MSc project

Deep learning-based stomach segmentation in MR images to monitor gastric emptying and protein coagulation

Background

Understanding the digestion of milk proteins is key when choosing or developing products for people who have trouble ingesting enough protein such as older adults, athletes and critically ill. Milk proteins tend to clot in the stomach (coagulation), which affects gastric emptying and therefore protein digestion. A new method to better understand and quantify these processes is to image the stomach using magnetic resonance imaging (MRI) [1], followed by segmentation of the stomach in the resulting images. However, due to intra- and interpatient variations, movement artefacts and intensity changes of the gastric content over time, automatic segmentation of the stomach remains a major challenge. In addition, it remains unclear which textural features in the gastric content can be used to quantify protein coagulation and how changes in texture can be detected.

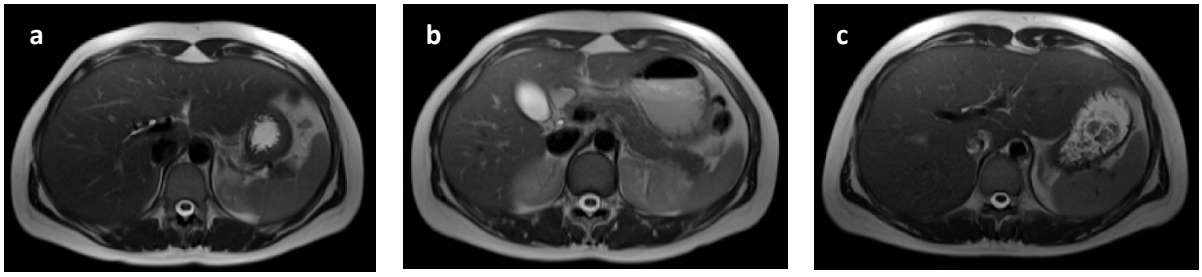

Figure 1: Examples of MR images showing an empty stomach (a), filled stomach at t=3 minutes (b) and protein coagulation at t=50 minutes (c).

In recent years, there have been unparalleled advances in deep learning for various medical image analysis tasks. In this project, you will experiment with using convolutional neural networks (CNNs) for segmentation of the gastric content on MR images. Possible research questions to work on during this project include comparing 2D and 3D CNN training strategies, training a CNN to recognize different textures or amounts of protein coagulation, or experimenting with training CNNs on different time points in the gastric emptying cycle.

This MSc project will be performed in collaboration with the Division of Human Nutrition and Health of Wageningen University & Research (WUR).

Requirements

Python programming, image analysis, deep learning (CNNs)

Contact

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References

[1] Spiller, R., & Marciani, L. (2019). Intraluminal Impact of Food: New Insights from MRI. Nutrients, 11(5), 1147. doi:10.3390/nu11051147