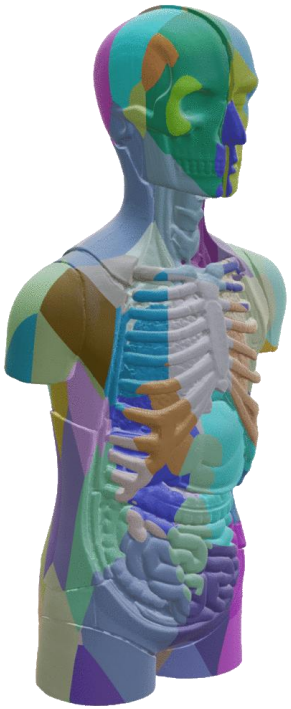
MedShapeNet: A Large-Scale Dataset of 3D Medical Shapes for Computer Vision

https://medshapenet-ikim.streamlit.app/



project logo

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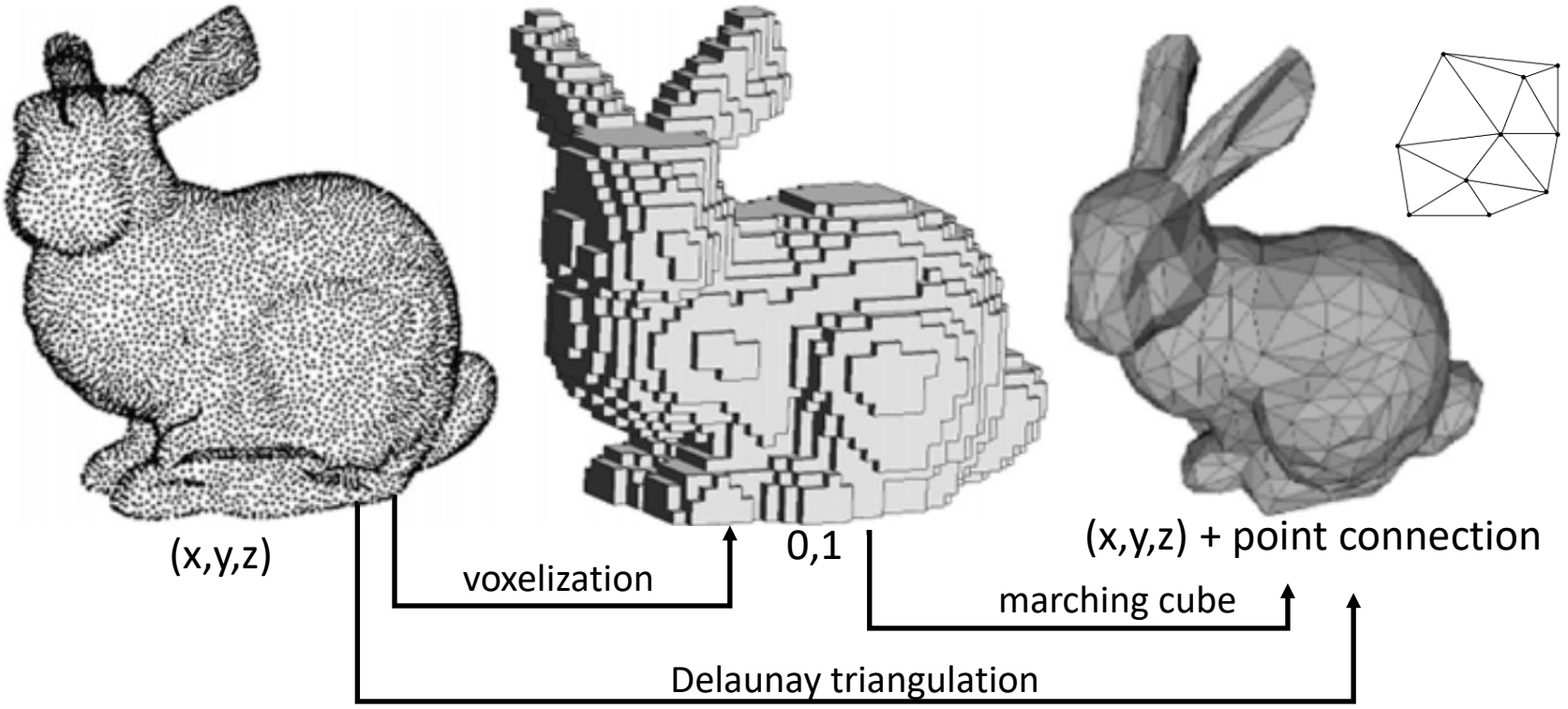
3D Shape Representations

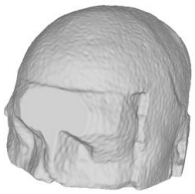


From left: The Stanford bunny model represented as ***point cloud***, ***voxel occupancy grid*** and **mesh** [1]

[1] Hoang, L., Lee, S.H., Kwon, O.H. and Kwon, K.R., 2019. A deep learning method for 3D object classification using the wave kernel signature and a center point of the 3D-triangle mesh. Electronics, 8(10), p.1196.

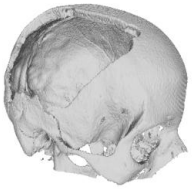
3D Medical Shapes

ShapeNet: shape completion, retrieval/recognition, reconstruction, etc

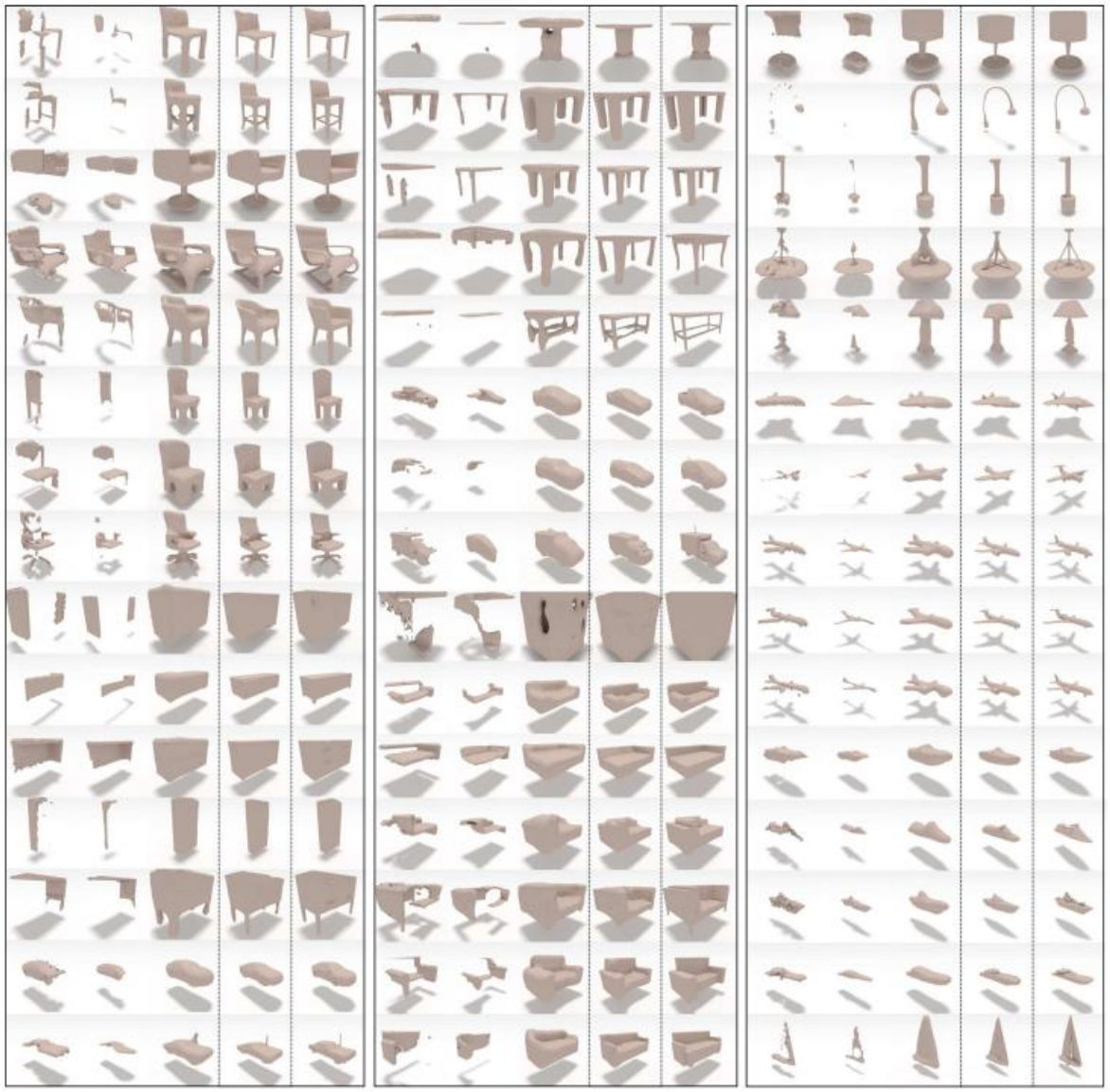


skull (MRI)

skull (CT)

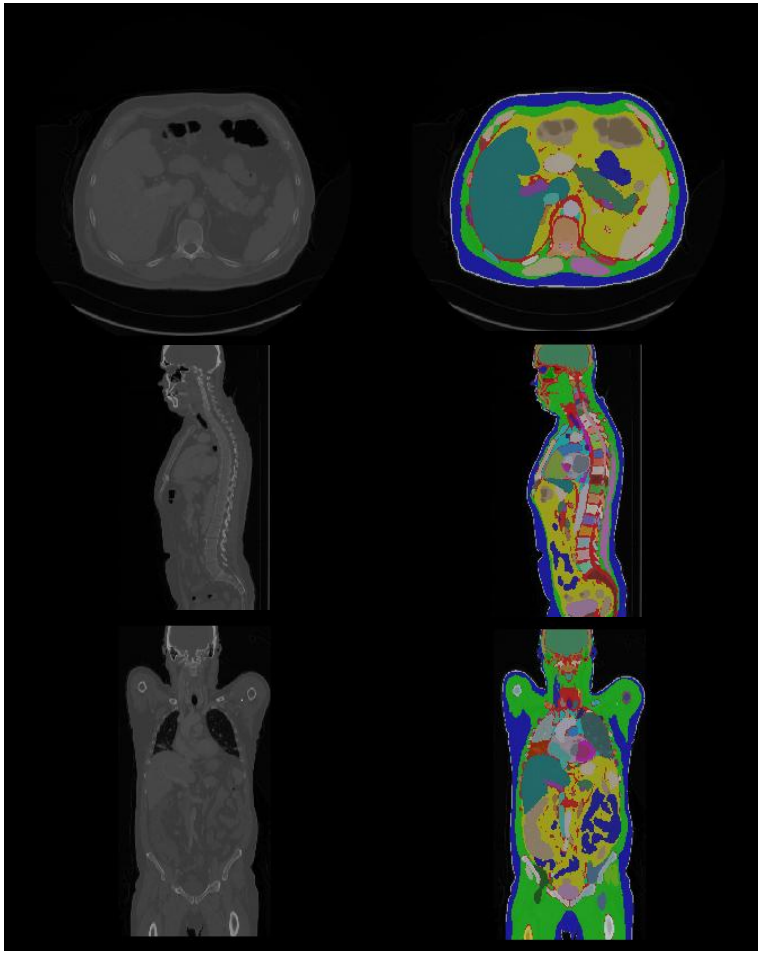


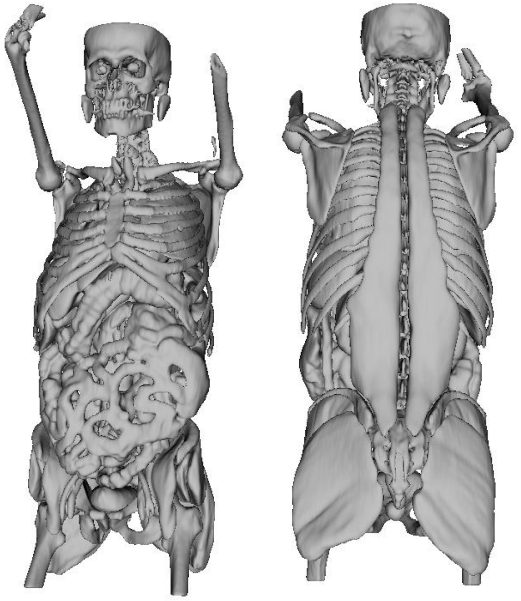
cranial_defect (CT)



a large collection of the 3D CAD models of real-world objects: chair, desk, car, airplane, etc.

Shape Acquisition: Whole-body CT Segmentations





~ 130 anatomies per case / over 500 cases

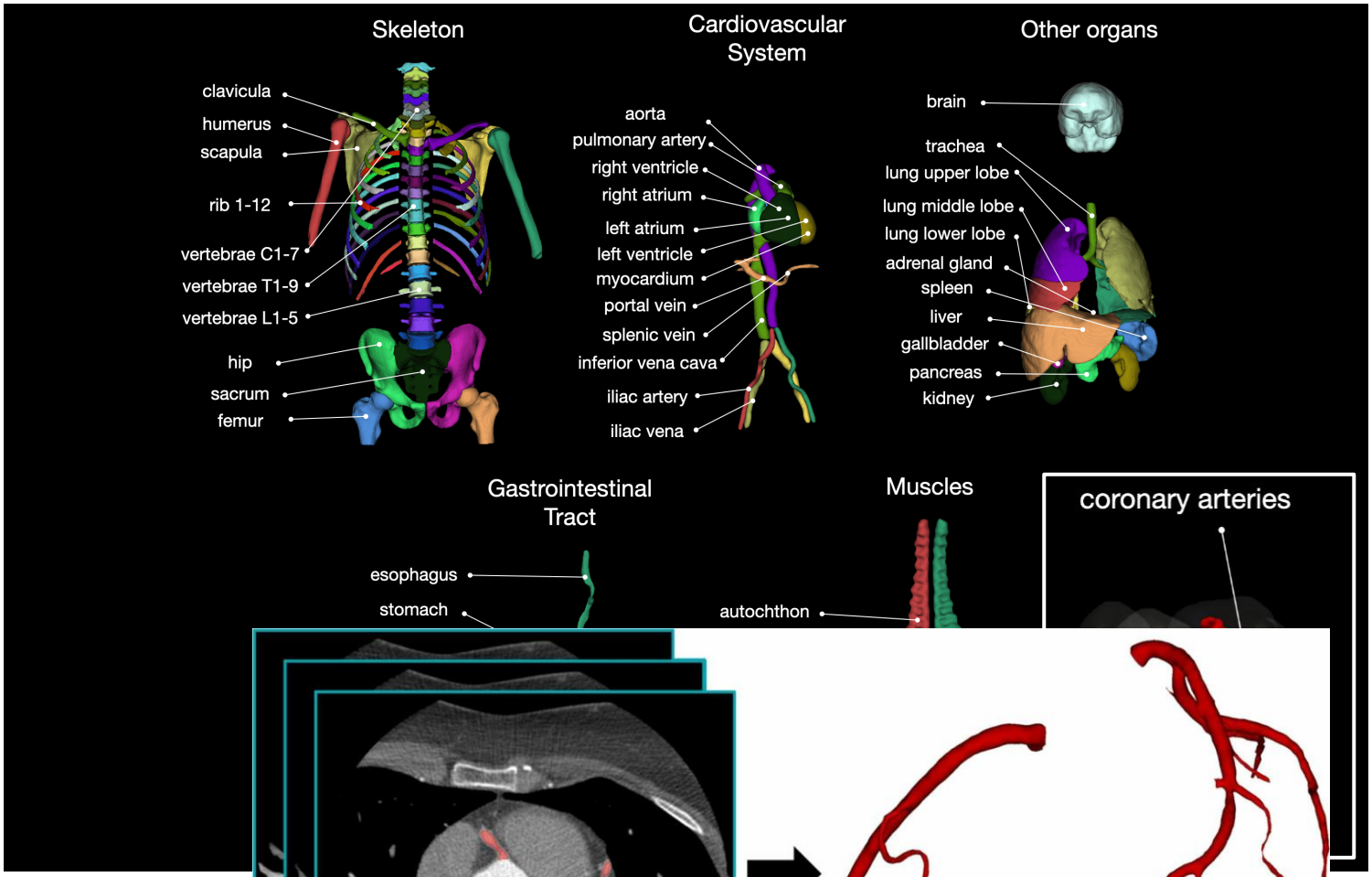
dense annotation ✗

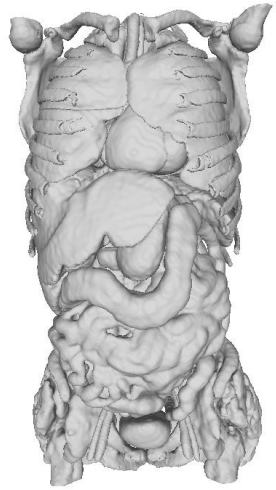
pseudo-labeling ✓

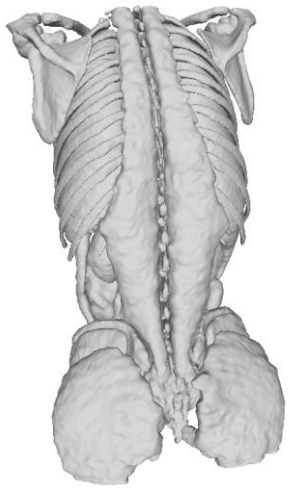
[1] Seibold, Constantin, et al. "**Accurate Fine-Grained Segmentation of Human Anatomy in Radiographs via Volumetric Pseudo-Labeling**." arXiv:2306.03934 (2023).

[2] Seibold, Constantin, et al. "**Reference-guided pseudo-label generation for medical semantic segmentation**." Proceedings of the AAAI conference. Vol. 36. No. 2. 2022.

Shape Acquisition: Whole-body CT Segmentations



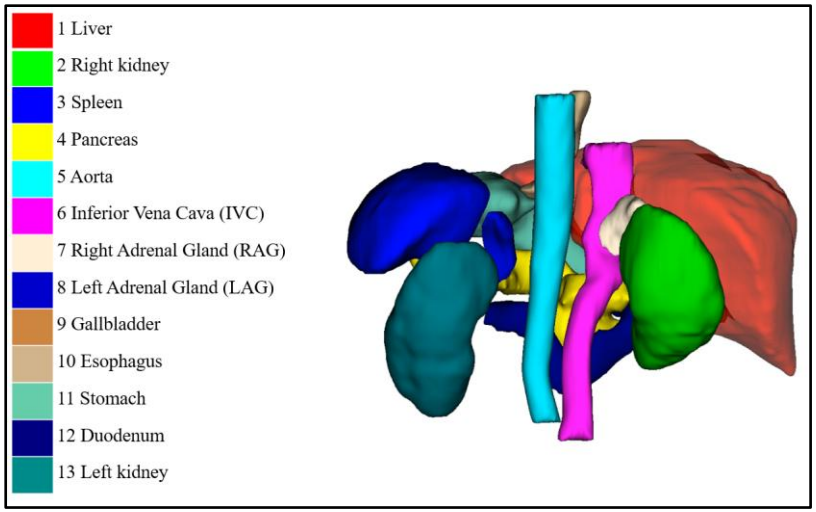




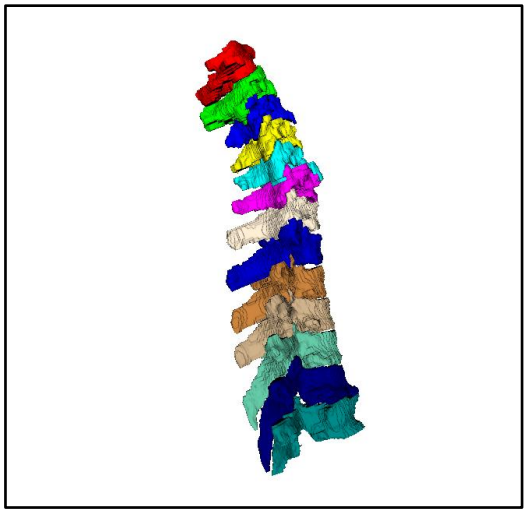
TotalSegmentator …er case / over 1000 cases

Slice-wise coronary vessels annotation (Ramtin Gharleghi et al., CMIG, 2022)

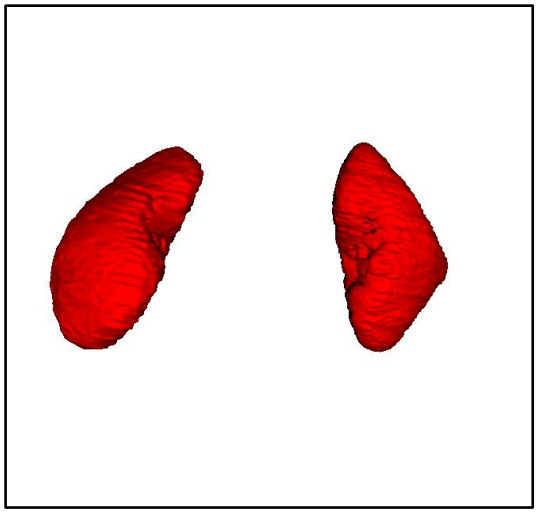
Shape Acquisition: Medical Image Segmentations



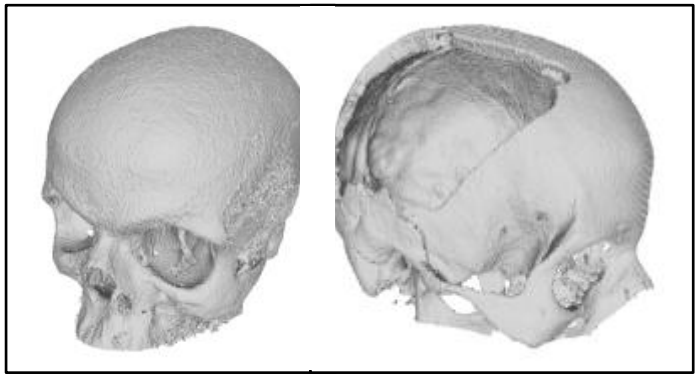
FLARE: Abdomen organs



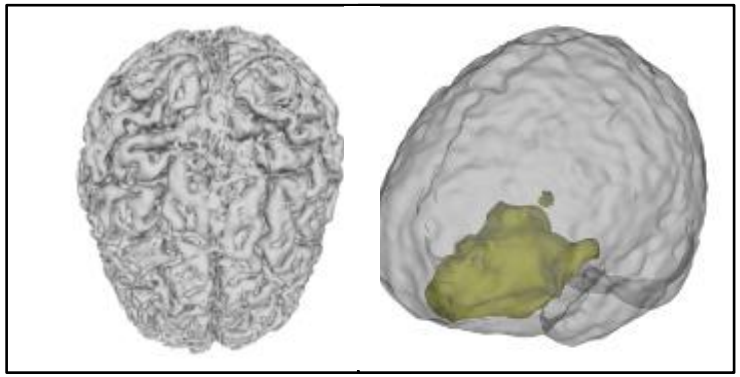
VERSE: Vertebrae



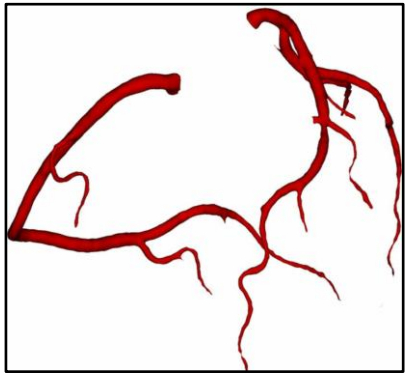
KiTS: kidney tumor



AutoImplant: healthy & defective skull

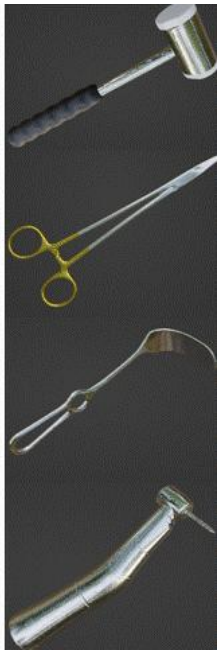


Healthy & tumorous brain

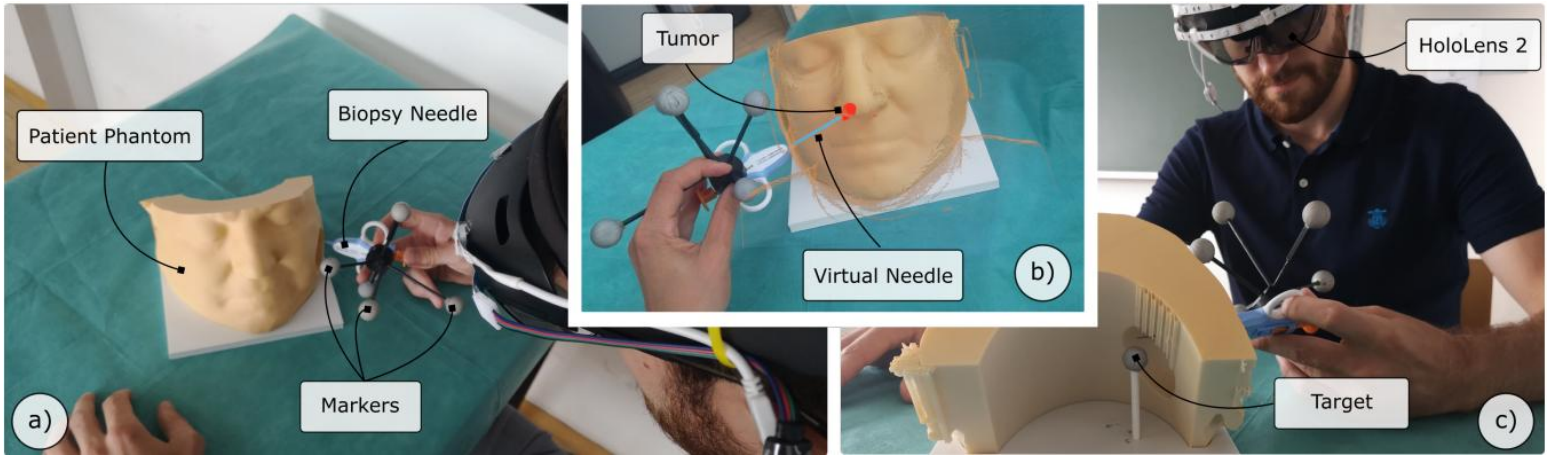


ASOCA: healthy & diseased coronary artery

Shape Acquisition: 3D Surgical Instrument Models

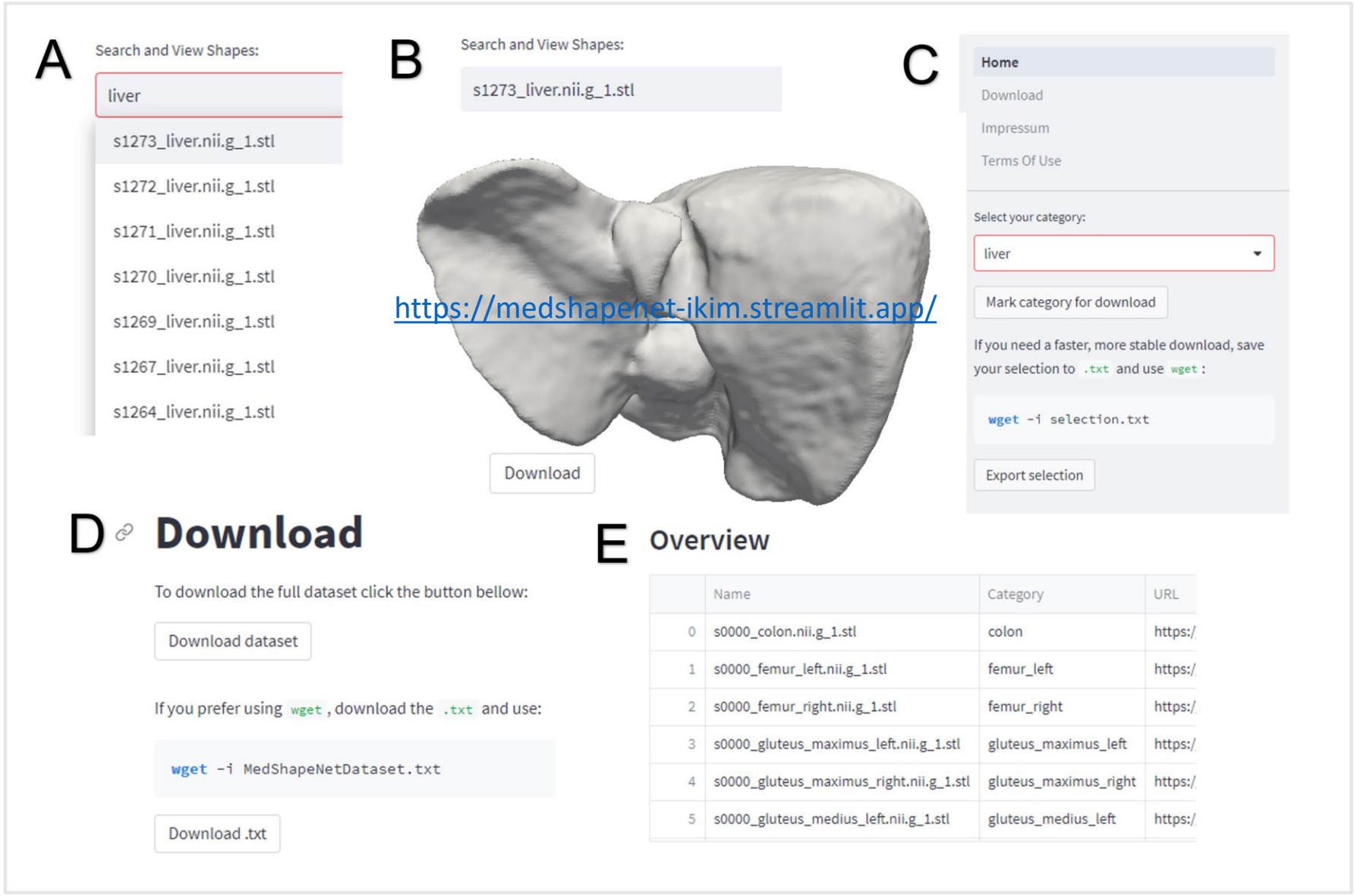


100 instrument models acquired using structured light 3D scanners (https://xrlab.ikim.nrw/)



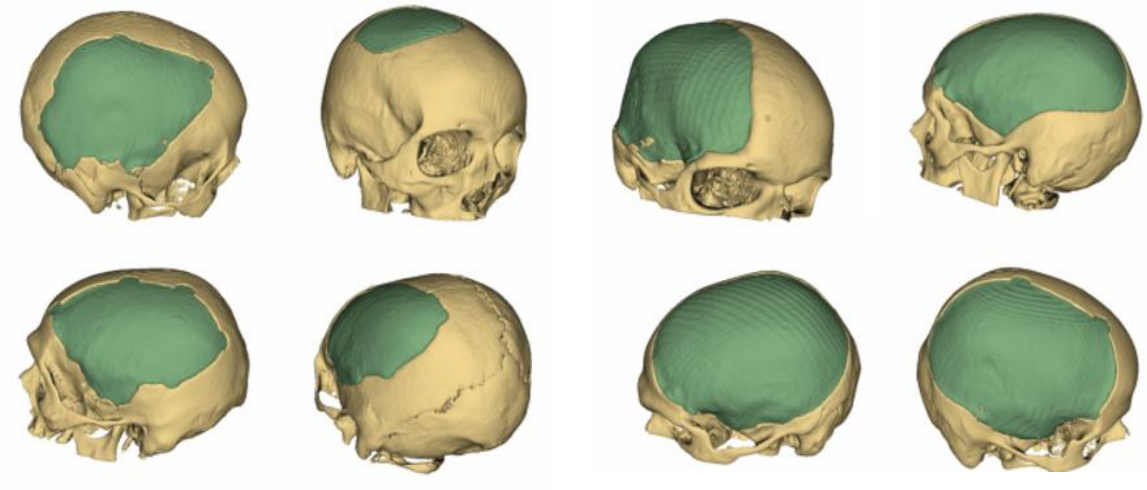
surgical tool tracking in augmented reality (C. Gsaxner, J.Li., et al. 2021, 27th ACM VRST)

User Interface: search, inspect and download medical shapes

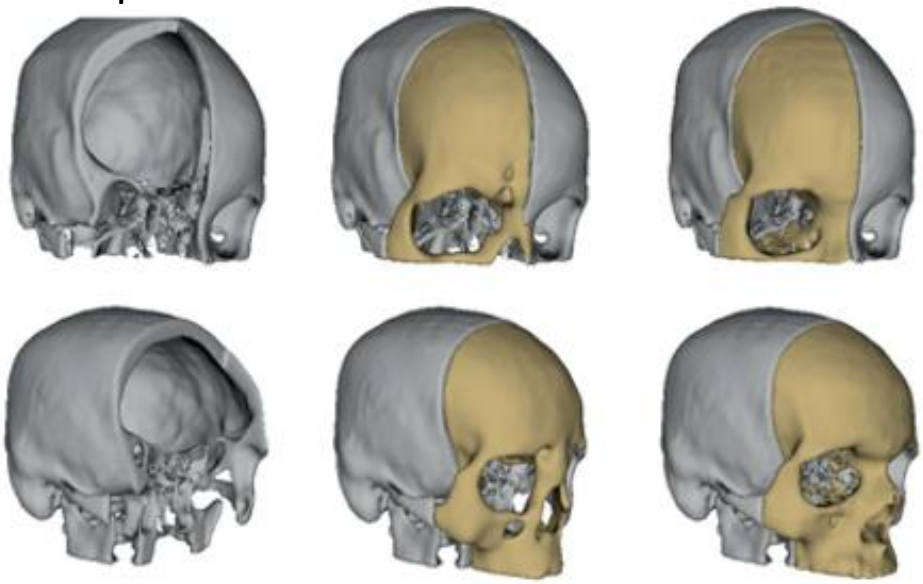


Shape storage: Sciebo (https://hochschulcloud.nrw/) (2TB)
Server host: Streamlit (https://streamlit.io/) (1GB)

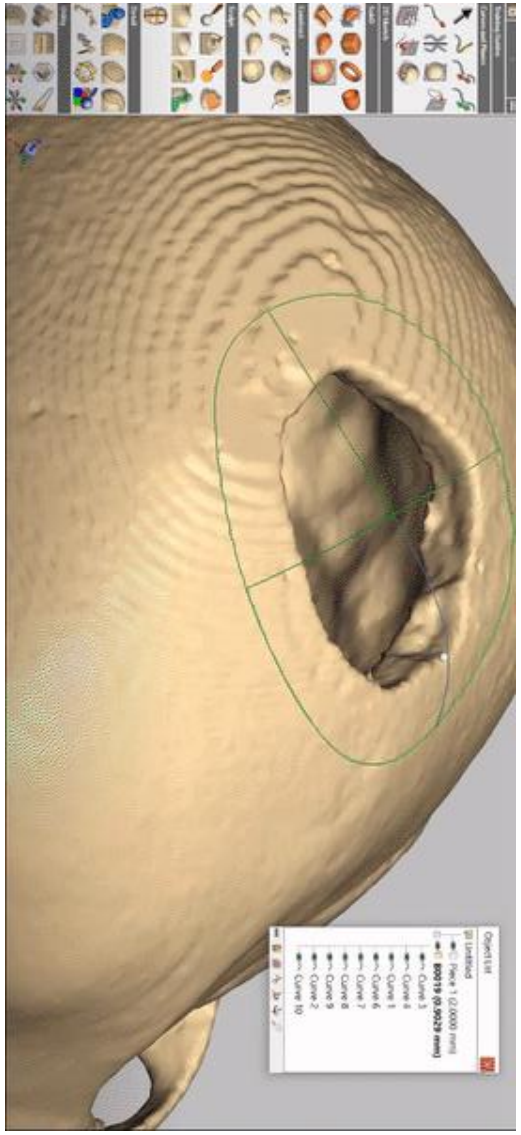
Use Cases: Craniofacial Implant Design



input reconstruction groundtruth

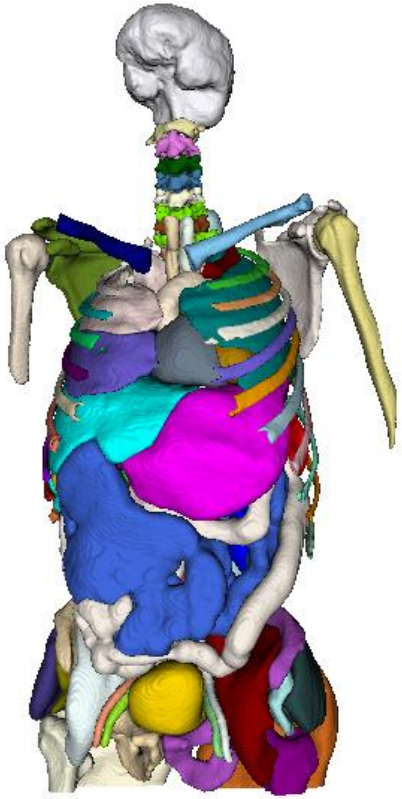


data-driven automatic design



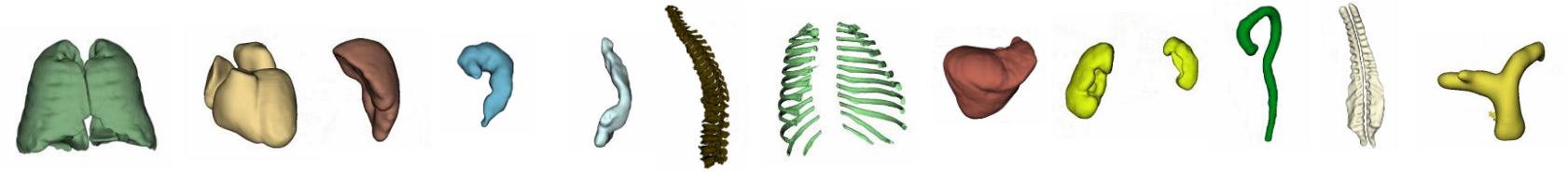
manual design

Use Cases: Anatomy Education



normal

diseased



lung heart spleen stomach pancreas spine rib cage liver kidney aorta autochthon muscles pulmonary artery

Use Cases: Statistical Shape Models

Conclusion

- MedShapeNet is an alternative for common shape benchmarks, like ShapeNet, for computer vision research.
- MedShapeNet is also a unique, general-purpose dataset for a variety of medical problems, such implant design and instrument tracking.
- MedShapeNet facilitates the translation of vision algorithms to medical problems, and bridges the gap between the two disciplines.

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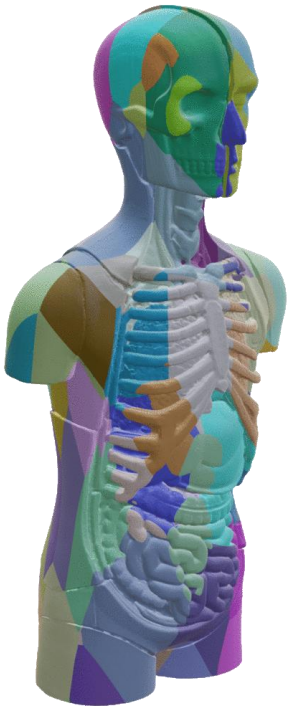

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https://github.com/Jianningli/medshapenet-feedback

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