

EE/CprE/SE 4910 WEEKLY REPORT 6

10/17/24 – 10/24/24

Group number: 40

Project title: 3D Gaussian Splatting With Dynamically Raytraced Lighting

Client: Jackson Vanderheyden & Brian Xicon

Advisor: Simanta Mitra

Team Members/Role:

Ethan Gasner - Documentation Manager.

Kyle Kohl - Communication Manager.

Jackson Vanderheyden - Graphics Scope Manager.

Brian Xicon - Machine Learning Scope Manager.

Luke Broglio - Schedule Manager.

- **Weekly Summary:** This week we collectively continued to work on our design document, specifically the requirements portion of the document. The Machine learning Team discussed problem formulation further for the Gaussian Point Optimization “ironing out” the details for this as well. The Graphics Team worked on the ray tracer architecture in Unity by laying out the command buffer and started working on a 3D Gaussian file parser for Unity.
- **Past week accomplishments**

Ethan Gasner: I analyzed the data sets discovered during the previous week or so and started the formulation of our machine learning problem and how we will tackle the gaussian points. As of now the best/ most feasible solution is still the initially suggested Stochastic Gradient Descent. Neural networks were considered, but are most likely not necessary.

Kyle Kohl: I learned about shader, blending, and texture basics in Unity and how we will be implementing them for our project. I also learned how to incorporate a simple camera, spheres, surface normals, antialiasing, and diffuse materials in a raytracer.

Jackson Vanderheyden: I finalized the Context and Techniques document (18pgs), which includes all necessary resources, project context, math equations, and algorithms needed to complete the ray tracer and ML. I have created all of the compute shader files and created a command buffer that calls each stage of the rendering pipeline. I also did code review for Luke’s Merge Request

(MR).

Luke Broglio: This week I have been working on creating a .ply file which can store Gaussians for our system. Because .ply files are different based on the elements defined in the header our system needs a consistent header capable of describing the 3D Gaussians. Once I completed the header I wrote a parser in C# which can read in the 3D Gaussian files and store them as C# objects so they can be used within Unity. I also started a shader which displays Gaussians read in from the .ply files for demo purposes. [A merge request with my changes for reference.](#)

Brian Xicon: This week I collected some of the necessary datasets we will be using for this project and listed them in a folder under our machine learning folder in the repository. I also researched a lot more on the tactics for achieving our Gaussian Point Optimization problem. Lastly, I created the necessary key to access our repository.

○ **Individual contributions**

<u>NAME</u>	<u>Individual Contributions</u>	<u>Hours this week</u>	<u>HOURS cumulative</u>
Ethan Gasner	Constructed the optimization problem involving the gaussian point allowing for prototyping.	6	36
Kyle Kohl	Researched compute shaders, blending, and textures techniques and how to apply them to our project. Learned more about general computer graphics. I also gained access to the repository.	6	36
Brian Xicon	Gained access to the repository, collected necessary datasets and listed them in folder, Researched more on the tactics for achieving our Gaussian Point Optimization problem.	6	36
Jackson Vanderheyden	Finalized the Context and Techniques document, created all compute shader files, and linked them using a command buffer. Did code review for Luke's MR.	6	36
Luke Broglio	Designed the header for .ply files which store 3D Gaussians, wrote a parser for the files to read them into our Unity project, started a shader which displays the read in Gaussians in 2D for demo purposes.	6	36

- Plans for the upcoming week

Ethan Gasner: In this upcoming week I plan to officially formulate the Gaussian point optimization problem in collaboration with the other Machine learning individuals and get it added to the appropriate documentation. Then similarly to last week, I will explore problem formulation for the material predictor using the optimized Gaussian points.

Kyle Kohl: This upcoming week I plan to learn more about general graphics, specifically Normal maps, tangent space, SDFs & lighting. After that I will see what it takes to create a unity package and then list it in the Unity Asset Store. Lastly, I will research a way to run pytorch models in Unity. If I have time, I would like to learn the basics of BVH and how to incorporate it in a raytracer.

Jackson Vanderheyden: This week, I plan to finish the primary ray generation compute shader before our demo with Mitra (Tuesday). If time allows for it, I will also implement a basic ray-triangle collision and coloring before the demo. Once the basics are done, BVH and incorporating a Gaussian file will be the next steps.

Luke Broglio: This upcoming week I am going to finalize the 2D demo Gaussian render before our meeting with professor Mitra on Tuesday. After that I will create a second iteration of the Gaussian .ply file and parser which is capable of storing the relightable 3D gaussians which will be produced by our machine learning model and used by the raytracer.

Brian Xicon: This week, I hope to be able to begin the construction of our Gaussian point optimization problem.

- Summary of weekly advisor meeting

No Advisory meeting this week. See previous weekly report.