Kinetic

Team member:

Demuth Axel
Geraldes Pereira Dorian

Supervisor :

Pierre Alliez
Vincent Chabannes

1. Introduction

2. Tools

3. Implementation
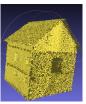
4. Result

Introduction

Objectives

- **Reading Process and Mesh Conversion:** Convert data from stl file to ply and xyz file with normals on points
- **Application of the Kinetic Algorithm**
- **Recovery of Material Labels**
- **Utilization on City Modeling**

Challenges

- **Generating point cloud from stl file**

ACJasmin stl

ACJasmin point cloud

- **Parameter Optimization**

Cgal

- C++ library for geometric calcul
- Provides data structures and algorithms for:
    - Computational geometry
    - Mesh generation and processing
    - Geometry processing
    - Surface and volume manipulation
- For our usage Kinetic surface reparation algorithme, file reader

Kinetic Kinetic algorithm is an geometric algorithm to work on 3D mesh it uses geometric primitive with an energy based model to fit the primitives to the model.
Energy formule:

$$U(x) = w_f\, U_f(x) + w_s\, U_c(x) + w_c\, U_c(x)$$

to calculate the best primitive to fit the mesh. then we have a list of geometric operation on each primitive

- merging

- splitting
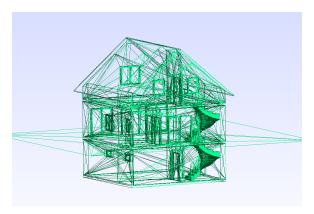
- transfer

- insertion

- exclusion

Here the speudo code of the application of geometric application :

Algorithm 1 Pseudo-code of the exploration mechanism

1: Initialize the primitive configuration $\mathbf{x}$
2: **repeat**
3:     Initialize the priority queue Q
4:     **while** top operation i of Q decreases energy U **do**
5:         Update $\mathbf{x}$ by operation i
6:         Update Q
7:     **end while**
8:     Update $\mathbf{x}$ by the global transfer operator
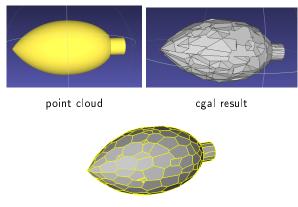9: **until** no update modifies $\mathbf{x}$ any more

STL (STereoLithography)

- File format for 3D modeling
- Stock a collection of triangle composing the mesh without any other information

Introduction
Tools
Implementation
Result

3zones example
ACJasmin example

first result

First we can show you what KSR algorithm is capable of:

point cloud

cgal result

inria result
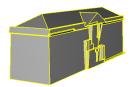
Figure: Visualization of results on a flame

Introduction
Tools
Implementation
Result

3zones example
ACJasmin example

first result

point cloud

cgal result

inria result
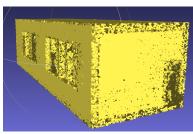
Figure: Visualization of results with a building

Introduction
Tools
Implementation
Result

3zones example
ACJasmin example

3zones example

3zones   3zones point cloud

Figure: point cloud conversion

Introduction
Tools
Implementation
Result

3zones example
ACJasmin example

result

normal by Meshlab   normal by Cgal
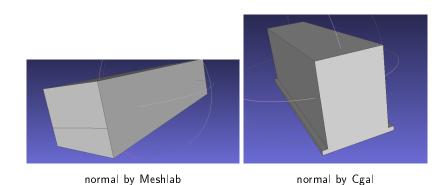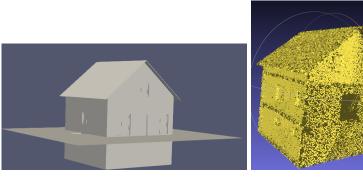
Figure: result on 3zones example

Introduction
Tools
Implementation
Result

3zones example
ACJasmin example

ACJasmin example

ACJasmin   ACJasmin point clouds

Figure: point cloud conversion

Introduction
Tools
Implementation
Result

3zones example
ACJasmin example

cgal kinetic result

primitives   result
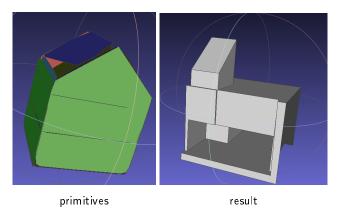
Figure: result on ACJasmin example using cgal algorithm

Introduction
Tools
Implementation
Result

3zones example
ACJasmin example

INRIA kinetic result

primitives   result
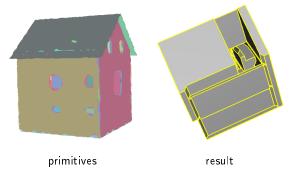
Figure: result on ACJasmin example using INRIA algorithm

Introduction
Tools
Implementation
Result

3zones example
ACJasmin example

reference I

📄 Mulin Yu, Florent Lafarge, Sven Oesau, and Bruno Hilaire.
Repairing geometric errors in 3D urban models with kinetic data
structures.
ISPRS Journal of Photogrammetry and Remote Sensing, 192,
October 2022.

📄 Jean-Philippe Bauchet and Florent Lafarge.
Kinetic Shape Reconstruction.
ACM Transactions on Graphics, 2020.

📄 The CGAL Project.
CGAL User and Reference Manual.
CGAL Editorial Board, 5.6.1 edition, 2024.

Introduction
Tools
Implementation
Result

3zones example
ACJasmin example

reference II

📄 Mulin Yu and Florent Lafarge.
Finding Good Configurations of Planar Primitives in Unorganized
Point Clouds.
In *CVPR 2022 - IEEE Conference on Computer Vision and Pattern
Recognition*, La Nouvelle-Orléans, United States, June 2022.

📄 Ktirio - construction et immobilier.

📄 Cloudcompare - 3d point cloud and mesh processing software.