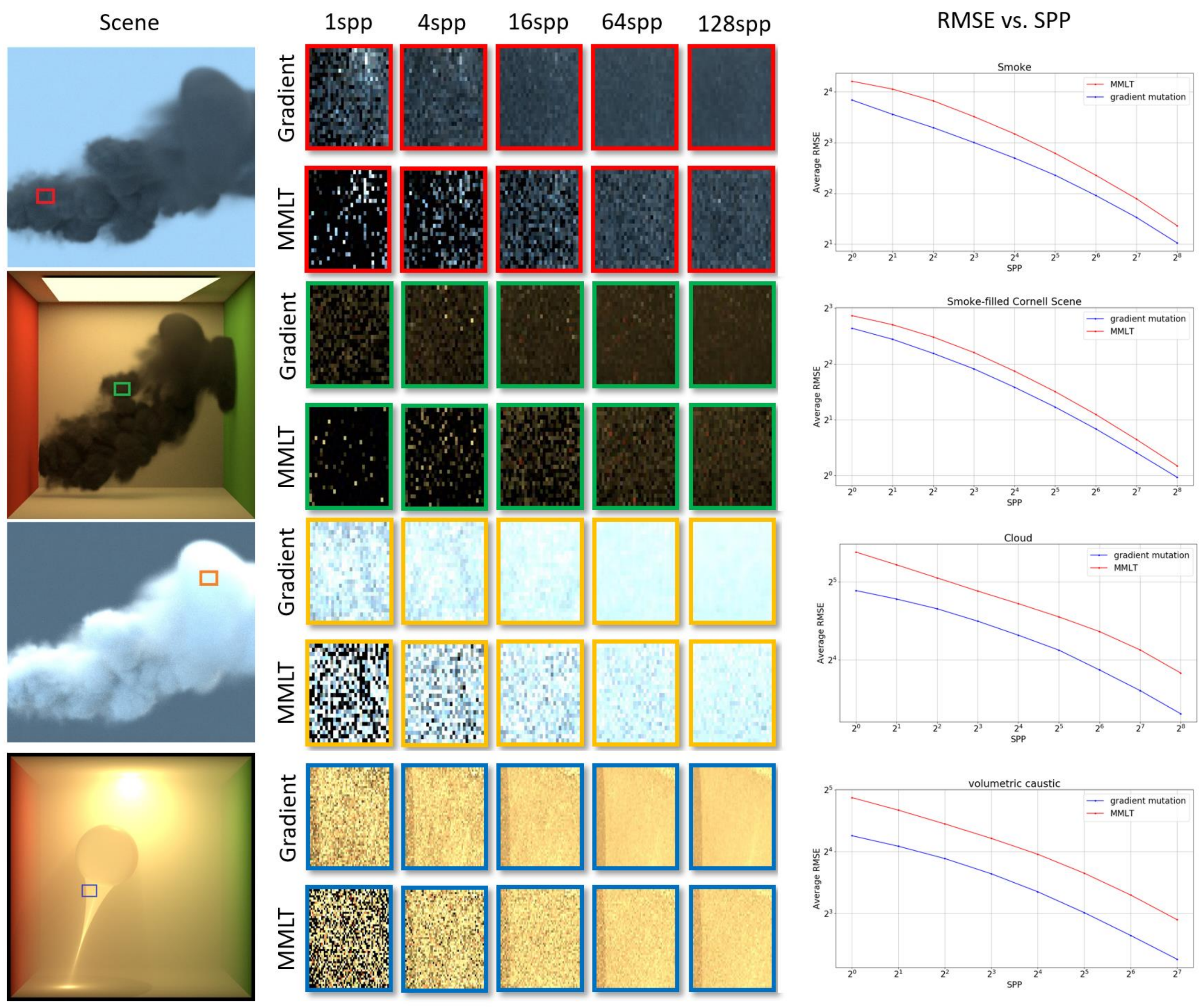
(Peter)G.Lu

Project portfolio

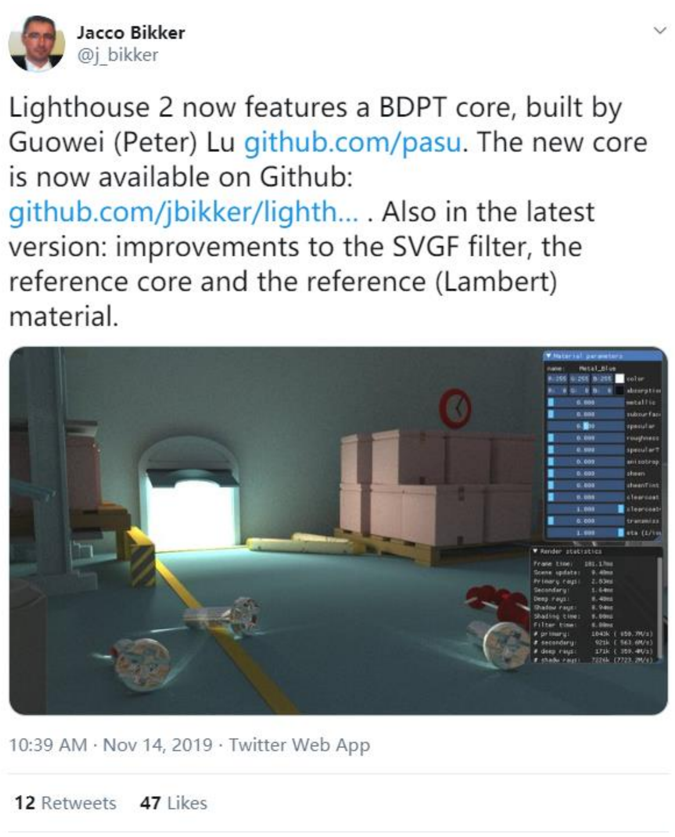
Master's thesis project
Gradient-Domain Volume Rendering



We compute the path-space gradient of one light path with respect to one vertex in the medium; then, we design a strategy to generate correlated paths in MMLT and use this gradient algorithm to estimate the contributions. We can do so with limited computation, as we avoid the expensive construction and radiance evaluation of entirely new paths.

GitHub PDF Slides

Small project
Streaming BDPT based on Light House 2



Jacco Bikker
@j_bikker

Lighthouse 2 now features a BDPT core, built by Guowei (Peter) Lu github.com/pasu. The new core is now available on Github: github.com/jbikker/lighth... . Also in the latest version: improvements to the SVGF filter, the reference core and the reference (Lambert) material.

10:39 AM · Nov 14, 2019 · Twitter Web App

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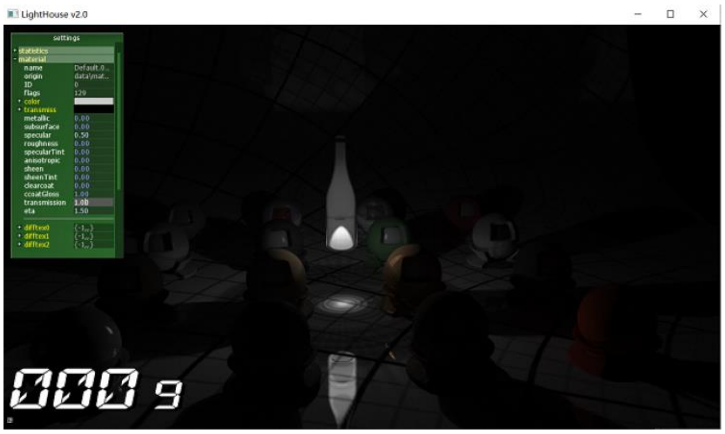
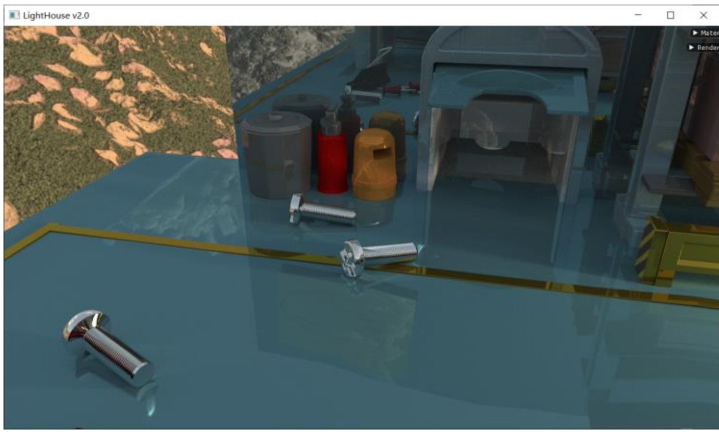




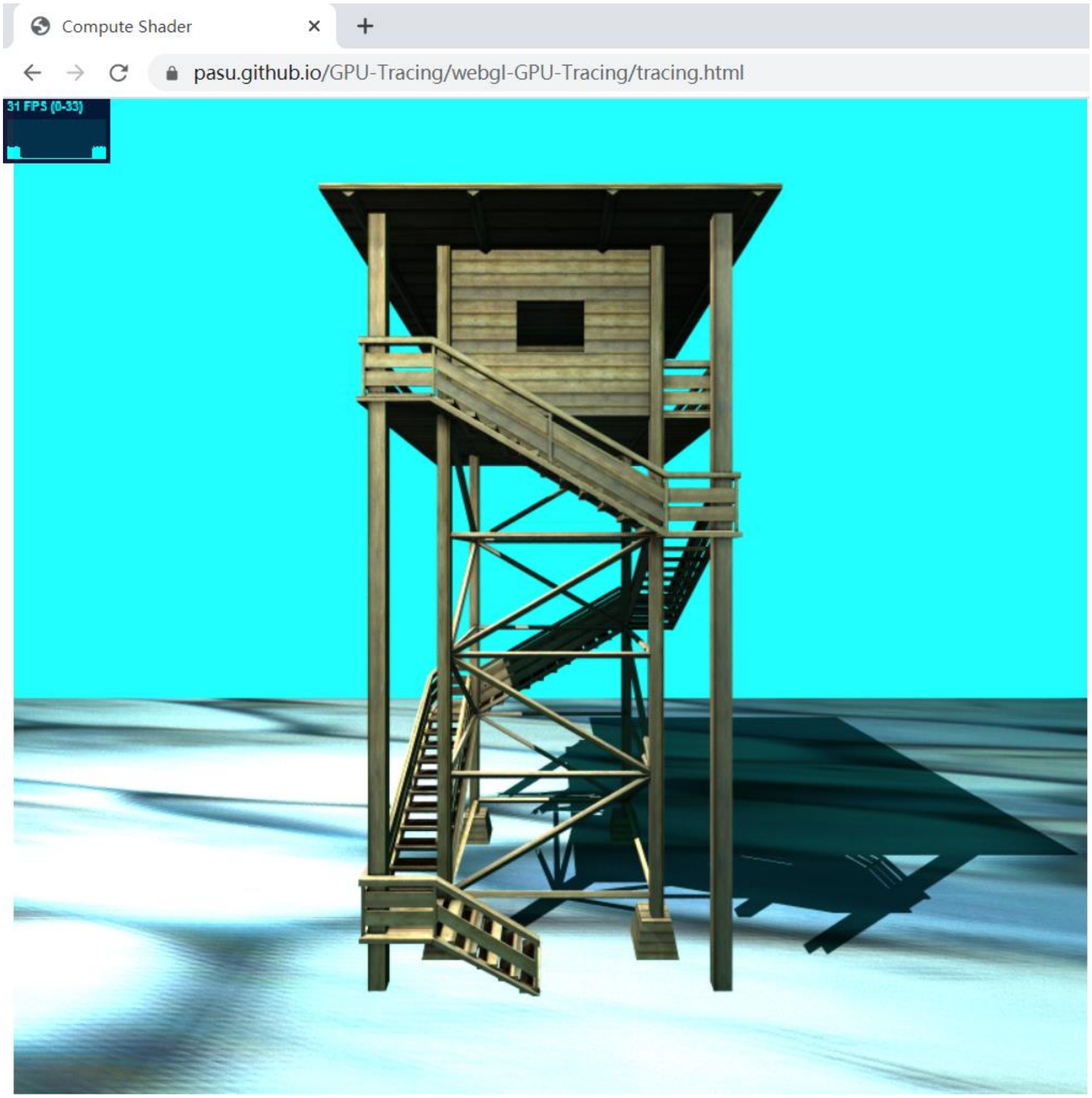
Light House 2 is a rendering framework for real-time ray tracing. I built this streaming BDPT render system, which can handle difficult lighting setting such as caustic and non-symmetric scattering situations including refraction and shading normal.

Major skills include:

- C++
- CUDA
- OptiX
- Wavefront
- Batching Ray for visibility test

GitHub PDF Video

Path Tracing (GPU&WebGPU)
C++/JS/Compute Shader



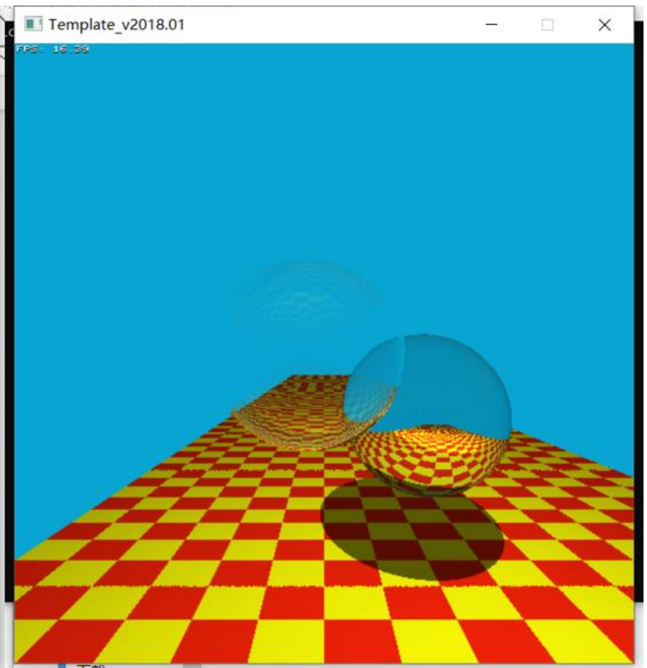
A path tracing toy written in C++ and JS. Uses computer shader. You can build the BVH of the scene and save it as binary on the desktop, then, load this binary and view the scene interactively on the Browser which supports WebGL 2.0 Compute. It supports wavefront and megakernel.

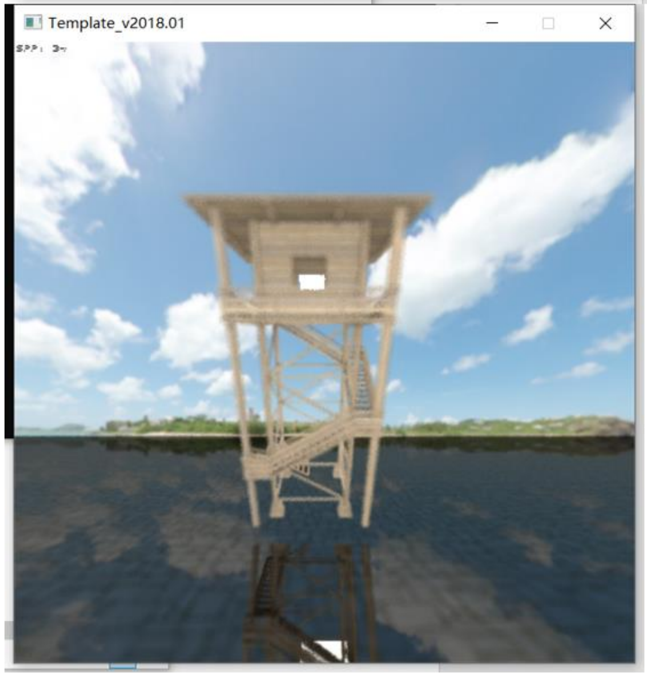
GitHub   Demo

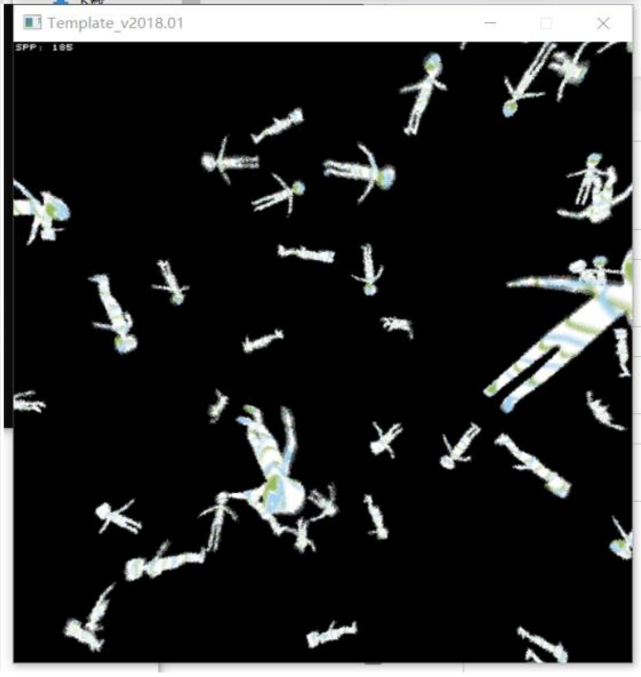
Path Tracing (CPU)

C++

Template_v2018.01







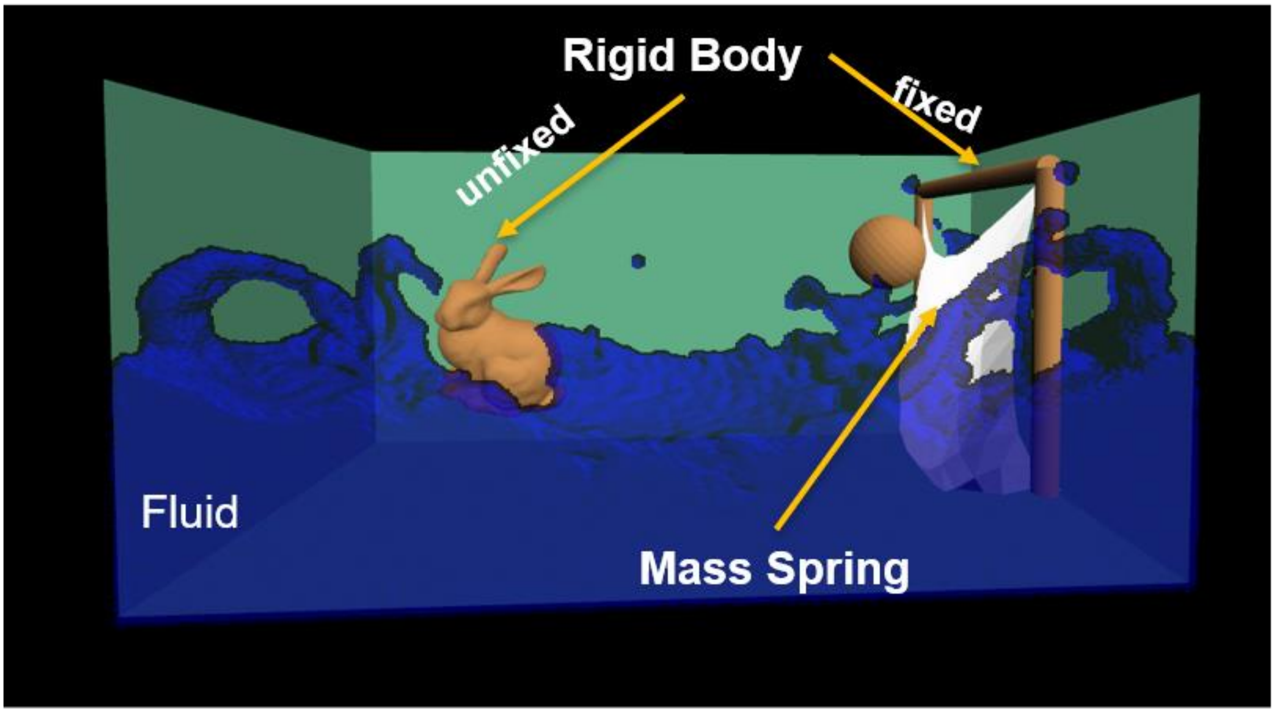
A fully featured ray tracing, which is the assignment of the Advanced Graphics. Major features are:

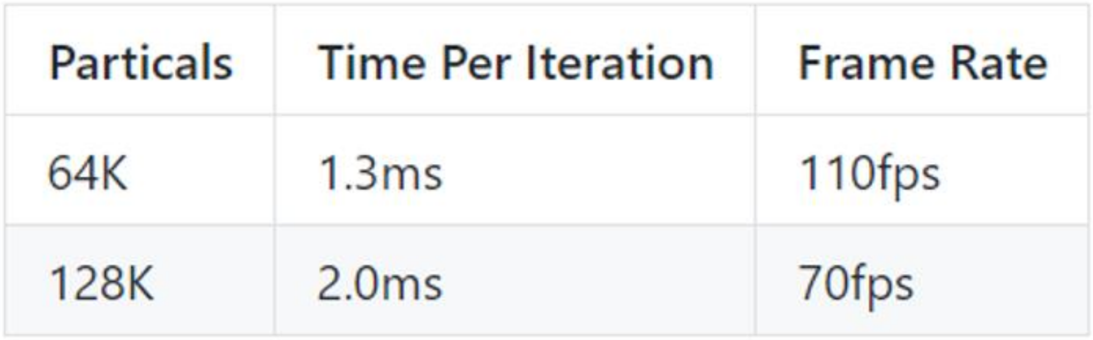
- BVH (SAH + Top-Level + SIMD Intersection)
- NEE+MIS, Photon Mapping (Simple), Ray Packets
- Depth Field, Motion Blur
- Multithreading, Filter

GitHub Video

Position Based Fluid Simulation

C++/Compute shader/OpenGL





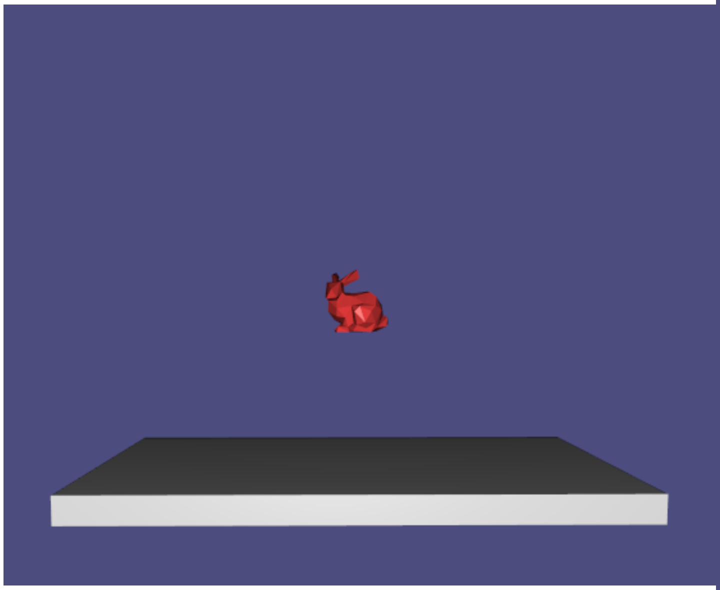
Particals	Time Per Iteration	Frame Rate
64K	1.3ms	110fps
128K	2.0ms	70fps

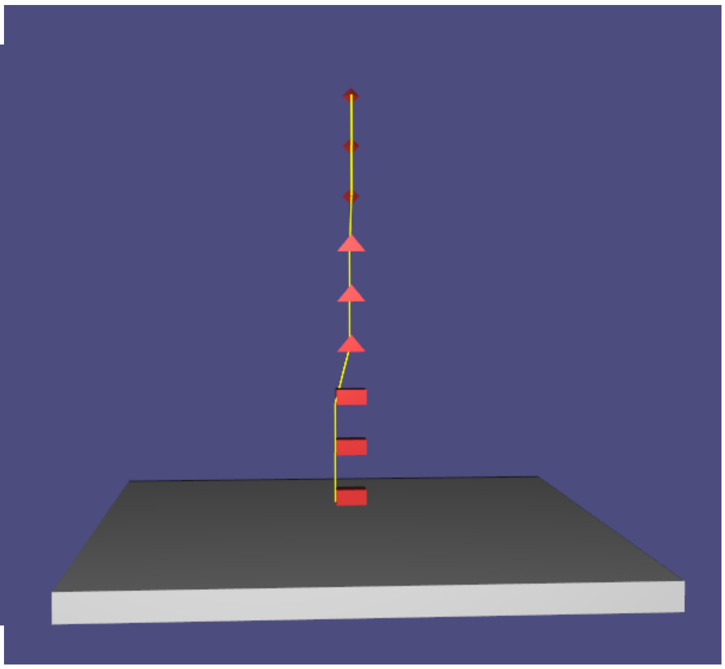
Fluid simulation is the Mini-project of the course 'Game Physics', which was inducted into the **Game Physics Hall of Fame** (2nd place). The key idea is enforcing incompressibility using position constraints. It includes fluid-rigid body, fluid-cloth interaction and fluid surface reconstruction.

GitHub   Video

Rigid and Soft Body Simulation

C++





This is the assignment of the course 'Game Physics'. It includes three parts:

- Rigid bodies and collision
    - multiple interpenetrations and collisions
    - impulse-based collision resolution
- Constraints
- Finite-Element Soft-Body Deformation

Rigid bodies and collision: GitHub

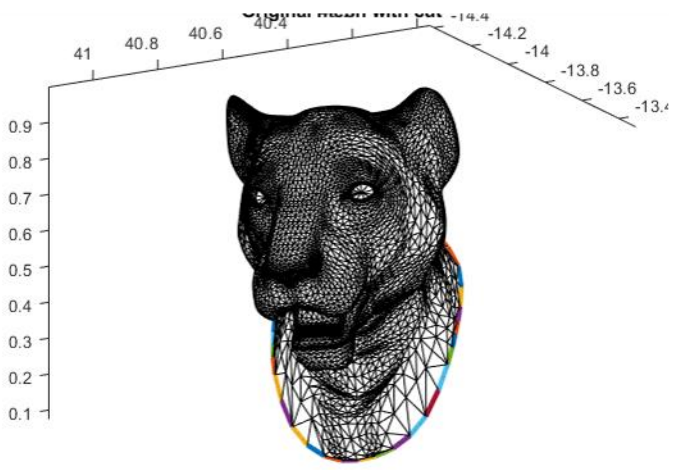
Constraints : GitHub

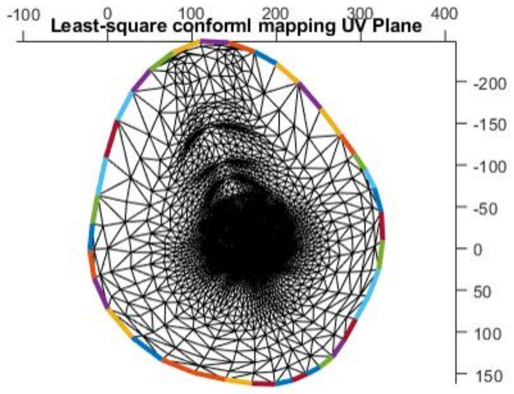
Soft-Body Deformation: GitHub

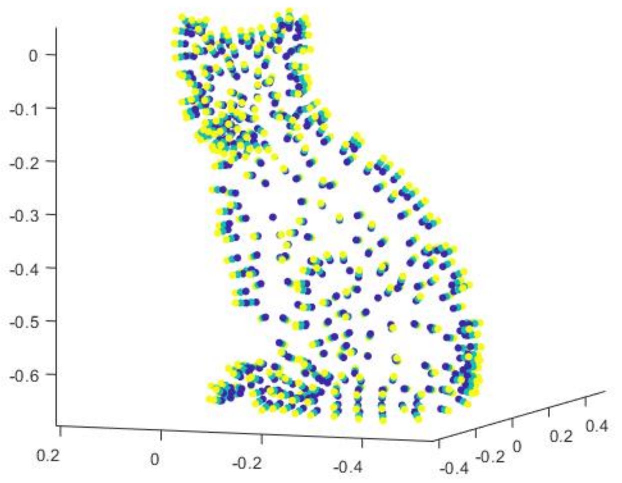
Video

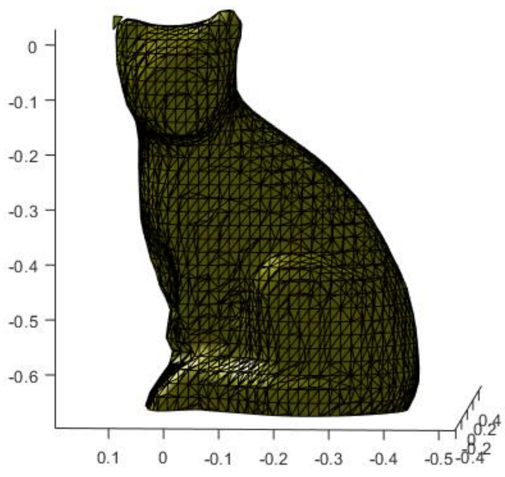
3D Model

matlab





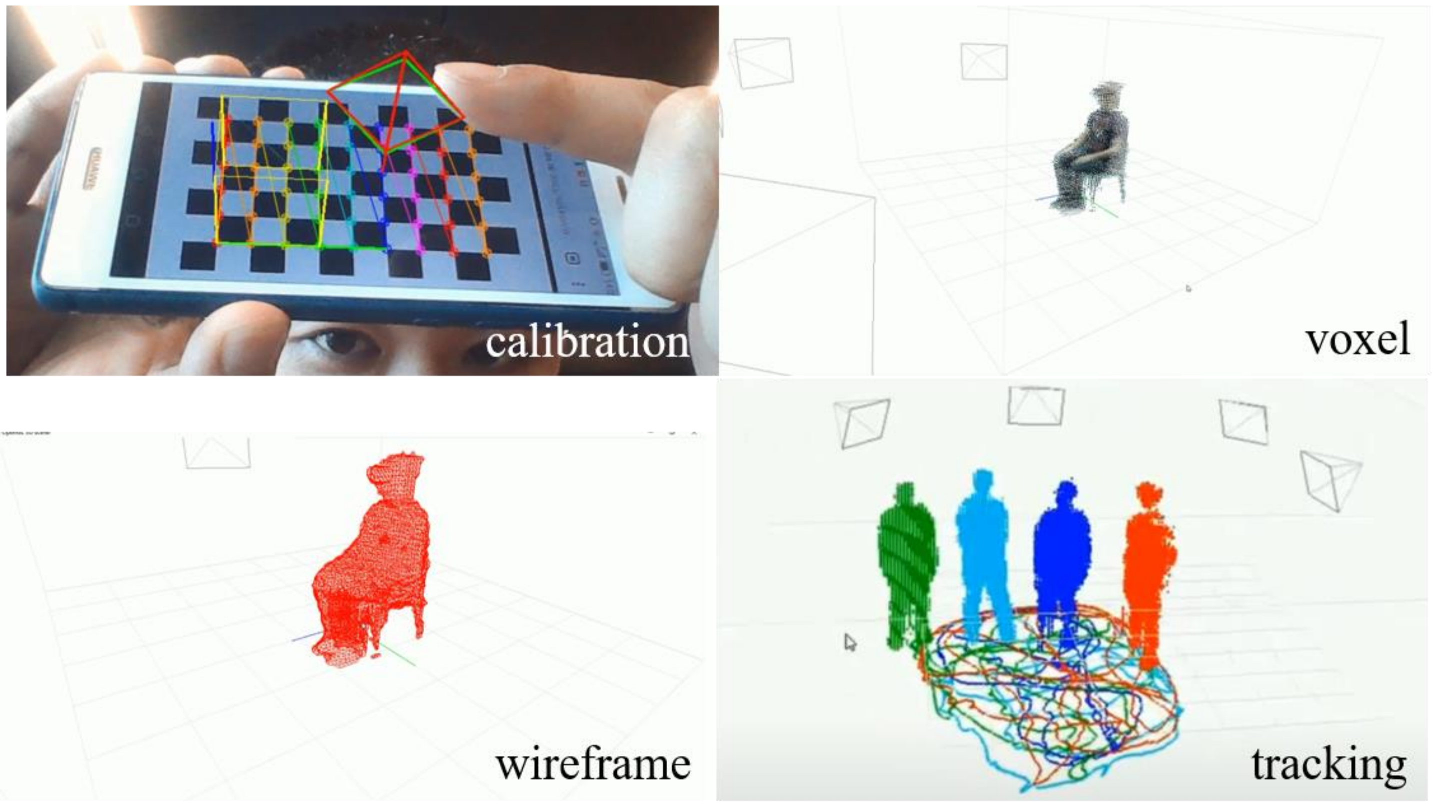




I self-studied the course '3D model' and did these practices including linear least-squares system using sparse matrices, a simple version of the moving least squares, and Least-Squares Conformal Mapping algorithm. **Academic integrity**: I did this practice with the help of the reference code. Strictly speaking, this is not my own code

Video

Voxel-based 3D Reconstruction and Tracking C++/OpenCV

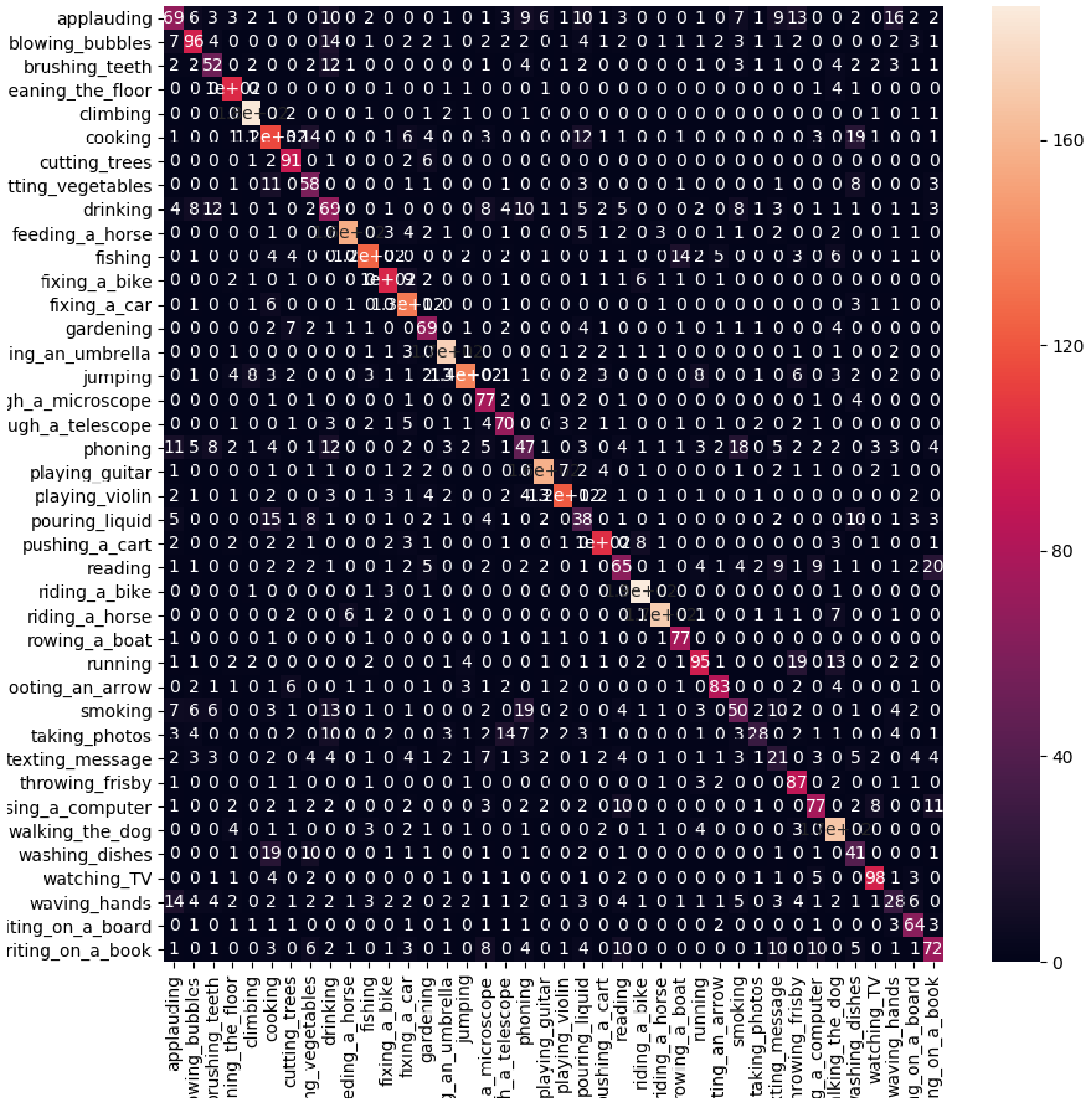


This is the assignment of the course ‘Computer Vision’, which includes the camera calibration, voxel-based 3D reconstruction and tracking. The major skills are:

- Marching cube
- K-means

GitHub Video

Action Recognition with Automatic Model Search
Python/Keras/Tensorflow

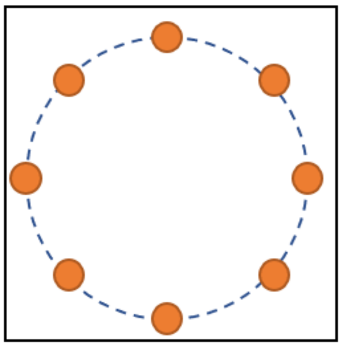


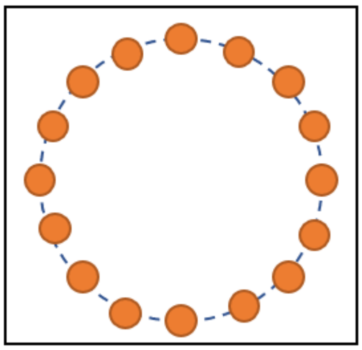
This is the project in the course ‘Computer Vision’. We created a Neural Network architecture capable of classifying human actions of the Stanford-40 dataset and optimized it by using methods such as Transfer Learning, weight decay, and custom learning rates.

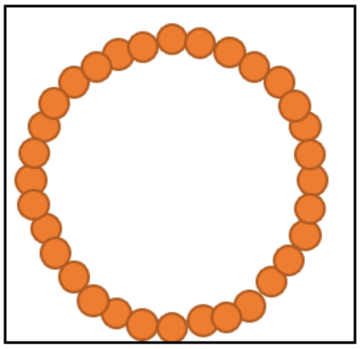
GitHub PDF

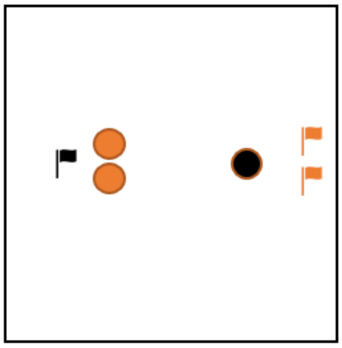
A Comparative Study of Collision Avoidance Algorithms

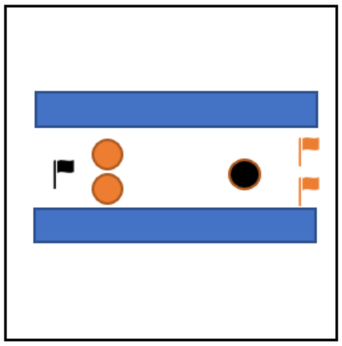
C++

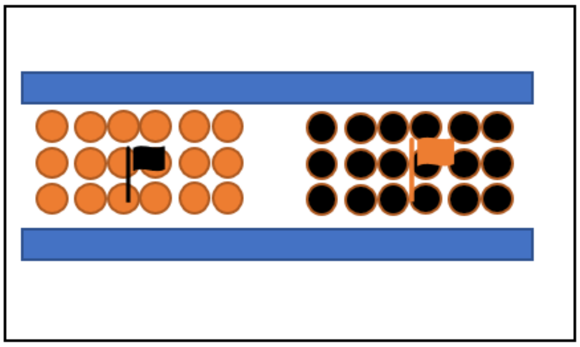

8-way-confusion

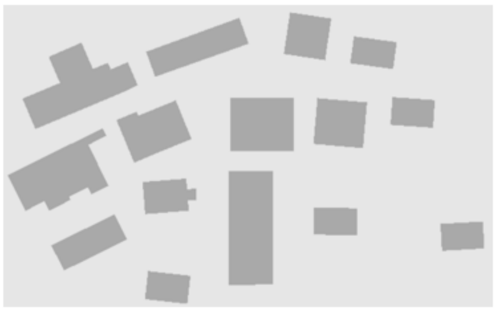

16-way-confusion


32-way-confusion


crossing


Squeeze crossing

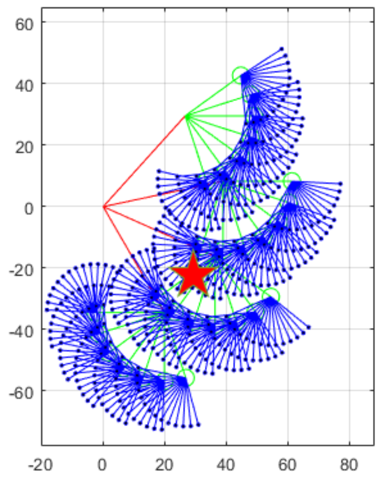

Group intersection

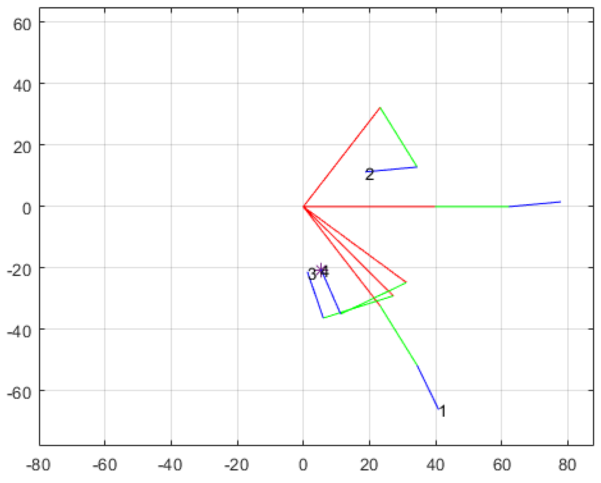

Large scale scenario

This is the project of the course 'Crowd Simulation', we added the *implicit crowd algorithm* to the UUCS(Utrecht University Crowd Simulation) framework. UUCS is a closed source project. We compared this algorithm with other major algorithms in several test scenes.

PDF Video

Inverse Kinematics for Human Fingers
matlab



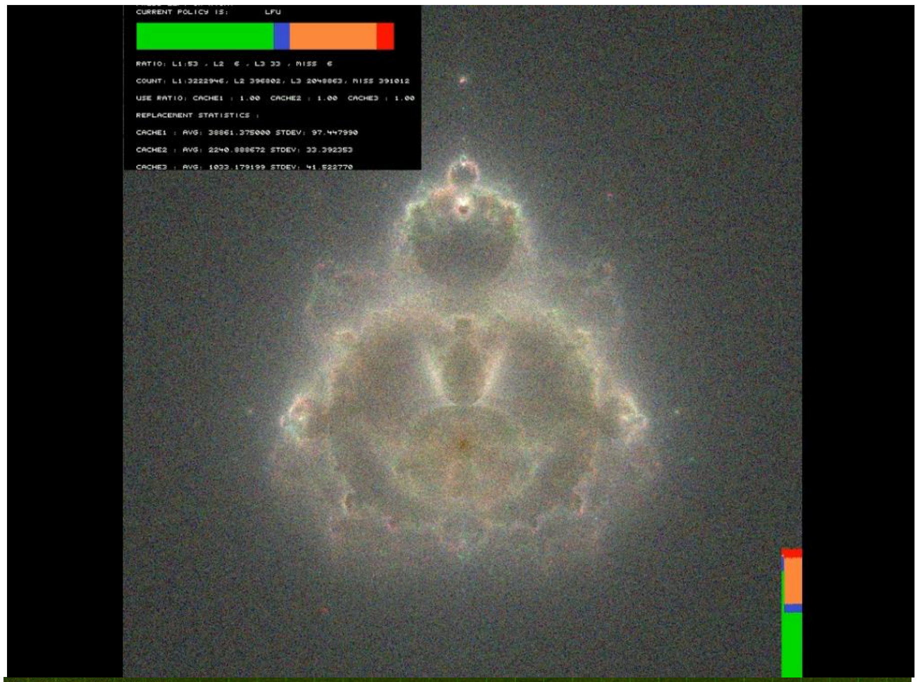


This is the project of the course ‘Motion and Manipulation’. First, we simulate the positions one finger (with three joints) can reach. And we use the inverse Kinematics method to compute the angle of each joint iteratively to reach one given position with the constrained joint angles. We provided three solvers:

- Pseudo Inverse
- Pseudo Inverse with Optimization Derivation
- Extended Jacobian Method

GitHub PDF Video

CPU Cache Simulator and Optimization
C++



```
CURRENT POLICY IS:       LFU
RATIO: L1:53 , L2  6 , L3 33 , MISS  6
COUNT: L1:3222946, L2 396802, L3 2048863, MISS 391012
USE RATIO: CACHE1 : 1.00  CACHE2 : 1.00  CACHE3 : 1.00
REPLACEMENT STATISTICS :
CACHE1 : AVG: 38861.375000 STDEV: 97.447990
CACHE2 : AVG: 2240.888672 STDEV: 33.392353
CACHE3 : AVG: 1033.179199 STDEV: 41.522770
```

```
BLUE ARMY: 298  RED ARMY: 2474
```

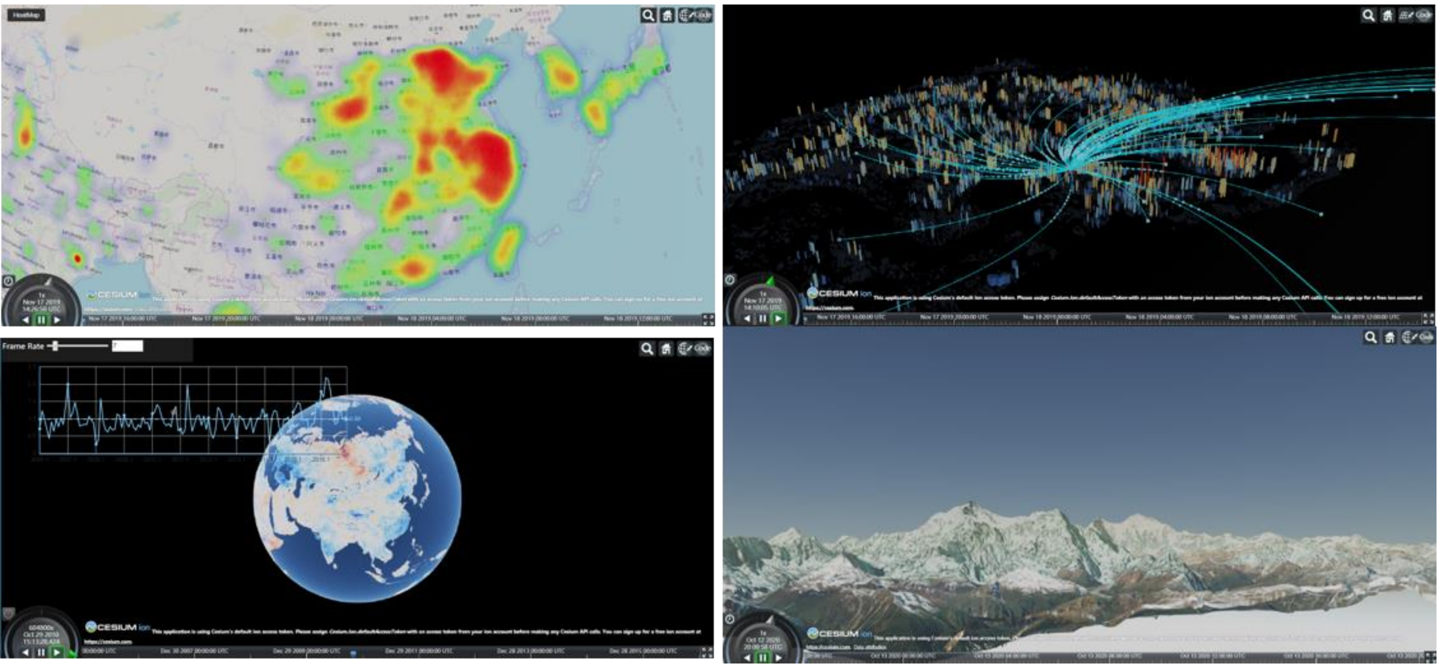
The assignments of the course 'Optimization and Vectorization'. In the cache simulator, there are three levels cache, and we provide six eviction policies. A tool is provided to monitor the hit ratio. Finally, we can use all the skills we learned to optimize the performance of a small game. I speedup 25 times

GitHub Video

Examples for Cesium

JS/WebGL

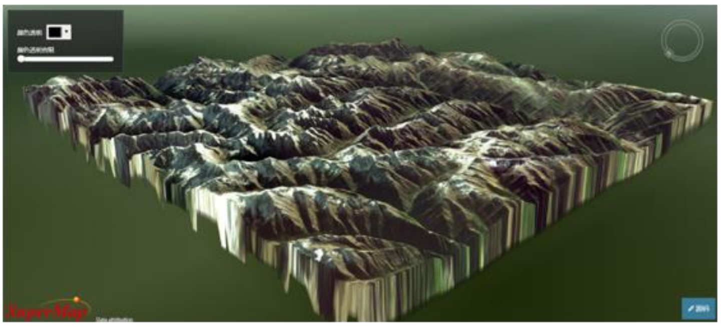
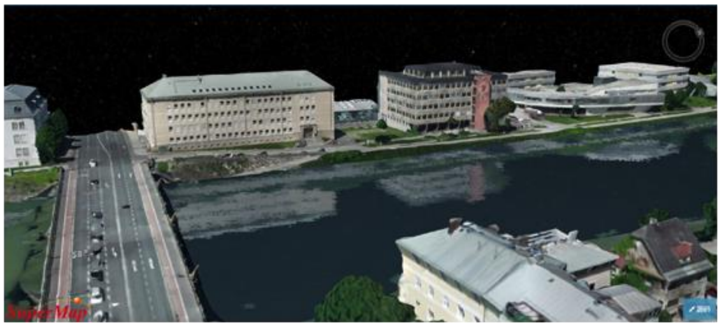
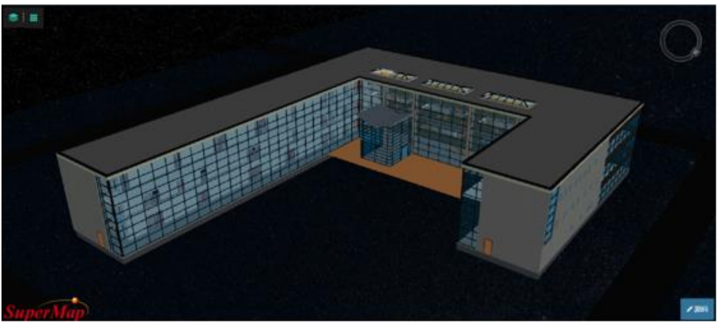
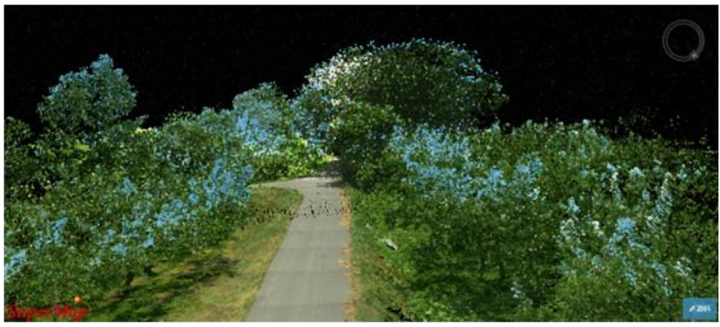
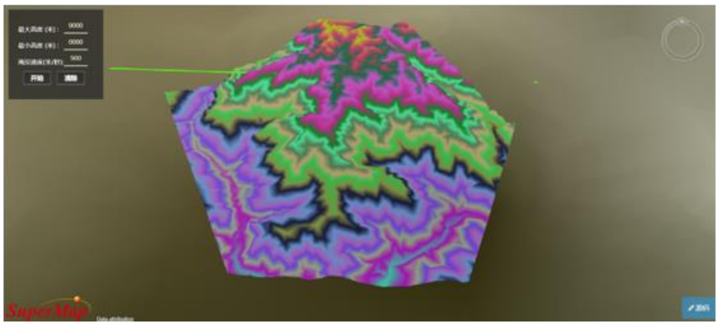
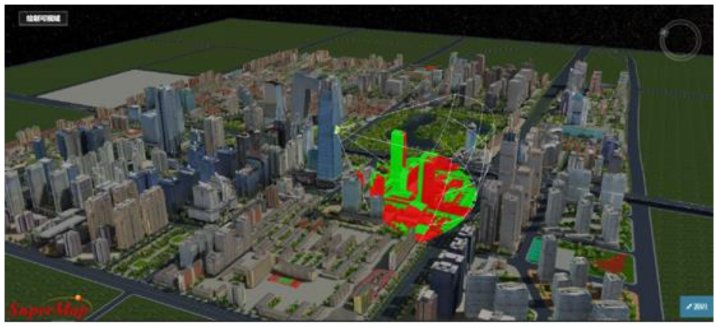
GitHub | Watch 42 | Star 320 | Fork 135



CesiumJS is an open source JavaScript library for creating world-class 3D globes and maps. I create several visualization demos based on this library, such as real-time global AQI(air quality index), tax flow, ten years of global temperature change, and global terrain.

GitHub | Video

S3M
C++/JS/WebGL

S3M is one specification (T/CAGIS 1-2019) in China for the transmission and loading of massive meshes, including oblique photograph, BIM and point cloud. We can do the analysis and visualization on this Spatial geographic data. I was the core engineer to design and develop this format, including the data generation, loading and rendering on the Browser.

GitHub