24783 - Advanced Engineering Computation
Project Proposal

Christopher Cortez, Zhuhan Qiao, Teng Tu, and Austin Wang

Feb 12 2019

1 Efficient RANSAC for Point-Cloud Shape Detection

- **Authors:** Ruwen Schnabel, Roland Wahl, and Reinhard Klein
- **Published To:** Computer Graphics Forum
- **Year:** 2007

This paper presents an algorithm that decomposes point clouds into inherent shapes. The algorithm is robust even in the presence of many outliers and a high degree of noise. The proposed method also scales well with respect to the size of the input point cloud and the number and size of the shapes within the data. Application areas include measurement of physical parameters, scan registration, surface compression, hybrid rendering, shape classification, meshing, simplification, approximation and reverse engineering.

We will implement this algorithm and analyze its computational complexity. Possibilities of C++ libraries that will be used in the implementation include PCL (Point Cloud Library). We will run benchmarks by processing point clouds generated from 3D CAD models and visualize the resulting detected shapes. If time permits, we will also run the algorithm on point clouds extracted from real RGBD images.

2 Variational Shape Approximation

- **Authors:** David Cohen-Steiner, Pierre Alliez, Mathieu Desbrun
- **Published To:** ACM SIGGRAPH
- **Year:** 2004

The paper presents a novel and versatile framework for geometric approximation of surfaces. Using the concept of geometric proxies, the framework can drive the distortion error down through repeated clustering faces into best-fitting regions. The new approach is entirely discrete and error-driven, and does not require parameterization or local estimations of differential quantities. There is also a new metric based on normal deviation, which shows its superior behavior at capturing anisotropy.

For a tentative schedule, we plan to first understand and implement the algorithm using suitable data structures and sub-algorithms. In this part, we need to break down the task into individual units that can be assigned to each team member and check if there are any external libraries we could use. Then, for further verification, we will test it more on different geometry ranging from simple shapes such as letters and polygons to more complex ones including organic shapes and mechanical parts. In addition, we will also look into how the number of proxies affects the performance of the algorithm.

3 Computer vision framework for object monitoring

- **Authors:** Theerayod Wiangtong, Sethakarn Prongnuch
- **Published To:** International Conference on Electrical Engineering/Electronics, Computer, Telecommunications and Information Technology
- **Year:** 2012

This paper presents the use of Visual C++ integrated with OpenCV library as a framework for video analysis applications. Conventionally, applications are developed and control using textual-based Win32 console. In this work, however, the library can be applied in Windows form that helps users to visually control algorithms implemented in applications. The framework, written in OOP style, tailors the existing library into three main class methods; initializing, running and ending. Streaming data can be captured from USB cameras, IP cameras and video files. Implementing computer vision algorithms include object counting and object monitoring is demonstrated. Results show that algorithms work well and they can be developed in short time.