

BSc projects – How do deep neural networks approach image registration?

Conventional image registration methods are often based on iterative optimization. These methods are usually quite slow, which makes them unsuitable for online use in image-guided procedures, such as radiation treatment or robot-assisted surgery.

In the last three years, methods that employ convolutional neural networks have been proposed to address this problem [1, 2, 3, 4]. Although it takes a lot of time to train these networks, once they are trained they are typically several orders of magnitude faster than conventional registration methods.

Convolutional neural networks are often regarded as black boxes: it is often said that nobody knows what they do exactly. In this project you are going to implement a neural network for image registration that actually allows us to obtain insight in how it tackles this complex problem. Using a technique called regression activation maps [5], you are going to assess what the neural network you have trained takes into account when doing registration.

This project will be implemented using Python, and some basic understanding of Python is recommended for this project. You will also learn how to use the Linux operating system on remote servers with GPU computation power. The final report will be written in LaTeX.

Keywords

Registration, deep neural networks, convolutional neural networks

Contact

Koen Eppenhof, k.a.j.eppenhof@tue.nl

References

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- [2] De Vos et al., DLMIA workshop MICCAI 2017
- [3] Dalca et al., MICCAI 2018
- [4] Eppenhof et al., TMI 2018
- [5] Wang and Yang, arXiv:1703.10757