Analyzing Point Clouds
Bridge Inspection Project

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INTRODUCTION

Bridge Inspection Project involves

- Flying an UAV with sensors like Camera, LIDAR, GPS
- Scanning the bridge using LIDAR
- Capturing high-res images
- *Building a 3D model of bridge*
- *Analysis of point cloud model to estimate coverage and error*
- Tool to visualize the bridge from different viewpoints
- Establishing a timeline of the models to analyze the changes

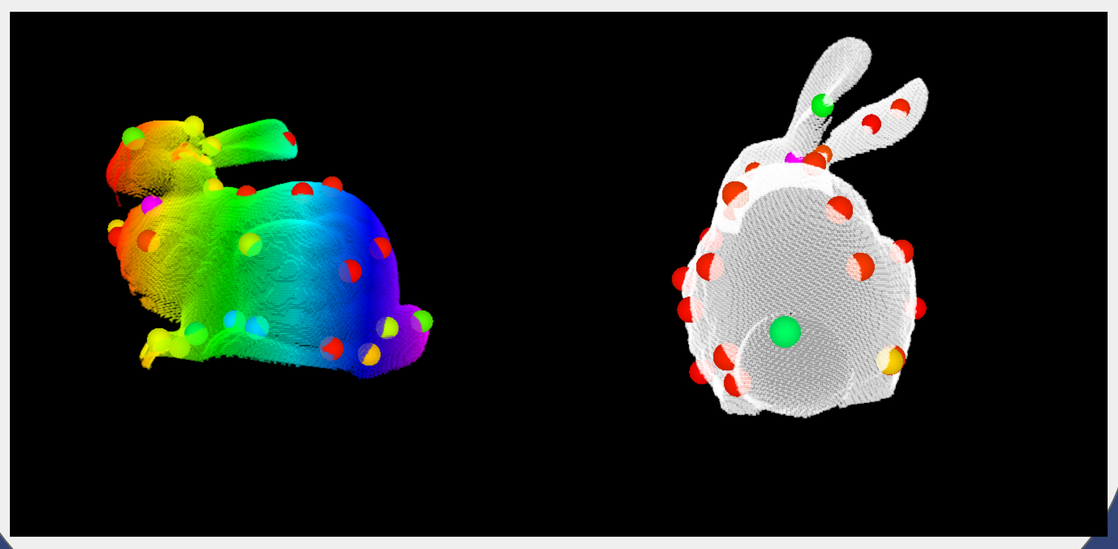
REGISTRATION

Goal : Given 2 clouds of same region find the transformation

Generic process of registration:

- Get Keypoints of point cloud
  - *SIFT, Harris Keypoints, NARF*
- Describe with Feature descriptors
  - *PFH, SHOT,RIFT, ESFE*
- Feature matching to establish correspondences
  - *ICP, SAC*

Objective: Minimize *alignment error*



COVERAGE

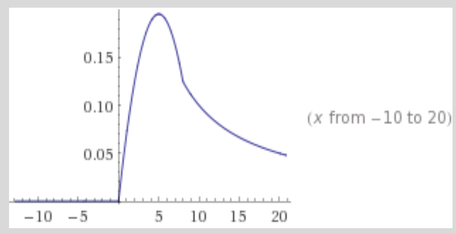
Given clouds G, Q represent coverage using $\langle \gamma_G, \gamma_Q \rangle$ where

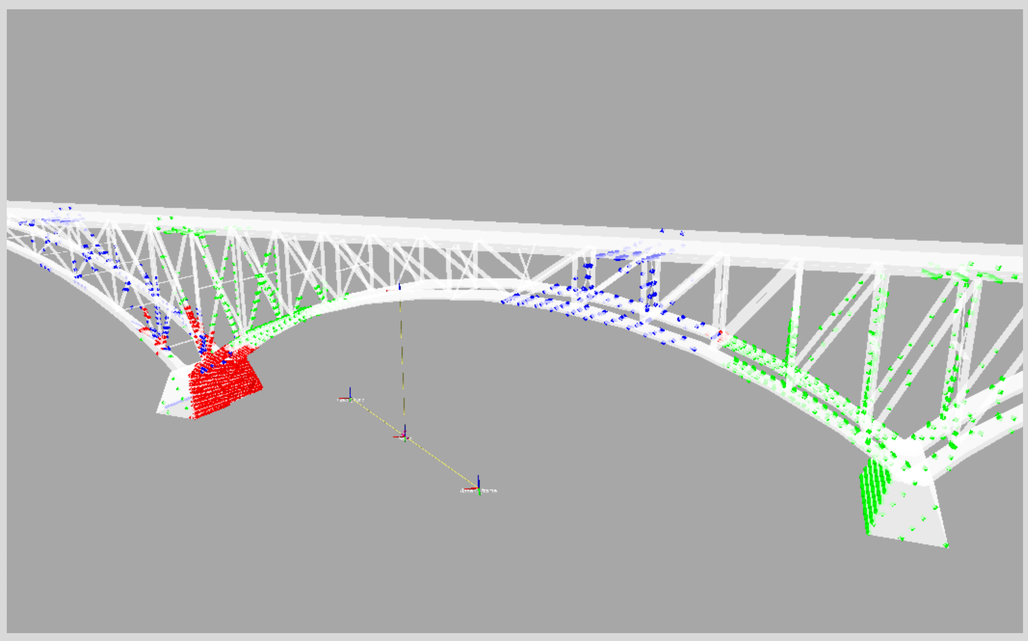
$$\gamma_C = \frac{\text{Region covered by cloud C only}}{\text{Observable world region}}$$

Process of estimating coverage:

- Partition union of 3 sets
  - Cloud G' = G-Q
  - Cloud Q' = Q-G
  - Cloud G∩Q
- Assign area factor to each point
- Compute the fraction of area in each partition

$$A(x) = \begin{cases} x(T-x)/K, & x \le \eta T \\ 1/x, & x > \eta T \end{cases}$$





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