

Weekly Report (4.28–5.04)

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1 Task Description

- a) Find a proper field or topic for project of this course.
- b) Do some research of the proposed field/topic.

2 Task Progress

- a) Find a topic

By far, I still have not been given a field to research by my director, and since the project requirement said that: "The project must include a significant programming component of computer graphics techniques", and my major (or my director's research topic) is heavily on Computer Vision, this project can possibly do benefit to my future work.

I have wanted to try some DL tools and never put it into action, mostly because I am too lazy and the other reason is that I have not found a nice scenario to apply this tech. There seems a rise in research of **synthetic dataset and tools for computer vision**. The main reason is that dataset of real world can be hard to obtain and processed for usage. And some scenario can be expensive to produce in real world, for example, car accident on the road for a self-driving car dataset.

Depending on the application, collecting large datasets can be very difficult. Often the limiting factor, especially in datasets of images, is annotating the images with ground truth labels.

-- Using Virtual Worlds, Specifically GTA5, to Learn

So, many researchers are trying to apply ML/DL/RL tech to train and experiment on the synthetic dataset and apply on the real world data (or something like this, I have not inspected too much). So the only problem left now is how to synthesize these data, there are many attempts and some of them seem appealing.

So my project is to ingest these possible ways to make synthesis dataset and do some simple experiments of them. Hopefully, the things learned here can be useful for my future work, and I think the chances are pretty high.

As stated, my proposal project name is **A survey of ways to synthesize data (images) with Simulation Software**.

- b) Some research of synthesis methods.

The results are shown in part 3 -- existing solutions.

3 Existed Main Problems and Solutions

There are three main fields about the intended project:

- 1) Physics Simulations, like Bullet, Havok, MuJoCo, ODE and PhysX, etc
- 2) Game Engines, like Unity3D, Unreal, cocos2d-x, godot and so on
- 3) Closed Games with API for developer, like GTA V

The first one can be part of the second one, and for **synthesis images** the second and third can be more appealing since they provide abundant images of various types.

4 Working Plan for Next Week

Try some of the physics simulations and game engines, the prospective ones are MuJoCo, Unreal and GTA V.

REFERENCES

Since most of my references are links on the internet, I just list the links instead of use the more official cite format.

- [1] Using Virtual Worlds, Specifically GTA5, to Learn Distance to Stop Signs, http://orfe.princeton.edu/~alaink/SmartDrivingCars/DeepLearning/GTAV_TRB_Final.pdf
- [2] Learning Physical Intuition of Block Towers by Example, <https://arxiv.org/pdf/1603.01312.pdf>
- [3] Games engines, <https://github.com/showcases/game-engines>
- [4] MuJoCo, <http://www.mujoco.org/index.html>
- [5] OpenAI, <https://openai.com/>
- [6] OpenAI gym, <https://github.com/openai/gym>
- [7] UETorch , <https://github.com/facebook/UETorch>
- [8] DeepGTAV , <https://github.com/ai-tor/DeepGTAV>
- [9] synthetic-computer-vision , <https://github.com/unrealcv/synthetic-computer-vision>
- [10] unrealcv , <https://github.com/unrealcv/unrealcv>
- [11] udacity/self-driving-car, <https://github.com/udacity/self-driving-car>