SEMI-AUTOMATIC & VERSATILE POINT CLOUD SEGMENTATION BY REGION GROWING BASED ON NORMAL ESTIMATION

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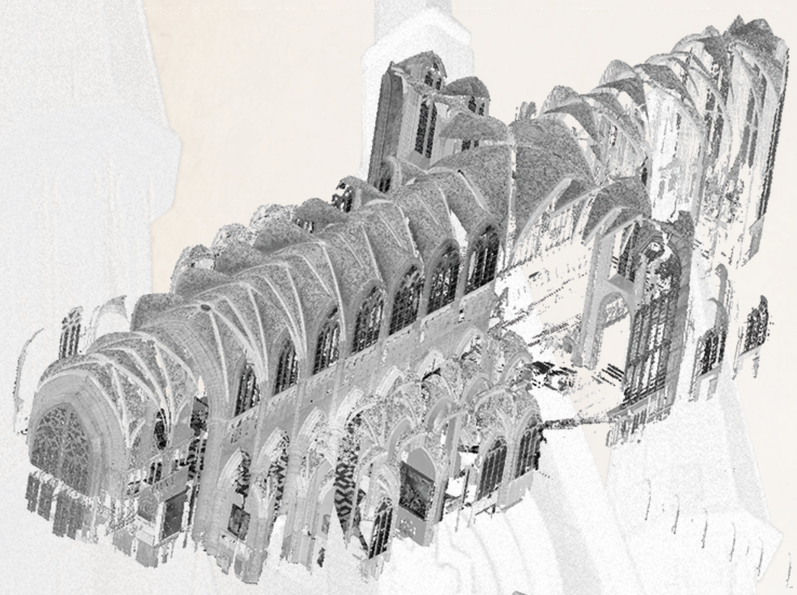
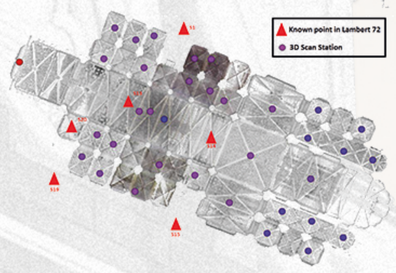
The Cathedral Saint-Paul of Liège: A Belgian masterpiece

We want to extract shapes for an archeological study on medieval construction out of a point cloud acquired with a 3D Scanner laser, representing the cathedral St-Paul of Liège. Considering the complexity of the monument, archeologicals means to extract information are time consuming and not always possible. The possibility to use the flexibility and the precision given by a 3D point cloud is tremendous. A large amount of different geometric primitives can be found contrasting with the amount of detail attached to such a structure (and the precision involve), perfect to serve as a complex data carrier showing the versatility of the post-processing algorithm

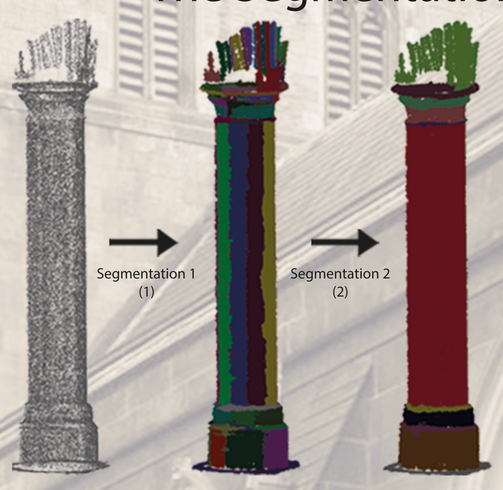
The 2 Billion Point Cloud



A 2 Billion Point Cloud acquired throught more than 65 stations is a very complex dataset. The need to develop an easier, faster & automatic process to organize & handle the amount of data is essential



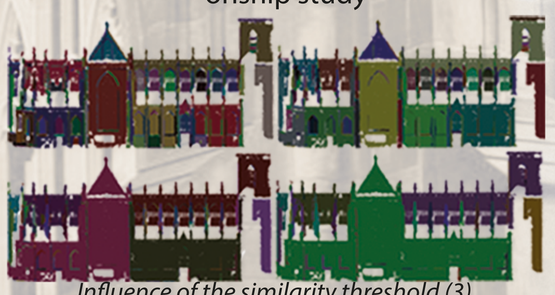
The Segmentation: theory & algorithm



1. Determination of the normal and curvature of every point
2. Region growing (1) grouping points with a similar normal
3. Relationship study (2) (connectivity, angle, size, symmetry, geometry) of every previous region to create final segmentation

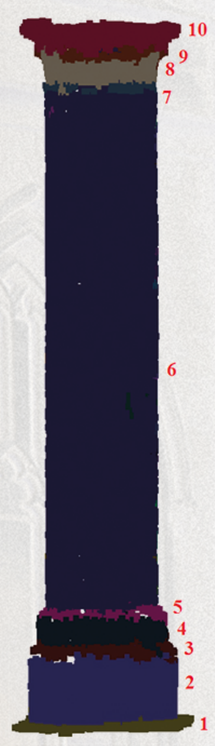
Input parameters :

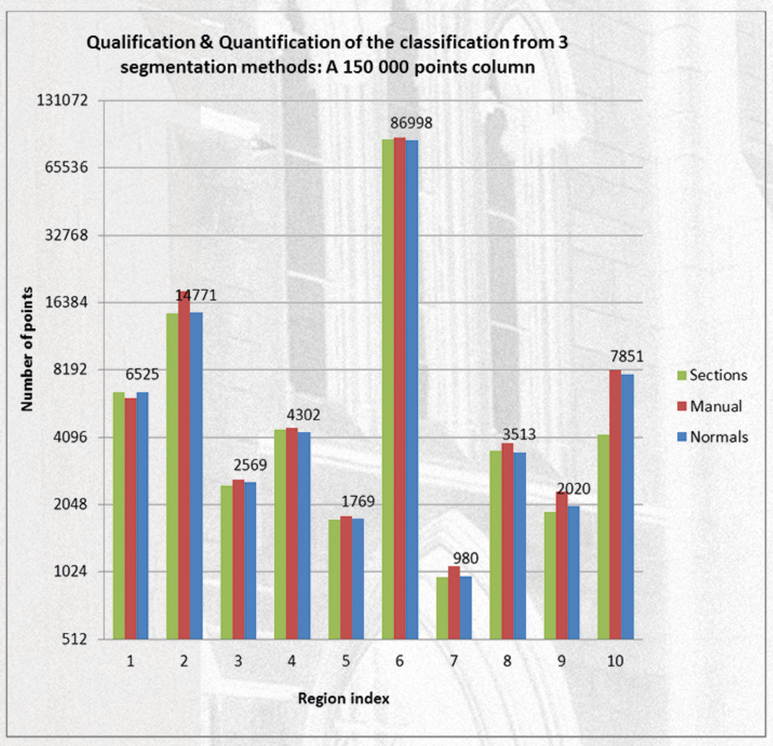
The similarity threshold: Difference between 2 normals. The closer to 0 it is, the more segmented the point cloud will be ((3): from left to right augmentation of the parameter)
The search radius: Euclidean distance limitating the neighborhood search
Minimum detail extracted: Will adapt the size of the cross section for the relationship study



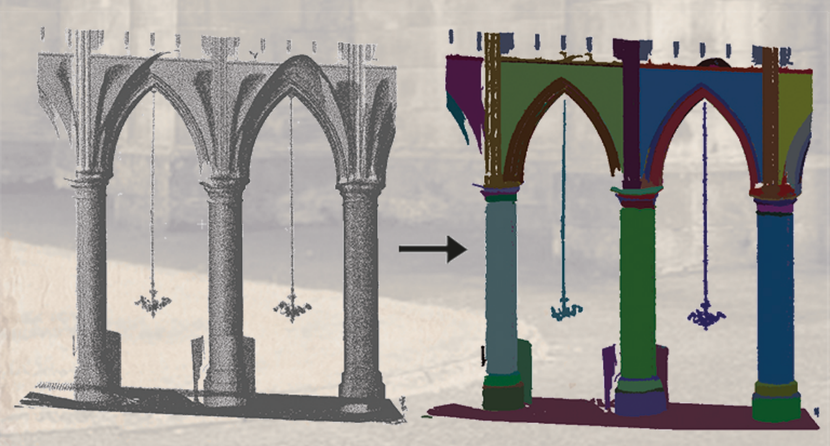
Influence of the similarity threshold (3)

Validation of the Segmentation method





Results: a precise automatic structuration of different elements of any scene



Segmentation of 500 000 points, part of the Cathedral Saint-Paul point cloud

Segmentation of a 1 Billion point Cloud representing the Colonster Castle (Liège)

Conclusion

This segmentation is a really efficient method to extract different elements from a point cloud to be considered, analysed and processed independently. We obtain a segmented point cloud that represents elegantly the scene and make it a base for a worthy analysis and reconstruction. This application to promote cultural heritage transcend what exist nowadays, and becomes a new way of transmitting history to future generations.