Knowledge distillation for landmark segmentation in medical image analytics

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Motivation: One major challenge that comes with deep learning approaches in medical image processing is the issue of high cost of expert annotated data. Therefore semi-supervised learning approaches are of high interest in the research community.
Methods: The application of the work concerns landmark segmentation by heatmap regression in thorax diagnostics. To keep the need of annotated data low an approach of knowledge distillation with application of a teacher-student concept will be persued. The essence of this method is to transfer knowledge from a pre-trained model or an ensemble of models to a new model. Originally this technique was introduced to reduce the capacity of huge good-performing networks while keeping the accuracy [1]. But it has also already been applied for semi-supervised learning purposes [2], what will be further investigated in this work. Aim of this master theses is to examine the benefit of student-teacher approaches in semi-supervised learning. For this purpose different variants of this method will be considered, implemented and compared to each other. This will be done in cooperation and with provision of data and infrastructure by Siemens Healthineers.

The Master's thesis covers the following aspects:

1. Literature research on state-of-the-art methods
2. Set up infrastructure and data used for the project
3. Implementation of algorithms in the framework
4. Training and tuning of hyper-parameters
5. Performance comparison of the different variants
6. Evaluation of developed algorithms

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References

[1] G. Hinton, O. Vinyals, and J. Dean, "Distilling the knowledge in a neural network," *arXiv preprint arXiv:1503.02531*, 2015.

[2] S. Sedai, B. Antony, R. Rai, K. Jones, H. Ishikawa, J. Schuman, W. Gadi, and R. Garnavi, "Uncertainty guided semi-supervised segmentation of retinal layers in oct images," in *International Conference on Medical Image Computing and Computer-Assisted Intervention*, pp. 282–290, Springer, 2019.