

COSC470 Research Project Report

Contour Splitting for Branching Structures in CT Image  
Reconstructions

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## Abstract

abstract text

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## 1 Overview

overview text Example citation [1, 2, 3]. Example URL <sup>1</sup>.

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<sup>1</sup><https://github.com/cstevenson3/cosc470writing/blob/main/survey.pdf>

## 2 Introduction

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## 3 Background

background text

### 3.1 Generic Methods

generic methods text

### 3.2 Correspondence Methods

subsection preamble text

#### 3.2.1 Contour Correspondence

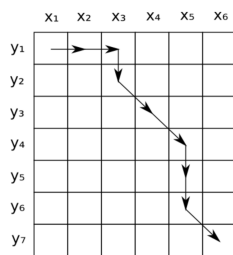
contour correspondence text

Example list:

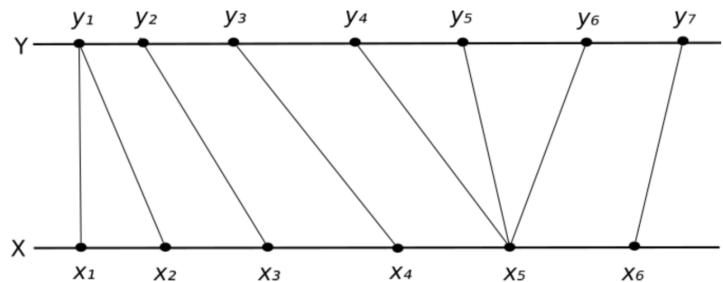
- item1
- item2
- item3

#### 3.2.2 Point Correspondence and Triangulation

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(a) DTW path  
through cost matrix



(b) DTW point correspondence

Figure 1: Two examples of DTW paths on contours X and Y [1]

text after figure declaration

#### 3.2.3 Branching Problem

branching problem text

## 4 Method

method text

### 4.1 Proposal

The proposed system consists of:

- Contour Splitting, a new approach to enabling point correspondence on branches and other structures
- Point Angle, an alternative algorithm for point correspondence.

Example figure ref (See Figure 2).

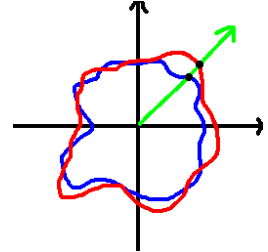


Figure 2: Points matched by angle from shared centroid

#### 4.1.1 Contour Splitting

For brevity, contour correspondences of 1-to-2 will be considered. Point correspondence algorithms act on 1-to-1 contour matchings, so 1-to-2 cases must be reduced to these.

Mackay’s approach was contour merging, where the 2 contour side of the correspondence is merged. The closest pair of points across the contours is found, to join them into a single contour (See Figure TODO). This gives a single 1-to-1 case for point correspondence to act on. A disadvantage of this method is that the merged contour has an unusual shape, which can cause point correspondence algorithms to behave poorly.

The proposed technique instead splits the 1 contour side of the correspondence. The best fit line to divide the 2 contour side is found, giving the angle of the line to split the 1 contour (See Figure TODO). Each half of the split 1 contour is paired with its corresponding contour on the 2 contour side. This gives two 1-to-1 cases for point correspondence to act on. The contours produced are well shaped and suitable for point correspondence algorithms designed for simpler cases.

### 4.2 Implementation

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## 5 Analysis

analysis text

### 5.1 Ground Truth

ground truth text

### 5.2 Visual Results

visual results text

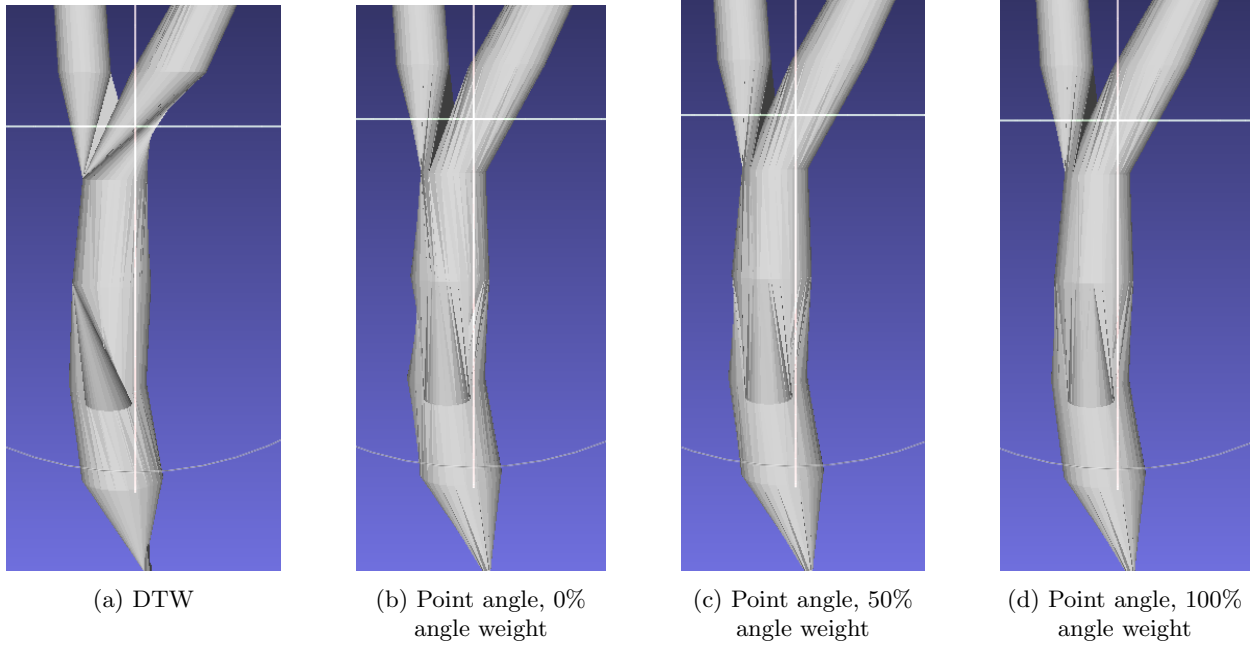


Figure 3: Reconstructions with 10 plane samples

### 5.3 Measurements

measurements text

### 5.4 Summary

summary text

## 6 Conclusion

conclusion text

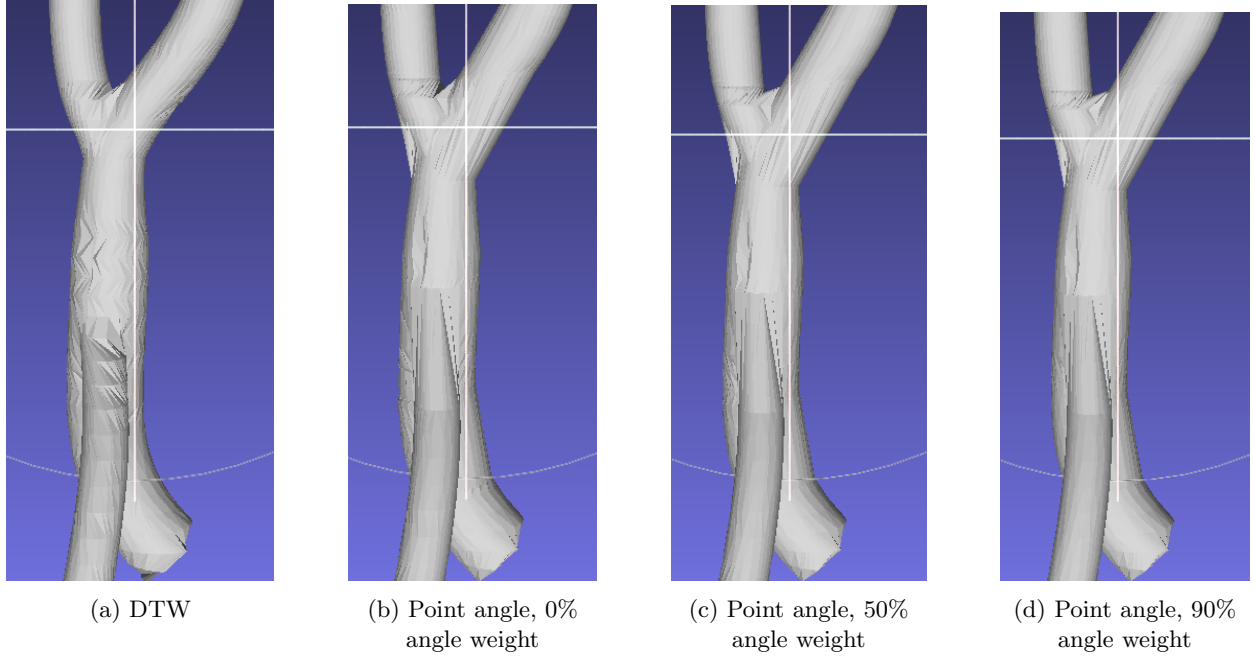


Figure 4: Reconstructions with 50 plane samples

## References

- [1] D. Mackay, “Robust contour based surface reconstruction algorithms for applications in medical imaging,” 2019.
- [2] R. Mukundan, “Reconstruction of high resolution 3d meshes of lung geometry from hrct contours,” in *2016 IEEE International Symposium on Multimedia (ISM)*. IEEE, 2016, pp. 247–252.
- [3] Z. Pan, S. Tian, M. Guo, J. Zhang, N. Yu, and Y. Xin, “Comparison of medical image 3d reconstruction rendering methods for robot-assisted surgery,” in *2017 2nd International Conference on Advanced Robotics and Mechatronics (ICARM)*. IEEE, 2017, pp. 94–99.

## 7 Appendix

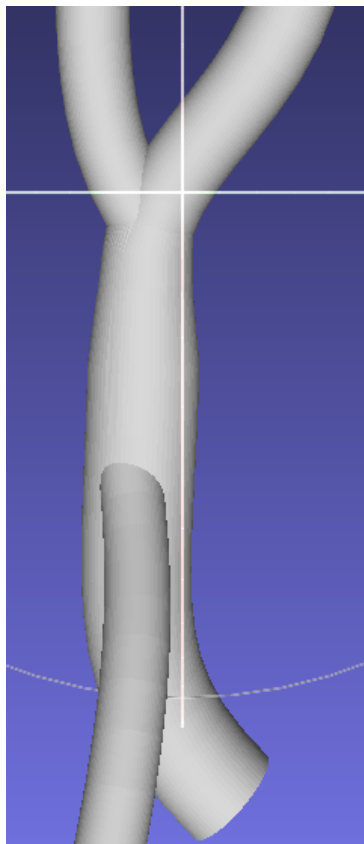


Figure 5: Original multi branch model