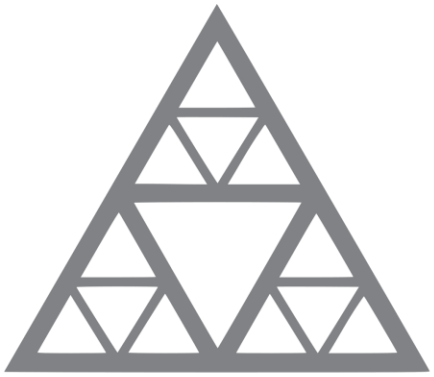


École des Ponts

ParisTech

Inria

Reconstruction 3D et Optimisation de maillages

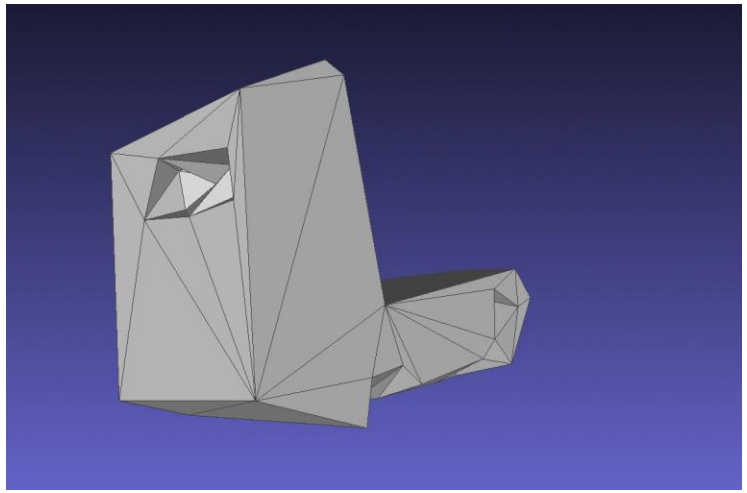
Romain Chaussonnier, Waël Doulazmi, Matias Etcheverry, Alexis Gadonneix, Ayoub Rhim

Objectif et enjeux

Comment obtenir un maillage simple d'un jeu d'images d'un objet dit "structuré ?

Applications:

- Impression 3D
- City Modelling

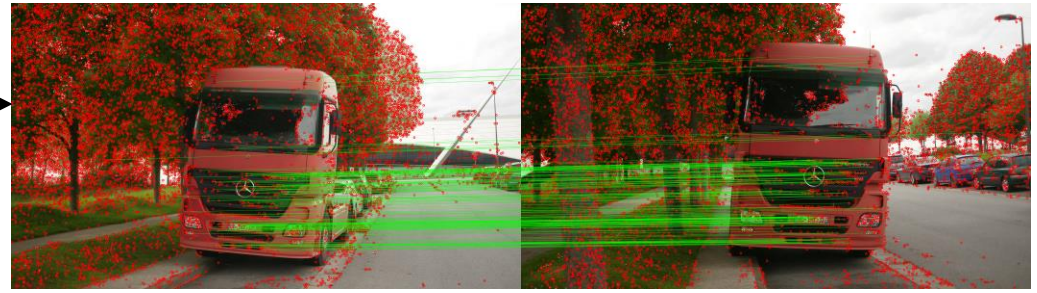


Feature extraction

SIFT

Feature matching

exhaustive



Geometry Verification

5 Point Relative Pose

Image Registration

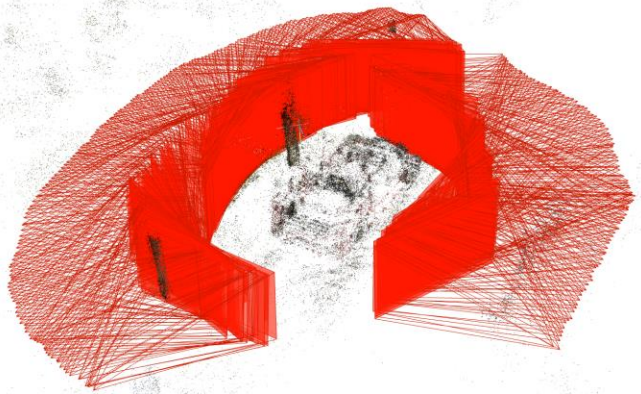
P3P

Triangulation

Sampling-based DLT

Bundle Adjustment

Ceres Solver



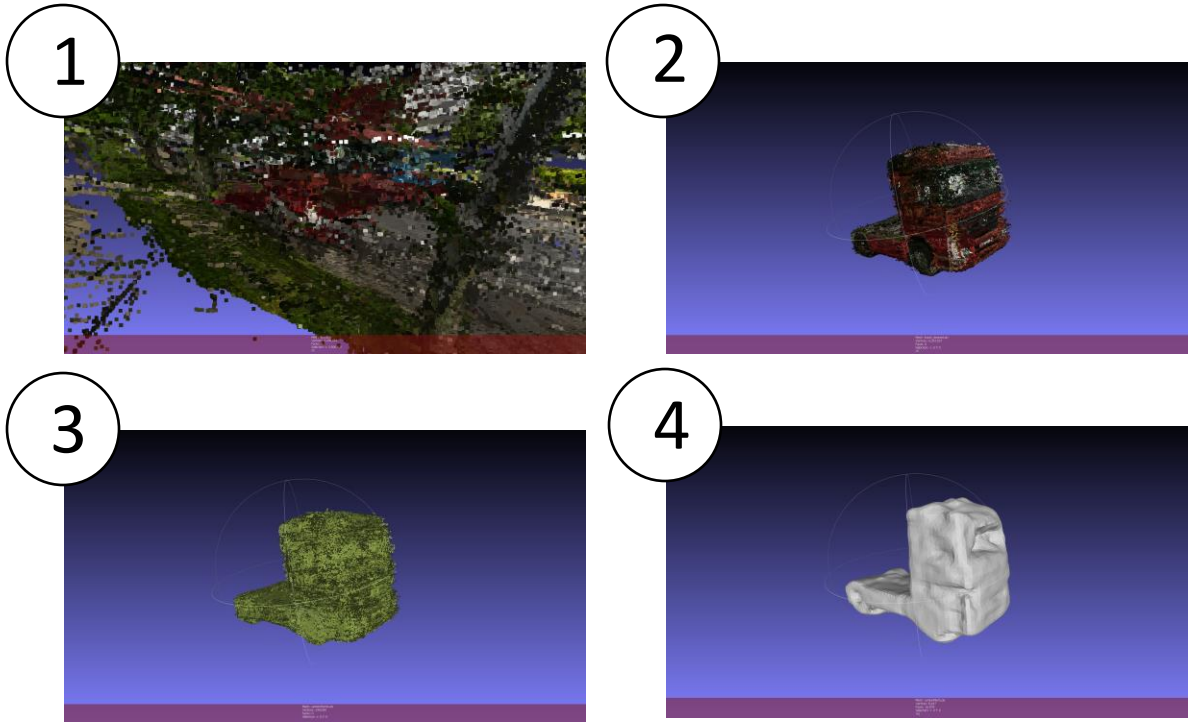
Robust estimation

RANSAC

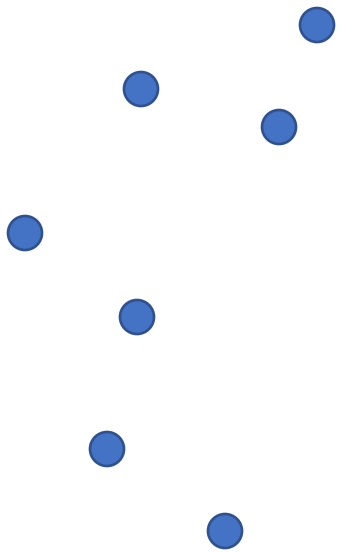
COLMAP

Création du maillage dense

- Sélection à la main
- Suppression des outliers
- Bilateral smoothing
- Échantillonnage
- Reconstruction de Poisson

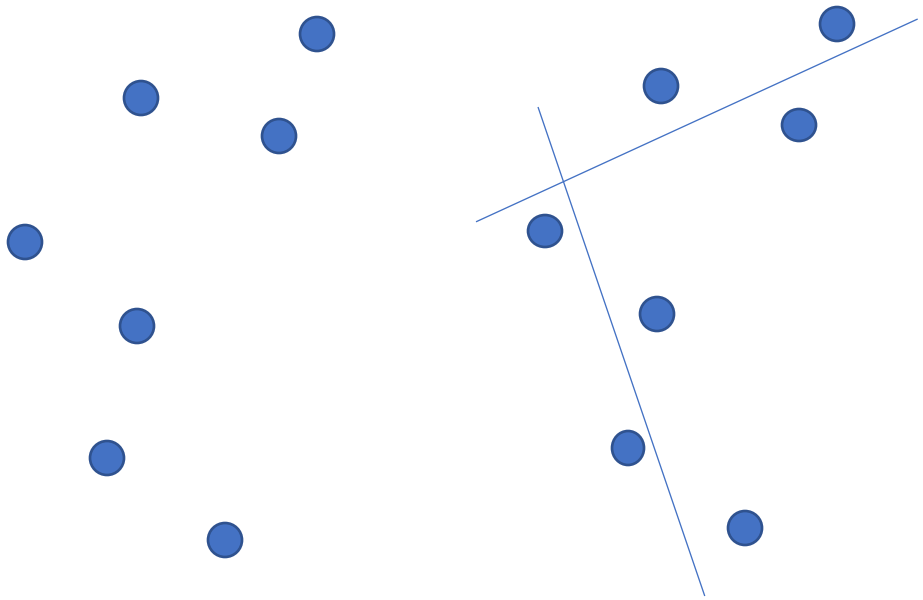


Pipeline d'approximation



Pipeline d'approximation

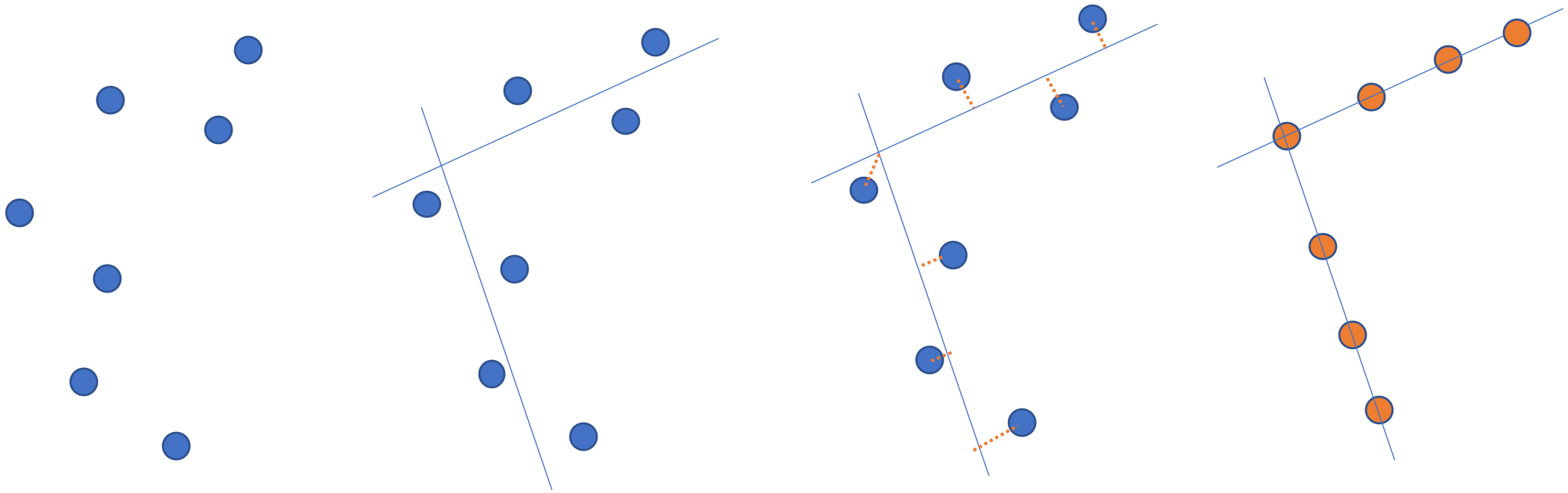
Détection de plans



Pipeline d'approximation

Détection de plans

Projection

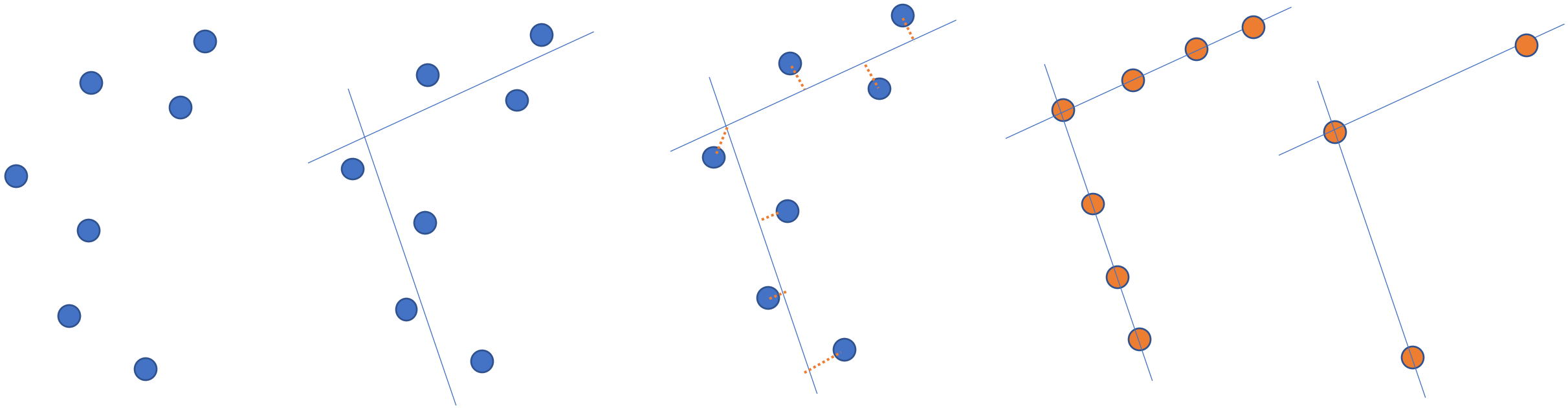


Pipeline d'approximation

Détection de plans

Projection

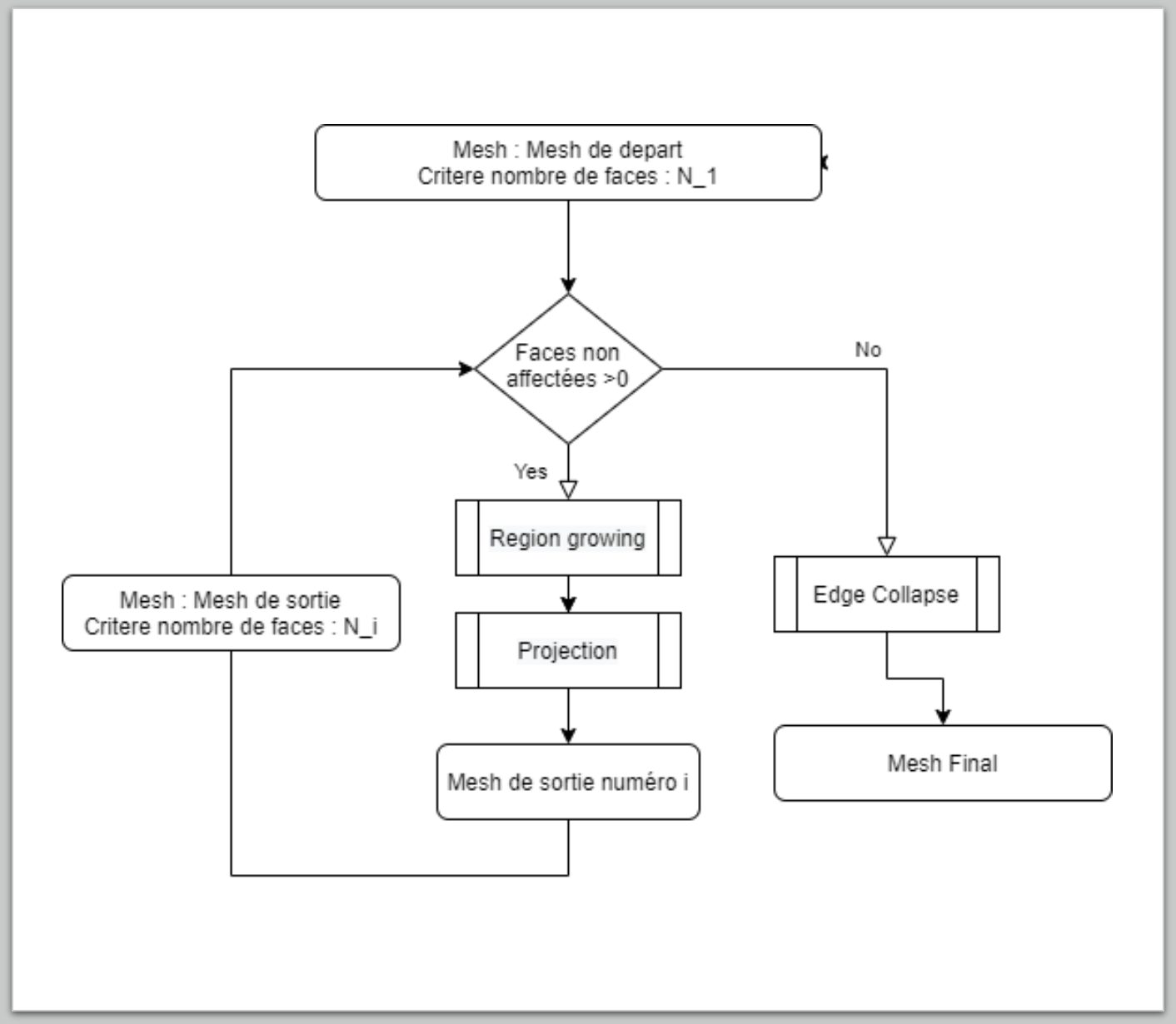
Edge Collapse

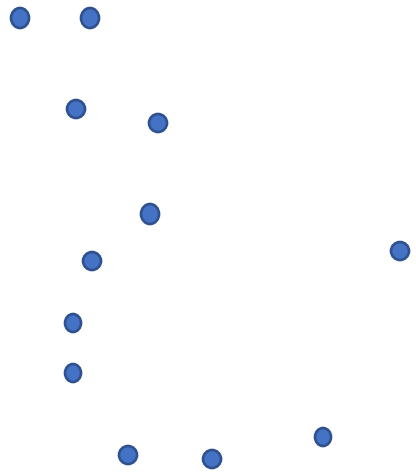


Approche hiérarchique

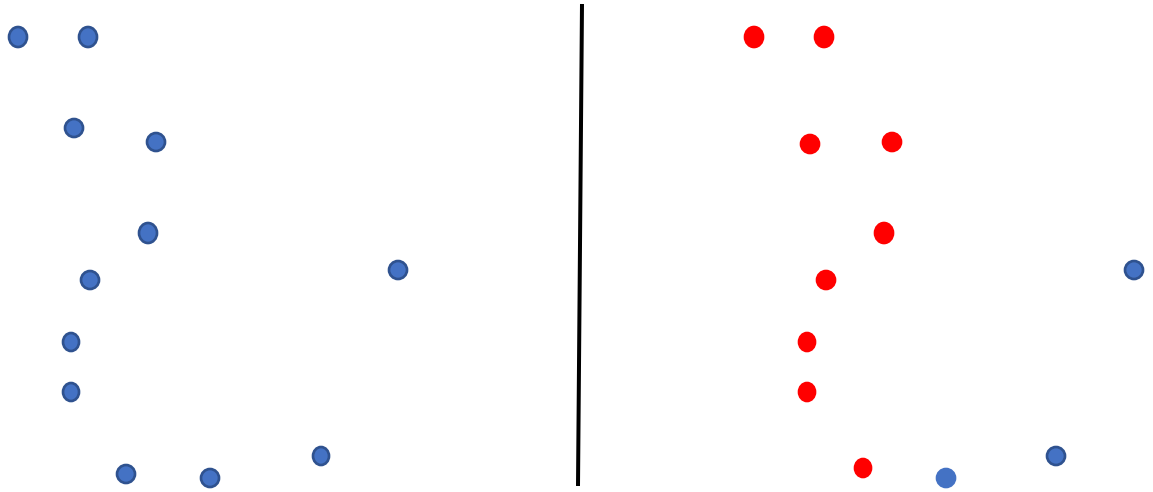
- N_i : nombre de faces minimale pour l'itération I

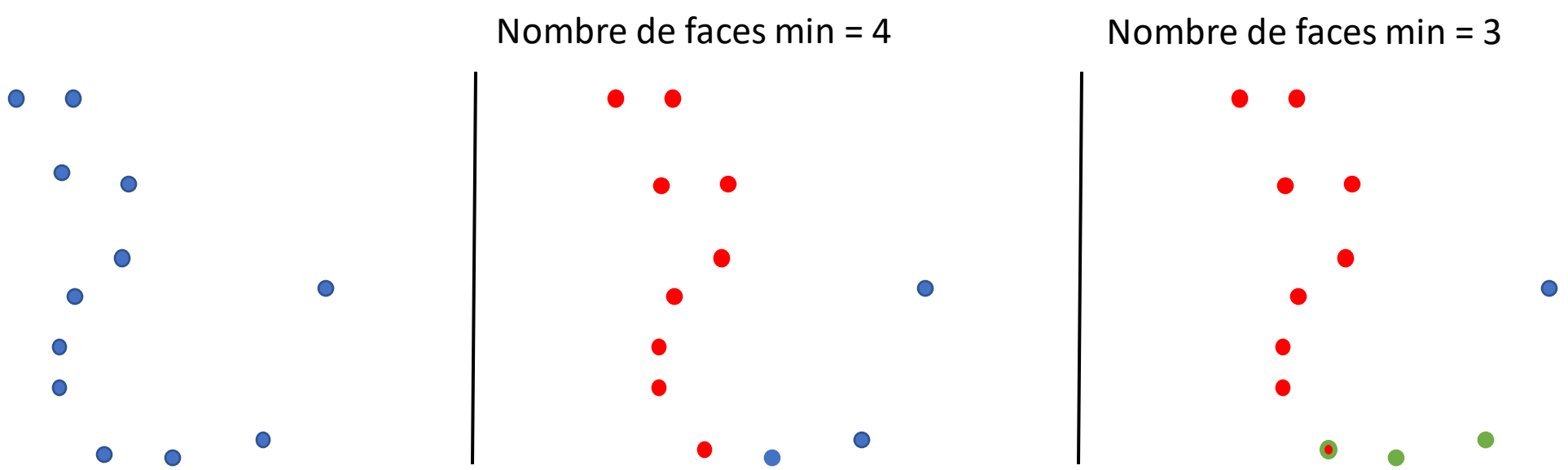
- (N_i) suite entière, strictement décroissante, de minimum 1





Nombre de faces min = 4

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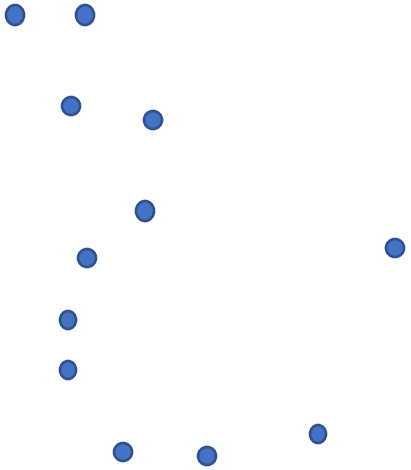
Nombre de faces min = 3



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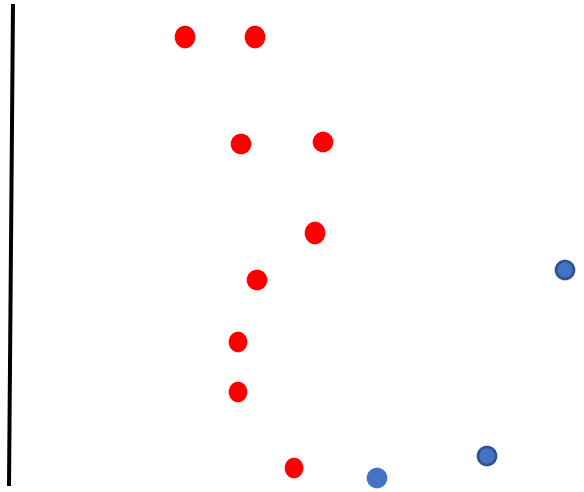
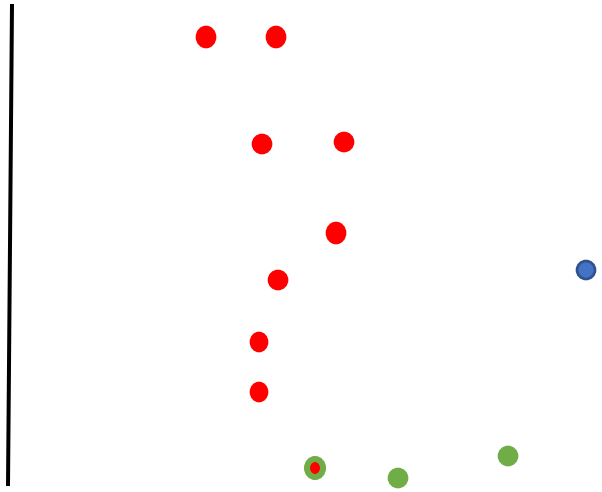


Nombre de faces min = 3



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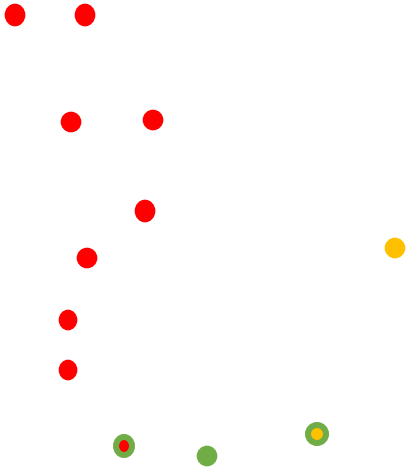

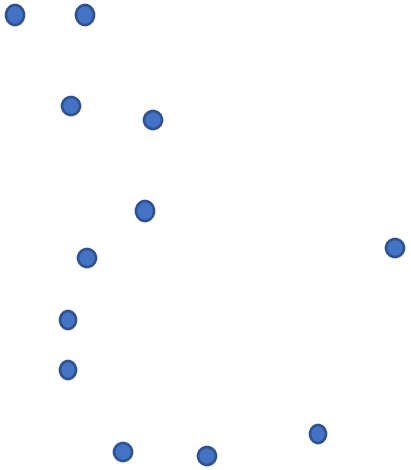

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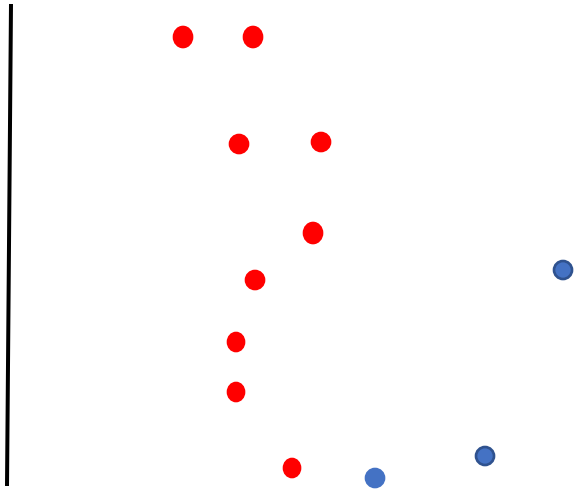

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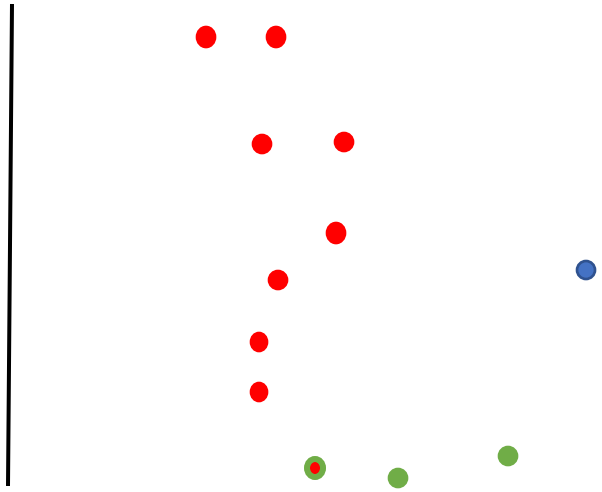

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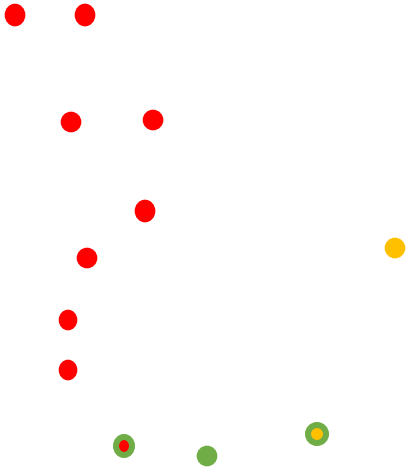
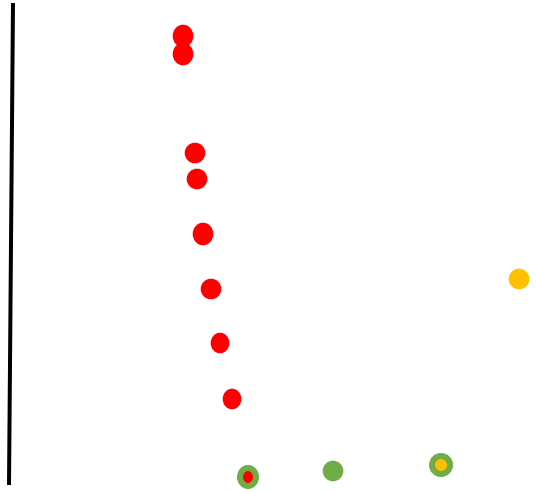
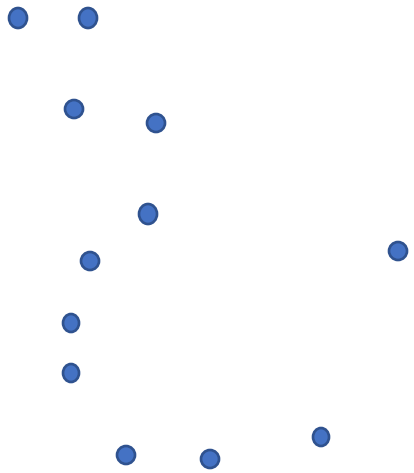


Projections





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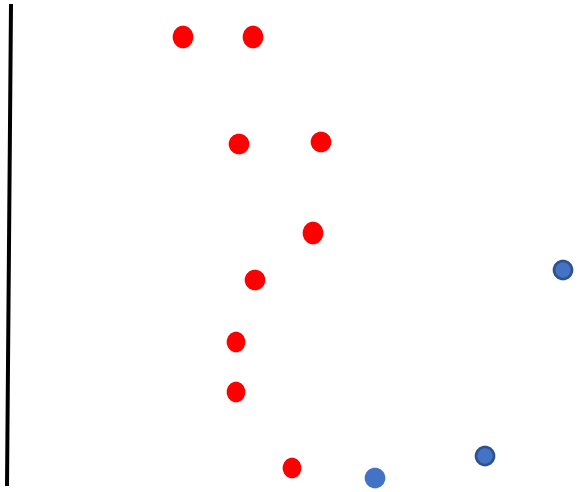

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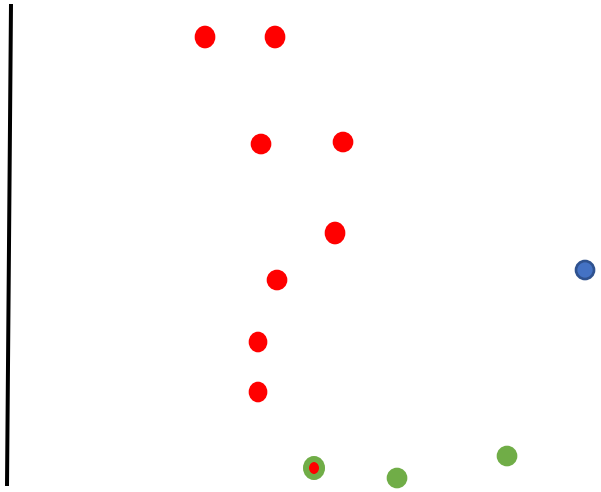

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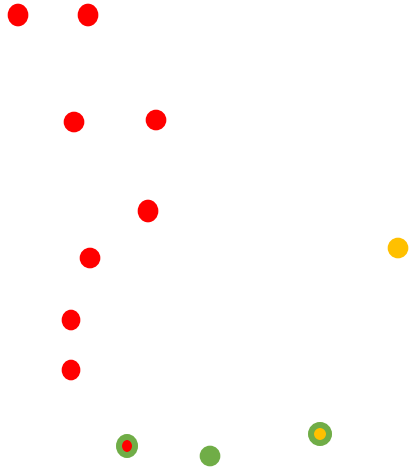

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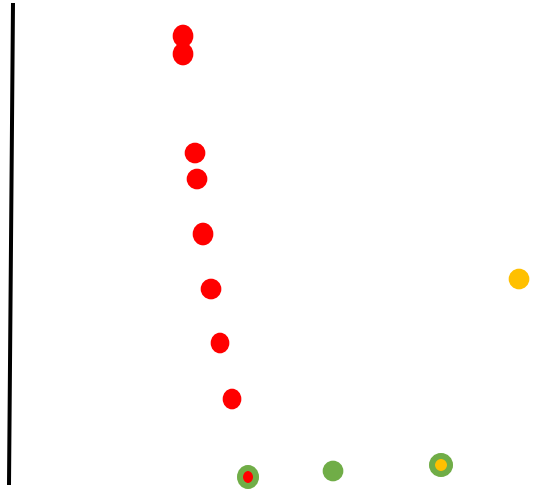
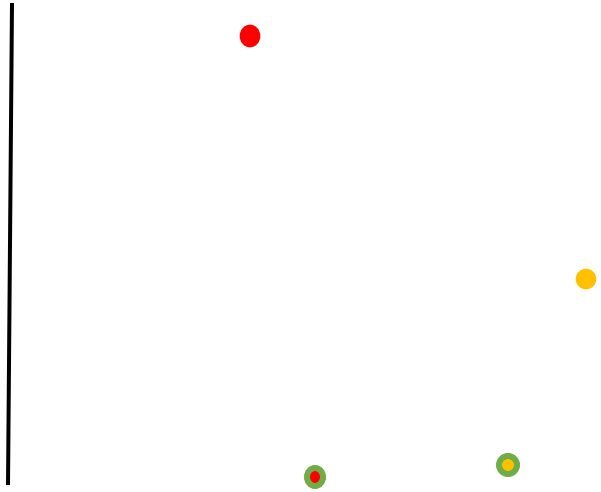
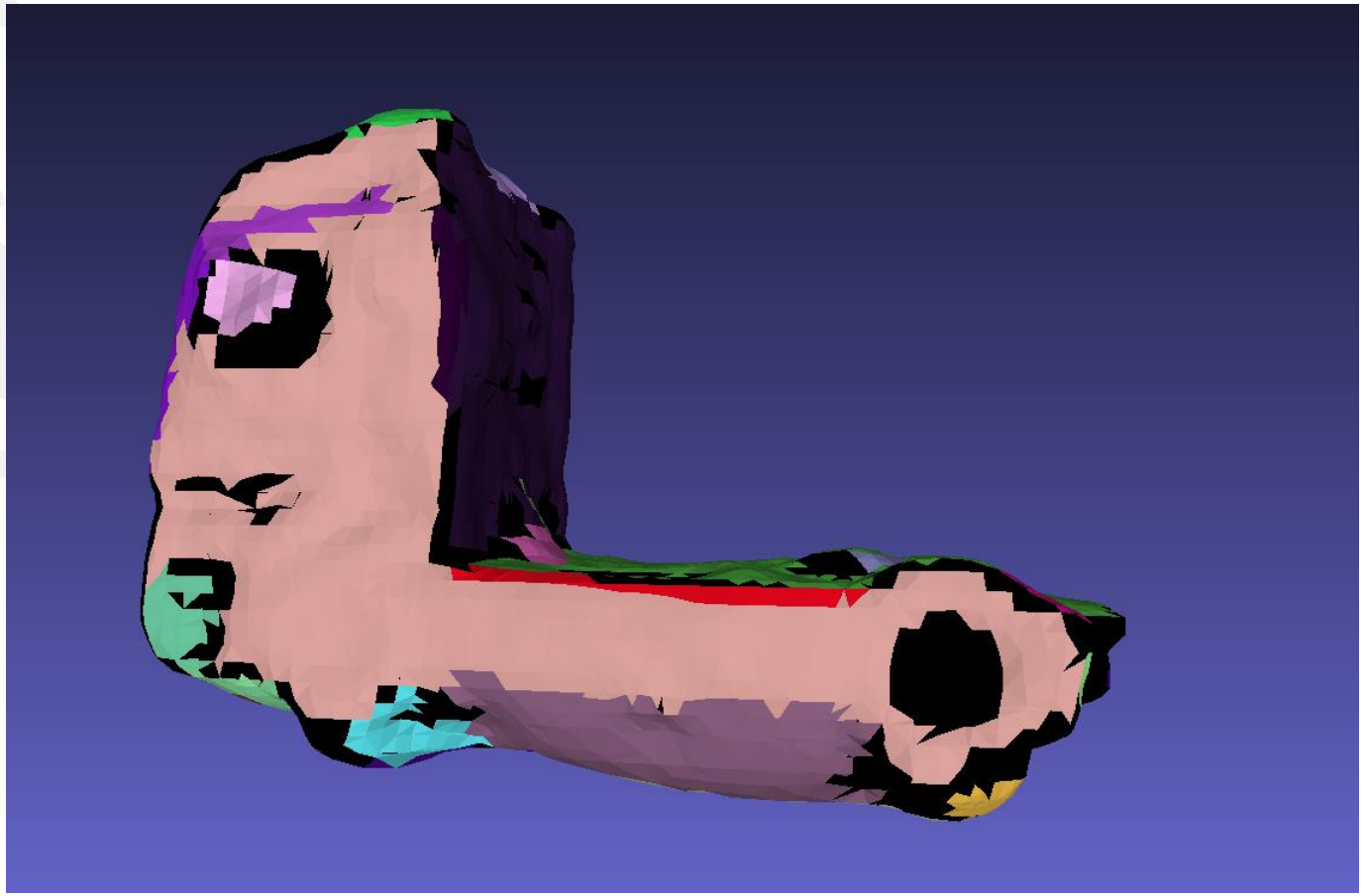
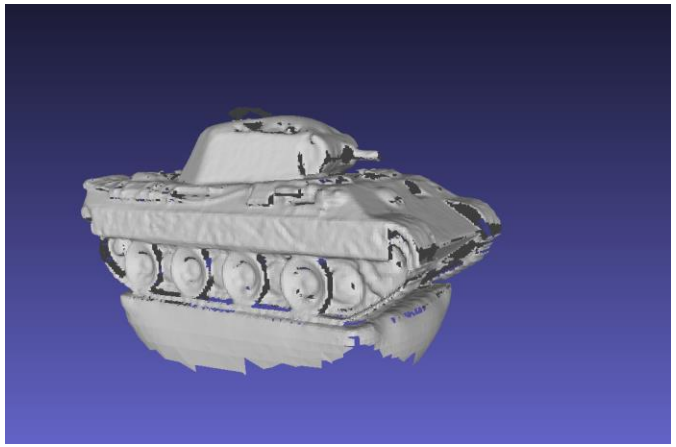
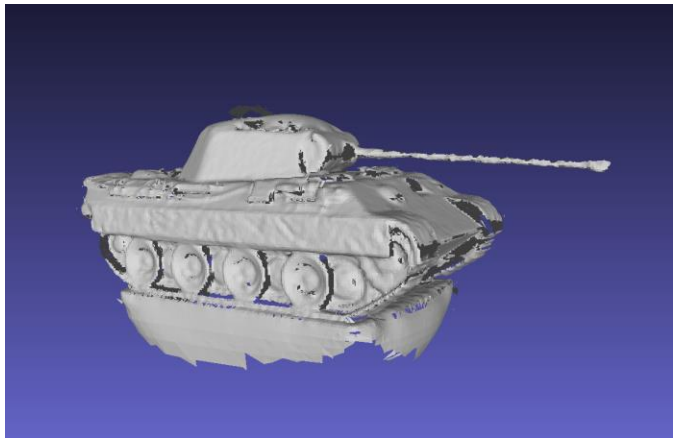


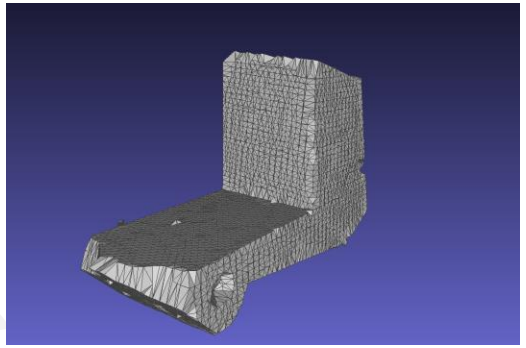
Décimation

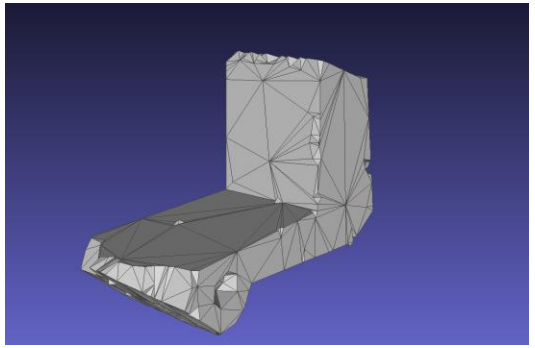


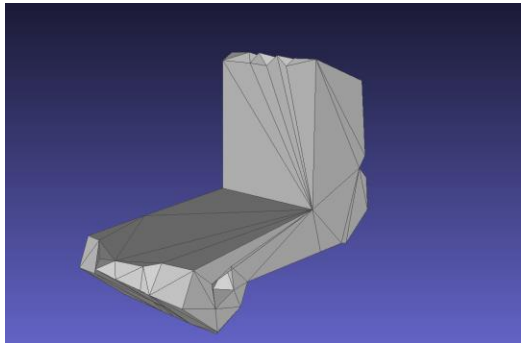


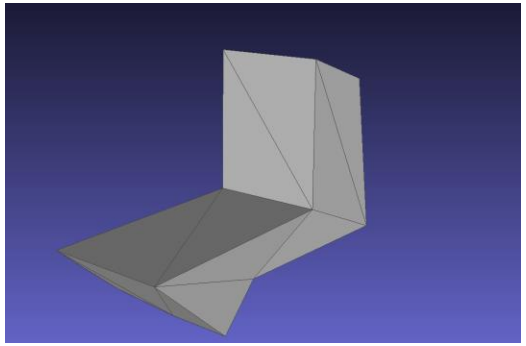






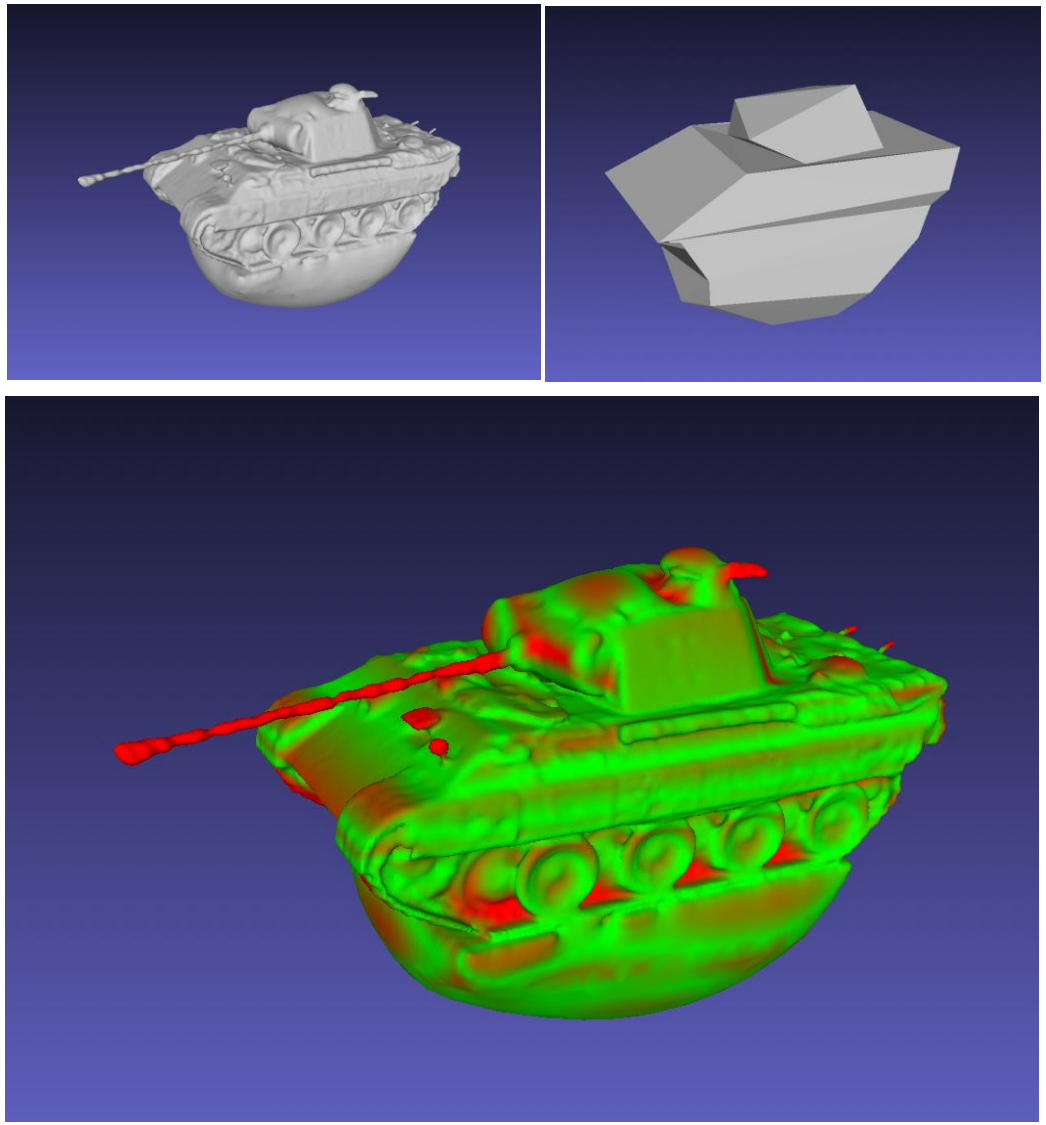






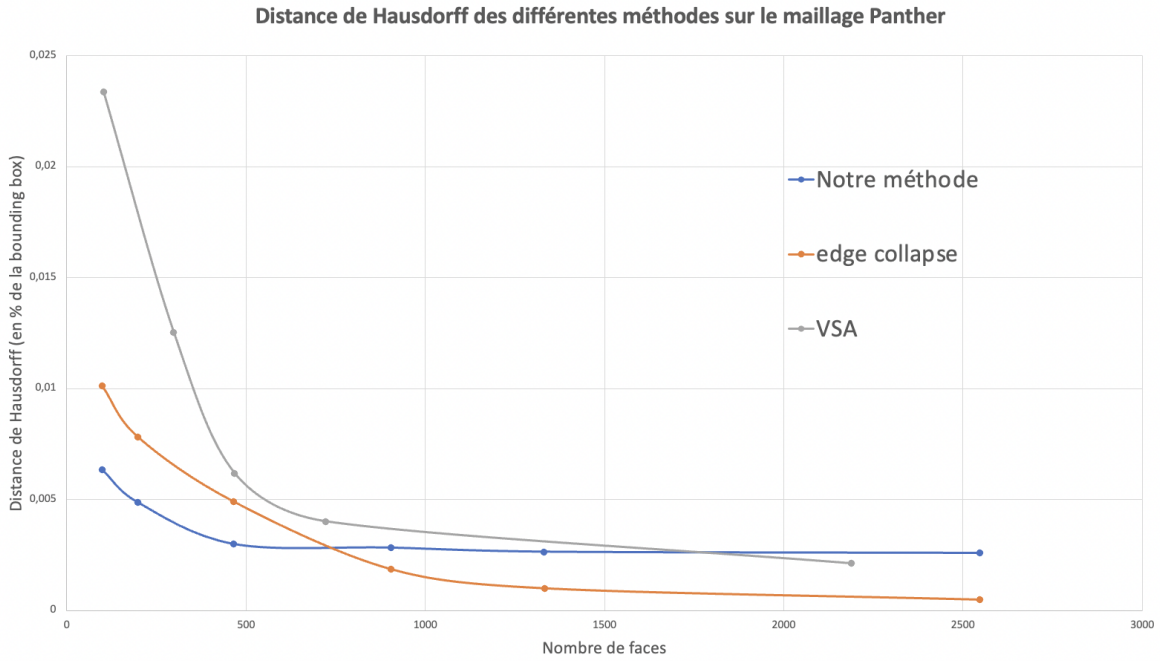
Critères de comparaison des maillages

- Nombre de faces
- Distance de Hausdorff
- Temps de calcul



Comparaison des méthodes de remaillage

- Performances différentes en fonction du nombre de faces en sorties
- Apparition d'un plateau



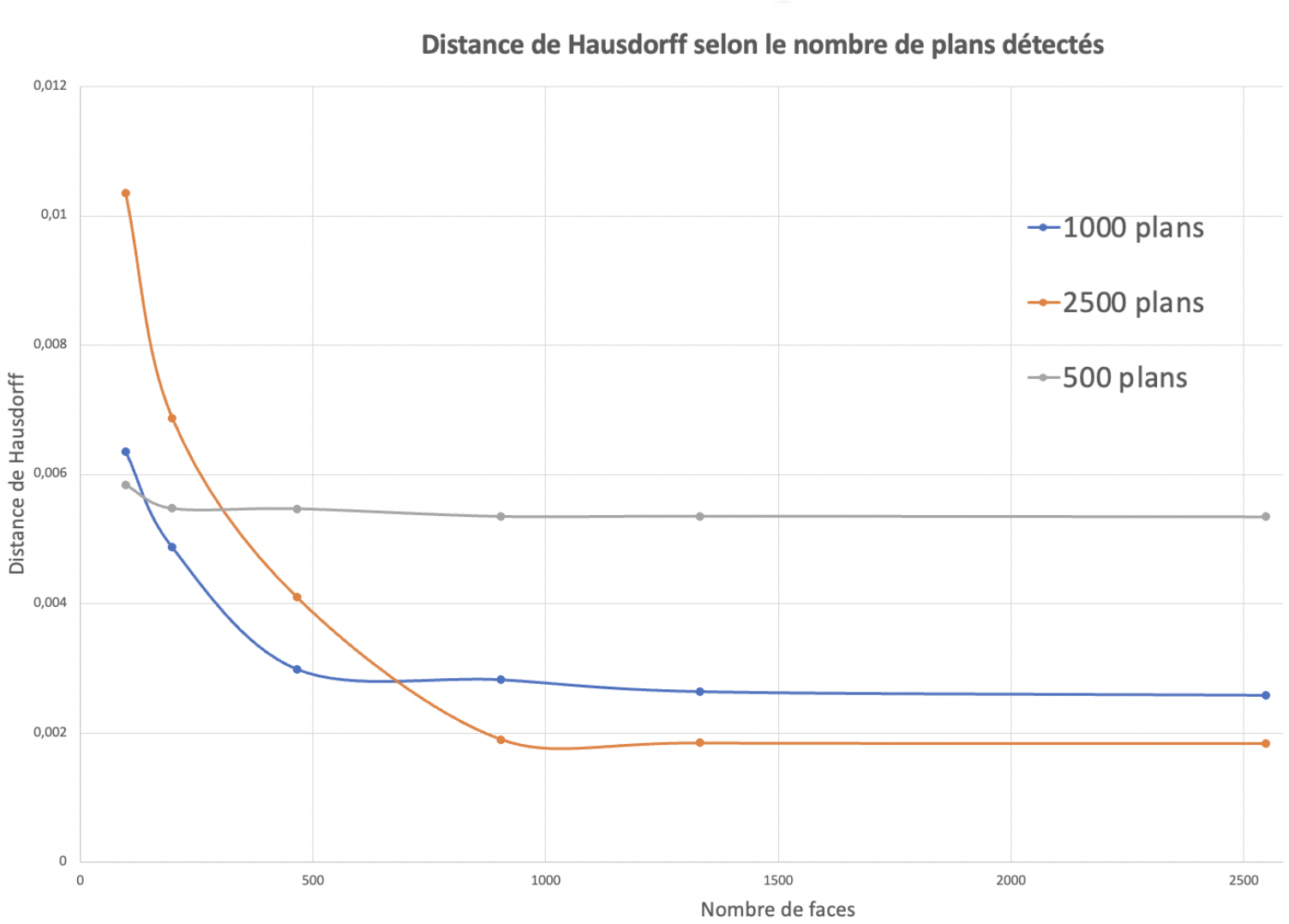
Conclusion et perspectives

- Création d'un pipeline performant depuis la prise de photo à l'obtention d'un maillage simple

- Améliorer l'automatisation
- Comparer aux méthodes à la pointe (kinetic shape reconstruction)
- Travailler avec des faces polygonales

Annexes

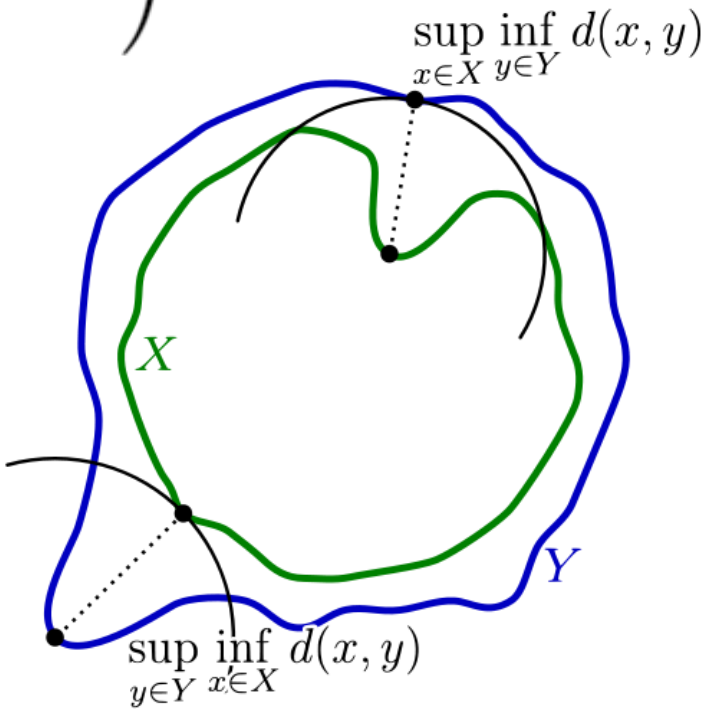
Choix des paramètres

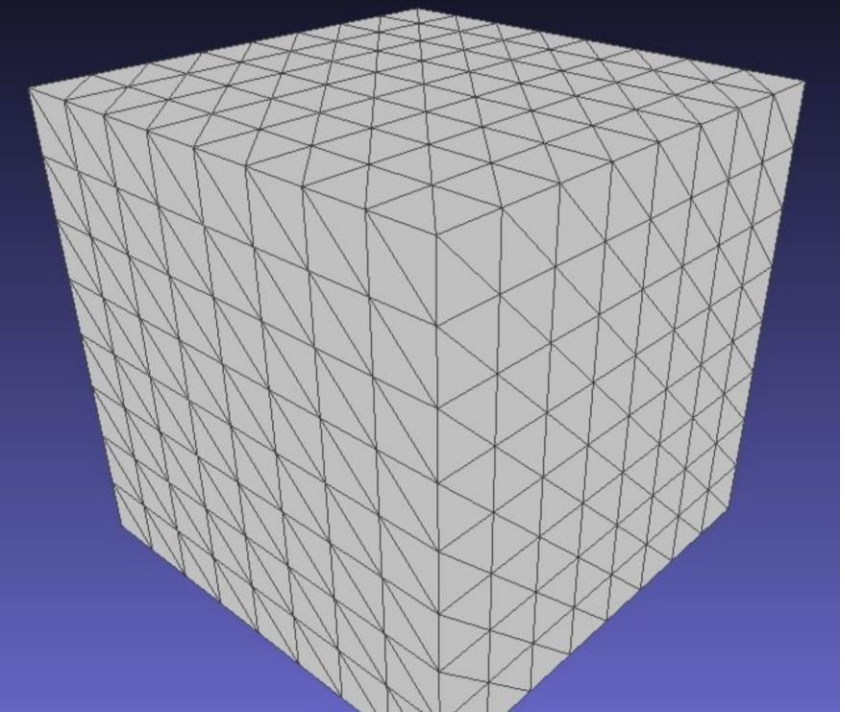


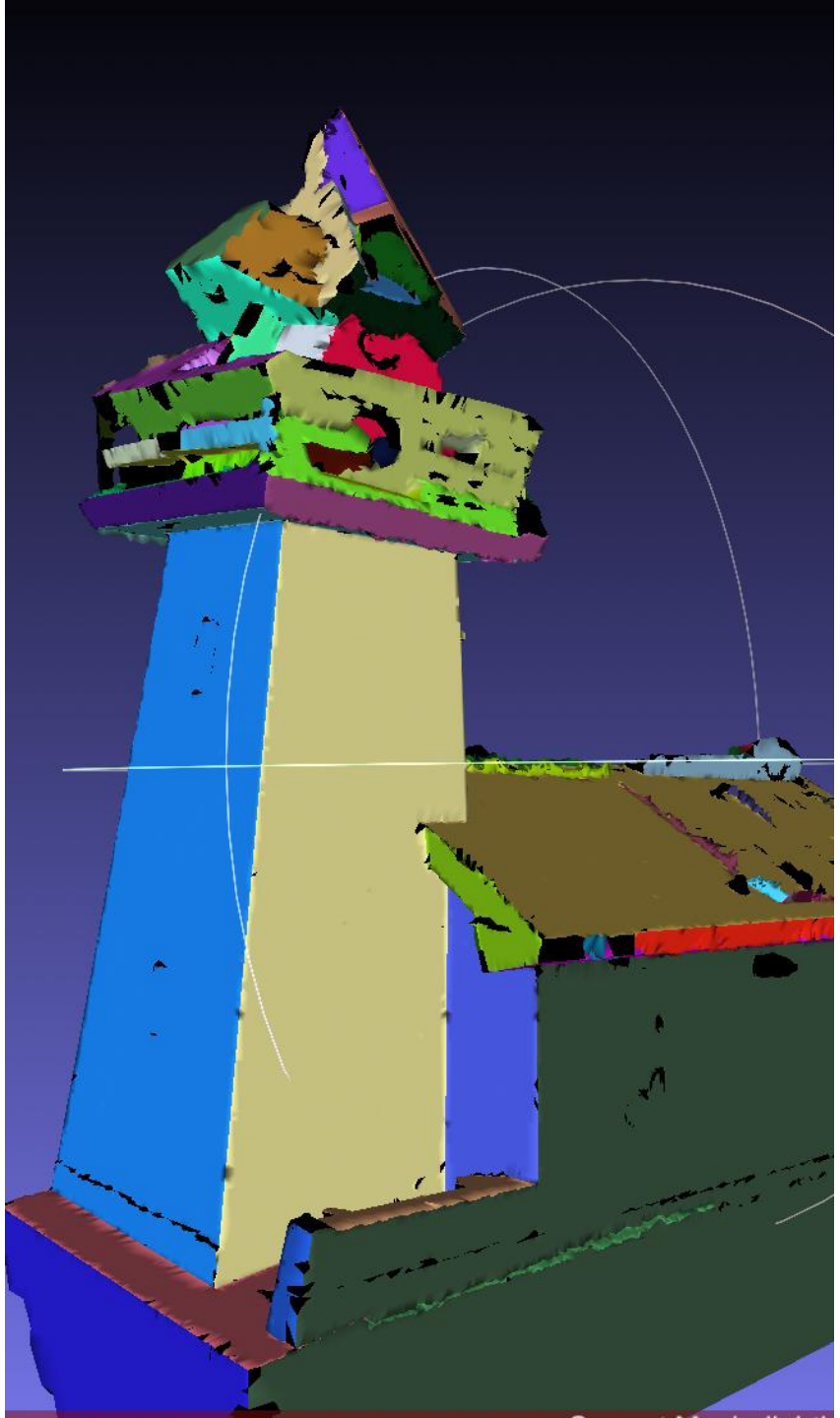
Distance de Hausdorff

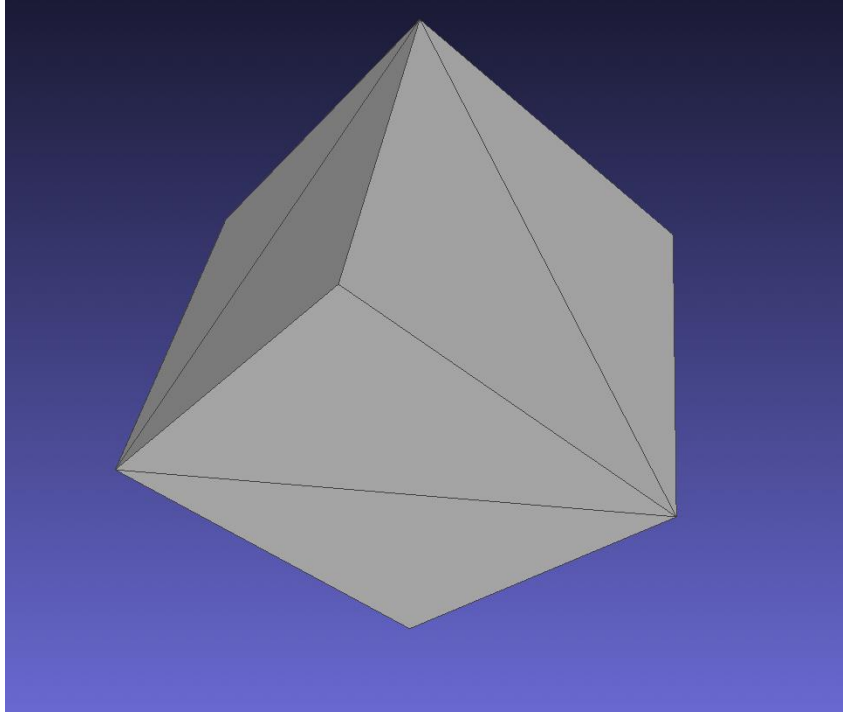
Soient deux maillages $\mathcal{X}$ et $\mathcal{Y}$. On définit la distance de Hausdorff D par :

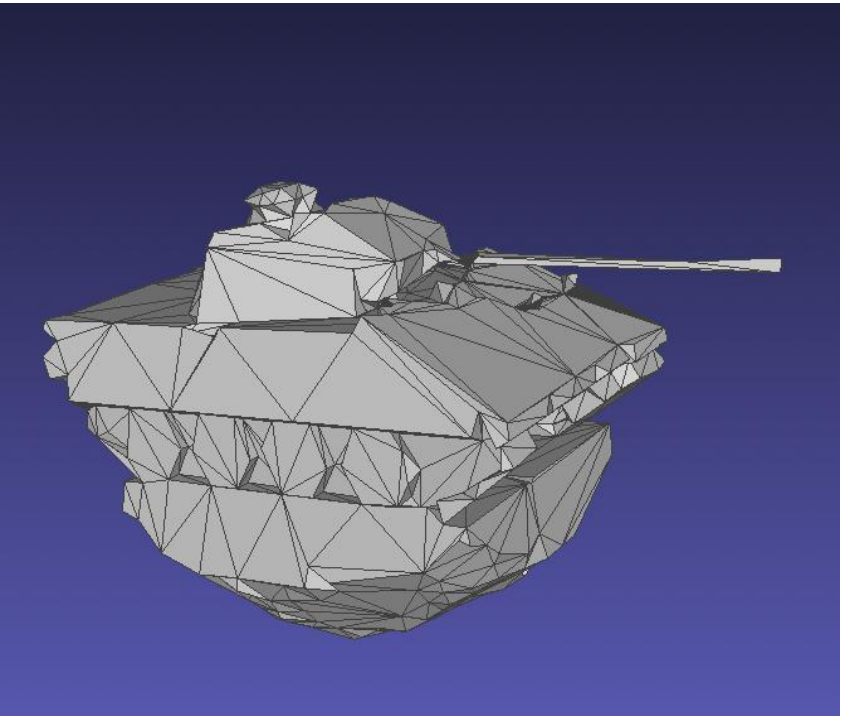
$$D(\mathcal{X},\mathcal{Y}) = \max\left(\sup_{x\in\mathcal{X}}\inf_{y\in\mathcal{Y}} \mathrm{d}(x,y),\quad \sup_{y\in\mathcal{Y}}\inf_{x\in\mathcal{X}} \mathrm{d}(x,y)\right)$$

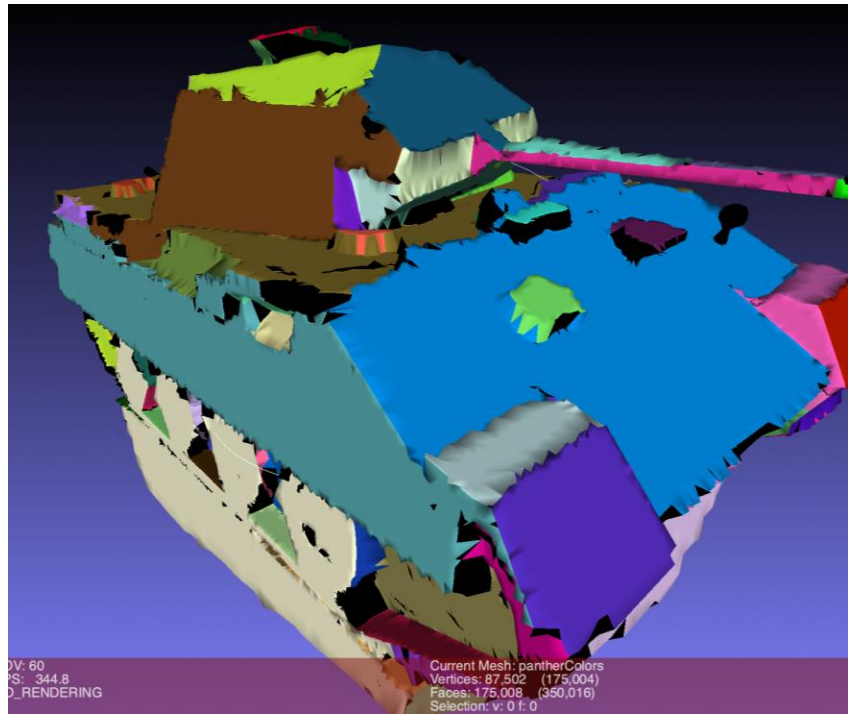








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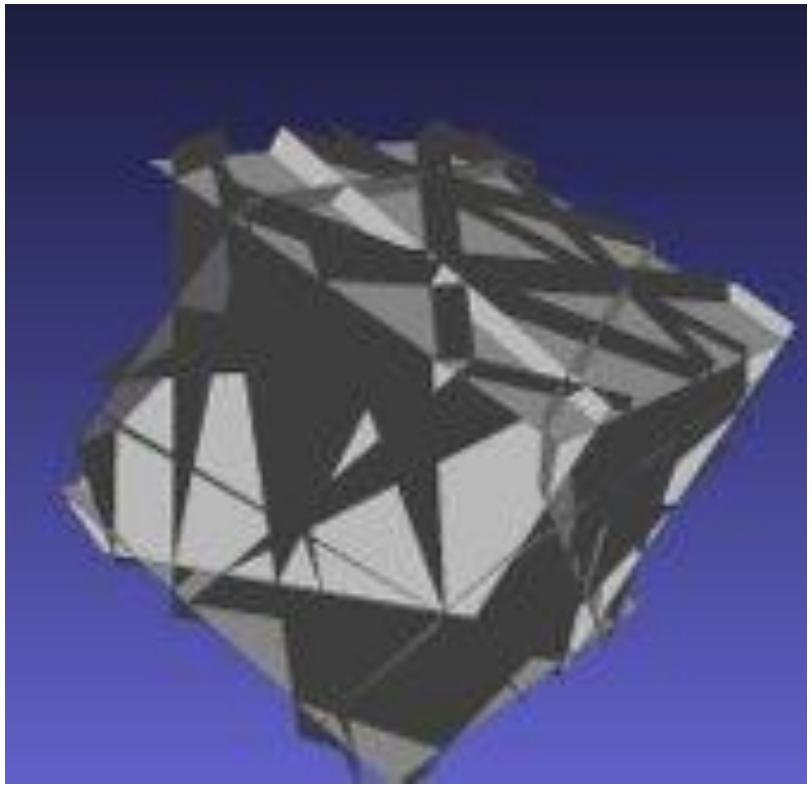
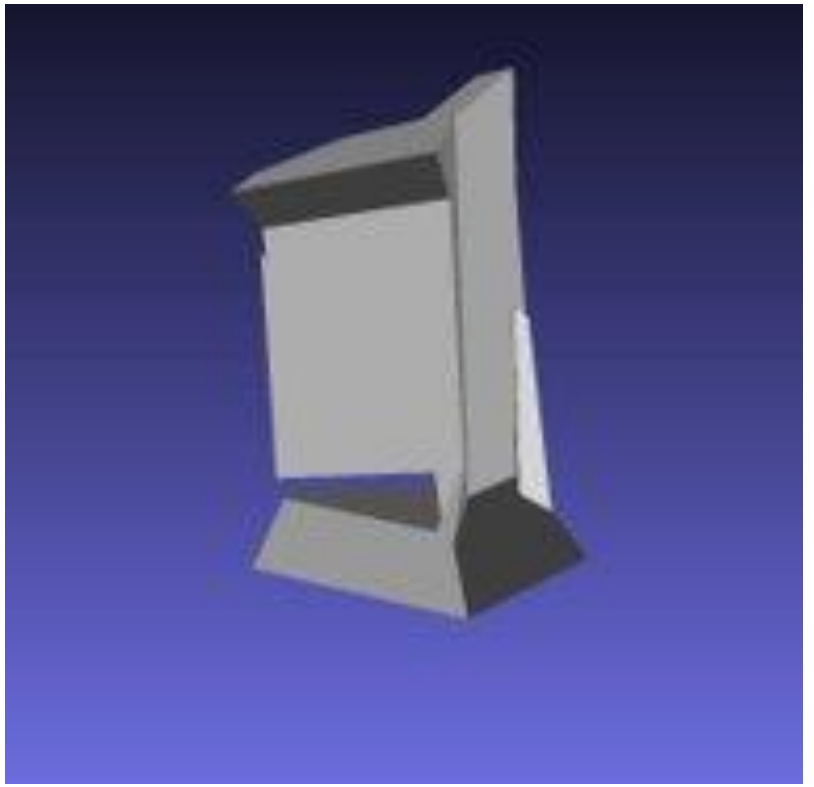
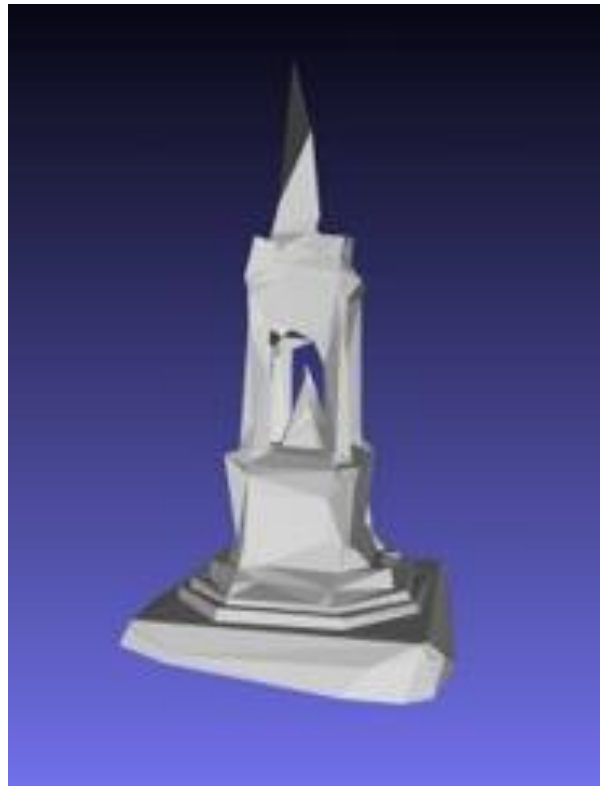
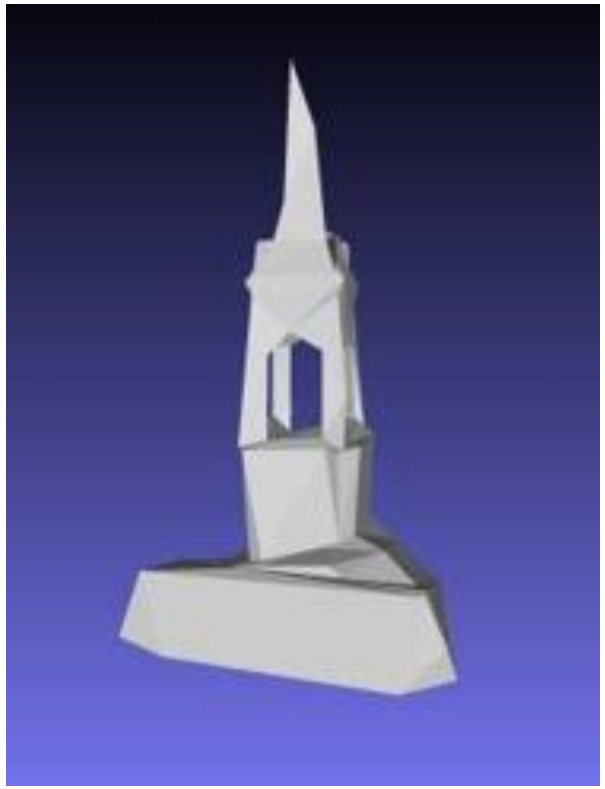
Vertices: 87,502 (175,004)
Faces: 175,008 (350,016)
Selection: v: 0 f: 0

Slicing

VSA



Edge collapse