DroneMOM

Drone Model Output Machine

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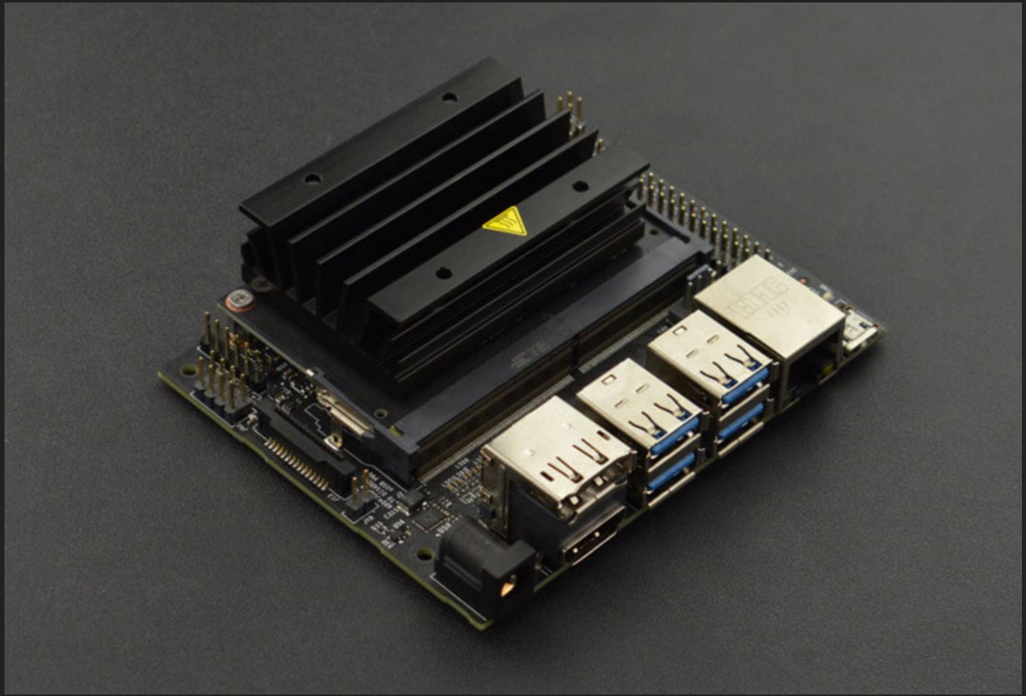
Github Repository

System Design

Jetson Nano

- System On Chip with Nvidia GPU
- Limited RAM + Storage
- Limited Processing Capabilities
- Used for Aerial Platforms
- Robot Operating System (ROS) provides system infrastructure



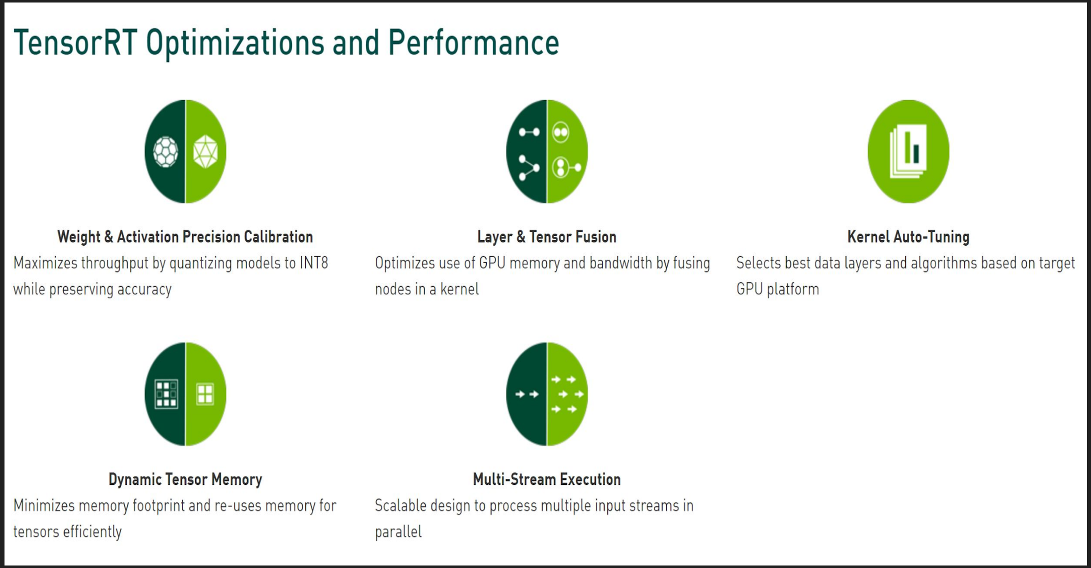
https://www.ros.org/
https://developer.nvidia.com/embedded/jetson-nano-developer-kit

Classification

- Utilized Mobilenet as architecture
- Accelerated classification with TensorRT
- Implemented cuda algorithms with shared memory
- Bounding Boxes show what is classified in the frame
- ~50ms per inference
- Used ROS to implement a complex system

What is TensorRT?

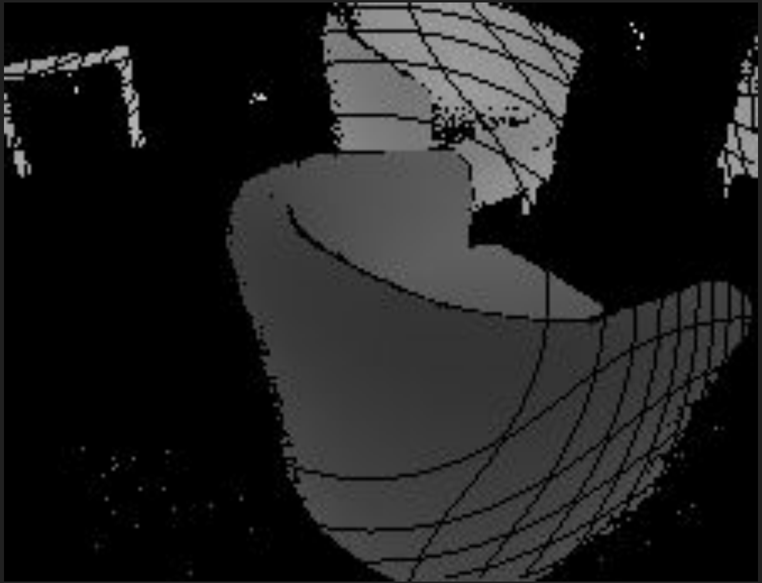
- Think of it like DXR
- Build a tensorRT engine (like CPU side of DXR)
- Run inference on GPU based on this accelerated engine.



Point Cloud Generation - Inputs

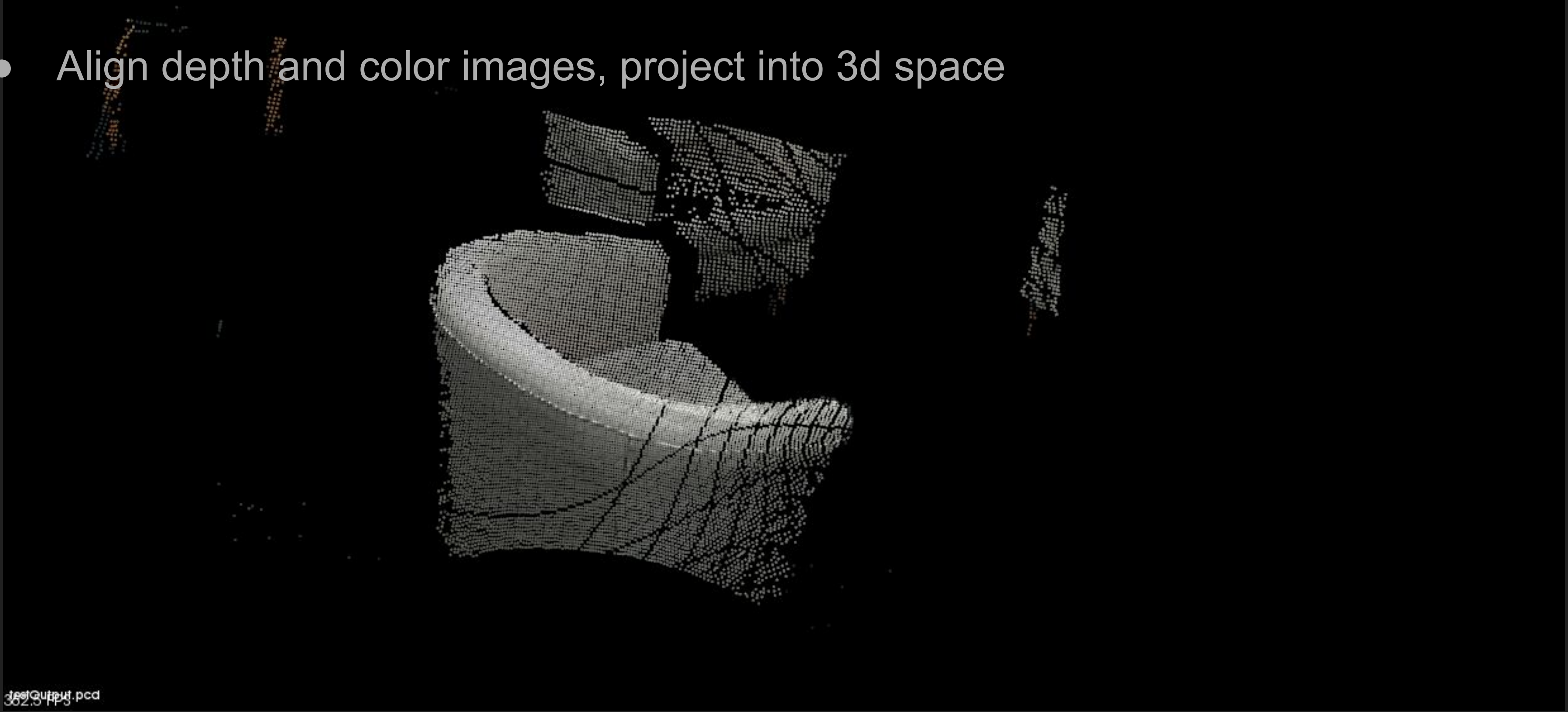
Color Image (resolution 1920x1080)

Depth Image (resolution 280x190)



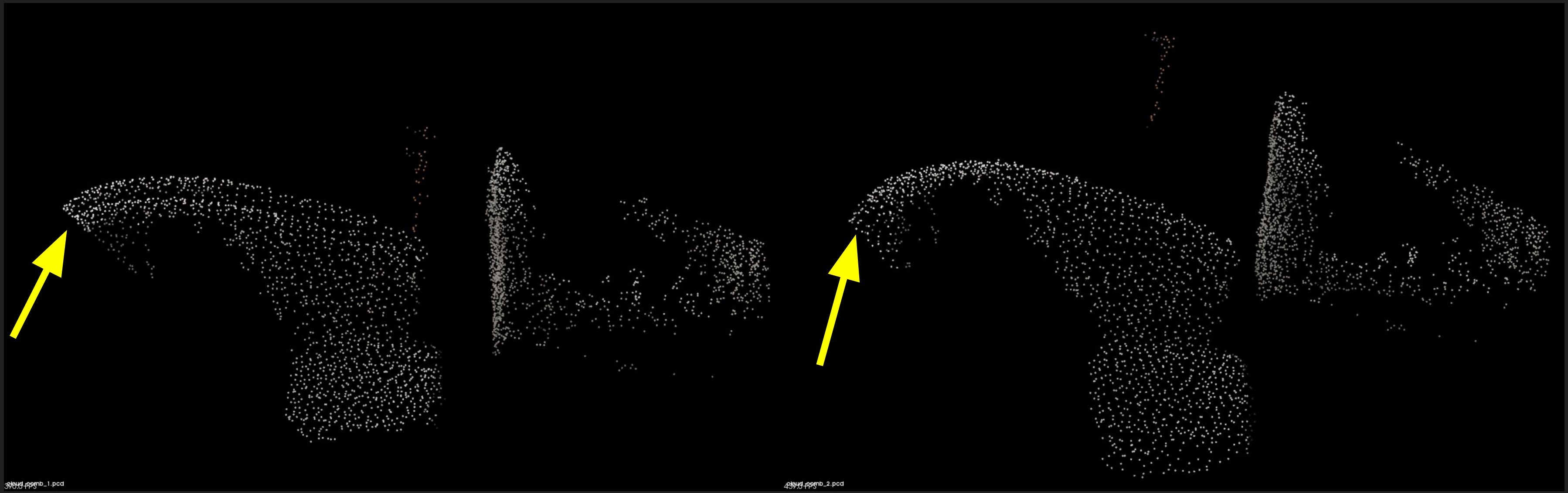
Point Cloud Generation - Projection

- Align depth and color images, project into 3d space



Point Cloud Generation - Alignment/Registration

- Align and register frames for subsequent point clouds



Unaligned

Aligned

Point Cloud Generation - Accumulation

- Accumulate subsequent frames to create overall point cloud

24 Frames

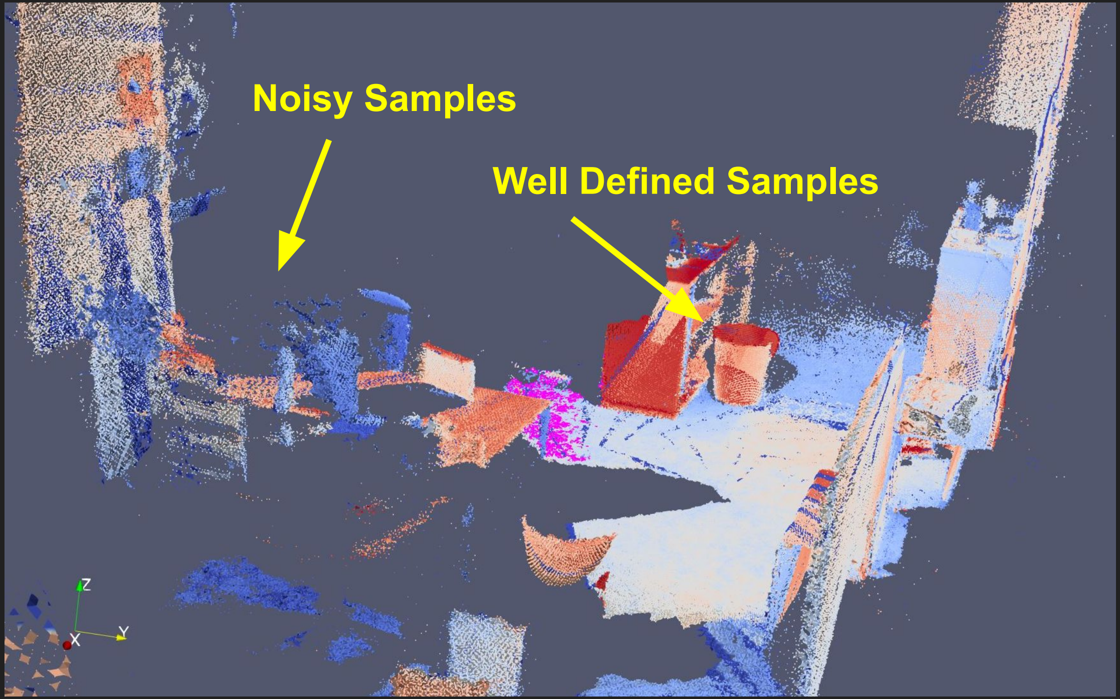
48 Frames

120 Frames

168 Frames

GLTF Mesh Construction

- Convert a Point Cloud into a GLTF Mesh
- Challenges
  - Noise in the Point Cloud
  - Too many points
  - Incomplete data



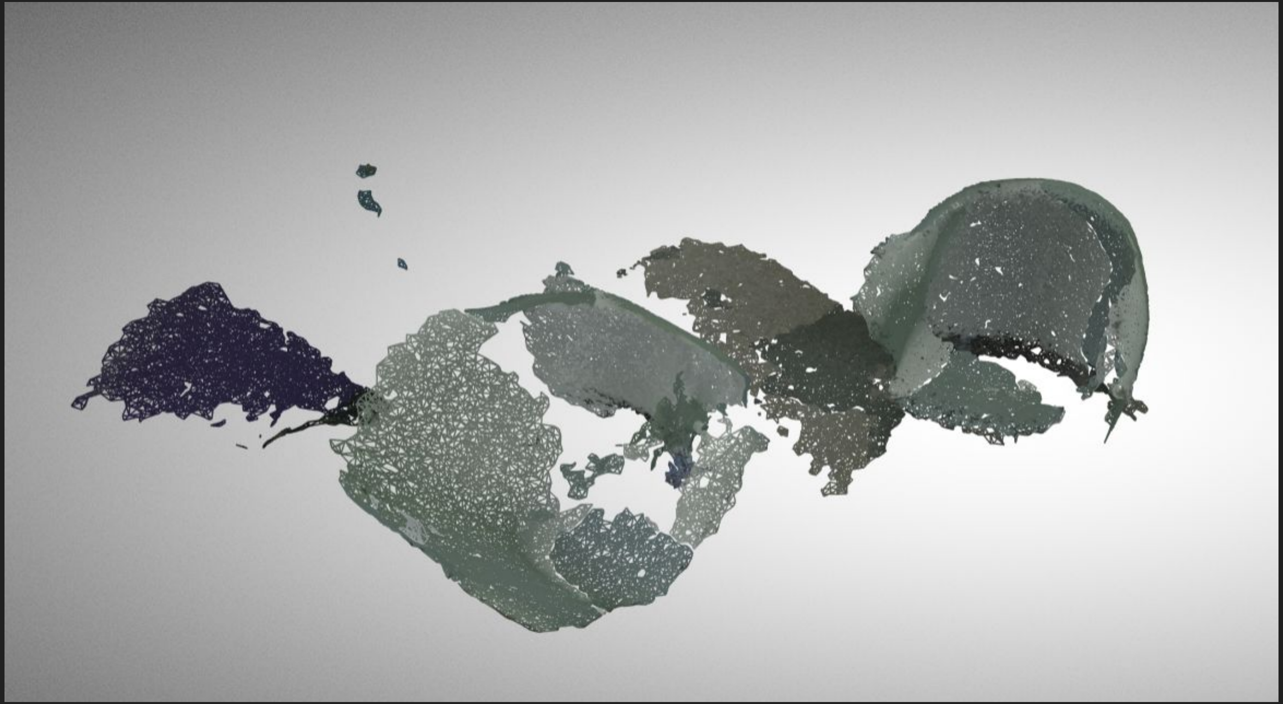
GLTF Mesh Construction Procedure

1. Downsample using a Uniform Voxel grid
2. Remove Statistical Outliers
3. Smoothing through Moving Least Squares
4. Point Normal Estimation
5. Greedy Triangulation Mesh Construction

Partial mesh using a small frame count

Output Mesh after 400 frames

- Chairs partially captured, floor captured within bounding box.



Output Mesh after 4,000 Frames

Not quite right…

- Coordinate system not preserved
- GLTF Winding Order causes back of mesh to not render.
- Future work to be done

Special Thanks + Credits

- Dewang and Vaibhav (Shadow Team, for Point cloud and ML help)
- Tim Kaldeway (for TensorRT advice and resources)
- Andrew Feng (for Mobilenet recommendation)

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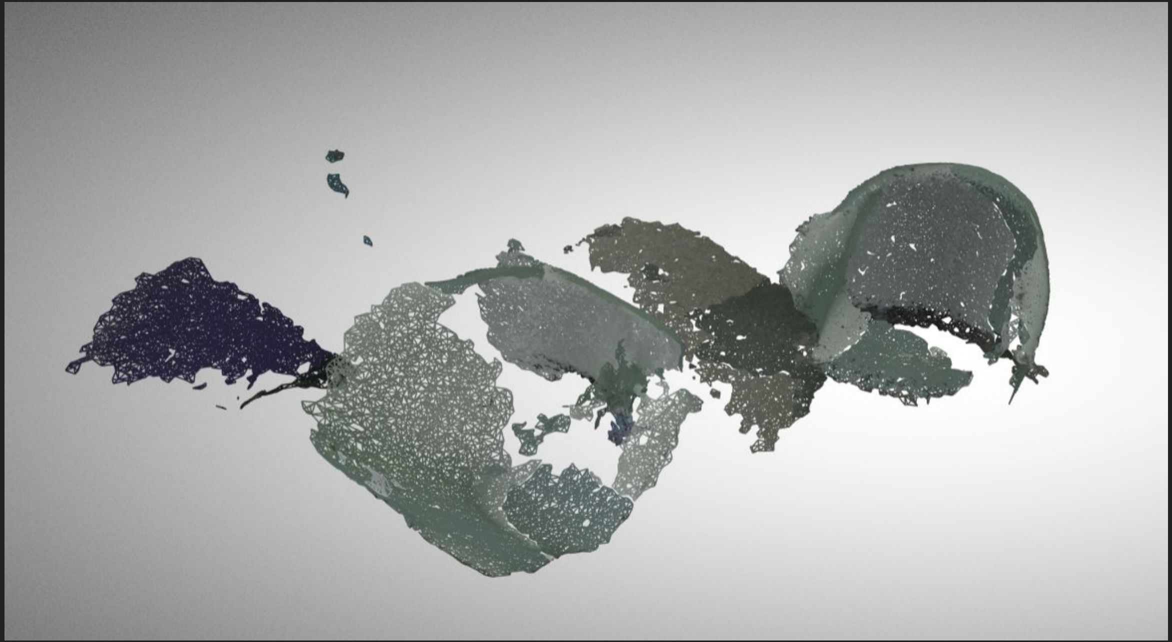

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