview

- Game AI
- Content & Evaluation
- Reference & Tools

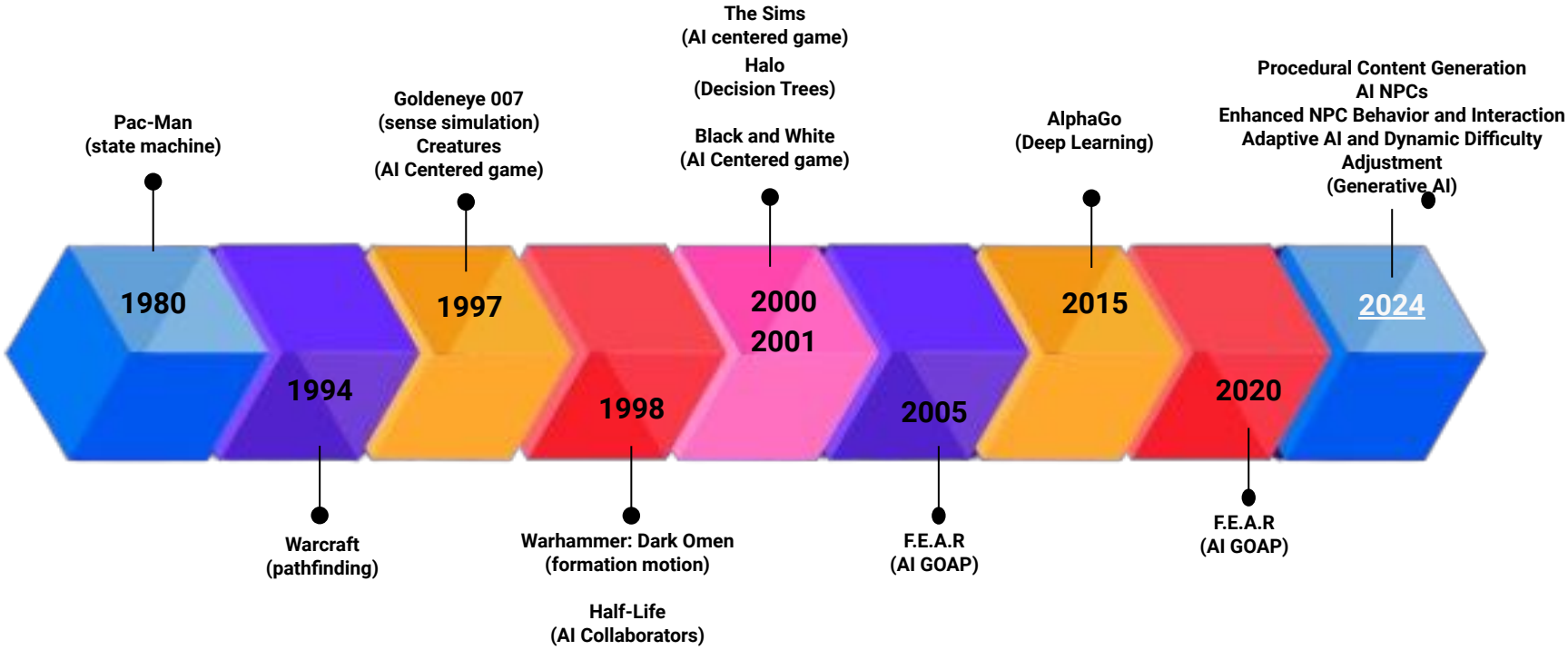


Game AI

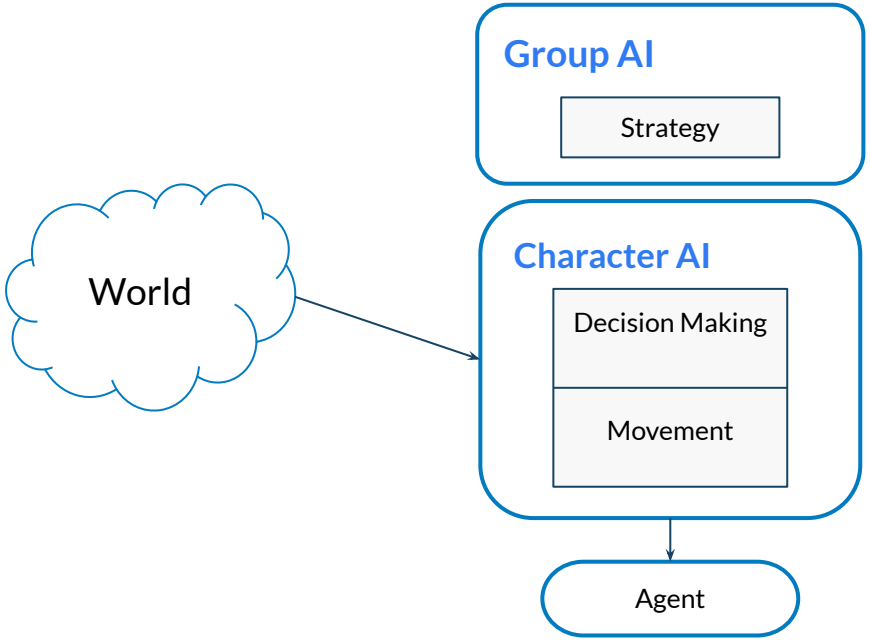
- **Definitions**
  - design agents that:
    - seems intelligent
    - nothing more
- **How**
  - movement
  - decisions
  - tactics



Brief History



Game AI Model



Game AI Properties

Building a game experience should be our main objective.

The complexity fallacy:

- Select always the simplest way to give the illusion of complexity
- Occam's Razor: the simplest explanation is most likely the right one

Perception window:

- Interaction with agents lasts a very short time.
- Try to avoid common sense behavioral changes

Memory & speed restrictions

Overview

- Game AI
- Content & Evaluation
- Reference & Tools

Roadmap

- **Main concepts:**
  - Movement (steering behaviours)
  - Planning for movement (pathfinding)
  - Decision Taking (behavior trees)
  - Machine Learning (neural networks and deep learning)
  - AI Game Design
  - **Generative AI(New topic this year)**
- **Goals:**
  - Game AI: common tools
  - Unreal & Blueprints

What we will learn?

- **Steering Behaviours:**
  - Wander & Hide
  - Flocking (enemy groups simulation)
- **Navigation Mesh & Pathfinding:**
- **World Interface (senses)**
- **Decision Making**
  - Behaviour Trees
  - Smart Objects & Planners
- **Group tactical movement and decision taking**
  - Tactical group movement & Blackboards for information sharing
  - Behavior Trees for group coordination

What we will learn?

- **Machine Learning:**
  - Deep Learning
  - Reinforced Learning

- **Generative AI:**
  - LLMs & Diffusion models

Evaluation

- **Competence 10%** : Questionnaires and small exercises in class
- **Follow-up exercises (Laboratory) 50%**,:
    1. Patrolling and Wander
    2. Flocking
    3. World interfacing and Knowledge
    4. Finite State machines
    5. Behaviour Trees (Behaviour Bricks)
    6. Machine Learning Exercise(Projectile Motion Regression)
    7. ML Agents I
    8. ML Agents II
    9. Tactical Behaviour Tree
    10. Extra labs:
        - Introduction to Python (Install, environments, main libraries)
        - Introduction to libraries(Os,Numpy, pandas, opencv)
        - Introduction of Keras and Use collaborative and GPUs
-

Evaluation

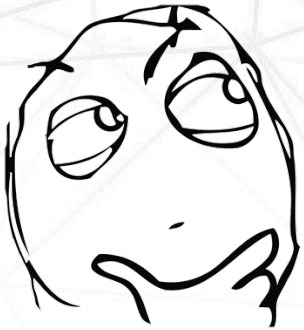
Final questionnaire at the end of each topic: 15%:

- Movement and Pathfinding
- World interfacing and Knowledge
- Decision Making
- Machine Learning
- Optimisation
- Strategy and Tactics
- Designing Game AI

Final Project 25% (in group of two): Develop a scene with multiple agents using the techniques learned in class. The project brief will be published in mid-November

Overview

- Game AI
- Content & Evaluation
- [Reference & Tools]



The future of video games will also be centered around artificial intelligence.

Link: https://gamengen.github.io

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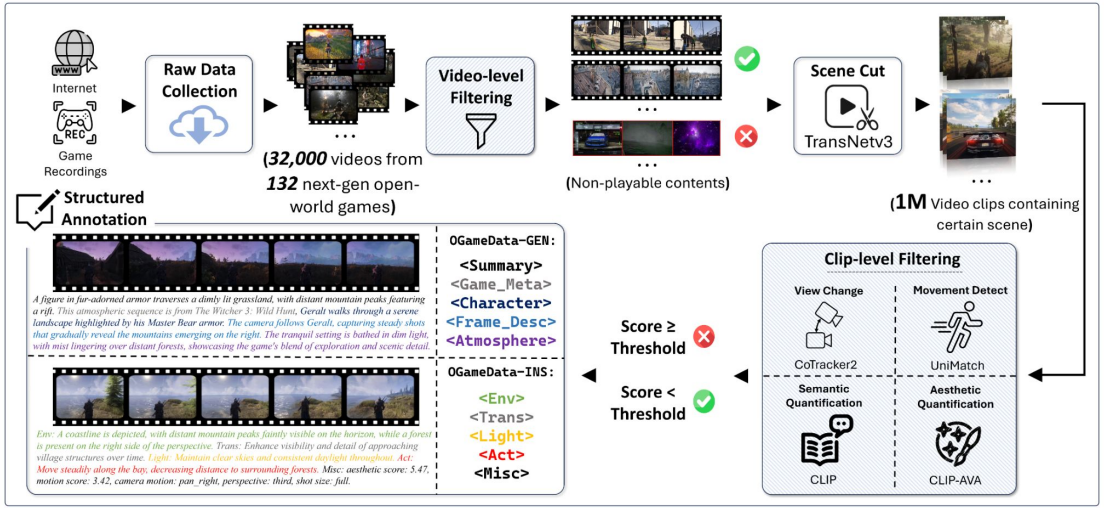


GameGen-O

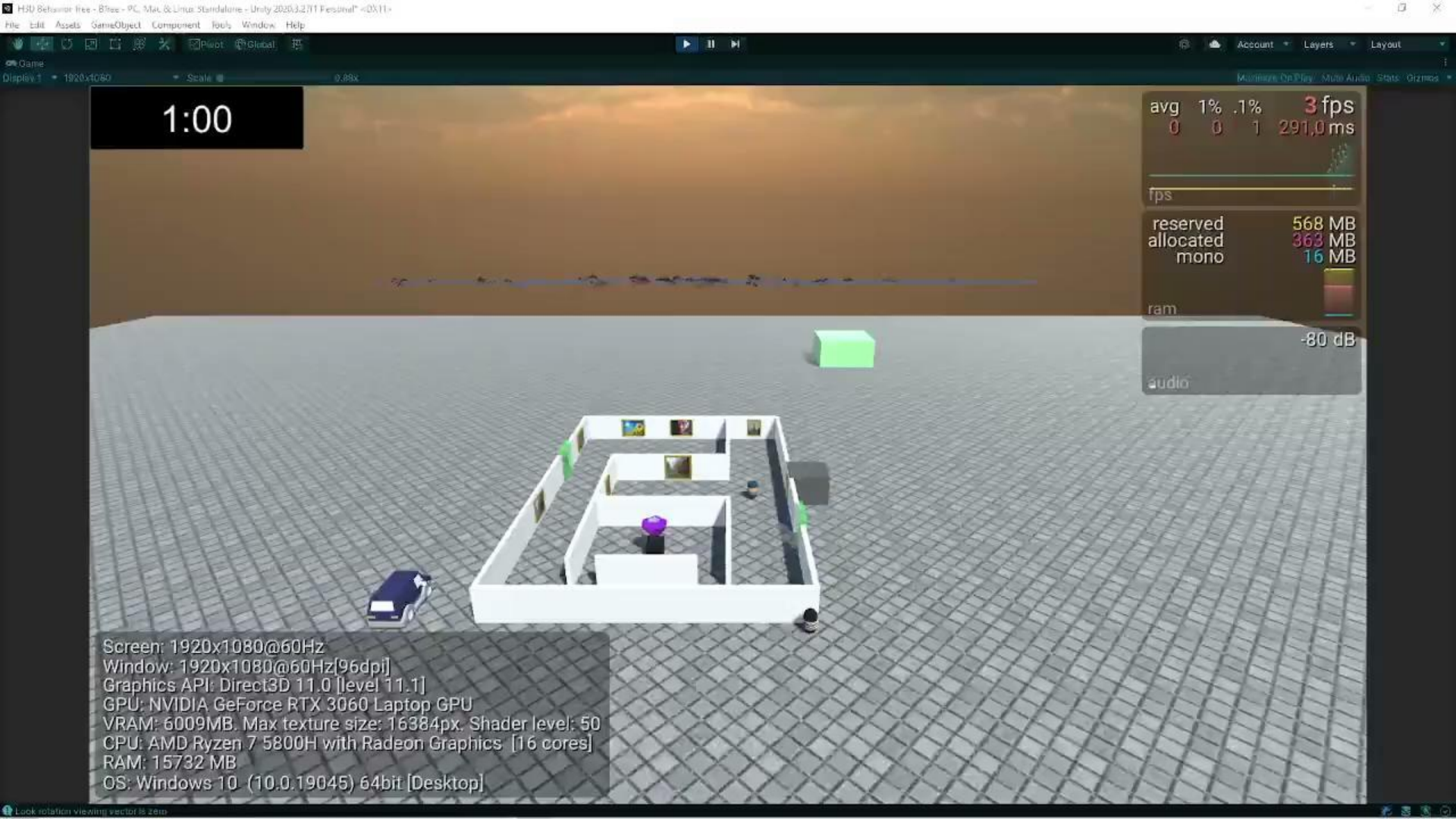
Link: https://gamegen-o.github.io

Software installation

- Python 3.11
- Jupyter notebooks in VSCode
- (optional) Test if you can use Google Colab
- (optional) Install Pip to install new packages

Introduction Lab

Link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fps
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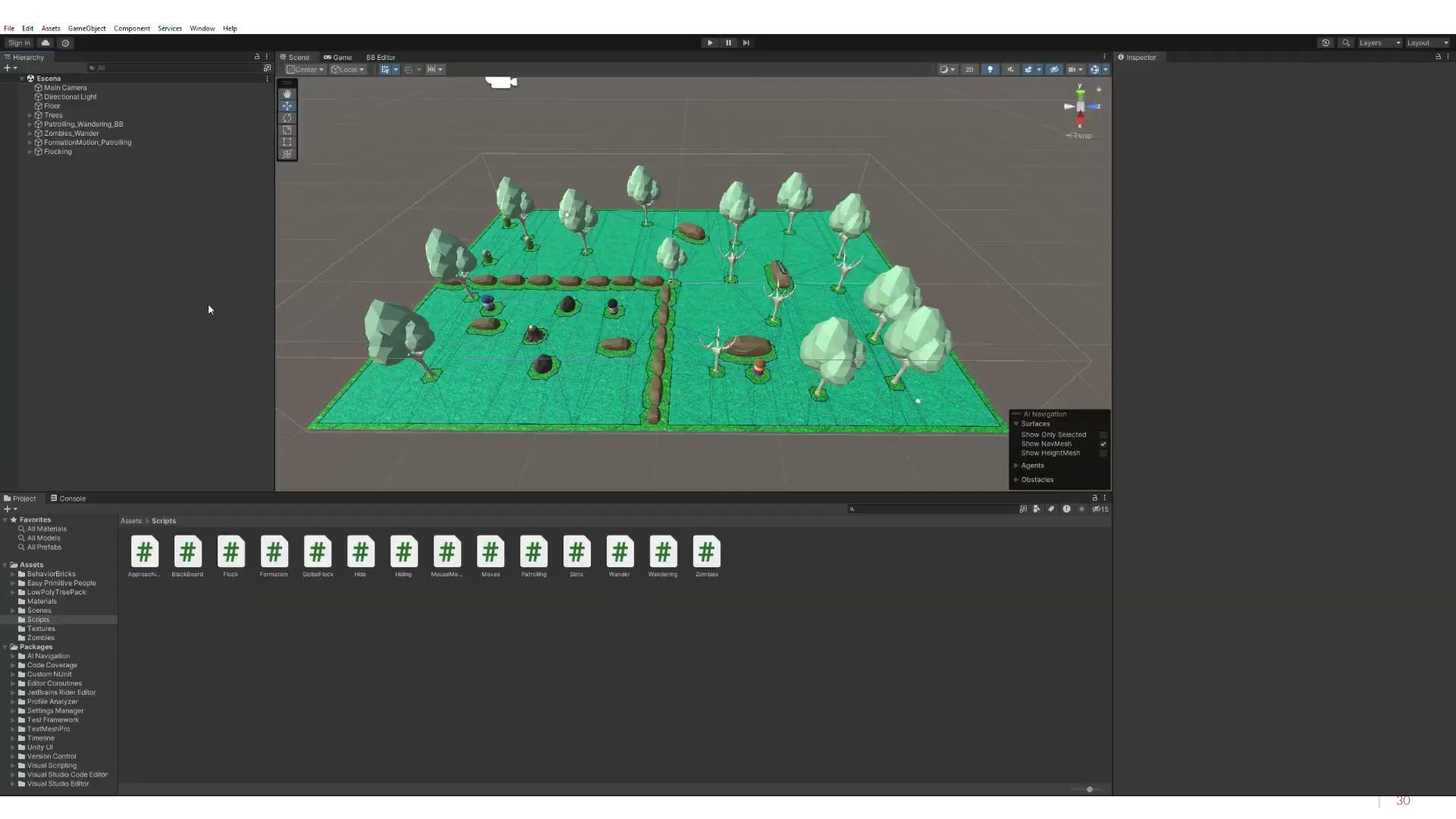
ram
-80 dB
audio
Screen: 1920x1080@60Hz
Window: 1920x1080@60Hz[96dpi]
Graphics API: Direct3D 11.0 [level 11.1]
GPU: NVIDIA GeForce RTX 3060 Laptop GPU
VRAM: 6009MB. Max texture size: 16384px. Shader level: 50
CPU: AMD Ryzen 7 5800H with Radeon Graphics [16 cores]
RAM: 15732 MB
OS: Windows 10 (10.0.19045) 64bit [Desktop]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Directional Light
Floor
Trees
Patrolling_Wandering_BB
Zombies_Wander
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Scene
Game
BB Editor
Persp
AI Navigation
Surfaces
Show Only Selected
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Agents
Obstacles
Inspector
Project
Console
Assets
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Wandering
Zombies
Favorites
All Materials
All Models
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Assets
BehaviorBricks
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LowPolyTreePack
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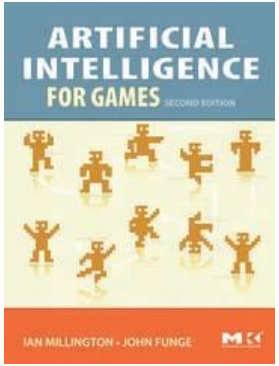
Scenes
Scripts
Textures
Zombies
Packages
AI Navigation
Code Coverage
Custom NUnit
Editor Coroutines
JetBrains Rider Editor
Profile Analyzer
Settings Manager
Test Framework
TextMeshPro
Timeline
Unity UI
Version Control
Visual Scripting
Visual Studio Code Editor
Visual Studio Editor

References

- **Books**
  - Ian Millington. *AI for Games (3rd ed)*. CRC Press, 2019.



- **Tools:**
  - **Unity (Personal Edition)** **Colab** **Hugging Face|**

Unity Colab Hugging Face