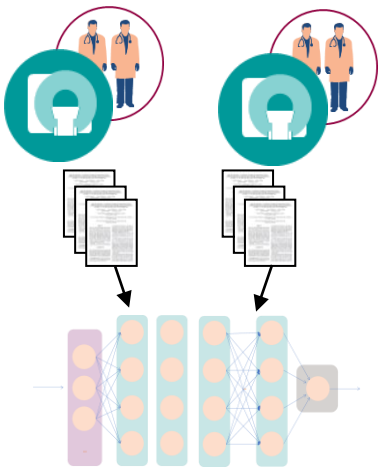
Bachelor's thesis/Internship in the Field of Medical Imaging: Federated Learning for 3D camera-based weight & height estimation

Division/Business Line: Siemens Healthineers, Computed Tomography (CT)
Function/Department: R&D CT Concepts, Image Analytics
Site: Forchheim

The R&D Department of Siemens Healthcare, Computed Tomography, develops advanced systems for medical image analysis. In order to drive Siemens' competitive power, R&D focuses on cutting-edge technology and the highest quality standards regarding system outcomes.



As part of CT scanning workflows, accurate measurement of patient geometry and biometrics is crucial for various tasks, including isocenter estimation, patient positioning, or scan dose estimation. To this end, Siemens Healthineers has developed the "FAST 3D Camera", a product that automatically measures patients using a 3D RGB-D camera. This technology supports clinicians in their daily work, leading to improved efficiency and better healthcare provision.

As a leading technology provider, Siemens Healthineers is committed to offering the best possible solutions to customers and patients. Regular updates with improved algorithm versions, including those based on Deep Learning, are provided. Although Deep Neural Networks are state-of-the-art for various medical tasks, they may struggle to generalize and lack robustness when trained on limited data. However, due to data security and privacy regulations, acquiring large and unified datasets in practice remains a challenge.

Therefore, this project aims to independently explore the potential of Federated Learning, an innovative approach to training machine learning models collaboratively while preserving data privacy. The student involved in this project will assist in onboarding multiple clinics into an existing Federated Learning environment and conducting comprehensive experiments to evaluate the algorithm's value, robustness, and clinical applicability.

The primary goals include:

- Conducting a comprehensive analysis of State-of-the-Art Federated Learning approaches
- Systematically evaluating the accuracy of algorithms, training time requirements, and the longevity of information to determine their effectiveness.
- Assessing the applicability of these approaches in relation to the specific field of application.
- Integrating the identified approaches into the existing software landscape of the department.

Profile:

- Good programming skills in Python
- Expertise in data analysis, medical imaging & pattern recognition
- Good communication skills (English/German).
- Hands-on experience with deep learning (e.g. Keras/Tensorflow) & Kubernetes/Docker is a plus

References:

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Li, L., Fan, Y., Tse, M., & Lin, K. Y. (2020). A review of applications in federated learning. *Computers & Industrial Engineering*, *149*, 106854.

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