HW1 – Develop a VE with autonomous virtual humans

- HW1 asks you to use what you have learned in week 1~5 to develop a virtual environment in which the user is surrounded by virtual humans with autonomous behaviors.
- Due: Next class meeting
- Upload ppt to Teams

The virtual human – Unity's Ragdoll

- Explain the 16 body parts of Unity’s Ragdoll model
- Show that the geometry (shape) of a bp is defined in the bp-mesh object

The virtual human – Unity's Ragdoll

- Explain following components of the bp object:
  - Rigid body
  - Collider
  - Configurable joints
  - Ground contact script

Unity's Ragdoll – State representation

- Explain the 243 values in the state representation

Unity's Ragdoll – Actions

- Explain the 39 actions to control the ragdoll model

Autonomous behavior controlled by a NN

- The virtual human will walk toward a dynamically placed goal
- The autonomous behavior is controlled by a NN trained with RL

Train the behavior-control NN using RL

- Show how to use the RL algorithms (either SAC or PPO) provided by Unity ML agent package to train the NN
- Train only 10K steps

Read csv file to dynamically generate virtual humans

- Add a script to read a csv file which defines the no. of virtual humans and their walking speeds to dynamically generate virtual humans in the VE

Enhance Unity's Ragdoll model to create our own virtual human

- Unpack Unity’s Ragdoll pre-fab
- Add image display
- Add score display

Our customized virtual human model

- Write a script to collect rewards and display the score

Our customized virtual human model

- Create pre-fabs

Add first-person controller

- The user is immersed in the VE using first-person perspective

Publish stand-alone exe

- Demo your metaverse with a video

Discussion

- Describe the two important characteristics of the VE developed in HW1: AI-generated and cyber-physics integration
  1. Cyber-physics integration – If the csv file contains information about the real-world situation, then the VE developed in this HW is a simple version of the so-called “digital twin” or “cyber-physics integration”.
  2. AI-generated – the virtual humans in the VE have autonomous behavior controlled by a NN trained with RL

Future research – Metaverse development

- AI-generated and cyber-physics integration are two important characteristics (other than Web3.0, block chain, NFT,…) that distinguish metaverse from VE or games
- The VE developed in HW1 could be extended to develop a metaverse in the future