Atelier du CLARA : Rencontre régionale Cancer du foie 2020

ANALYSIS AND PROCESSING MRI SEQUENCES FOR VOLUMETRIC RECONSTRUCTION OF LIVER ANATOMY AND HCC DETECTION

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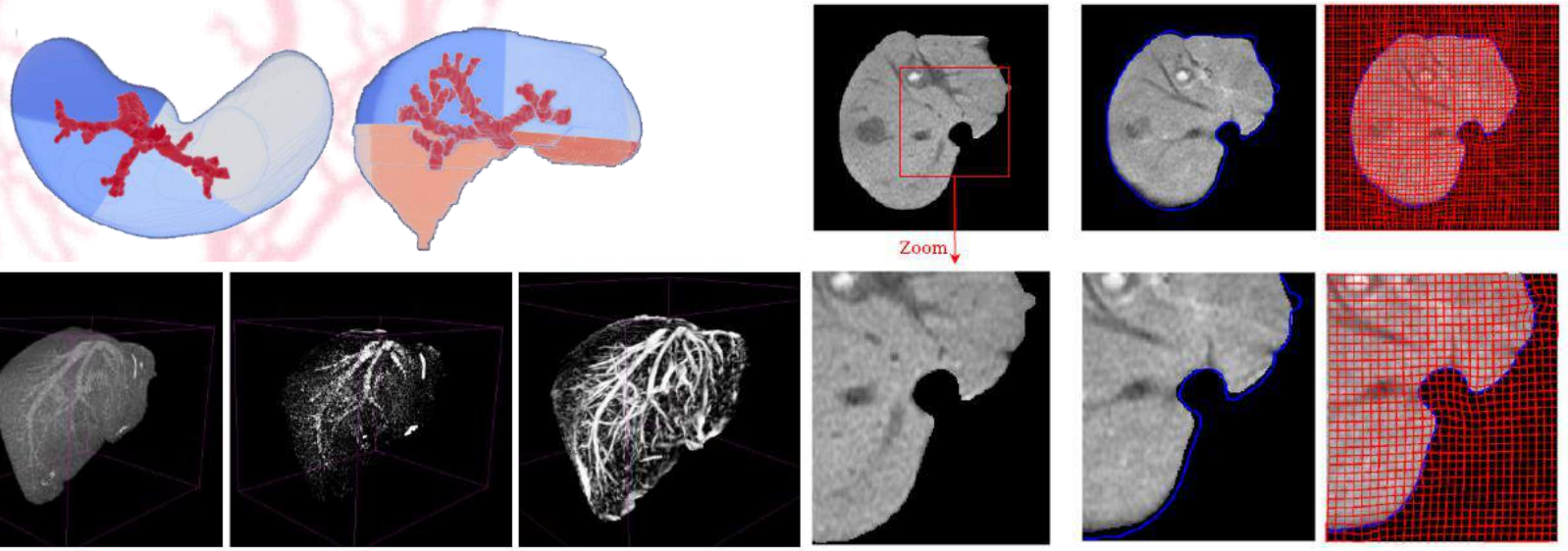
ANR R-Vessel-X Project

http://tgi.ip.uca.fr/r-vessel-x/

MEDICAL IMAGE ANALYSIS

- ANR R-Vessel-X project
  - Reconstruction of liver volume / vessels in CT and MRI
    - Automatic liver anatomy reconstruction [Comput Med Imag Grap 2019]
    - Couinaud representation, HCC localization [Comput Biol Med 2019]
  - Recent advances in MRI sequence analysis / processing
    - Benchmark of vesselness filtering [IEEE ICPR 2020]
    - Joint registration and segmentation [IEEE IPTA 2020]

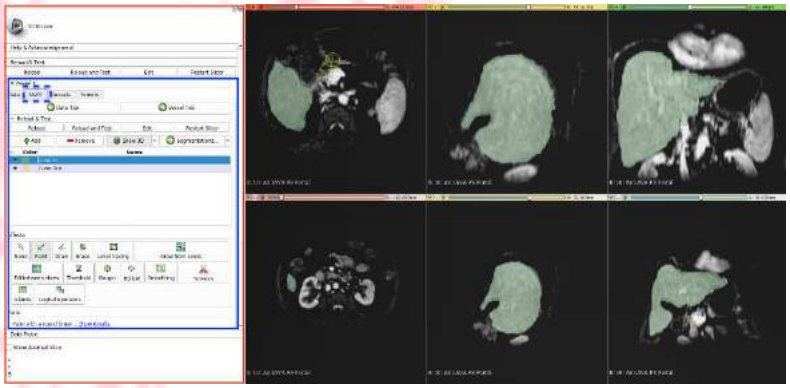


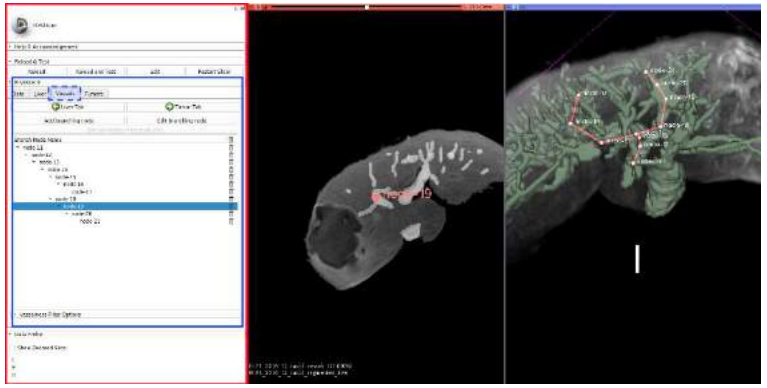
COLLECTING ANNOTATED DATA

- Annotation
  - Plays a key role in the creation of reference datasets
    - For benchmarking image analysis algorithms
    - For training machine learning systems
  - Dataset's relevance depends on software ergonomics
- Liver cancer
  - DCE-MRI - Dynamic contrast enhanced MRI
  - A popular modality for diagnosis, e.g. HCC
  - But no public database for hepatic DCE-MRI
- Our progress
  - Agreement from CERIM
  - Storage by data center IBO

A PUBLIC ANNOTATION SOFTWARE

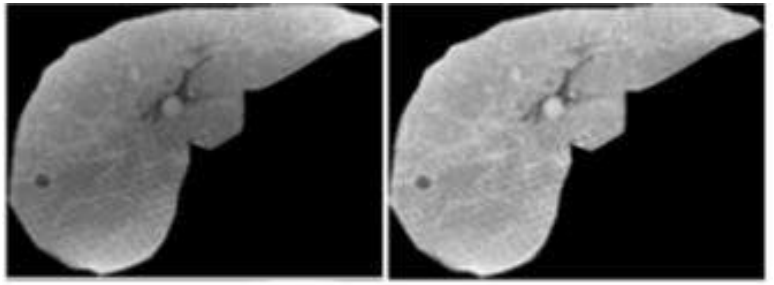
- A 3D Slicer plug-in, online by Jan. 2021
  - Divided into 4 steps
    - Loading and managing medical imaging data
    - Liver segmentation
    - Vessels annotation
    - Tumor segmentation
  - Integration of already existing 3D Slicer tools
    - Segmentation for liver/tumors: Paint, eraser, level-set tracing, etc.
    - VMTK centerline annotation for vessels



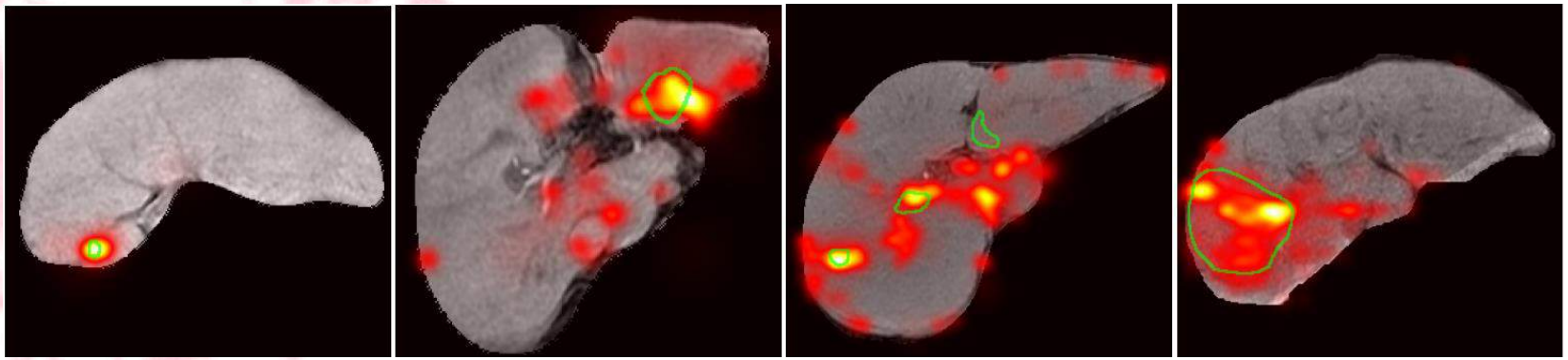


HCC DETECTION IN DCE-MRI

- MRI enhancement
  - Reduce signal inhomogeneities
  - For a better HCC detection

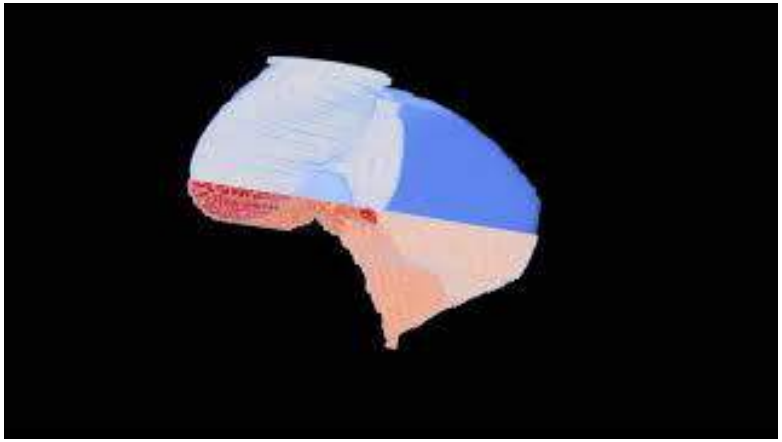


- Machine/deep learning
  - U-Net detection by processing all MRI phases [ICCVG 2018]
  - CNN detection for each phase [ICPRAI 2020]
  - Multi-label CNN integrating staging [Int J Pattern Recogn, 2021]



TAKE HOME MESSAGE

- Computer science / engineering
  - AI, machine / deep learning
  - (Bio)medical image analysis / processing
  - Bring advises in your projects
- Annotation of hepatic DCE-MRI sequences
  - Provide public version (Jan. 2021)
  - Building a large dataset



https://youtu.be/FNN6Yo5qxbQ

https://youtu.be/IF4l9CXl23g

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