Online 3D Object Mesh Pose Recognition: Midterm Report

Mike Hagenow (mhagenow 9079441078) and Kevin Welsh (kpwelsh 9081472293)

April 1, 2020

Abstract

Many of the existing methods for 3D object pose recognition from point clouds have deficits that make them not ideal for a aviation manufacturing environment. In this work, we proposed to extend existing methods for 3D object recognition. Our original plan was to create a method we termed Face-Based-Features RANSAC where we create mesh correspondences between points and faces from a mesh, rather than sampling the face of the mesh and doing point to point correspondences as is typical in existing methods. We have successfully implemented and tested this algorithm. Sub par performance has led us to pursue a new method which utilizes skeletonizer and an informed variation of Iterative Closest Point (ICP) to fit arbitrary meshes in reduced runtime. So far, this method has been successful in recognizing and accurately fitting meshes. Looking forward, we are excited to improve the performance and robustness to error and occlusions and believe we are on track to developing a new method that can be used by the community in arbitrary 3D mesh recognition.

1 Overview

1.0.1 Current State

Our progress so far has been good with thoughtful evaluations and such. We originally aimed to do face-based features. While such an approach is valid and we demonstrate results using it, the performance is fundamentally limited... We have moved our focus to an updated method that combines a gradient-based deterministic approach

1.0.2 Difficulties

things are hard sometimes...

1.0.3 Next Steps

solve the problems and change the world...

2 Details of Progress

2.1 Efficient RANSAC

In order to better understand fitting of arbitrary, we first developed a form of Efficient RANSAC in order to study and better understand the limitations and strengths of the method. We have been successful in developing a prototype that is capable of fitting three of the primitive geometries: spheres, cylinders, and SOMETHING ELSE!

2.1.1 Implementation Details

We have provided an end-to-end python implementation for the efficient RANSAC. There is a $\text{run}_e ffficient_r ansacmodulethatt$

INSERT EQUATION

For our method, in order to allow for

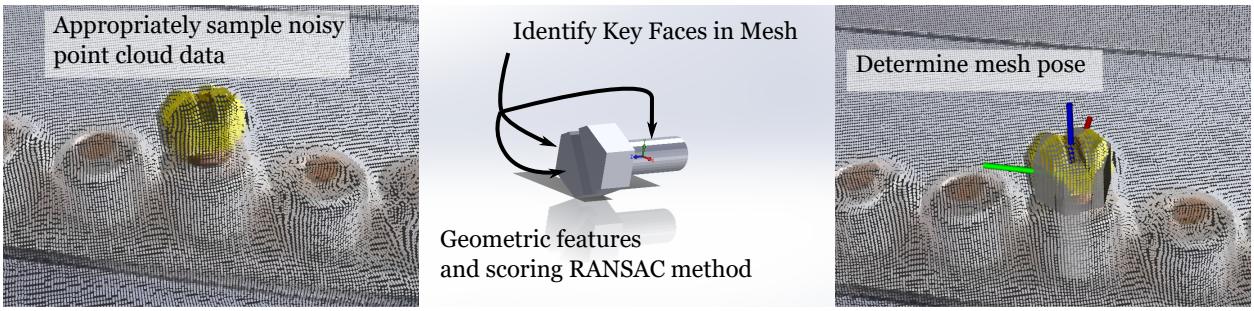

Figure 1: General problem statement to fit an arbitrary mesh to noisy point cloud data. Our method will describe geometric features and scoring to find likely objects and poses in the point cloud.

2.1.2 Lessons Learned

Everything is a lie.

2.2 Face-Based Features

2.3 Iterative Closest Point

2.4 Skeletonizer

2.5 Utilities

Many other programmatic contributions along the way...

2.6 Investigations with Existing Methods

3 Evaluation of Performance

4 Mid-Project Timeline

References