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| **Synthetic Data Challenge** | | |
| 130\_Recruitment | Date: | 17/05/2022 |
| Performed by: | Vlad Catalin Savenco |

A picture containing tray, tableware, dishware

Description automatically generated

# Introduction

“95% of Machine Learning lays in Data”. We have the same belief. But to get the right data is 99,9% of time. This challenge deals with a small part of this mammoth task. Specifically, it deals with creating randomized environments that can be used to simulate real-world scenarios, or generate synthetic data, further used for training Machine Learning models.

Recommended time limit: ~ 8 hours

# Challenge Description

In this challenge you must combine your creative and coding skills in order to create randomized virtual environments.

Your mission, shall you choose to accept it, is to create a virtual room in a game engine of your choice that must contain, at minimum:

* Walls, windows, and a door (the usual suspects in a room)
* 2 different chairs
* A table
* A plant on the table
* A mug on the table
* Anything else you consider necessary

Feel free to take these objects from any public place, no need to design anything.

Then, using code, you must randomize the above mentioned such that at least 10,000 different variations of the above mentioned can be created. The versions must vary in:

* Position of objects/camera
* Lighting + optionally, weather
* Textures of objects
* Optionally, types of objects – for example you can change the type of chairs in some variations, but again, by code

An important condition is that all variations must be “realistic”. This means:

* No flying mugs or plates, all must sit on the table
* No objects blocking the door
* Anything else that you wouldn’t normally find in your house

Make sure to export the renders in a user-friendly format, so that we can access and review them :).

You are free to extend the environment, add more objects, etc. Showcase your skills and passions.

## A dining room table with chairs Description automatically generated with low confidence

## Recommendations for chapter 3

- You are free to use any software/resources available online. The internet is your friend.

- Write down ideas, thoughts, issues you had and how you overcame them - be brief and on point

- What different solutions are available and why some were chosen over others

- Extra points for well documented research & code

- Track your time

At the end, send this document with chapters 3 and 4 filled in, and any other code/video/image/links - using a service such as [WeTransfer](https://wetransfer.com/) if needed, or a single .zip archive to [octavian@dotlumen.com](mailto:octavian@dotlumen.com) and [cornel@dotlumen.com](mailto:cornel@dotlumen.com) with the subject "[SD Challenge] Firstname\_Lastname". Feel free to add your comments in the email.

**Have fun!**

# Implementation

I have started the task by creating a well detailed schematic of what I wanted to achieve with my generator. Unfortunately in the 8 hours of time I was not able to achieve all the goals I have set.

How does the generator work:

* It spawns a floor asset.
* The floor will spawn 4 walls surrounding it, making sure that there is at least a wall with a window and one with a door. It also set the texture of the walls to a random one available.
* The floor will also spawn a table in the middle of the room and set its texture randomly.
* The table has access to 6 spawn points for chairs and it will use anywhere between 2 to all 6 to generate chairs and will set them to a random texture.
* The table also has access to 6 spawn points for plates, and can spawn anywhere between 0 to 6, and it has 2 spawn points for plants and 3 for mugs, and will spawn one of each.
* All the prefabs and materials are stored in 2 scriptable objects, data structures that allow for easy customization in engine.

How does the image generator work:

* It generates a room.
* It creates a folder with the name of the room.
* It generates 50 pictures in that room.
* It deletes the room.
* It repeats indefinitely. (this is a bug…..like it will not stop….there is an int that counts all the generated rooms, when that reaches max it will crash).

Considerations:

* I wanted to have all the objects spawn on the surfaces of other objects instead of having spawn points, but I ran into some issues and because I wanted to fit everything in 8 hours I decided to give up on that. ( the chairs would spawn close to the table on the floor, the items on the table would spawn randomly on the surface of the table, all of this would happen using surface normal on collisions to make sure objects do not intersect).
* I wanted to have more items generated such as sofas/ tvs/ paintings/ bookshelfs/ lamps/ and even simulate different times of day.
* I was unable to find actual modular walls/ tables/ chairs that didn’t require some sort of modification so I quickly made some in Blender in such a way that any texture would look ok on them (more or less).
* With a bit more time I would have made the assets load from folders or even in the application, offering more customization to the generator.
* The camera has some issues and sometimes clips through objects.

# References

***Materials:***

All materials used have been taken from: <https://opengameart.org/>

***Models:***

Mug model: <https://sketchfab.com/3d-models/plain-mug-19c8fe5702b544d0a1409d3dac1cf90e>

Plate model: <https://sketchfab.com/3d-models/assietteplate-5166f44ef6ca4d298a497acdf9b38a58>

Plant model: <https://sketchfab.com/3d-models/potted-plant-83986836419445edb3e507b9eb0c786b>

***Tutorial:***

Tutorial on how to take a Screenshot in Unity: <https://www.youtube.com/watch?v=lT-SRLKUe5k&t=144s>