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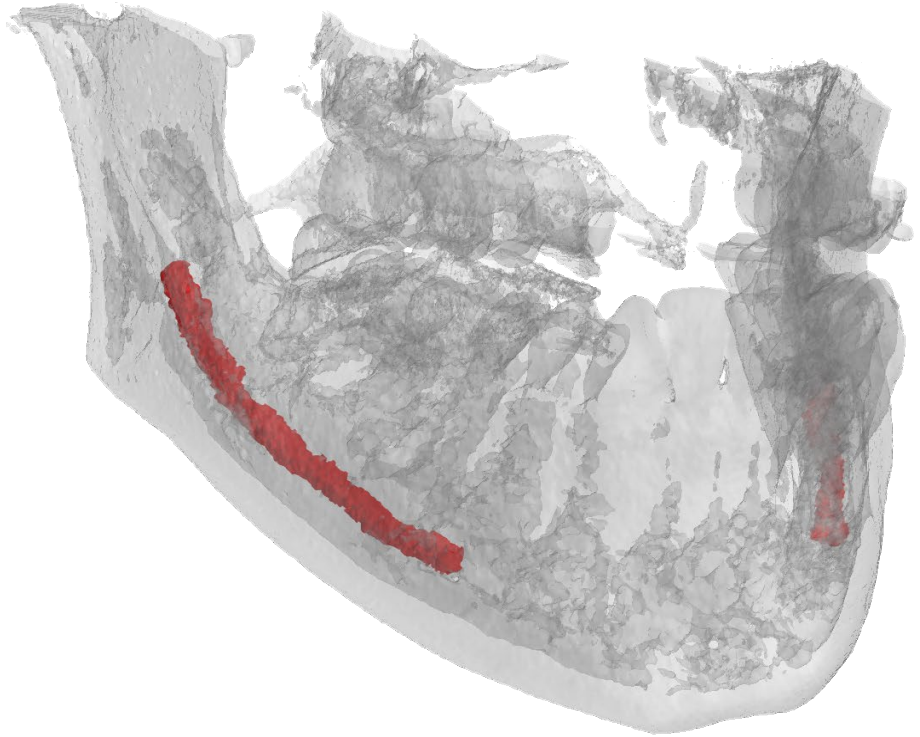
A Cone Beam Computed Tomography Annotation Tool for Automatic Detection of the Inferior Alveolar Nerve Canal

Cristian Mercadante[1], Marco Cipriano[1], Federico Bolelli[1], Federico Pollastri[1], Mattia Di Bartolomeo[2], Alexandre Anesi[3], and Costantino Grana[1]

[1]Department of Engineering "Enzo Ferrari", University of Modena and Reggio Emilia
[2]Surgery, Dentistry, Maternity and Infant Department, Unit of Dentistry and Maxillo-Facial Surgery, University of Verona
[3]Department of Medical and Surgical Sciences for Children & Adults, Cranio-maxillo-facial Surgery, University of Modena and Reggio Emilia

Inferior Alveolar Canal

- The inferior alveolar nerve (IAN) is a branch of the mandibular nerve which supplies sensation to the lower teeth
- Its **position** is of great relevance for avoiding severe injuries during surgery operations
- Labeling 3D volumes is **tedious** and patients are **sparsely** annotated using 2D view
- We introduce a novel tool for a precise and fast 3D annotation of the IAN



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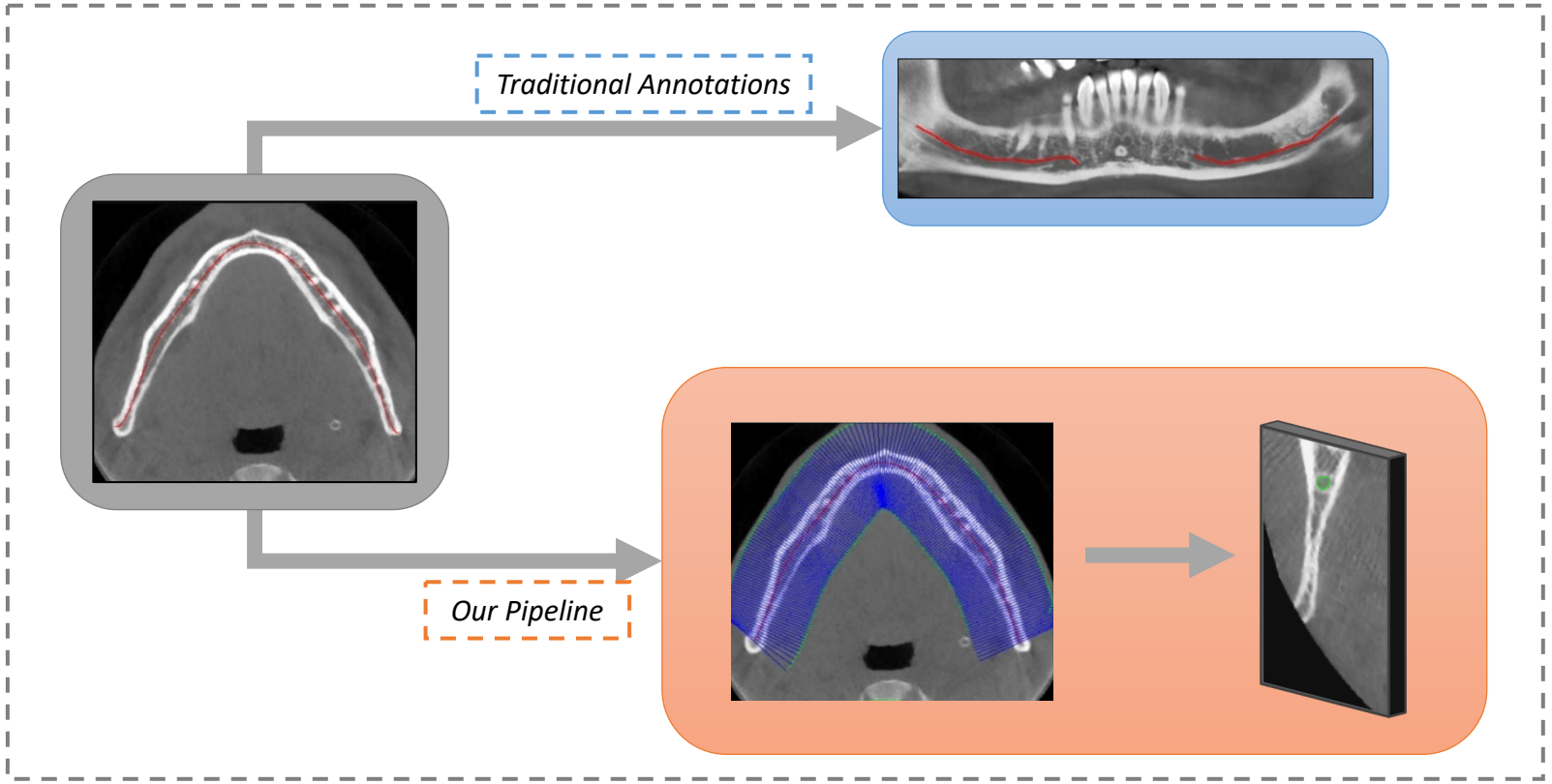
Annotations

- Traditionally made on 2D panoramic views extracted from a spline along the dental arch
- We exploited the spline to generate a set of 2D cross-sectional views



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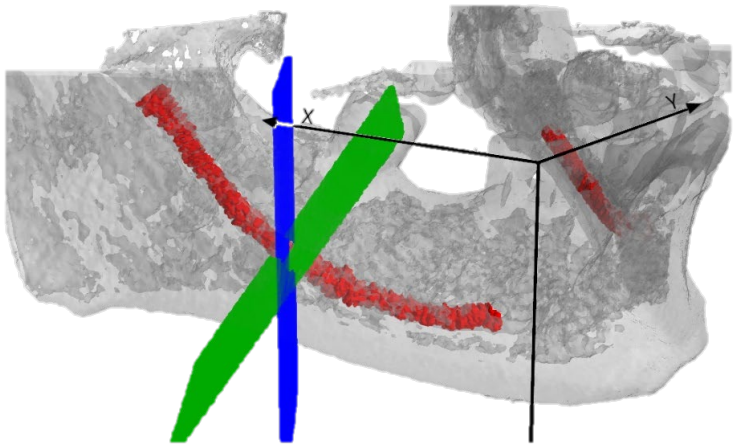
The Annotation Tool

- Allows to annotate the cross-sectional views and generate a 3D labeled output
- Active contours support and speed-up the annotation process
- Export is available in multiple formats (e.g. NumPy file and PNG images)
- Better views can be obtained using tilted planes

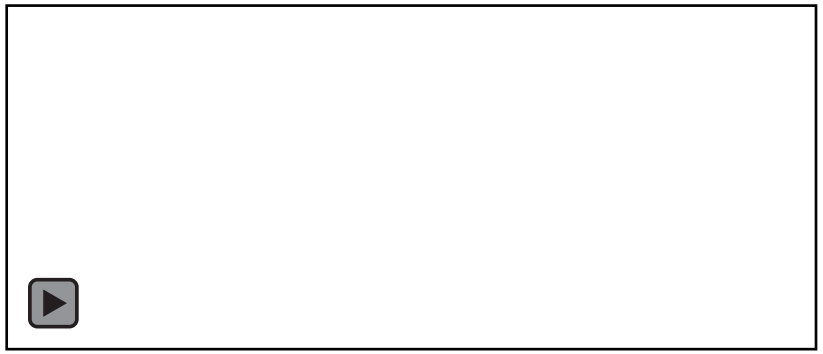


Applications

- Annotation tool evaluation is performed generating three datasets from four patients and training the classic UNet3D architecture for a segmentation task
- Results proved that our network is able to generalize despite the few data available

	2 Labels			3 Labels		
	GTD	*GSD*	*ASD*	*GTD*	*GSD*	*ASD*
P1	0.67	0.68	0.63	0.54	0.55	0.51
P2	0.44	0.42	0.45	0.67	0.34	0.29
P3	0.59	0.42	0.41	0.63	0.26	0.26
P4	0.61	0.54	0.46	0.65	0.35	0.26

IoU (IAN for 2 labels) and mIoU (internal IAN and contour for 3 labels) of our network trained with slices generated by guided tilted planes (GTD), guided straight planes (GSD), and unsupervised straight planes (ASD).



Qualitative result from a sequence of predictions. Original image on left, annotation from the tool in the middle, network prediction on the right.

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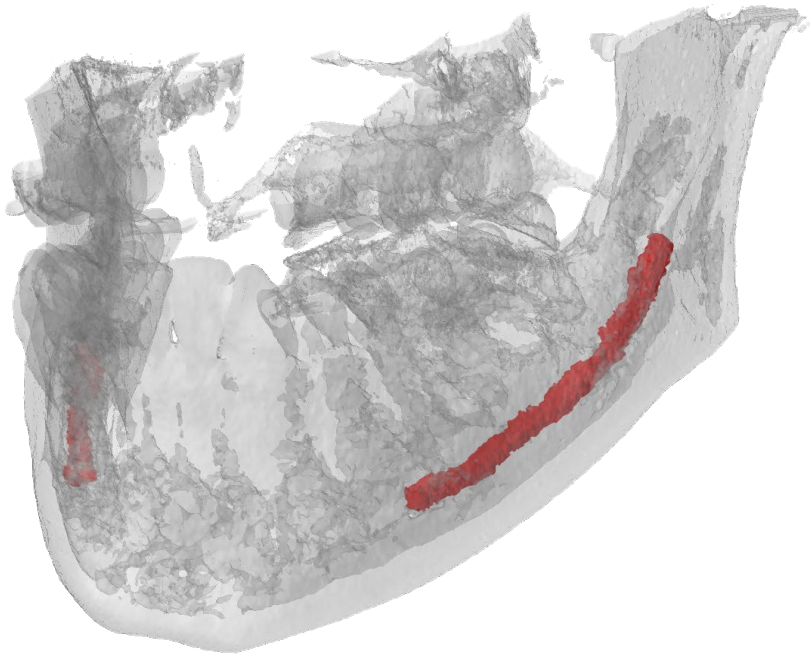
Conclusion

- Great advantages in the annotation process:
  - **3D output,** fast and user-friendly set of features

- Useful for **Deep Learning** algorithms:
  - Big datasets can be generated from few patients, allowing researchers to work with 3D neural networks in scarce data environments



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