IEEE Transactions on Neural Networks and Learning Systems (IEEE TNNLS)

Special Issue on: Explainable and Generalizable Deep Learning for Medical Imaging

Introduction

Deep learning has been pervasive in medical image analysis. However, the pace of adopting deep learning into clinical radiology practice is not as fast as expected. One of the main reasons is that deep learning has not gained sufficient confidence and trust from radiologists and clinical physicians. Typically, trust in a medical decision offered by deep learning is built upon a rationale that: (i) is easily interpretable; (ii) is relatable to the user; (iii) connects the decision with contextual information about the choice or to the user's prior experiences; and (iv) reflects the intermediate thinking of the user in reaching a medical decision. For medical image analysis, the explainability of deep learning models is particularly important to gain medical professionals' trust and adoption. Meanwhile, for deep learning model developers, the explainability is critically important to detect flaws in model behavior and to potentially improve the models, e.g., identifying and interpreting those shortcuts in deep learning. Another equally important issue in deep learning for medical imaging is the generalizability of learned models from data, including both the overfitting problem and the out-of-distribution problem, given that different imaging centers or hospitals could generate medical image datasets with various cofactors and characteristics for the same type of disease or condition. This generalizability challenge has been amplified in recent years due to the fast growing of available medical imaging datasets from different sources. Importantly, the challenges of explainability and generalizability in deep learning for medical imaging are not isolated; instead, they are highly correlated with each other. For instance, advancement in explainable deep learning is very likely to improve the generalizability of deep learning.

In response, this special issue calls for original and innovative methodological contributions to address key challenges on explainability and generalizability of deep learning for medical imaging. Submissions should focus on research and advanced development of the technical aspects of new image analysis methodologies, and all the developed new methods should also be evaluated or validated on real and large-scale medical imaging data.

Scope of the Special Issue

Topics of interests include, but are not limited to:

- Developments and validations of novel theories and methods of explainable and generalizable deep learning for medical imaging
- Adding domain experts into the loop of a more user-friendly model design and training process
- Developing better deep learning based debugging methods and tools
- Integrating domain knowledge and prior information into deep learning models
- Dealing with the vulnerability to adversarial examples
- Curating and integrating large-scale, high-quality expert-annotated meaningful labels of imaging data for explainable deep learning models
- Developing new methods for semi-supervised domain adaptation, unsupervised domain adaption, deep co-training, and etc.
- Developing novel statistical methods to assess and treat the distributional differences among different datasets
- Developing new deep learning methods with better explainability and generalizability

Timeline

- Manuscript submission: 15th April 2022
- Preliminary decision: 15th June 2022
- Revisions due: 1st September 2022
- Final decision: 15th November 2022

Guest Editors

- Tianming Liu, University of Georgia, USA
- Dajiang Zhu, University of Texas at Arlington, USA
- Fei Wang, Cornell University, USA
- Islem Rekik, Istanbul Technical University, Turkey
- Xia Hu, Rice University, USA
- Dinggang Shen, ShanghaiTech University, China

Submission Instructions

- Read the Information for Authors at http://cis.ieee.org/tnnls
- Submit your manuscript at the TNNLS webpage (http://mc.manuscriptcentral.com/tnnls) and follow the submission procedure. Include the following instructions in the header of the first page of your manuscript and cover letter: "Please submit the manuscript to the Special Issue on Explainable and Generalizable Deep Learning for Medical Imaging"