

CIS 565 FINAL PROJECT: MILESTONE I PRESENTATION

GROUP 3:

SRINATH RAJAGOPALAN

SOMANSHU AGARWAL

DHRUV KARTHIK

WORK AS OF NOW:

INCREMENTAL VISUAL 3D MESH CREATION

- We studied about the Incremental 3D Mesh creation visual odometry. Since the topic was new to all three of us, we explored many data processing techniques with 3D LIDAR point clouds.
- Started working with CPU version.

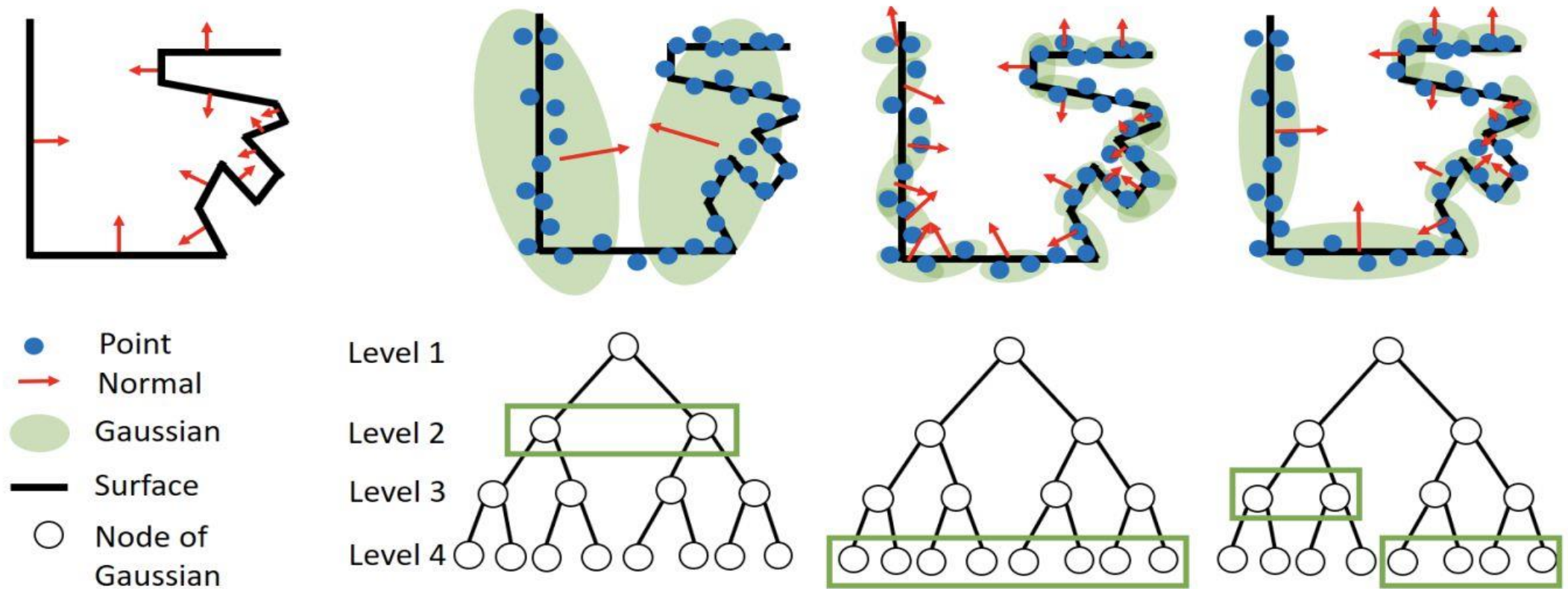


NEW PROJECT PROPOSAL:

GPU ACCELERATED POINT CLOUD REGISTRATION USING GAUSSIAN MIXTURE MODELS

- Traditional Iterative Closed Point (ICP) for scan matching has limitation of working only for few cases.
- We use Hierarchical Gaussian Mixture Models for Point cloud Registration.
- The proposed hierarchical approach achieves logarithmic complexity in model size and scales efficiently to data with billions of point cloud.

EXPLANATION OF ADAPTIVE HIERARCHICAL GMM MODEL



FEATURES OF THE PROJECT

- Nvidia released the paper in EECV 2018, but there is no code implementation available for HGMM with GPU's. Hence, we will be contributing to the academic community.
- Implementing this will be a wonderful challenge in applying many of the GPU acceleration concepts we learnt in the course (shared memory, memory coherence, parallel scans, CUDA streams,).

FUTURE MILESTONES:

- **11/25:** Complete GPU version of single model GMM registration. Prototype Python version for HGMM.
- **12/02:** Complete GPU version of Hierarchical GMM with CUDA/C++. Test it on a Waymo's 3D LIDAR data. Benchmark with other implementations.
- **12/09:** Implement additional optimizations (reduce bank conflicts). Test it on Dhruv's 3D LIDAR and deploy it for Real-Time PCR on Penn Campus.

REFERENCES

- <https://developer.download.nvidia.com/video/gputechconf/gtc/2019/presentation/s9623-gpu-accelerated-3d-point-cloud-processing-with-hierarchical-gaussian-mixtures.pdf>
- <https://arxiv.org/pdf/1807.02587.pdf>