# Mobile Application For 3D Mesh Model Enhancement for AR Applications

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Nowadays, a fundamental difficulty encountered in a wide range of computer graphics applications is the segmentation of arbitrary 3D objects into structurally meaningful constituent sections. Firstly, We introduce SEG-MAT, an efficient approach based on the input shape's medial axis transform (MAT). Specifically, we can create a simple and principled way to successfully detect the many sorts of junctions between distinct elements of a 3D structure using the rich geometrical and structural information stored in the MAT. Second, we examines the area of Augmented Reality, in which 3-D virtual elements are blended in real time into a 3-D actual world.

## Literature Review

In [14], the author improved upon a graph-based method for segmenting coloured 3D laser point clouds. This study presented a segment union criteria based on colour and surface normals utilising co- registered sensors. It is capable of segmenting coloured point clouds from both interior and outdoor situations. The experiment demonstrated that it can operate in real time and is far more resilient than segmenting laser data or colour images alone. The disadvantages of this technology are that it necessitates a complicated sensor setup and that the segmentation results are color sensitive.

In [15], the author suggested a RANSAC-based technique for segmenting both mesh and point cloud data. This approach can recognise fundamental forms in disorganised point clouds automatically, and it incorporates a performance optimization phase while maintaining the accuracy of the output. This approach is resistant to outliers in point cloud data and even to high levels of noise. One disadvantage of this technique is that it must scale adequately to the size of the input point clouds and the size of the forms in the data.

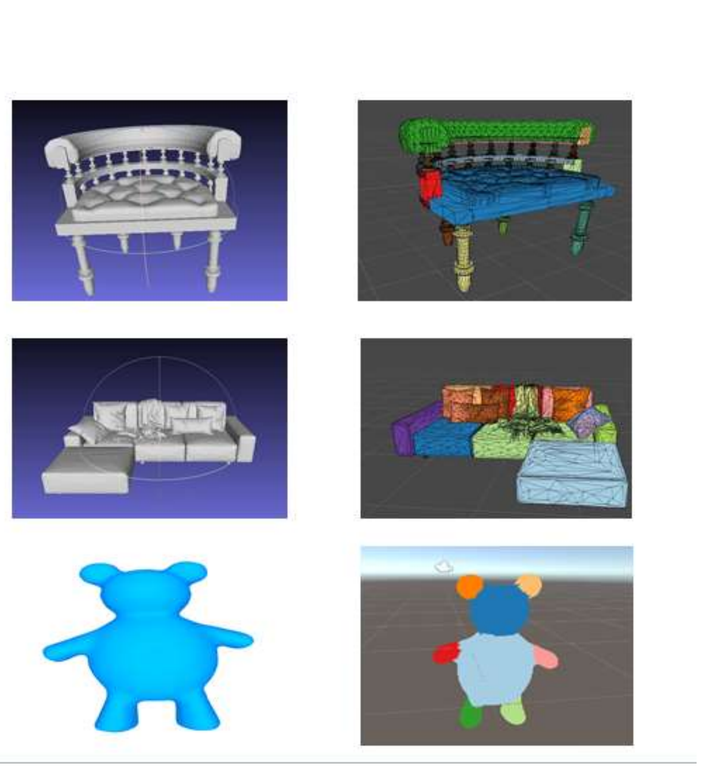
In [16]. A Digitalizing Construction Monitoring (DCM) framework model was proposed, and various phases were discussed. A pilot case study on the Larkin Mosque Car Parking Project was carried out to assess the validity of using Photogrammetry techniques to extract 3D coordinate values using Photo Modeler Software. Preliminary results demonstrate that significant control over extracting 3D co-ordinate values from 2D digital photos has been established, which can then be integrated into the digitalized system to automate the construction project monitoring process

## Methodology

We present an efficient method, called SEG-MAT, based on the medial axis transform (MAT) of the input shape. First we present an overview of the system before diving into the specifics of its primary components. The approach contains four basic phases for segmenting a given 3D geometry, (1) Initialization: calculate the MAT of the input 3D object (called the base MAT) and define its MAT graph. (2) Structural decomposition: simplify the base MAT further to obtain a structured MAT from which to derive the topological junctions (i.e., non-manifoldness and dimensionality change); and cut the MAT graph into connected components along the junctions explicitly suggested by the structured MAT. This stage produces a rough segmentation result. (3) Geometrical decomposition: execute region growth on each linked component by evaluating the geometrical junctions (i.e.,thickness variation and sharp bending) to produce a refined segmentation of the MAT from the coarse segmentation. (4) Finally, map the MAT domain segmentation results to the input shape's surface mesh and modify the segmentation findings and cut bounds.

## Results

A



B

## Conclusion

In this paper we first introduce SEG-MAT, a simple, robust, and fast approach for 3D shape segmentation based on the medial axis transform (MAT). SEG-MAT is useful at segmenting arbitrary forms across a broad range of complexity and noise levels due to the usage of structural and geometrical information stored in the MAT. Given a 3D shapeand its MAT, we execute structural decomposition first by recognising the joints with the reduced MAT, and then geometrical breakdown by region expanding. Finally, the results of the segmentation are transferred from the MAT to the form surface. Extensive evaluations and comparisons with existing segmentation methods show that SEG-MAT is a better and competitive geometry-driven solution for real-world 3D shape analysis applications. The use of the structural and geometrical information encoded in the MAT makes SEG-MAT effective for segmenting arbitrary shapes across a wide range of complexities and noise levels. Second, enhance the segmented model by extend vertices, change color of any part, and hide/show it. Third, save the model after modifying it. Fourth, showing the segmented model in AR environment and see it from different perspective.

## References

[1] D. Khattab, H. M. Ebeid, A. S. Hussein, and M. F. Tolba, "3d mesh segmentation based on unsupervised clustering," in Proceedings of the International Conference on Advanced Intelligent Systems and Informatics 2016 (A. E. Hassanien, K. Shaalan, T. Gaber, A. T. Azar, and M. F. Tolba, eds.), (Cham), pp. 598–607, Springer Inter- national Publishing, 2017.

[2] H. Wang, T. Lu, O. K.-C. Au, and C.-L. Tai, "Spectral 3d mesh segmentation with a novel single segmentation field," Graphical Models, vol. 76, no. 5, pp. 440–456, 2014. Geometric Modeling and Processing 2014.

[3] J. Z. Hui Jia, "Extract Segmentation Lines of 3D Model based on Regional Dis- crete Curvature," International Journal of Signal Processing, Image Processing and Pattern Recognition, vol. 9, pp. 265–274, 2016.

[4] M. Attene and B. Falcidieno, "Remesh: An interactive environment to edit and repair triangle meshes," Proceedings - IEEE International Conference on Shape Modeling and Applications 2006, SMI 2006, vol. 2006, pp. 41– 41, 07 2006.

[5] E. Camuffo, D. Mari, and S. Milani, "Recent advancements in learning algorithms for point clouds: An updated overview," Sensors, vol. 22, no. 4, 2022.

[6] M. Berger, A. Tagliasacchi, L. M. Seversky, P. Alliez, J. A. Levine, A. Sharf, and C. T. Silva, "State of the Art in Surface Reconstruction from Point Clouds," 2014.

[7] Y. Guo, H. Wang, Q. Hu, H. Liu, L. Liu, and M. Bennamoun, "Deep learning for 3d point clouds: A survey," 2019.

[8] G. Hansen, R. Douglass, and A. Zardecki, "Mesh enhancement: Selected elliptic methods, foundations and applications," 03 2005.

[9] H. Hoppe, T. DeRose, T. Duchamp, J. McDonald, and W. Stuetzle, "Mesh optimization," p. 19–26, 1993.

[10] E. Zuckerberger, A. Tal, and S. Shlafman, "Polyhedral surface decomposition with applications," Computers Graphics, vol. 26, no. 5, pp. 733–743, 2002.

[11] A. Voinea, F. Moldoveanu, and A. Moldoveanu, "3d model generation of human musculoskeletal system based on image processing: An intermediary step while developing a learning solution using virtual and augmented reality," pp. 263–270, 05 2017.

[12] Q. Liao, X. Jin, and W. Zeng, "Enhancing the symmetry and proportion of 3d face geometry," IEEE Transactions on Visualization and Computer Graphics, vol. 18, pp. 1704–1716, 2012.

[13] J. Zhang, C. Wu, J. Cai, J. Zheng, and X.-c. Tai, "Mesh snapping: Robust interactive mesh cutting using fast geodesic curvature flow," Computer Graphics Forum, vol. 29, no. 2, pp. 517–526, 2010.

[14] J. Strom, A. Richardson, and E. Olson, "Graph-based segmentation for colored 3d laser point clouds," pp. 2131 – 2136, 11 2010.

[15] R. Schnabel, R. Wahl, and R. Klein, "Efficient ransac for point-cloud shape detection," Computer Graphics Forum, vol. 26, no. 2, pp. 214–226, 2007.

[16] Z. Memon, M. Abd Majid, and M. Mustaffar, "A systematic procedure for devel-
oping the 3d model to evaluate the construction project progress," Construction
Innovation: Information, Process, Management, vol. 7, pp. 187–199, 04 2007.