Introduction: Manually delineating organs is a cumbersome but necessary task in the workflow of external beam radiotherapy treatment. Deep learning (popularly known as artificial intelligence) can assist radiotherapists in this task, by automatically delineating (or segmenting) organs. There are multiple deep learning-based abdominal multi-organ segmentation studies on adult datasets in the literature. However, the number of studies on pediatric datasets is very limited. This work evaluates and compares multiple deep learning approaches for automatic abdominal multi-organ segmentation in pediatric CT scans.

Methods: U-Net and nnU-Net, two well established tools in the medical image analysis domain, are used and considered as baseline approaches. Additionally, two more recent approaches are tested. The first is attention gating, which is added to U-Net and nnU-Net. The second approach consists in using another architecture, i.e. a vision-transformer. All the networks are trained and tested on a pediatric dataset with expert organ delineations, using 60 images for training and 30 for testing. Next, a comparison of performance between different networks is made.

Results: All networks obtain a median DSC higher than 0.9 for all organs except for the pancreas (with DSCs above 0.75). The top-performing networks obtain a median DSC of 0.85 for the pancreas and DSCs above 0.95 for the rest of organs. Attention gating improves the results of the baseline models for several organs and the vision-transformer performs worse than the rest of networks.

Conclusion: The networks compared in this work obtain a robust automatic delineation of multiple organs in pediatric CT scans. The effectiveness of attention gating is demonstrated by enhancing the performance of the baseline models. Additionally, models show robust results across the full range of patient-ages and organ volumes.