# Unsupervised 3D Model Features Learning for Semantic-based Segmentation (SBS)

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## Abstract

Many existing 3D semantic model segmentation methods require user-input or supervised data to determine a reasonable number of segments for accurate segmentation. We apply a snake-based approach to automatically search for the boundary between two connected functional features. The search is guided by the skeleton model. The proposed approach courageously modifies the geometric meshes with respect to each sectional skeleton to ensure the snake meets end-to-end to form the complete rings. In the end, the created rings are reverted to their original coordinates to prevent geometric distortion. The entire process is done automatically without any user-input.

## Introduction

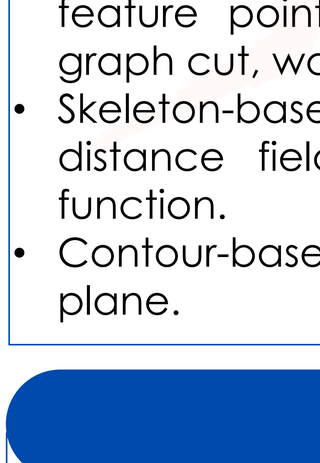
Technically, a model can be segmented either based on the geometric direction (called batch-type segmentation) or semantic shape (called part-type segmentation). We go for part-type segmentation because the segmented features are expressive to human eyes. It does not need any prior knowledge of the semantic features.

## Related Work

- Clustering method: iterative clustering, region growing, feature point-based clustering, fuzzy clustering with graph cut, water-shed and spectral clustering.
- Skeleton-based: Thinning and boundary propagation, distance field based, geometric and general-field function.
- Contour-based: Concave discontinuity of the tangent plane.

## Conclusion

We have fully-automated the segmentation process on unsupervised 3D models into semantic features. The output results show that our proposed SBS method is more robust and accurate in semantic segmentation.



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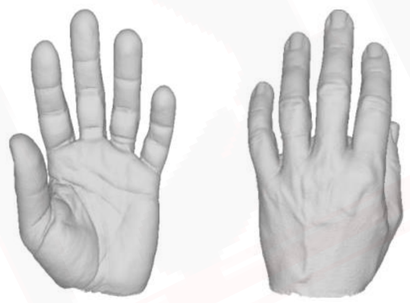
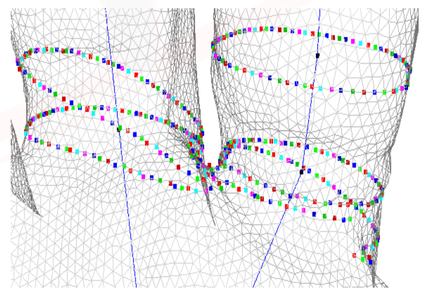
## Proposed Algorithm

1. Input of 3D model and generate skeleton features
2. Initiate surface point and relocation
3. Computation of minimum cost and relocation
4. Computation of prevention cost
5. Computation for snake along each feature till the end
6. Restoration to original coordinate

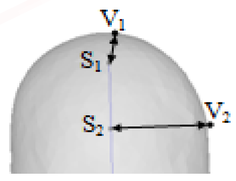
## Experimental Results



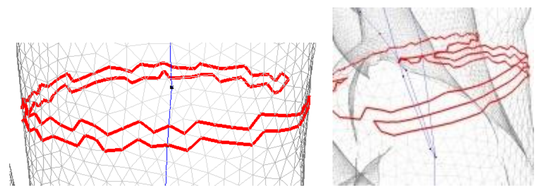
3D Models



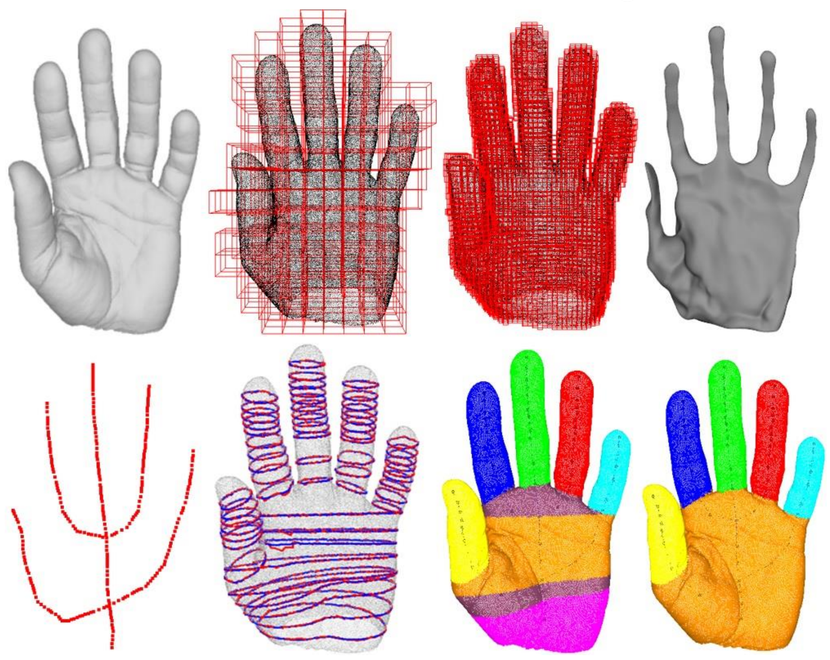
Rings generated




Initial surface point



Reverse rings



Entire process from 3D input model till the complete segmented semantic features

Comparison between our SBS method with other segmentation methods:




Segmented Dog model




Accuracy metrics for Dog model




Segmented Horse model




Accuracy metrics for Horse model