Modul: INF-BAS7
Semester: WS 2023
PrÃ¼fer: Jun.-Prof. Matthew McGinity

Lehrveranstaltung: Computer-_und_robotergestuetzte_Chirurgie
PrÃ¼fer: Sebastian Bodenstedt
List the pipeline we've talked about the whole semester. Say to each point 1-2 sentences.

Explain MRT or CT in detail?

How we reconstruct a CT image with Fourier-Transform?
1D Radon -> Fourier -> Coordinate Transformation -> inverse 2D Fourier

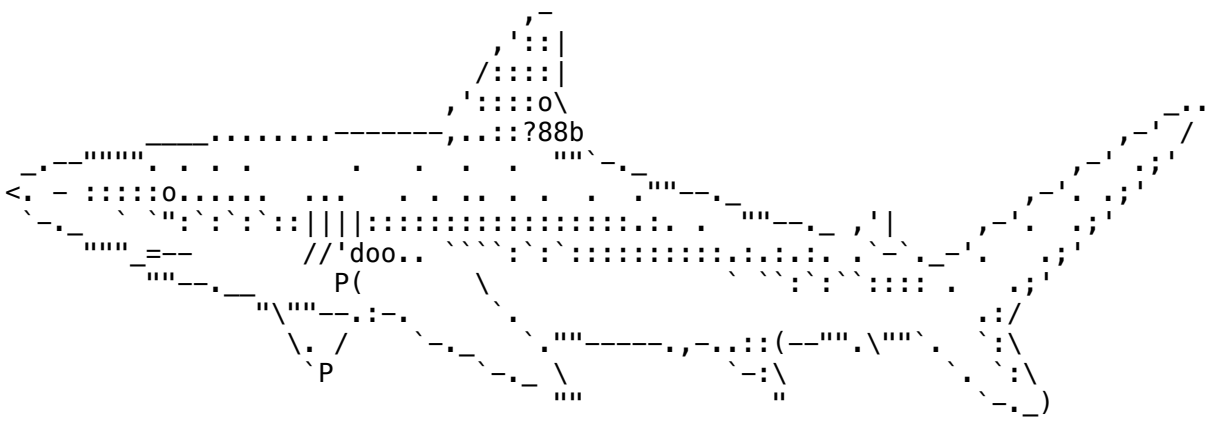
Pictures of kidney with tumor:
How we segment it?
Region growing and explanation how this works

How we segment this in the image of the endoscope?
CNN (is the only right answer)

How do neuronal networks get trained for this segmentation? Do we need to train them?
Yes, we need many labeled data

With which method we can train a network?
Backpropagation - Gradiert Decent

With stereo endoscopy, how we can map both pictures?
Epipolar Plane



That's your lucky cat(shark)
They assured me that they haven't eaten anybody yet. You've got this!

Module: INF-BAS7
Semester: SS 2023
Examiner: Junior Prof. Matthew McGinity

Course: Computer- and Robot-Assisted Surgery
Examiner: Dr. Sebastian Bodenstedt
- Explain the steps of the pipeline for computer and robot-assisted surgery discussed in the lecture.
    - 1. Image Acquisition
    - 2. Pre-processing
    - 3. Segmentation
    - 4. Modeling
    - 5. Registration
    - 6. Visualization
- Explain whether you want CT or MRI. [I chose CT]
    - Explain one of the reconstruction methods discussed. [Filtered Backprojection]
    - What problem is there with back projection if there is no filtering? [image becomes blurry because: high frequencies are responsible for sharpness in the image, low frequencies for smoothness, low frequencies are overrepresented by finite sampling of the recording angle]
    - How does the Fourier Slice Theorem relate to the reconstruction of a CT image? [1D Fourier Transform of an Attenuation Curve is a line through Fourier Transform of the 2D Object Function for the same angle]
- What is CT or MRI particularly suitable for as an imaging technique? [CT - bones, MRI - soft tissue]
- Are there any health concerns when using CT or MRI? [CT - ionised radiation, MRI - people with metal in their bodies (aka pacemakers, etc)]
- [An image of a minimally invasive operation on the kidney is presented] How can you segment the corresponding image parts (kidney/non-kidney)? [CNN]
- Explain the general structure and learning process of a convolutional neural network.
- How can you calculate depth information from the intra-operative images using the stereo camera model? [Stereo camera model, epipolar geometry, projection matrix, internal/external camera parameters]
- Which parameters are not included in the projection matrix? [Lens Distortion Parameter]
- Which registration method is suitable for registering the calculated point cloud with a pre-operative model? (Assuming that it is a rigid body)[Rigid Body Surface Registration]
- How does the Iterative Closest Point Algorithm work?
- What material properties does a so-called soft body have? [viscoelasticity]

Impression: Very relaxed atmosphere, help is given when necessary, small mistakes are forgiven. Grading corresponded to my own assessment.

Modul: INF-BAS7
Semester: WS 2019
PrÃ¼fer: Stefan Gumhold

Lehrveranstaltung: Computer-_und_robotergestuetzte_Chirurgie
PrÃ¼fer: Sebastian Bodensted

English version for the CMS students:
In general, the pipeline is always used in the exam, which is mentioned again and again in the lecture. Individual processing steps are gone through bit by bit. In this case, intraoperative tumor detection in the brain was chosen as the overall topic.

First question: How is the image provided? Which method is suitable? -> MRI, explaining why X-ray and CT are less suitable. Then explain what a CT does (MRI was another choice). What kind of radiation is it? How are images generated? Explain what Fourier transformation and back projection revealed (formulas were not asked, general approach!)

Then next to segmentation: What kind of segmentation is well suited for the MRI image? I should explain what exactly the intensity-based segmentation does, but I had a few hiccups here. The question was, what exactly are snakes and whether this procedure is automatic.

Then to the visualization: Suppose MRI and CT data were merged and you have an image of the skull that was reamed out. How can you get 3D information through the image? So half redirect to computer vision and stereo camera model. Explain basic epipolar geometry. The question was how to find a point on one camera from a point on the other camera. My answer was to transform from one matrix to the other matrix. But I don't think that was the right answer.

Last question: If you have these two data sets (i.e. 3D of camera and MRT/CT), how are they registered? Answer was point based registration, nor explain how ICP (iterative Closest Point) works.

In general less details were asked. Understanding is more important than knowing any formula. It is more important to know what the algorithm does than to know every step in detail.
Sebastian was very relaxed and friendly. I had some gaps especially in the intensity based registration, but the note was still quite ok.

tl;dr - explain CT (Fourier, back projection), segmentation (intensity based), stereo camera model (epipolar geometry), registration (surfaces, iterative closest point). Understanding more than knowing every detail.