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Week 7

Applications of Foundation Models and Efficient Diffusion Models to Dental Radiography to Assist Dental Treatment Planning
Melody Halbert, MS and Laura Brattain, PhD

Project Overview

- Teeth charting is a manual process at the office
- It is a two person job and is error prone
- We aim to use AI to automate teeth charting
- Since dental datasets are limited, we are using foundation models
- To assist in pre-surgical planning and patient education we aim to apply diffusion models to generate synthetic teeth for fitting

Proposed AI Tasks

Automated Segmentation of Teeth

- Zero-Shot ✓
- Fine tuning ✓
- YOLO Segmentation ✓
- YOLO prompt for fine tuning

Diffusion Model for Synthetic Teeth Generation

What Has Been Finished

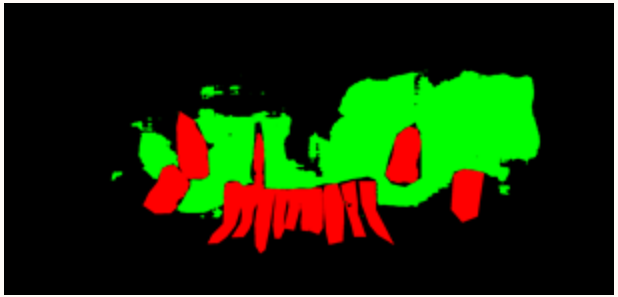
Zero-shot with MedSAM

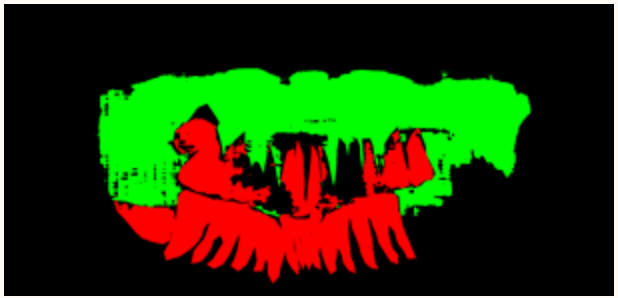
Zero-shot





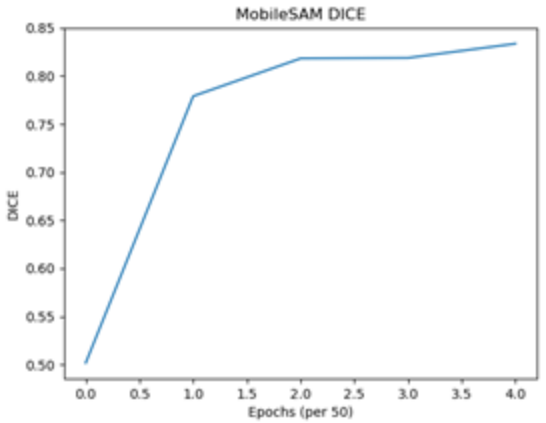
Zero-shot compared with Ground Truth





What Has Been Finished

Fine tuning with MobileSAM



Ground Truth Mask gt_mask_20.png

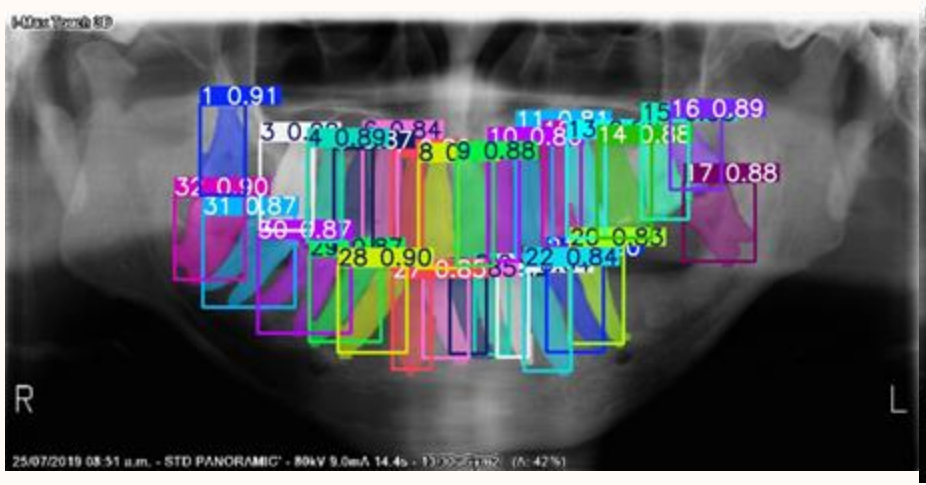


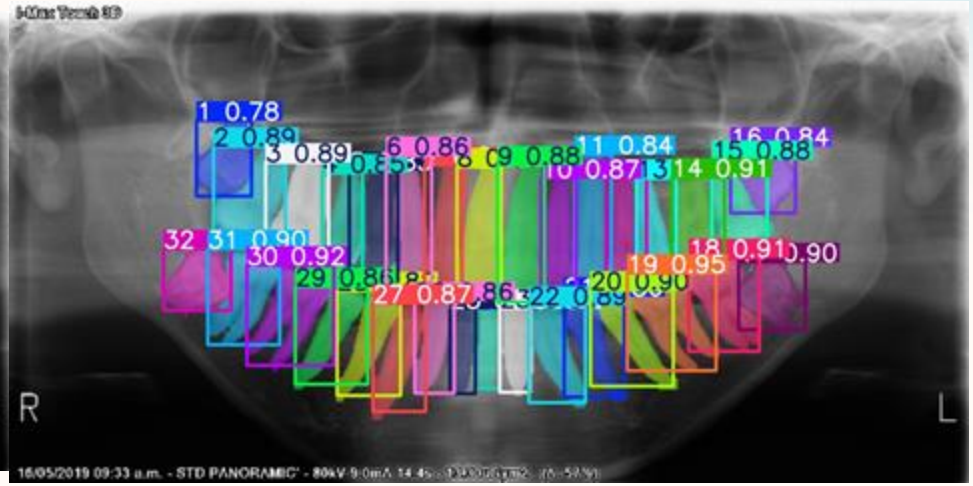
Predicted MobileSAM Mask



What Has Been Finished

YOLOv8 Segmentation and Labeling



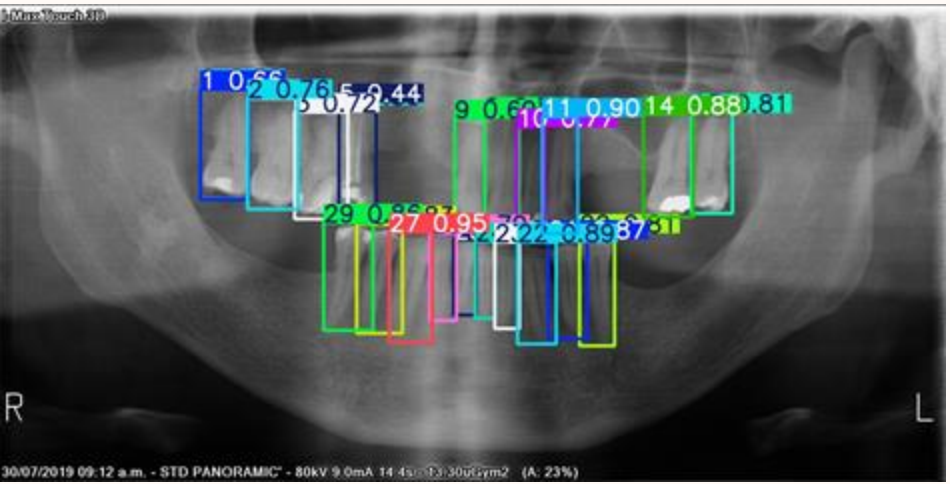


What Was Done This Week

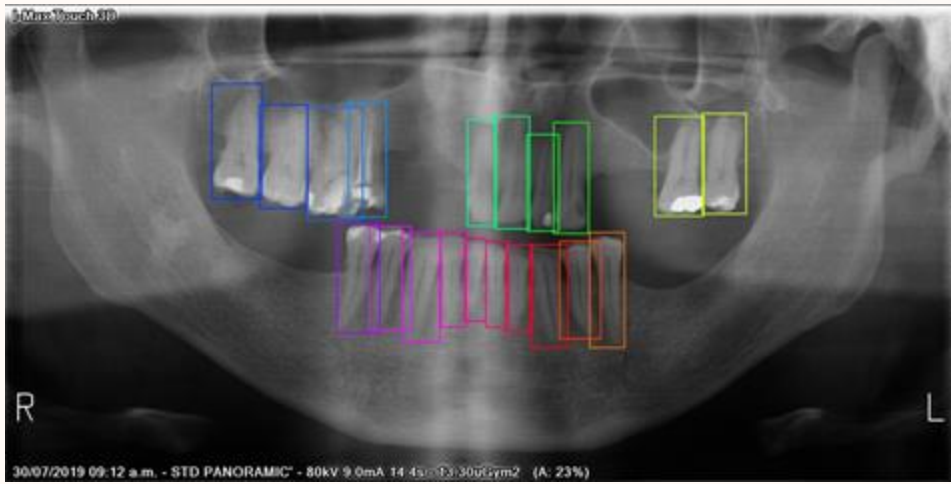
- Implemented Bounding Box Display Function
  - Gives us the ability to show bounding boxes and labeling after post processing the data
- YOLO Bounding Boxes with MobileSAM Fine Tuning Segmentation
  - (Talk about comparisons after seeing the segmentation)
- Diffusion Model Understanding

What Was Done This Week

YOLO Bounding Boxes
(no room for flexibility in displaying)



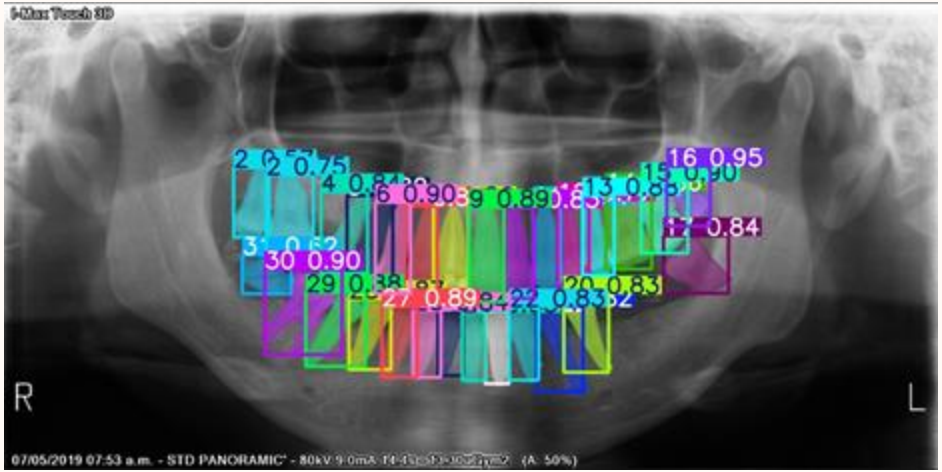
Custom Bounding Box Display*
(can display boxes after post processing)



*Non-Maximum Suppression Included

What Was Done This Week

YOLO Bounding Boxes with MobileSAM Fine Tuning Segmentation

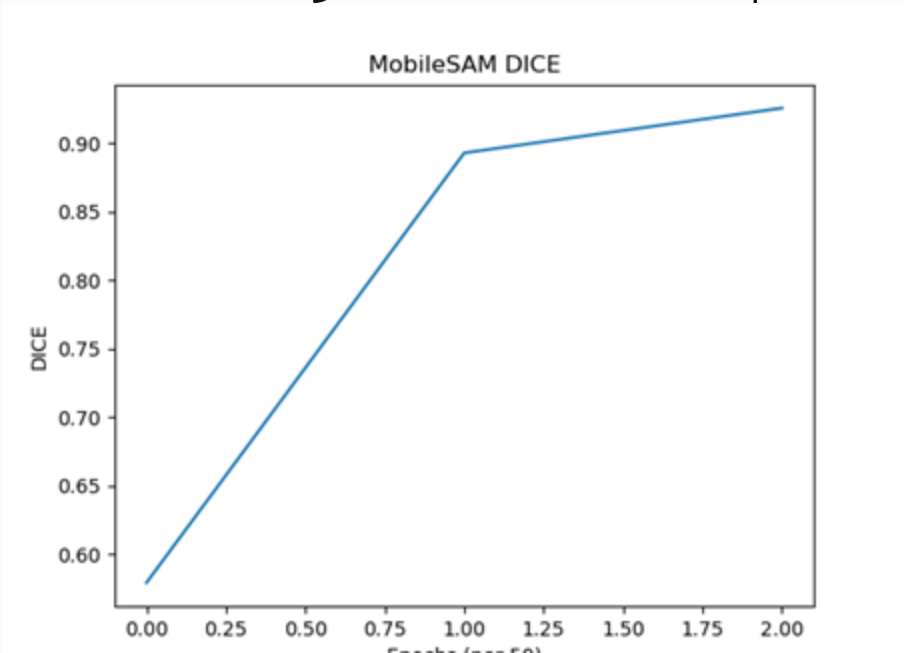


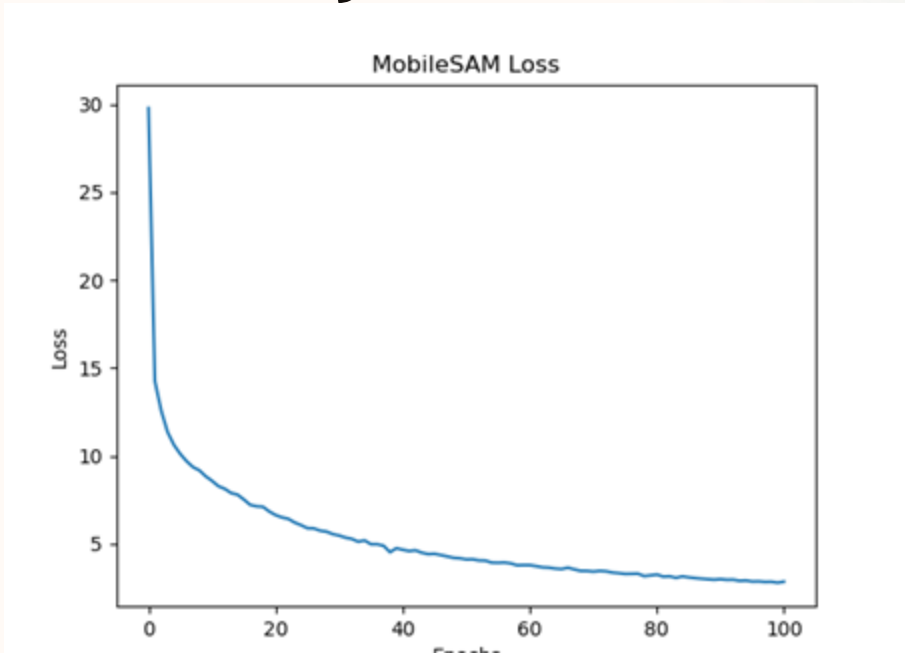


What Was Done This Week

YOLO Bounding Boxes with MobileSAM Fine Tuning Segmentation

- A lot longer to train, comparable to YOLO segmentation





Proposed AI Tasks

Automated Segmentation of Teeth

- Zero-Shot ✓
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Diffusion Model for Synthetic Teeth Generation

Next Week

- Go through diffusion model tutorials
  - https://github.com/varun-ml/diffusion-models-tutorial
  - https://github.com/FilippoMB/Diffusion_models_tutorial
- Propose diffusion model training tasks by Monday

References

SuperMedIntel. (n.d.). *GitHub - SuperMedIntel/Medical-SAM-Adapter: Adapting Segment Anything Model for Medical Image Segmentation*. GitHub. https://github.com/SuperMedIntel/Medical-SAM-Adapter/tree/main

https://zaradental.com/teeth-numbers-and-names/

https://www.kaggle.com/datasets/humansintheloop/teeth-segmentation-on-dental-x-ray-images/data

https://github.com/bowang-lab/MedSAM

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Thanks!