

Propositions accompanying the thesis
Improved Image Guidance in TACE Procedure

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1. During TACE interventions, 2D X-ray images without contrast agent are sufficient to automatically and continuously track the catheter and the guidewire in a static 3D model of the vasculature. (*chapters 2 and 3*)
2. A hidden Markov model is an efficient probabilistic solution to keep track of the catheter in the vasculature over time; this helps when catheter visibility in X-ray images is limited due to narrow field of view. (*chapter 3*)
3. Using convolutional neural networks, catheter, guidewire and contrast inflow can be automatically detected in real-time on 2D X-ray images. (*chapters 4 and 5*)
4. Convolutional neural networks enable powerful and real-time segmentation methods. However, they do not learn intelligent representations of the data yet. (*chapters 4, 5 and 6*)
5. Clinical images and instruments used in TACE procedures vary between hospitals and physicians; image guided interventions would benefit of protocol standardization and research on robust detection of different instruments. (*chapter 6*)
6. Our final objective function is patients and physicians.
7. In any endeavour, knowing how to fail quickly is an important skill.
8. Data are valuable, open data are priceless.
9. Preventing is preferable to curing.
10. Diversifying your activities helps to keep you sane.
11. You need three things to make tea: time, ember and friends. (*Tuareg proverb*)