Computer-Aided Diagnosis

Spring 2021

Healthcare is being transformed by advances in computer vision algorithms. Radiology departments across the world have been successfully piloting software that automatically identifies and characterizes disease in medical images. This allows physicians to prioritize patients with severe disease, and also helps identify incidental findings (disease that is discovered unintentionally, during evaluation/treatment for a different disease). Convolutional neural networks are already competitive with radiologists at detecting a number of common diseases such as pneumonia in chest x-ray [2] and hemmorhage on CT [1]. Still, many challenges remain for making such algorithms reliable diagnostic tools:

1. Incorporating textual information (previous clinical reports of the patient), longitudinal imaging (previous scans of the patient), multiple imaging modalities (multiple MRI sequences), or other patient data (demographics, lab values, genetics)
2. Learning to classify rare diseases (transfer learning)
3. Generalizing between clinical sites and scanners (robustness)
4. Interpretability and explainability (some of the techniques from Miniplaces part 1 are relevant here)

There are a number of large public datasets for different diseases/image types (The Cancer Imaging Archive https://www.cancerimagingarchive.net, MIMIC-CXR https://physionet.org/content/mimic-cxr/2.0.0/, DeepLesion https://nihcc.app.box.com/v/DeepLesion, etc.), as well as many challenges that focus on medical image analysis (https://grand-challenge.org/challenges/, Medical Segmentation Decathlon http://medicaldecathlon.com/)

Choose a disease or challenge that interests you and build a network that tries to further the state of the art.

References

[1] Monika Grewal et al. "RADNET: Radiologist Level Accuracy using Deep Learning for HEMORRHAGE detection in CT Scans". In: *CoRR* abs/1710.04934 (2017). arXiv: 1710.04934. URL: http://arxiv.org/abs/1710.04934.

[2] Pranav Rajpurkar et al. "CheXNet: Radiologist-Level Pneumonia Detection on Chest X-Rays with Deep Learning". In: *CoRR* abs/1711.05225 (2017). arXiv: 1711.05225. URL: http://arxiv.org/abs/1711.05225.