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# Prospects of semi-automatic segmentation of the mandible from CT images: A developmental study

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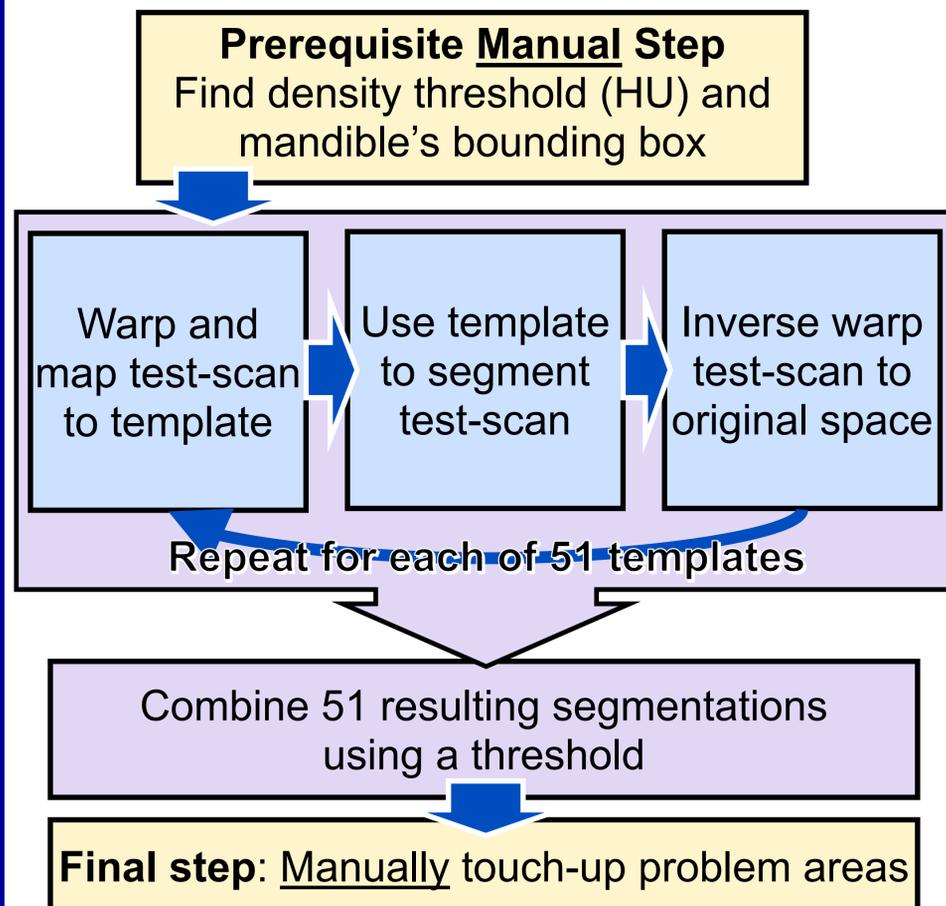
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## Introduction

- Accurate and precise segmentation of the mandible/jaw from CT scans is necessary to quantify growth.
- Manual editing of segmentations is a time consuming process and introduces a host of issues, including inter- and intra-rater inconsistency.
- We developed a semi-automatic segmentation pipeline to create mandible models with fewer man-hours (~20% of manual segmentation) and greater consistency.
- The purpose of this poster is to describe our pipeline and report on the accuracy of its automatic portion in comparison to purely manual segmentations.

## Methods

Fig. 1. Semi-automatic segmentation pipeline



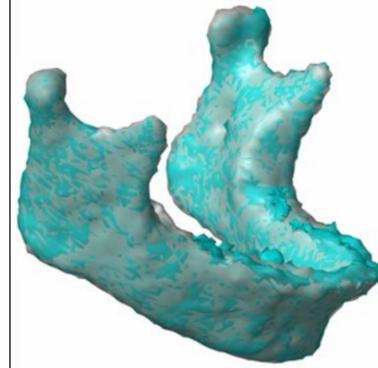
## 2. Testing the automatic segmentation accuracy

- To assess the accuracy of segmentation methods (manual vs. automatic), we conducted both a qualitative and a quantitative test.
- Both tests were performed on a set of 18 head and neck CT scans (n=18; 6 females, 12 males, ages birth to 18).
- The mandible of each CT scan was segmented manually and automatically for comparison.

### Quantitative Test

- The two mandible models (automatic and manual) for each case were compared by finding the percent of overlapping voxels between the two models (Fig. 2).
- As an exploratory measure, we plotted accuracy against age and sex (Fig. 3). These plots might help prognosticate the performance of the automatic pipeline across different groups.

Fig 2. Superimposed automatic (cyan) and manual (gray) mandible segmentations. Overlap in this case is 94.1%.



### Qualitative Test

- We used a rating scale from 1 to 5, with 5 representing optimal accuracy, to rate areas of importance:
  - Teeth
  - Condyles
  - Coronoid processes
  - Usability for making measurements
  - Overall accuracy
- First inter-rater reliability was established between a group of five raters.
- Then two blinded raters individually rated the two models for each of the 18 cases.

## Acknowledgements

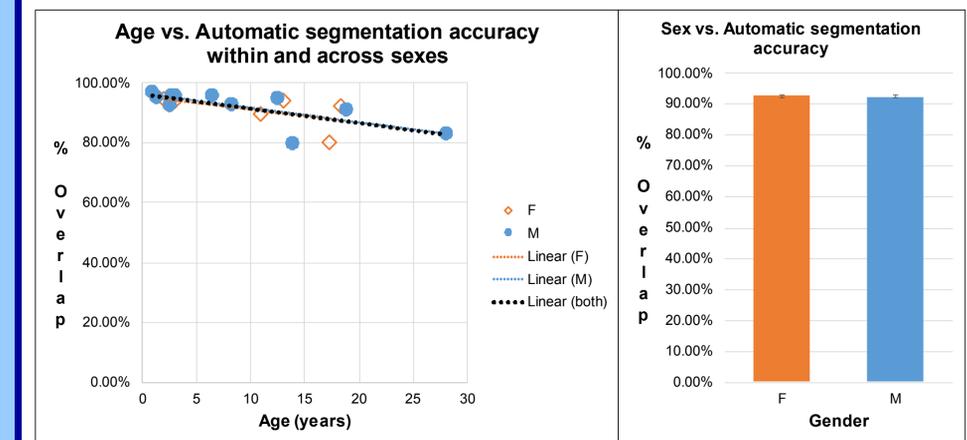
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## Results

### Quantitative Test

- The average percent overlap was 91.2%, with a range of 97.0% to 79.8%.

Fig. 3. Looking at accuracy against age and sex



### Qualitative Test

- Reliability analyses showed the two raters to be highly correlated in their ratings (ICC = 0.80, p < .001).

Table 1. Mean scores of segmentation methods

Segmented mandibles	Automatic	Manual
Mean score	3.57	3.75
SD	0.12	0.07

## Conclusion

- Even without manual touch-up of problem regions, automatic segmentation of the mandible from CT images can be highly accurate for various ages.
- A semi-automatic approach (automatic segmentation with manual touch-up) can achieve the same accuracy as purely manual segmentation with only about 20% of the necessary man-hours.