On the use of AI based autocontouring tools, a single institution experience

Mihály Simon

University of Debrecen, Clinic of Oncoradiology

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Disclosure

- University of Debrecen has a collaboration with MVision AI
- I have a consultant contract with MVision

AI is great, ML is great

- We`ve seen many impressive cases
- So, why don`t we use it all the time in the clinic?

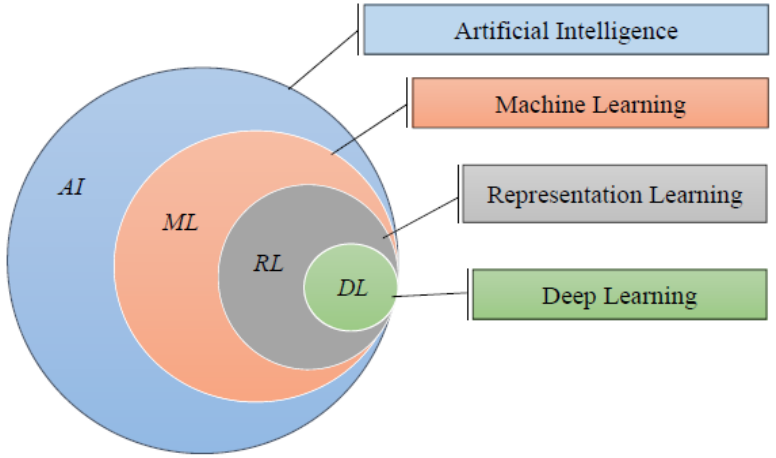

Figure 1. A simplified schematic overview or hierarchy of artificial intelligence fields.

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Chamunyonga, C., Edwards, C., Caldwell, P., Rutledge, P. & Burbery, J. The Impact of Artificial Intelligence and Machine Learning in Radiation Therapy: Considerations for Future Curriculum Enhancement. *J. Med. Imaging Radiat. Sci.* **51**, 214–220 (2020).

Some reasons

- Clinical heterogeneity
- Inadequate data
- Infrastructure, support
- Medical device regulations

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Clinical heterogeneity & inadequate data

- Patients are different
- Protocols are different
- Equipment is different
- ‚ground truths'

- Data for training is finite and biases (false assumpions) are learned by the algorithm

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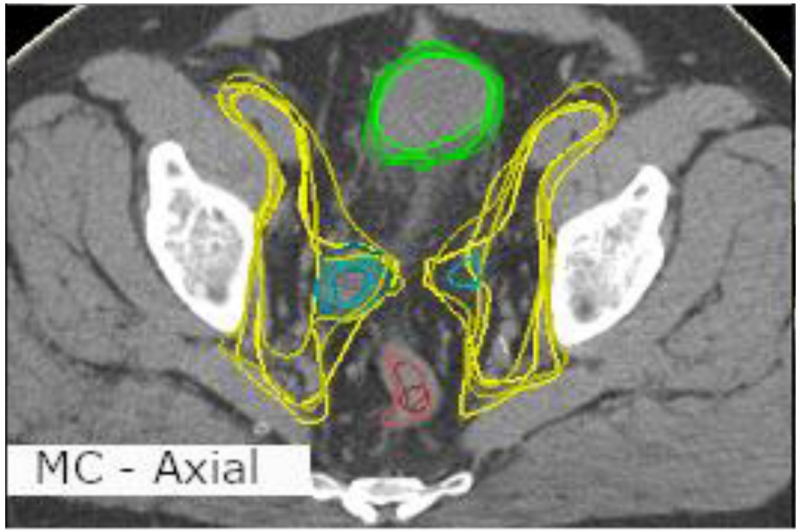
"The truth is rarely pure and never simple"

Oscar Wilde, The Importance of Being Earnest, 1895, Act I
Irish dramatist, novelist, & poet (1854 - 1900)

Clinical heterogeneity & inadequate data



MANUAL METHOD

EDITED FROM

AUTOMATIC METHOD

20% increase in consistency

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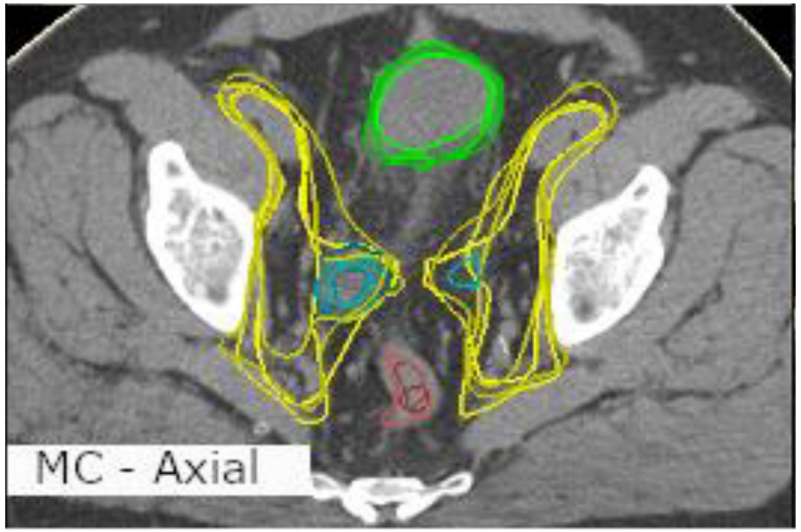
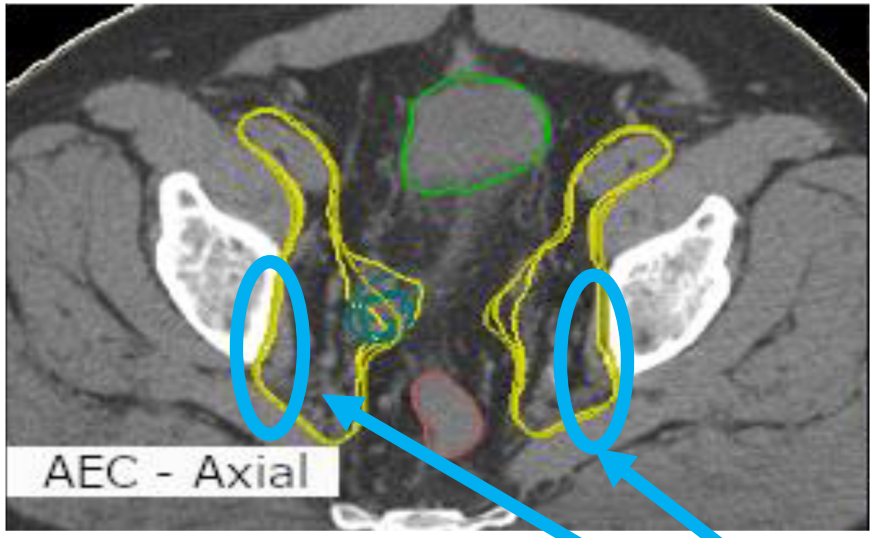
DIAGNOSTICS **2020**, 10(11), 959;

Clinical heterogeneity & inadequate data



MANUAL METHOD



EDITED FROM

AUTOMATIC METHOD

20% increase in consistency

Not in Pivotal or RTOG

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DIAGNOSTICS **2020**, 10(11), 959;

On what would you like to have your AI based on?

Expert opinion, based on consensus of some experts with no measurable quality

International guidelines, based on standard consensus with measurable quality

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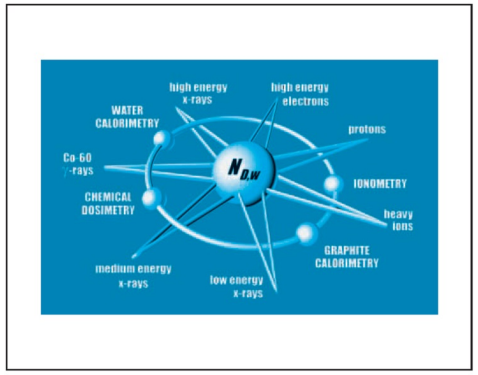
Guidelines are used in medical physics for a long time



TECHNICAL REPORTS SERIES No. **398**

Absorbed Dose Determination in External Beam Radiotherapy

An International Code of Practice for Dosimetry Based on Standards of Absorbed Dose to Water

Sponsored by the IAEA, WHO, PAHO and ESTRO

INTERNATIONAL ATOMIC ENERGY AGENCY, VIENNA, 2000

<2%

<20%?

Stereotactic Ablative Body Radiation Therapy (SABR): A Resource

SABR UK Consortium

Version 6.1

Endorsed by

The Faculty of Clinical Oncology of The Royal College of Radiologists

Version 6.1, January 2019

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Debrecen

- 2000-2200 new patients per year
- 4 linacs (1 Synergy, 3 Versa HD)
- 1 Elekta Nucletron MicroSelectron
- RayStation 11B
- 3D conformal and VMAT treatments
- SRT
- SBRT (lung, bone mets, adrenal, prostate, liver mets)
- TBI, TSE

- 7 radiation oncologists
- 6 trainee rad oncs
- 8 physicists
- 3 dosimetrists
- 23 RTTs

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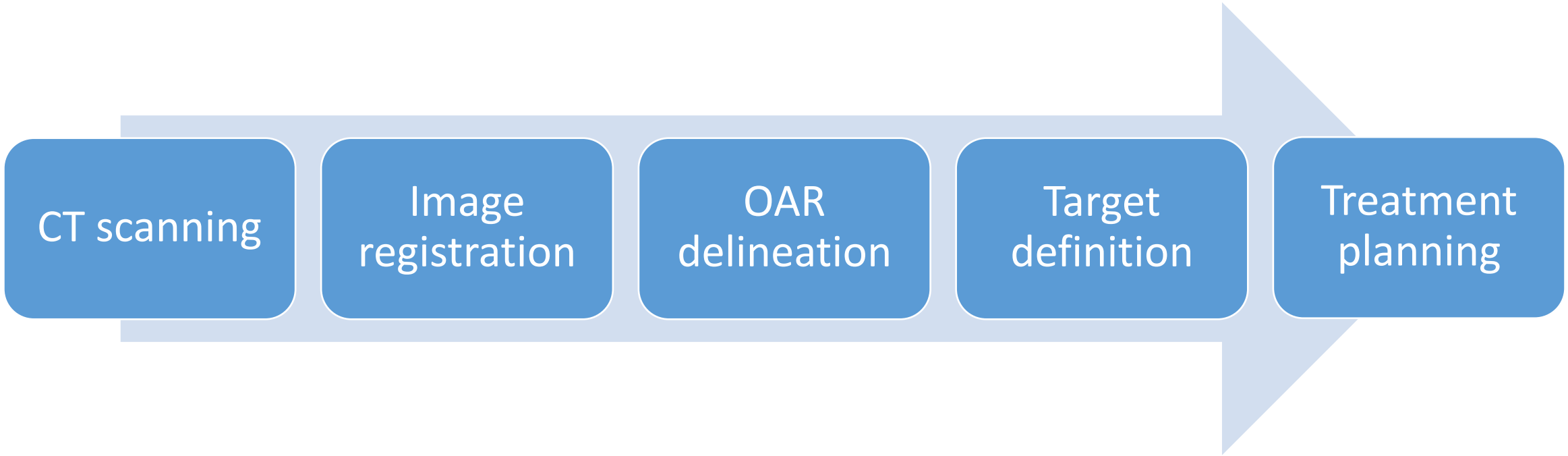
Patient preparation workflow



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Patient preparation workflow

Good, fast and reliable

Looking for good, fast and reliable

Excellent

Good, fast and reliable

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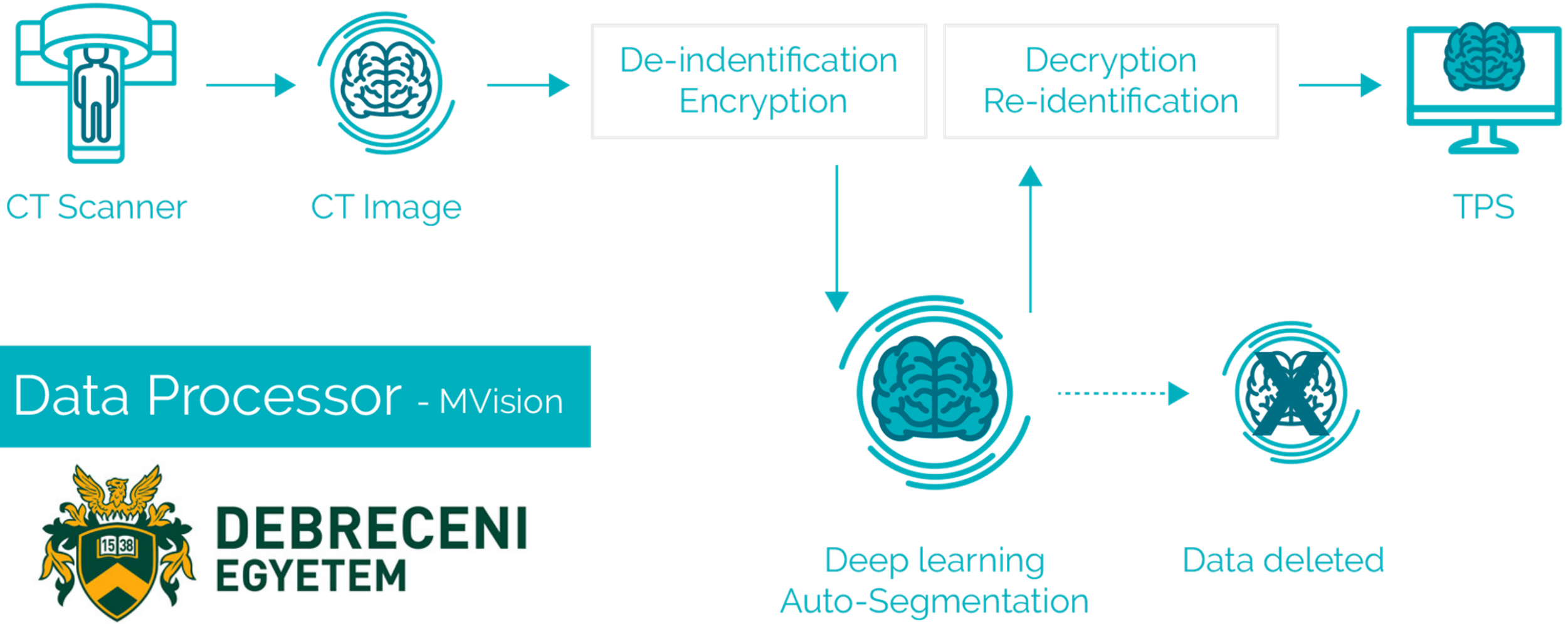
Cloud based system (GDPR)



Data Processor - MVision

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Models

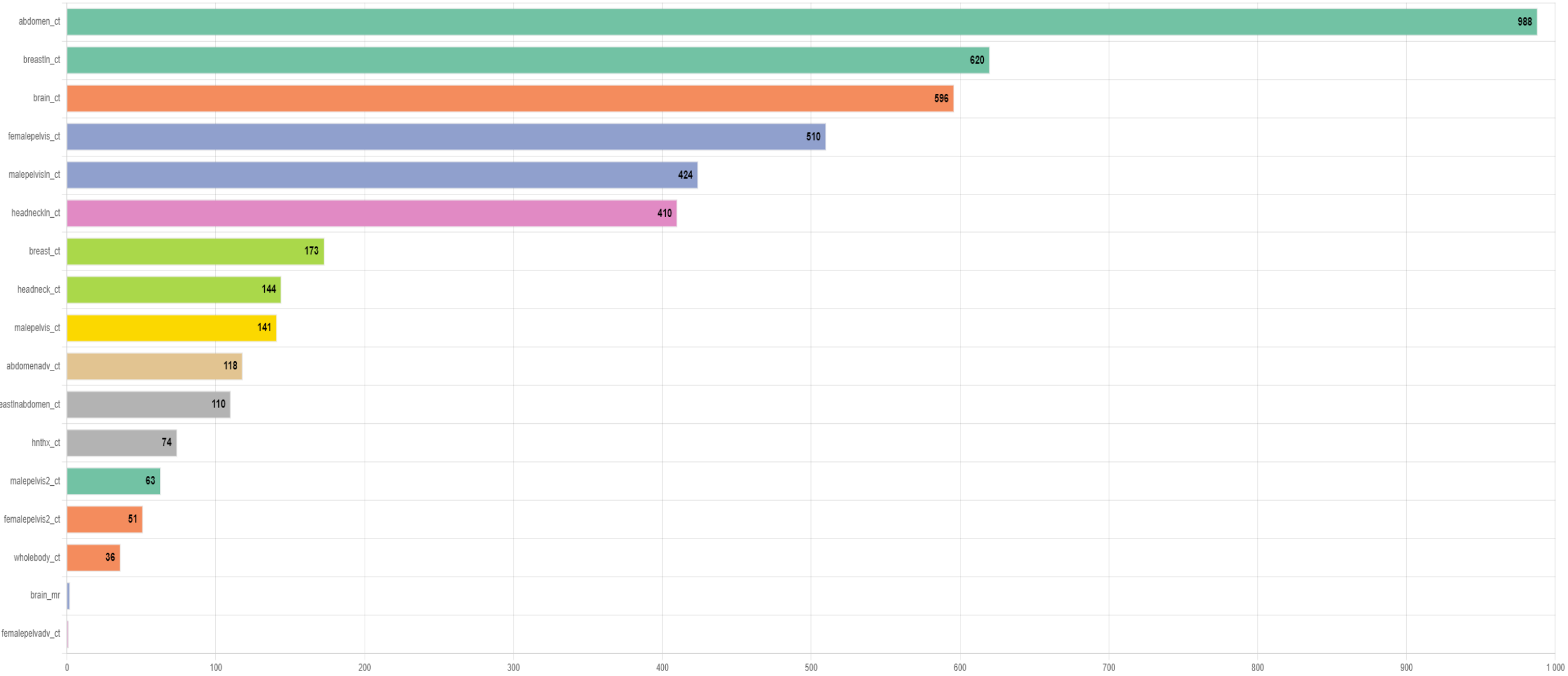
CT models

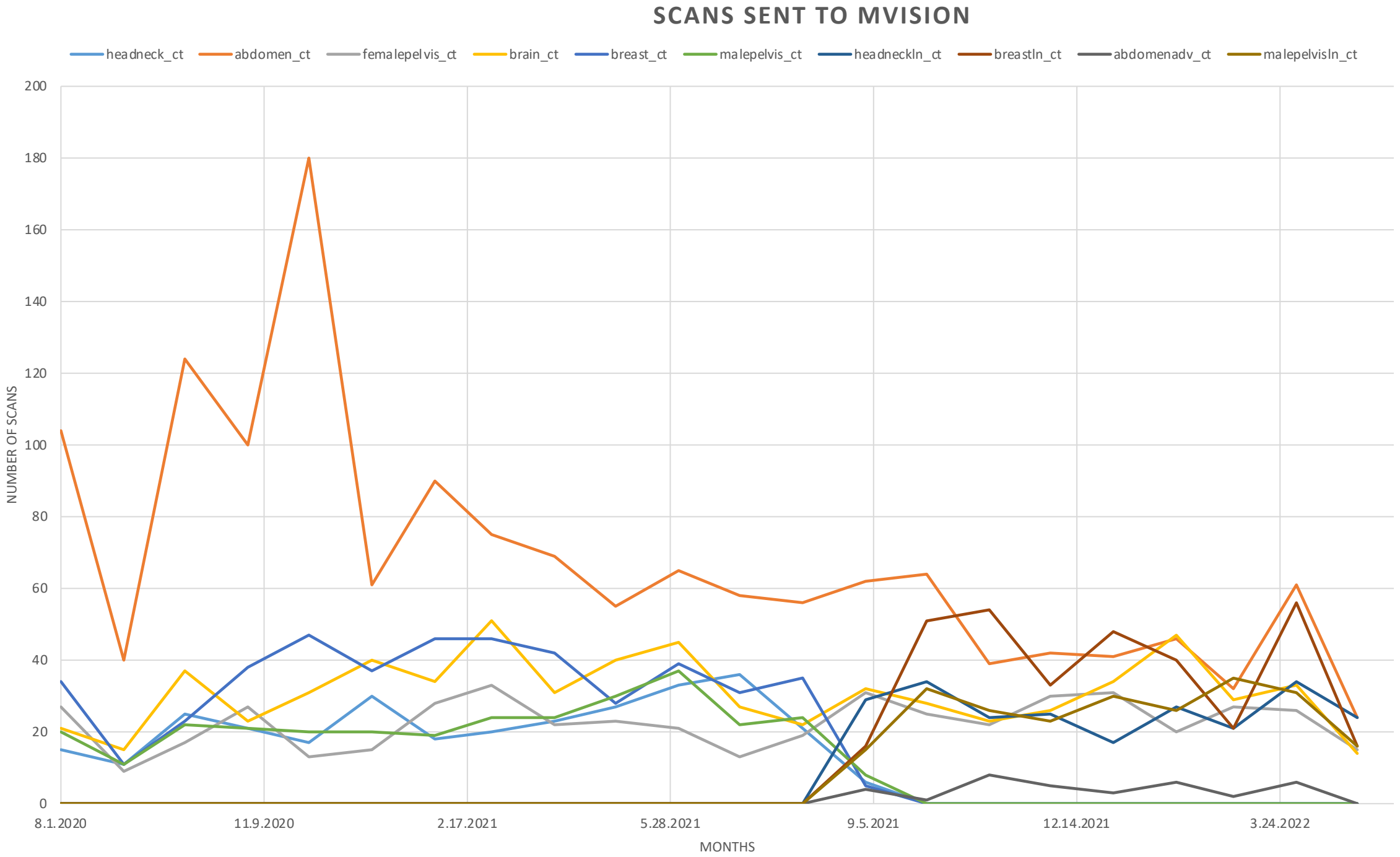
- Brain
- Head&Neck
- Head&Neck with Lymph
- Abdomen &lung
- Abdomen & Lung SBRT
- Breast
- Breast with Lymph
- Female Pelvis
- Female Pelvis Advanced
- Male Pelvis
- Male Pelvis with Lymph

MRI models

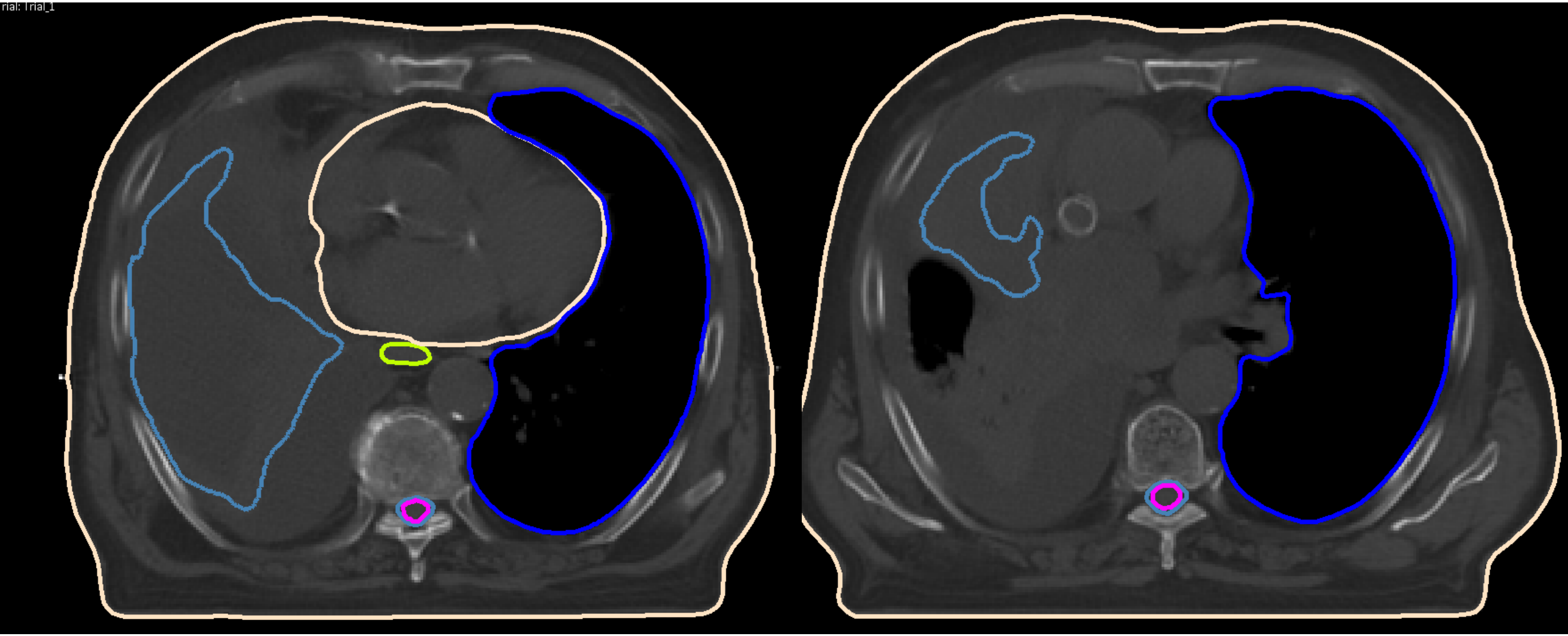
- Brain
- Male Pelvis

All models since 18-03-2021: 4461




SCANS SENT TO MVISION
headneck_ct
abdomen_ct
femalepelvis_ct
brain_ct
breast_ct
malepelvis_ct
headneckln_ct
breastln_ct
abdomenadv_ct
malepelvisln_ct
200
180
160
140
120
100
80
60
40
20
0
NUMBER OF SCANS
8.1.2020
11.9.2020
2.17.2021
5.28.2021
9.5.2021
12.14.2021
3.24.2022
MONTHS

Some cases:
closed trachea



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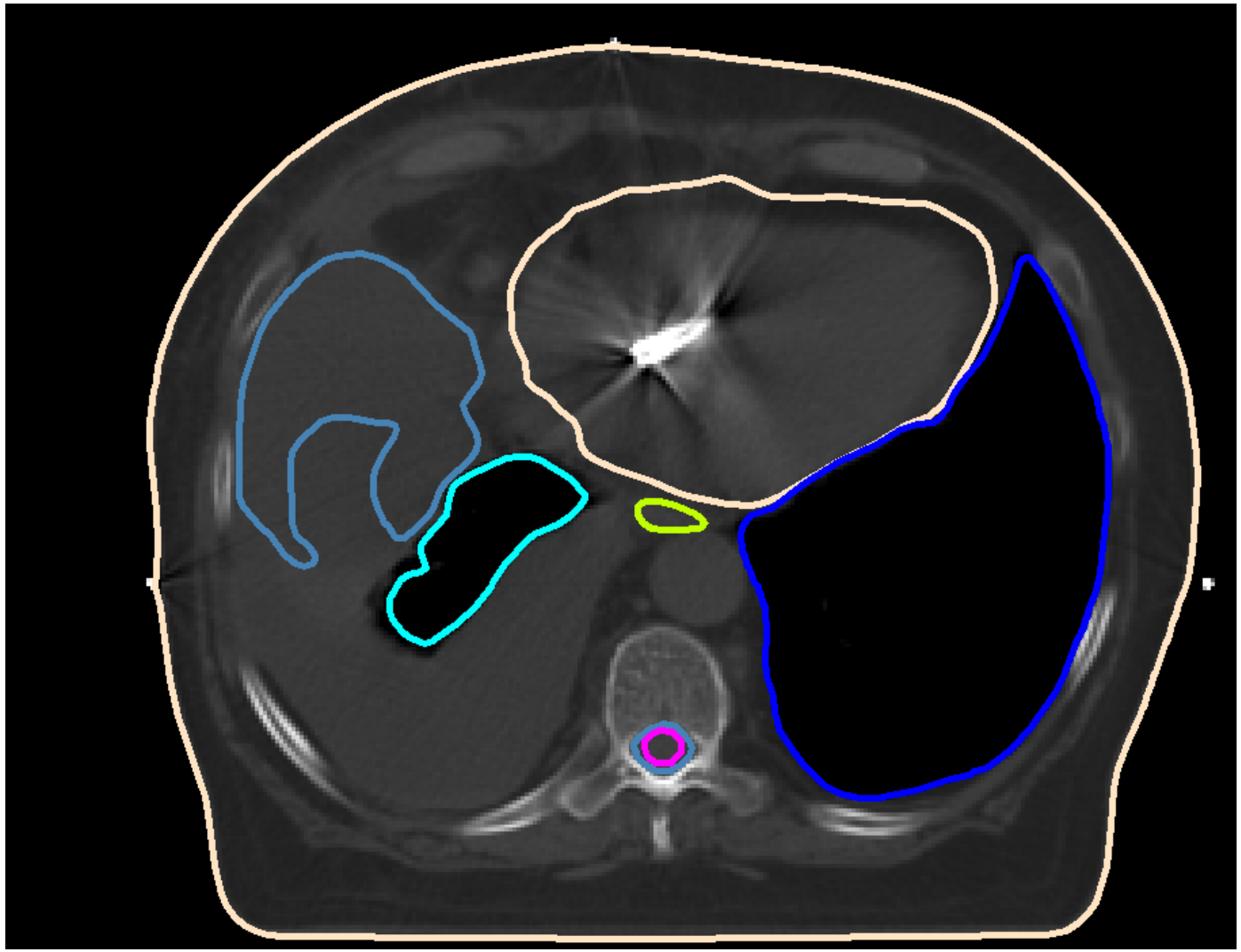
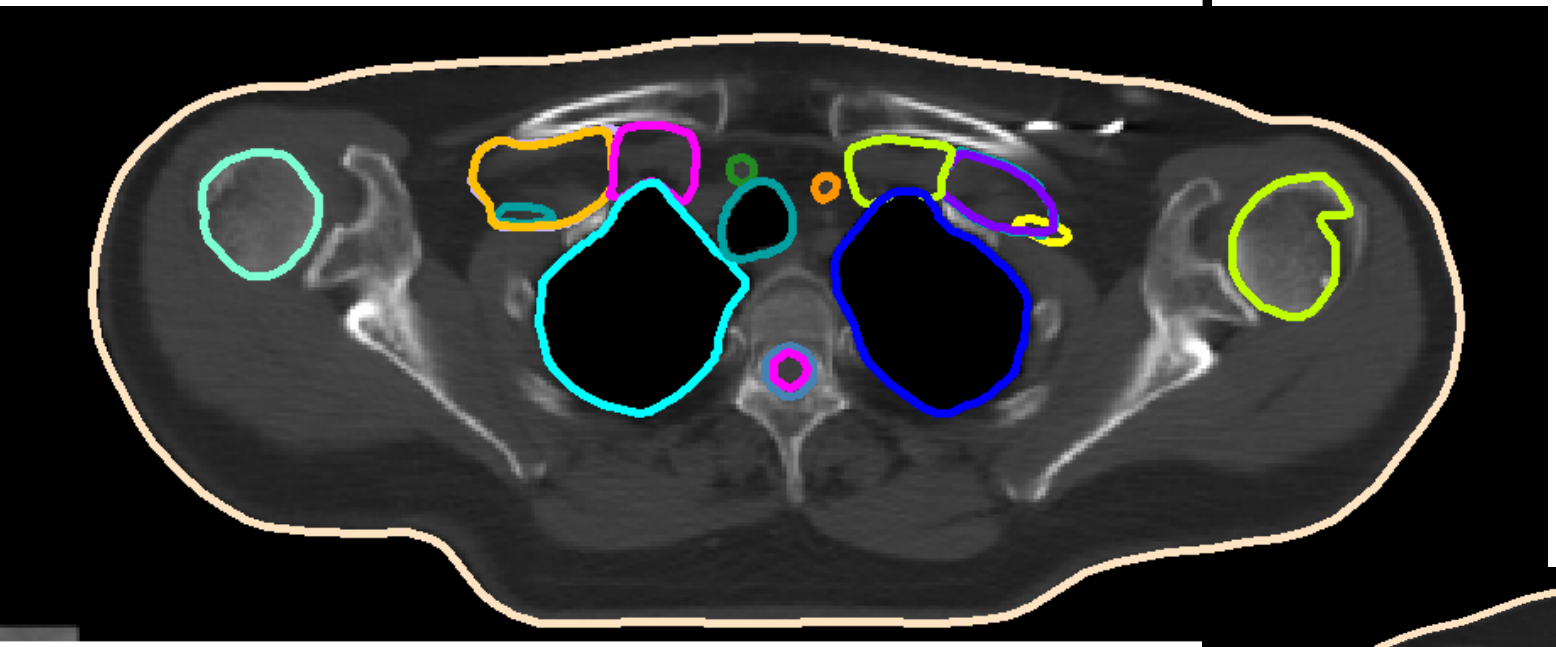
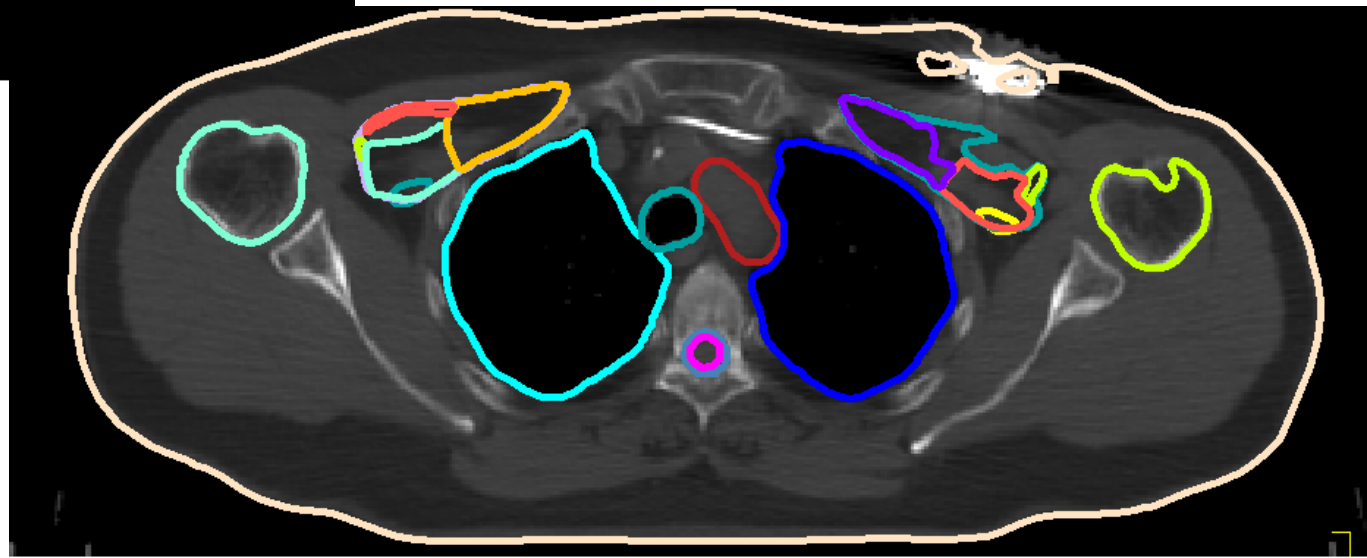


Some cases:
ICD present





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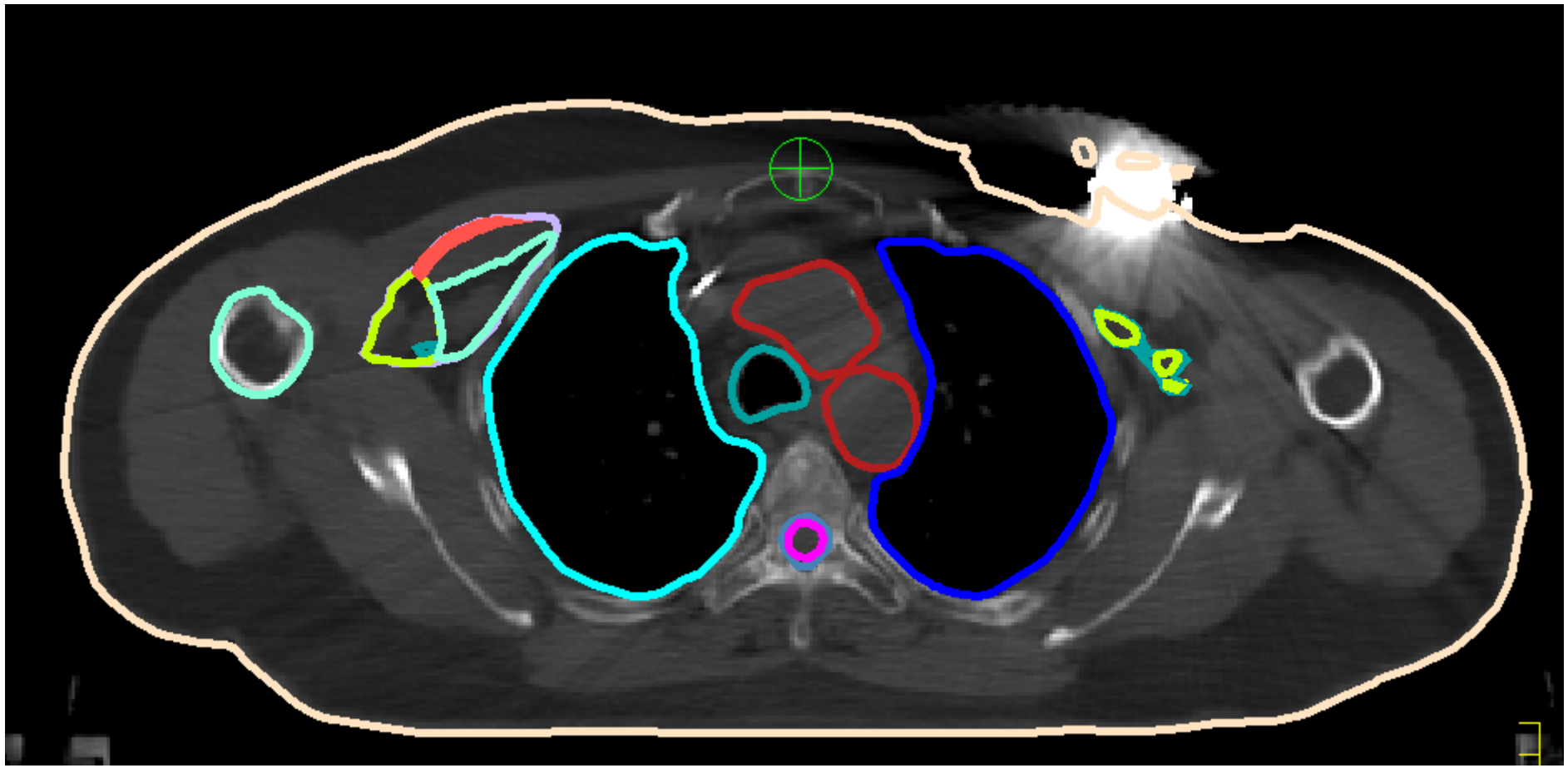
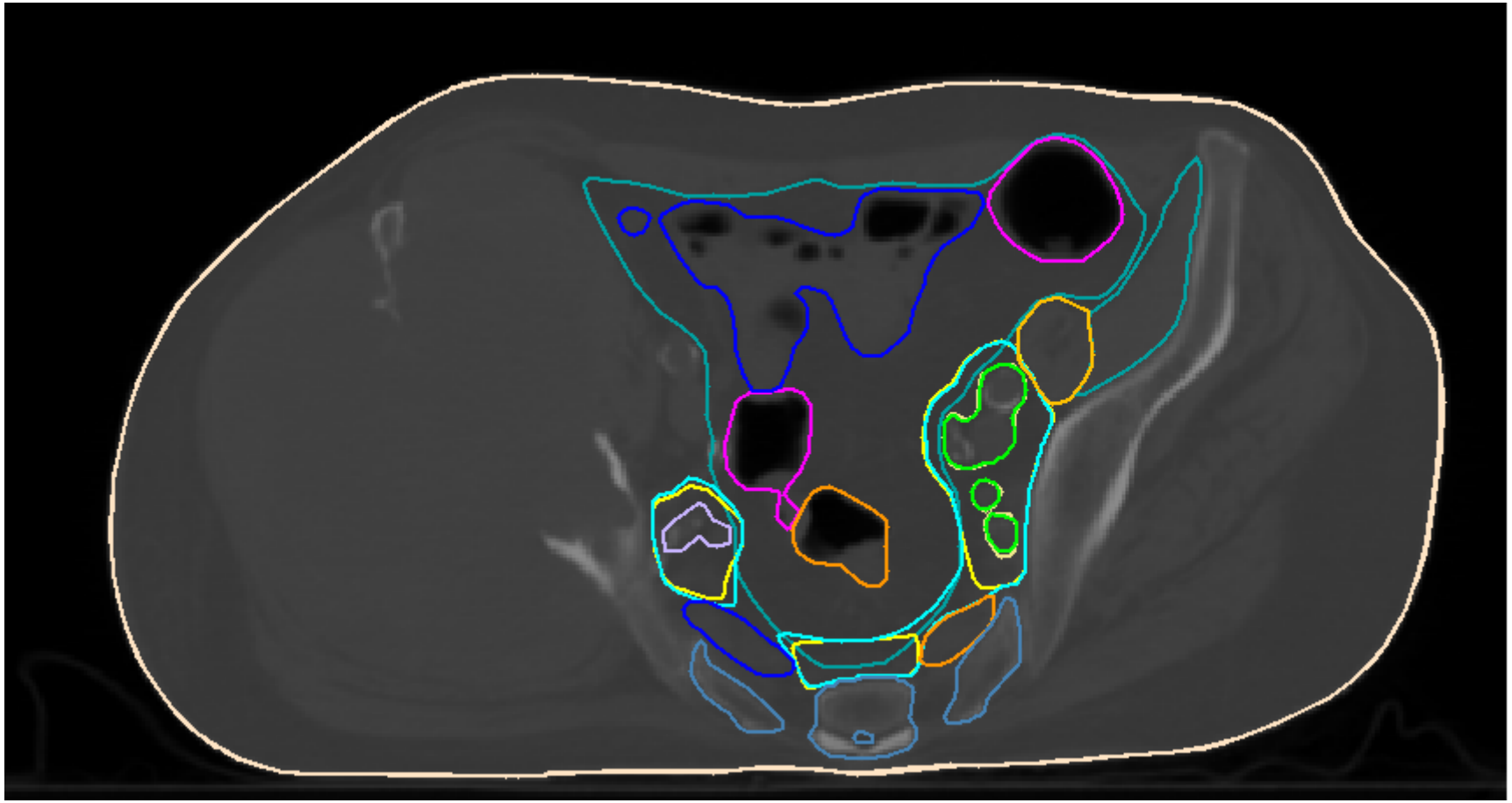


Some cases:
strange anatomy



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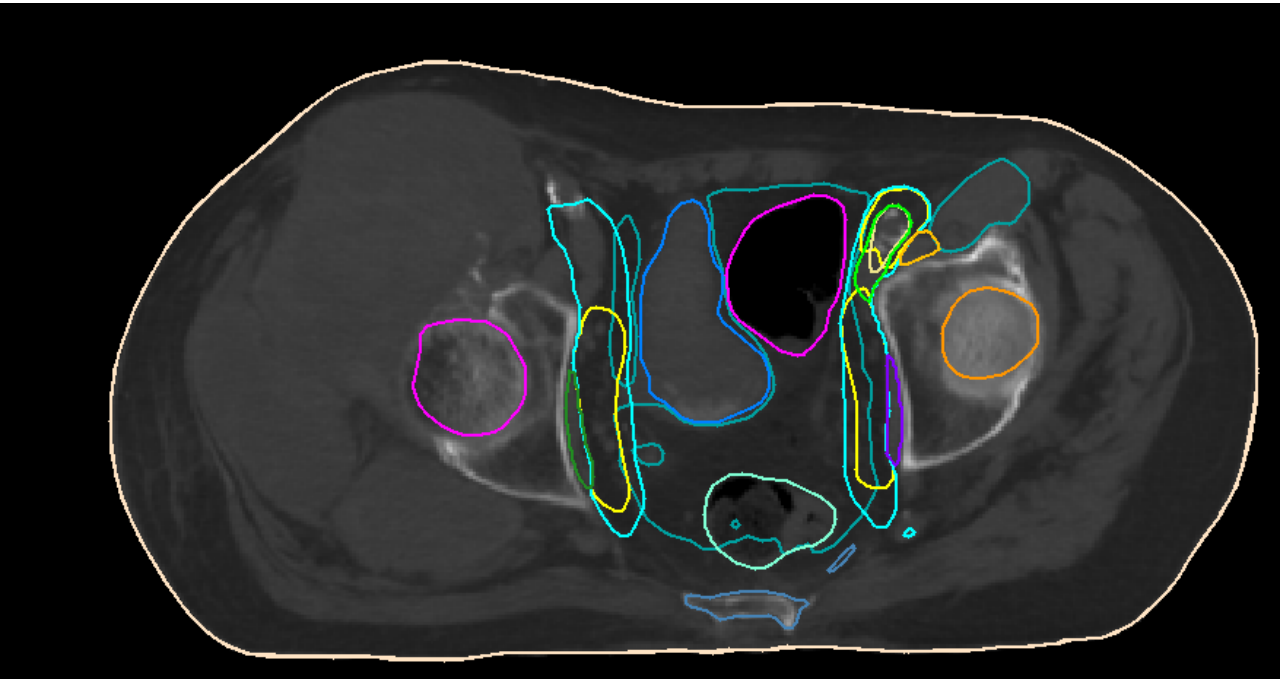

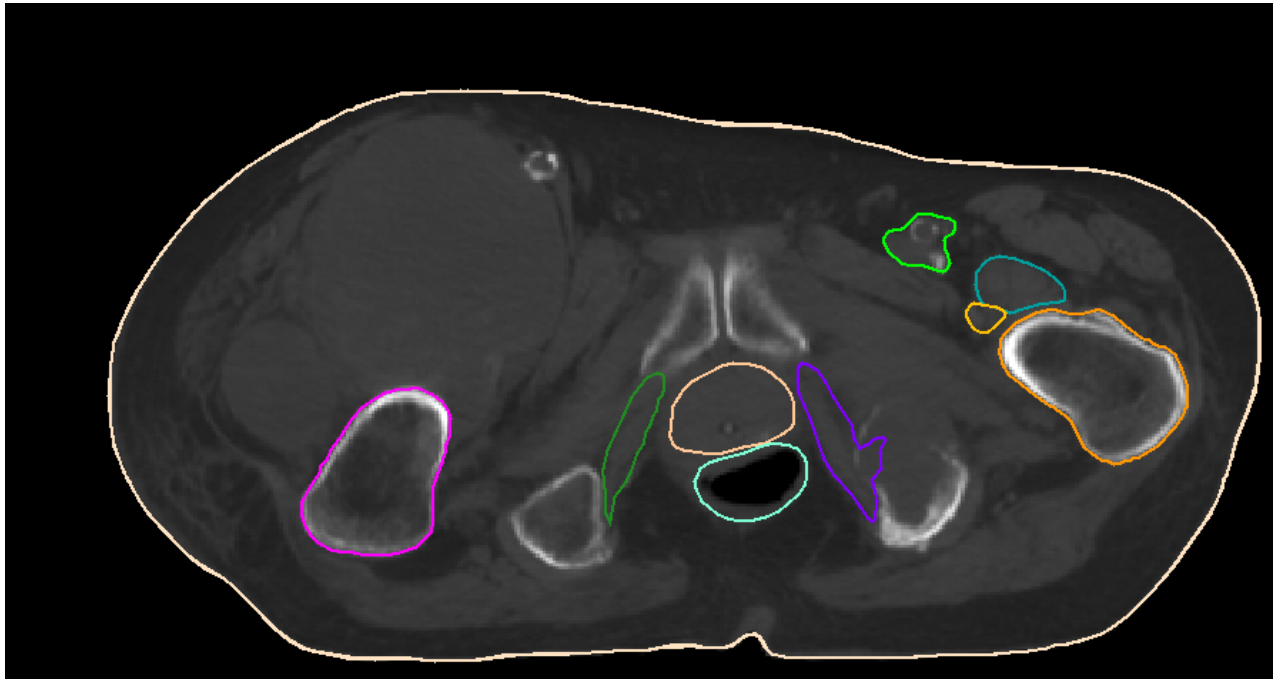

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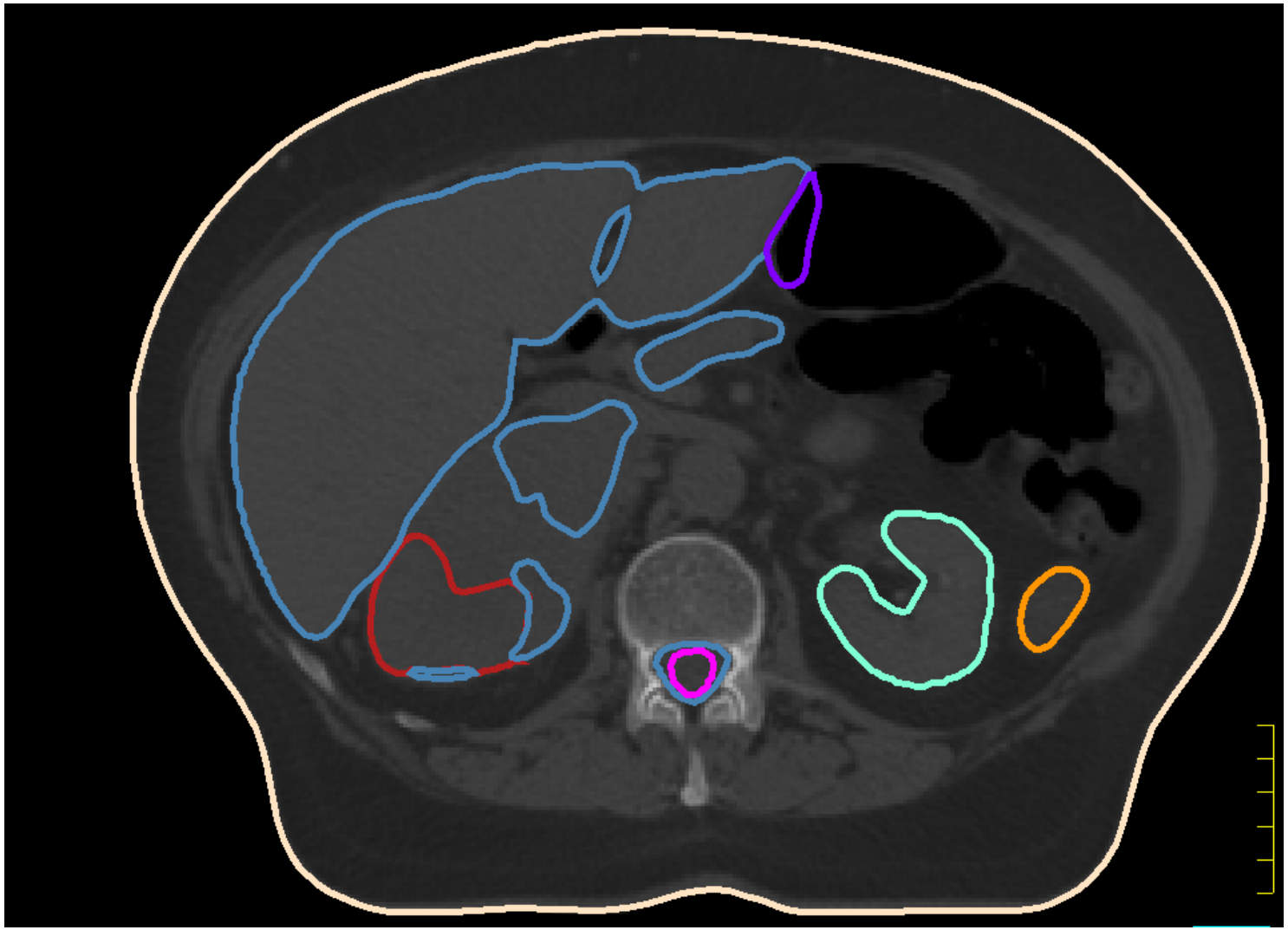
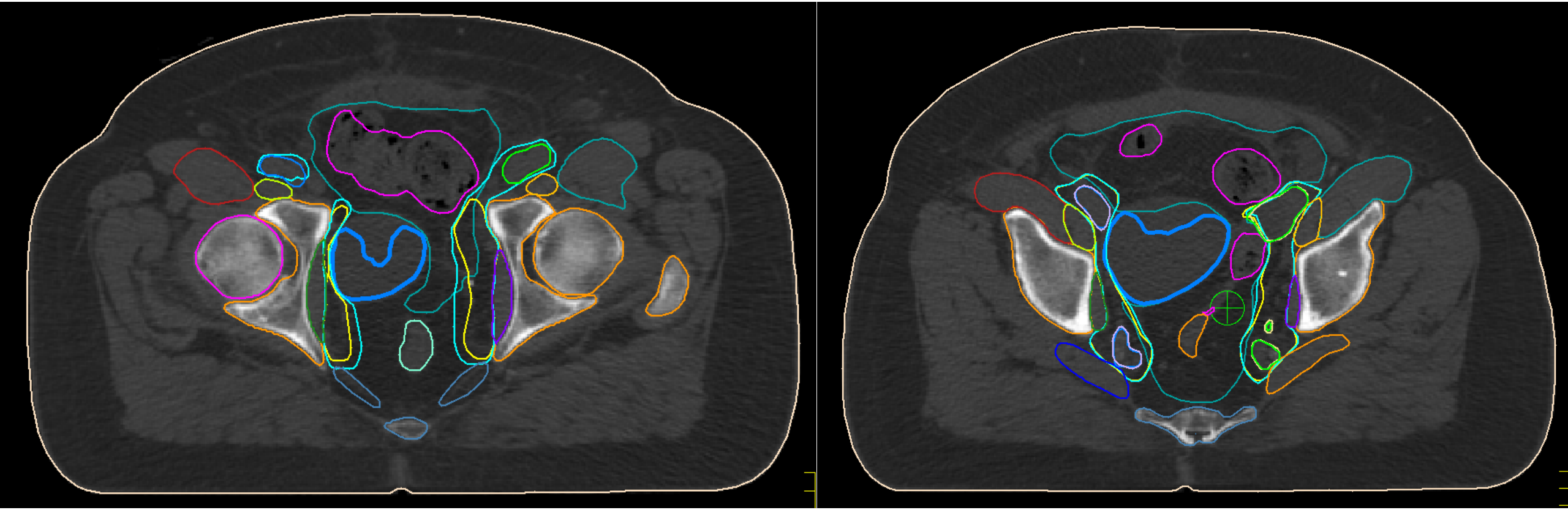


Some cases:
missing organs



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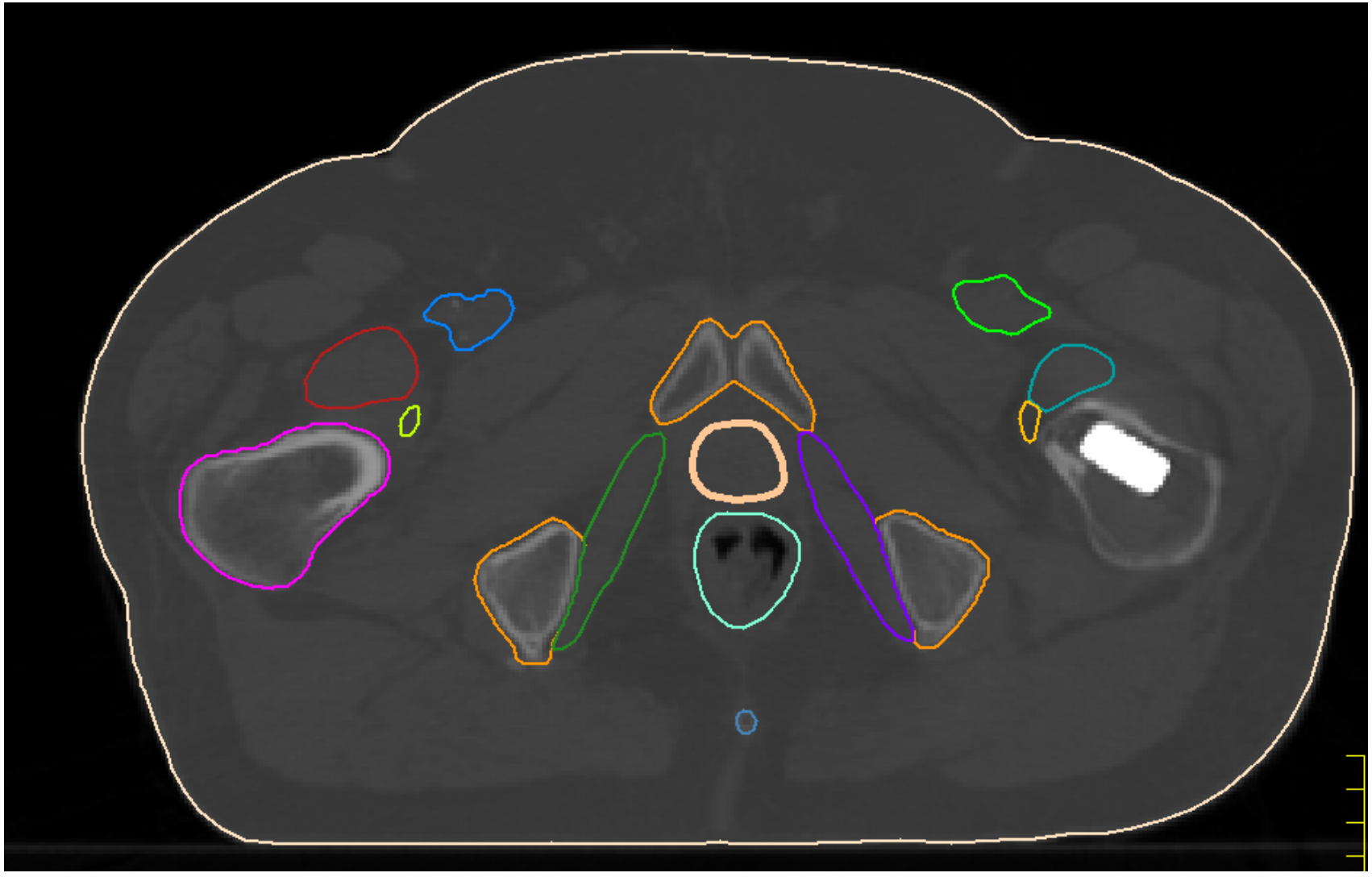

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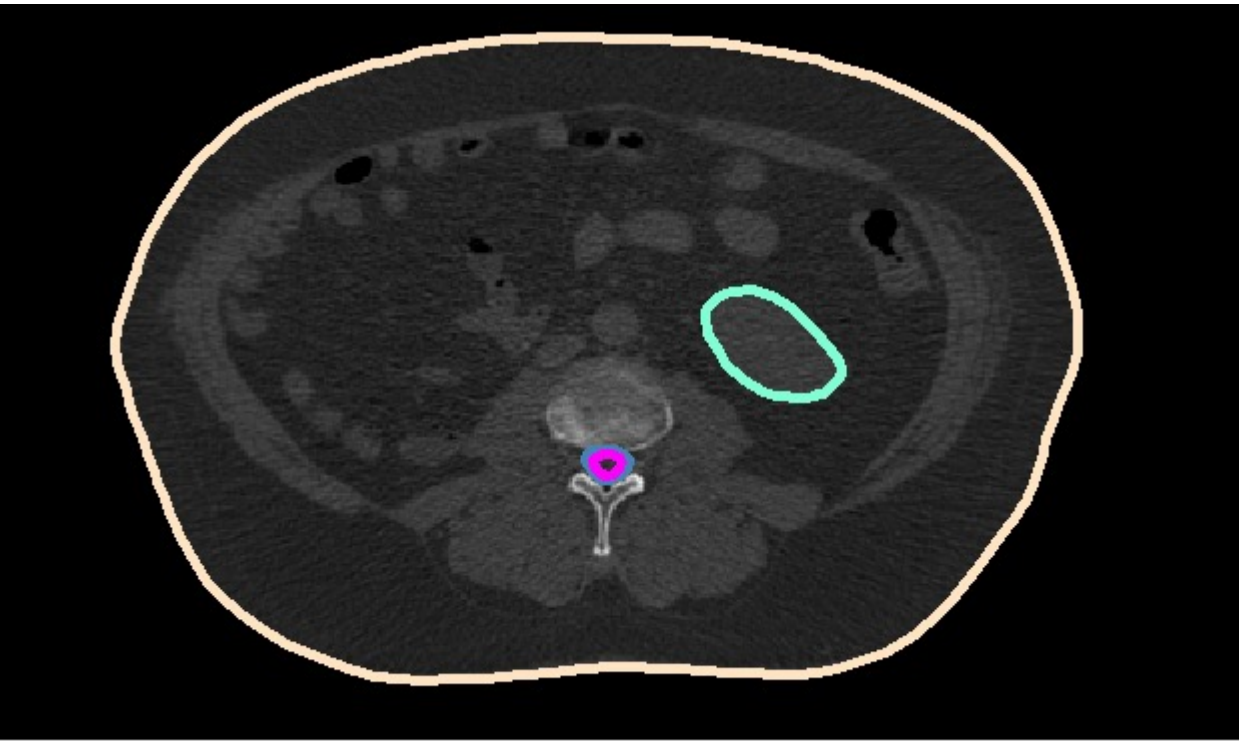

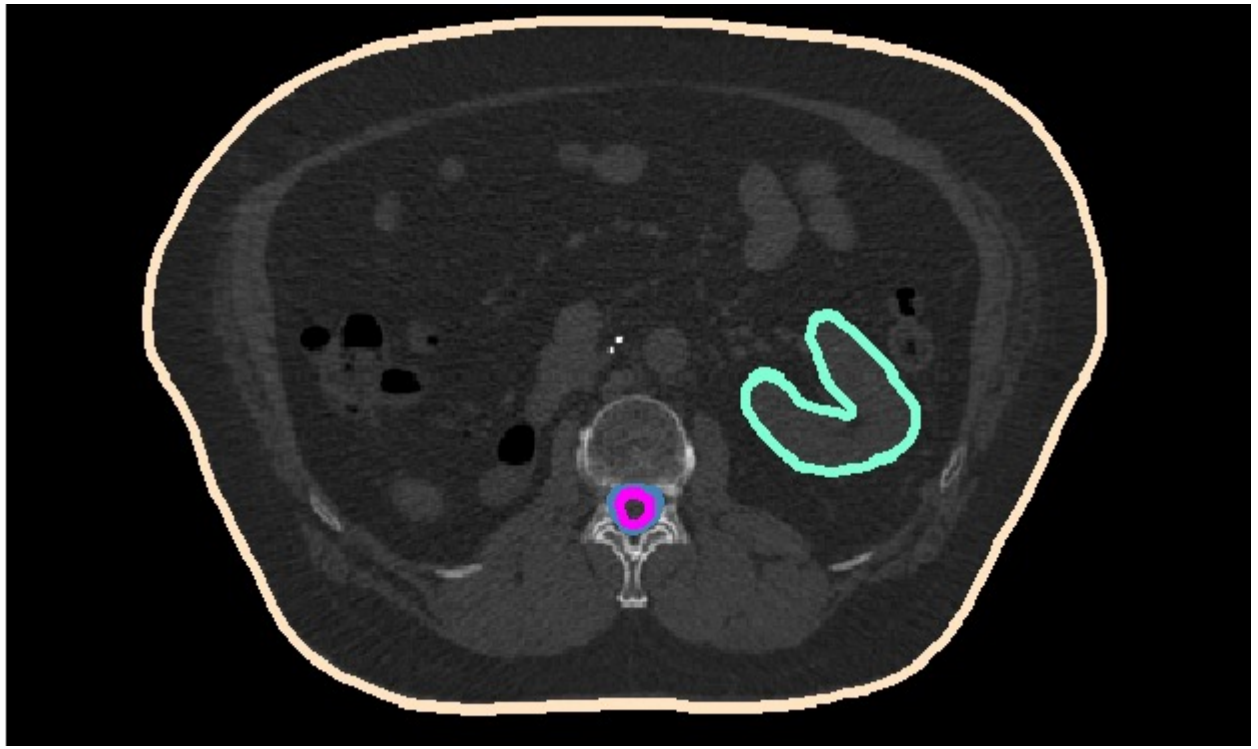

Conclusions

- You can gain:
  - Speed
  - Consistency
  - Reliability

- But!
  - Clinical translation is hard
  - Algorithms may not work very well outside training environment

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Thank you for your attention!