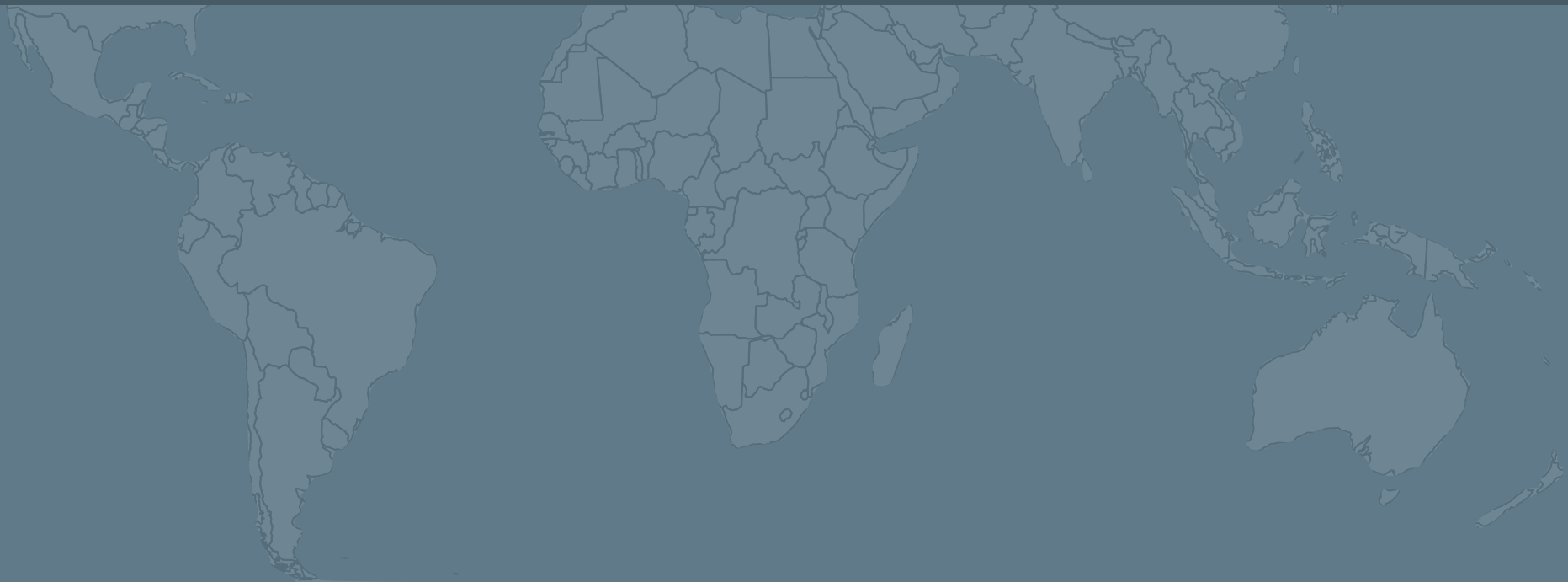


3D spine reconstruction from bi-planar radiographs for spine pathologies



The team

42 is the answer + Med Phys

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The need for dose reduction

- Medical images based on ionizing radiation is one of the most useful and important tools
- Spine pathologies
 - Idiopathic scoliosis
 - Kyphosis
 - Lordosis
 - Osteoporosis
 - Trauma
 - ...

Diagnostic procedure	Effective dose (mSv)	Chest RX equivalent	Period of natural radiation
Chest RX	<0.01	1	<1.5 days
Thoracic spine RX	0.7	35	4 months
Lumbar spine RX	1.0	50	5 months
Chest CT	8.0	400	3.6 years
Abdominal CT	10.0	500	4.5 years

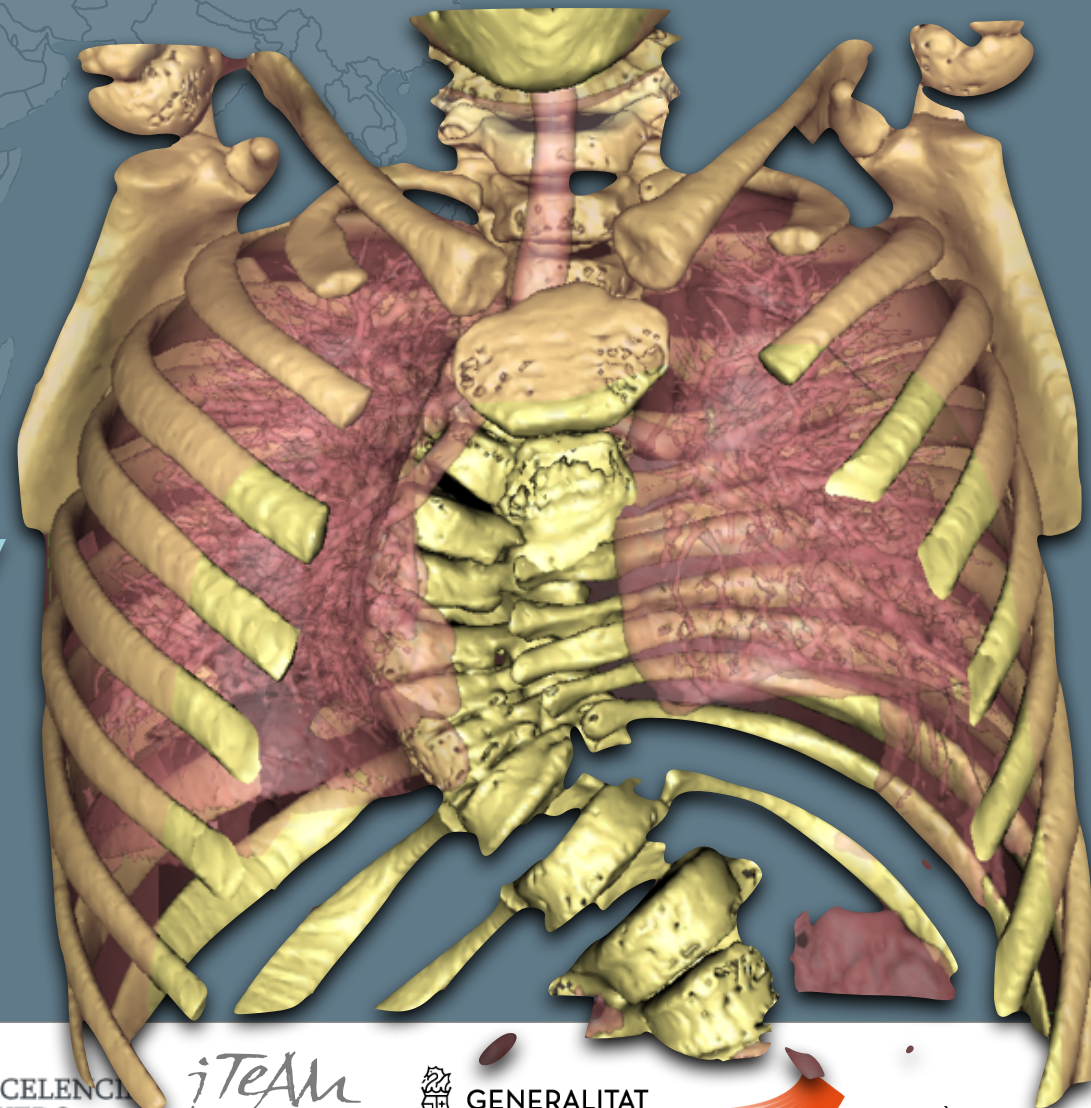
Effective dose radiation (Source: European Commission. Radiation Protection 118)

The need for dose reduction

- Evidence suggests that intense exposure of ionizing radiation for spine imaging increases the risk of cancer
- CT scans biases the morphology of the spine
- 3D imaging is important to correctly estimate prognostics and patient follow-up and for treatment planning
- **Pediatrical patients**

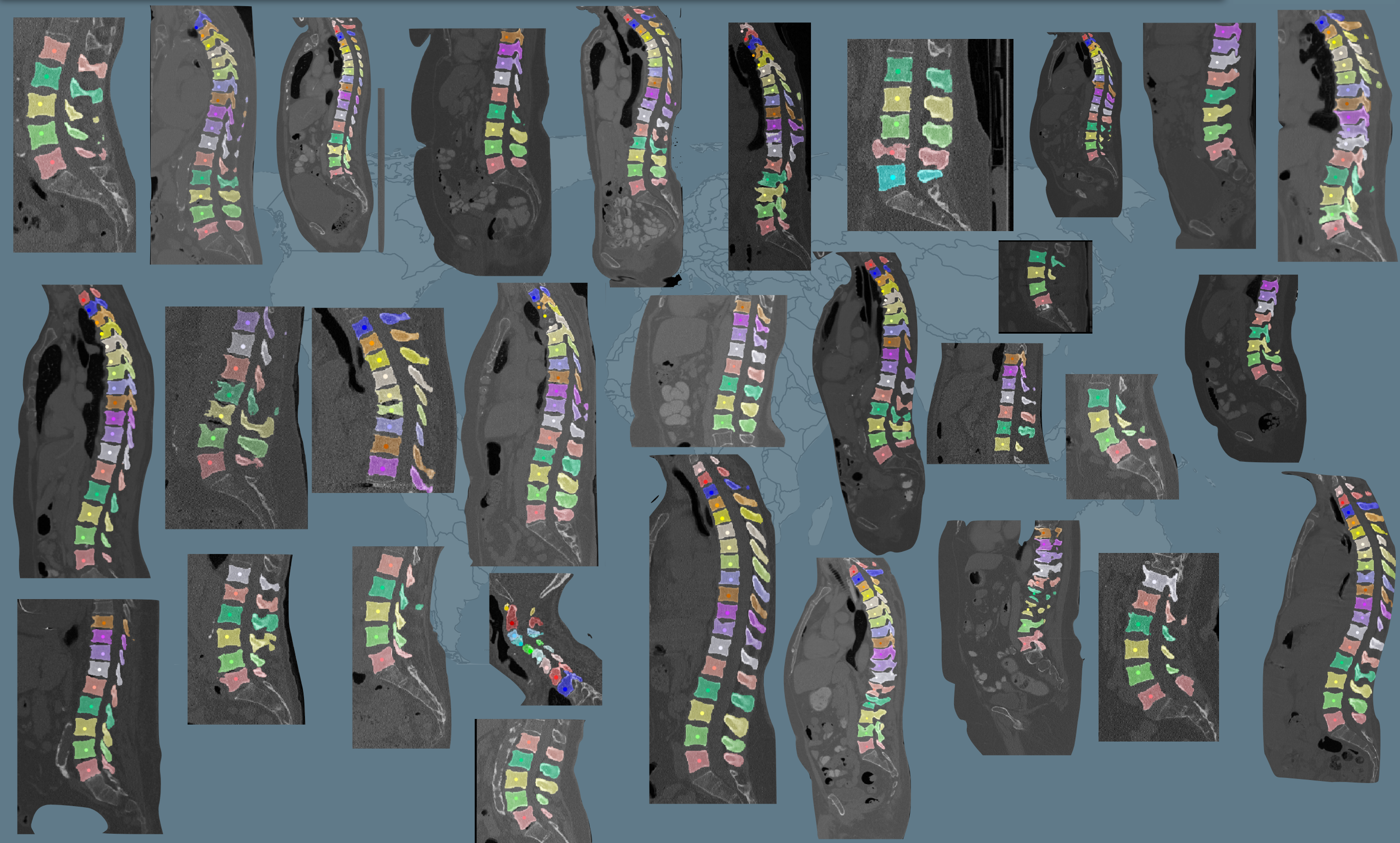
A 3D SPINE reconstruction in a standing position is needed with a radiation dose as low as possible

- Supervised Deep Learning
 - DATASET of CT scans from Hospital La Fe
 - CEIC approval
 - DICOM images
 - Deep Learning models
- Computer Vision
 - Stereo vision, projective geometry
 - Computer vision libraries in C++

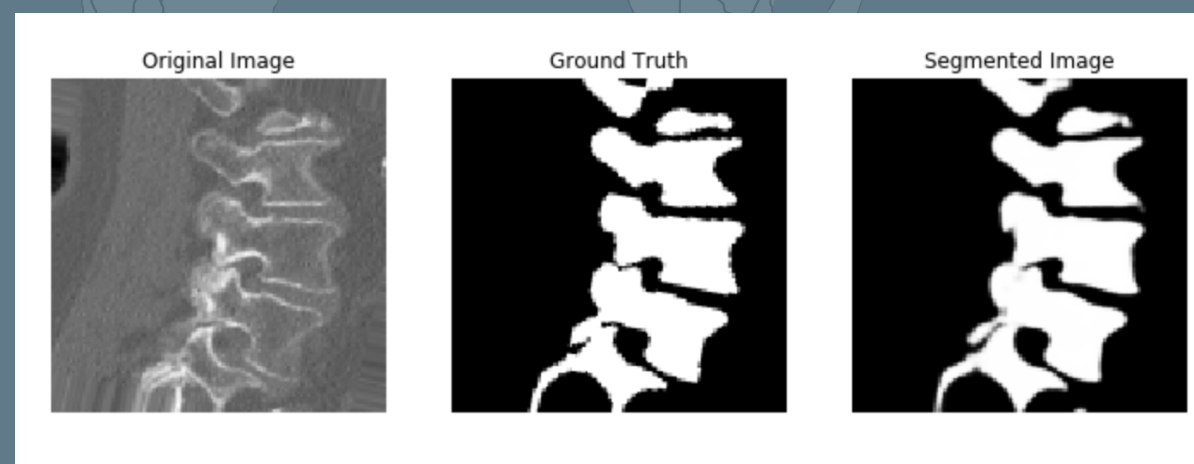


- DATASET of CT scans from Hospital La Fe
 1. Approval of the **Ethical Committee** for a retrospective and anonymized data gathering.
 2. DICOM to **Nifti format** and **Visor**. Coordinates and spacing.
 3. Average **Image size**: $512 \times 512 \times 300 \times 16$ bits $\approx$ **157.3 Mb**
 4. Need for a **ground truth**: manual segmentation and classification

Dataset

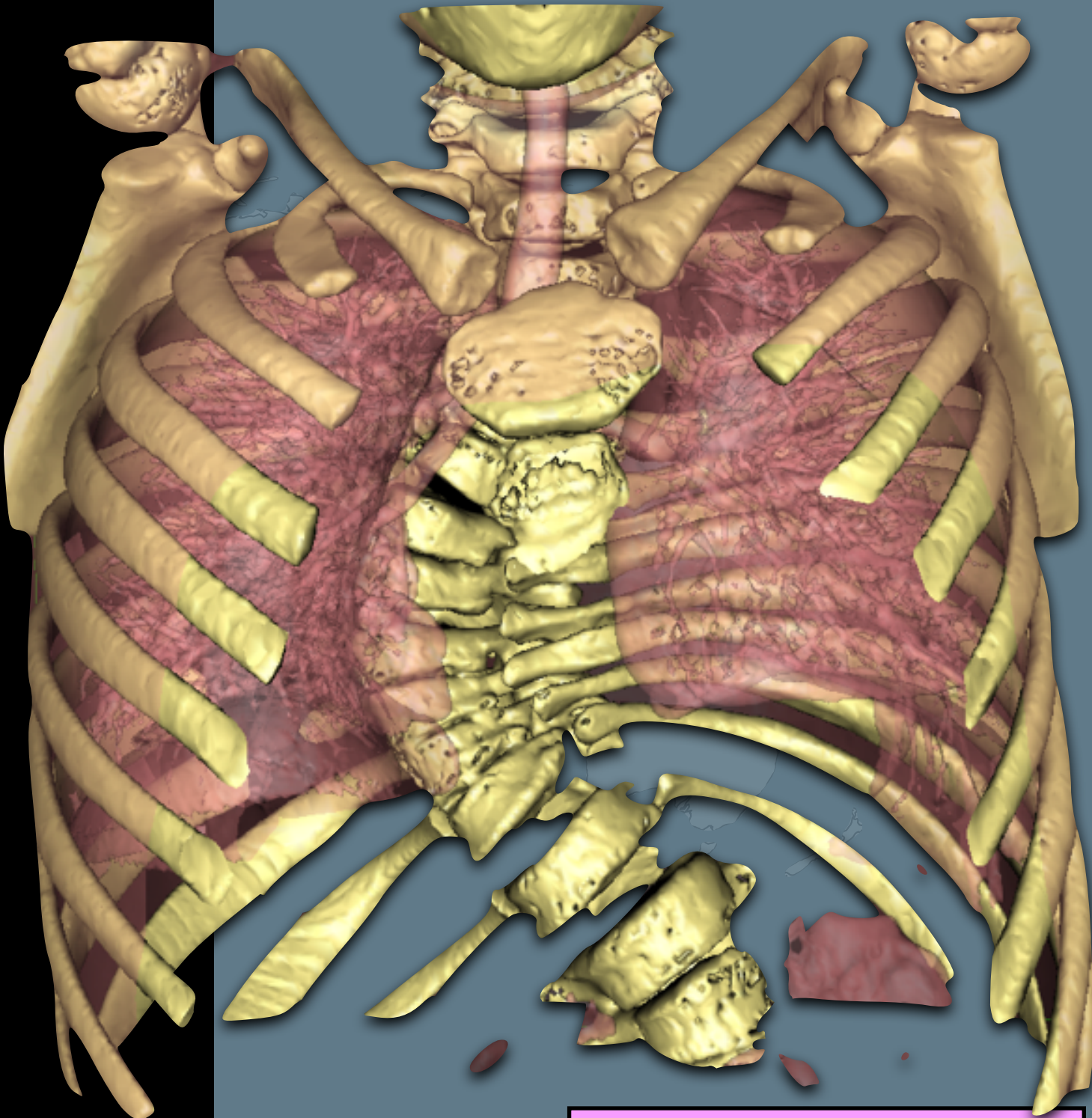
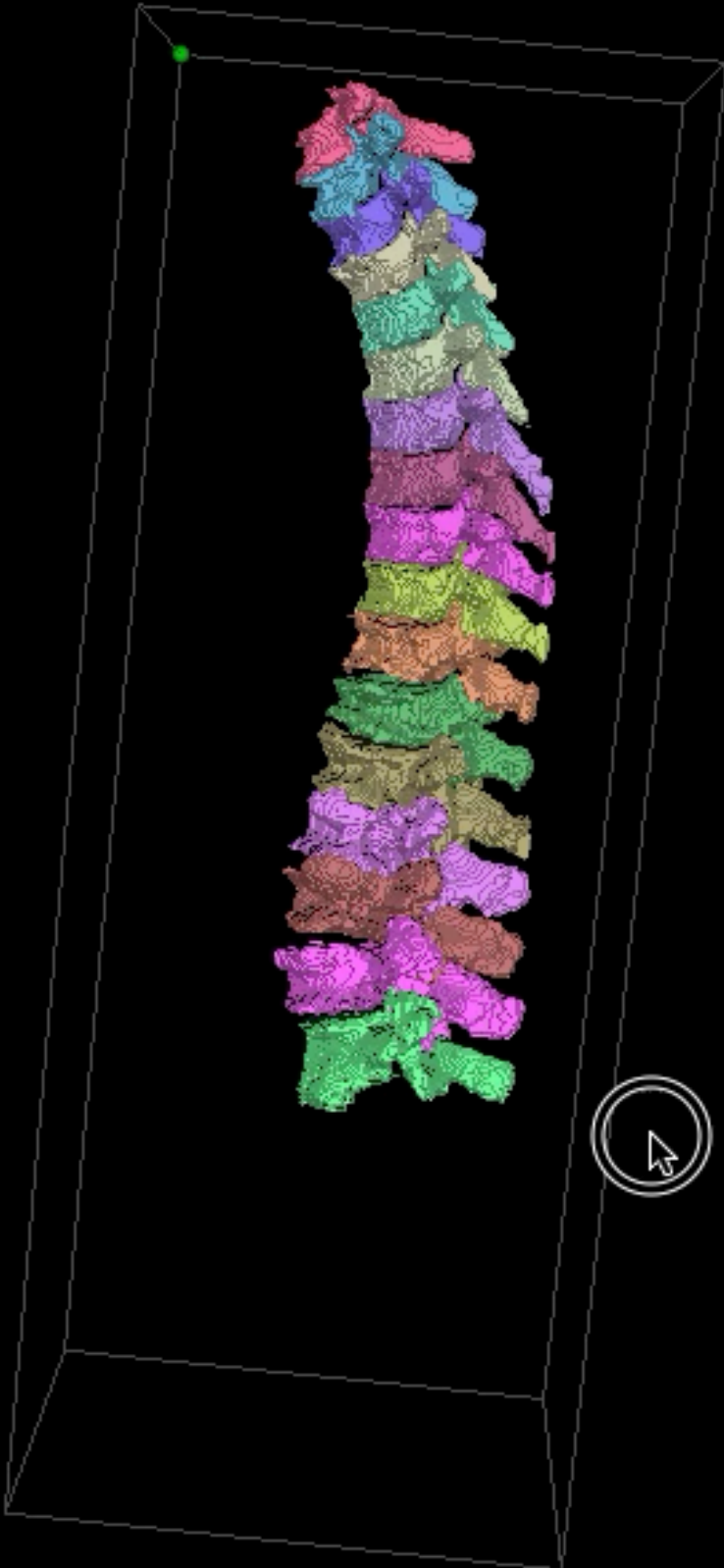


- 2D and 3D Convolutional Neural Networks
- Supervised training with Tensorflow and Torch
- Data augmentation
- GPU training acceleration using Artemisa infrastructure $\approx 6k$ hours
- CNN with an average number of learnable parameters of $\approx 10^7$





COMPUTED @ IFIC ARTEMISA 2019



Credits IFIC 42 team

- Clinical developments need reproducible developments
- The IFIC Control Version System (CVS)
- Software runtime isolation (modern containers)
- Extensive documentation (WIKI and publishing)

Conclusions

- Still an ongoing project.
- **Medical Imaging** is one of the most benefited fields in ML.
- Focused on radiation dose reduction.
- **Precision medicine and cost reduction.**
- We are aware of regulations, ethics and other medicine ML exploitation topics.

Acknowledgements

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AVI AGÈNCIA VALENCIANA
DE LA INNOVACIÓ

THANK YOU VERY MUCH
FOR YOUR ATTENTION

