



Tutorial: Explainable Deep Few-shot Learning on the Cloud and its Application in Medical Imaging Informatics

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Abstract

This tutorial aims to mainly provide a professional forum to share state-of-the-art in few-shot learning medical image analysis research, and how we can tackle the problem using high-performance cloud infrastructure, while we are also providing model explainability and interpretability. Moreover, this hands-on-practice tutorial teaches how to implement explainable deep few-shot learning for two clinical use cases, including: (1) object localization, and (2) image segmentation on the cloud.

Description

Deep learning computer vision algorithms have already demonstrated successful applications in a variety of medical image analysis tasks, including image registration, image segmentation, anomaly detection, object localization, and image classification. While scientific progress in deep learning and pattern recognition has led to advanced medical imaging strategies with almost human-like performance, there are still some fundamental issues that restrict deep learning methods to achieve their full potential in clinical practice. Evidently, deep learning medical image analysis often needs a large column of manually annotated training images to perform well, and they are also challenged by their explainability and interpretability. Furthermore, training and validating deep learning algorithms are computationally expensive. The former raises a set of problems, including but not limited to: (1) annotating medical images requires significant medical knowledge which makes the annotation process expensive and very time consuming, and (2) providing a large amount of annotated medical images is basically challenging due to high privacy-preserving standards in the healthcare community. The two latter, however, become vital for their application in clinical use cases.

This tutorial aims to mainly provide a professional forum to share state-of-the-art in few-shot learning medical image analysis research, and how we can tackle the problem using high-performance cloud infrastructure. Moreover, this hands-on-practice tutorial teaches how to implement explainable deep few-shot learning for two clinical use cases, including: (1) object localization, and (2) image segmentation on the cloud. It will also facilitate interactions among students, researchers, developers, and physicians who are interested in deep learning explainability and learning from a few-samples in medical imaging informatics.

Objectives

This will be a half-day workshop (4 hours). We will allocate about 45 minutes for an invited keynote presentation, plus 3 hours to introduce Oracle Cloud Infrastructure, Oracle for Research, Oracle Workstation Service, plus two hands-on-practice using Python programming language on Oracle Cloud Infrastructure (OCI).

- **Keynote**; 45 minutes (in-person)
- **Introduction to Oracle for Research**; 30 Minutes (virtual)
- **Introduction to Oracle Cloud Infrastructure**; 30 Minutes (virtual)
- **Break**; 15 Minutes
- **Hands-on-Practice**, 2 hours (in-person)
 - o Computational Tasks:
 - Object Localization (Image modality: MRI)
 - Image Segmentation (Image modality: X-Ray)
 - o Programming Language:
 - Python
 - o Data:
 - Knee MRI and X-ray images from NIH OAI publicly available dataset.
 - o Cloud Infrastructure:
 - Oracle

Note (1): In this tutorial, we will demonstrate how to train models for image localization and segmentation using conventional deep learning methods, and deploy them on the Oracle Cloud Infrastructure (OCI) platform. It is important to note that OCI does not currently offer a public few-shot training option for these tasks. However, by utilizing the tools and resources available on OCI, we can effectively train and deploy models for these applications.

Note (2): There will be a chance for the audience to sign up for an Oracle Cloud Starter Award ahead of this tutorial. Further information is available [here!](#)

Intended Audience

The target audience includes students, researchers, clinicians, physicians, and professionals in health informatics. Researchers and students working on medical imaging informatics and others interested in sharing experiences in explainable few-shot learning in health informatics are strongly

encouraged to attend. We also welcome students who wish to closely interact with health informatics experts. Potential attendees may come from AI, machine learning, and medical imaging. The anticipated number of attendees is around 20-30.

Duration

This will be a 4-hour half-day tutorial.

Travel Award

This tutorial offers travel awards (in the amount of \$400 maximum per person) for two members/students of a group or community that are underrepresented in developing or utilizing artificial intelligence (AI), machine learning, and deep learning. For the purposes of this support, eligible individuals include US citizens, permanent residents, and non-citizen US nationals who identify as members of racial and/or ethnic groups that have been shown by the National Science Foundation to be underrepresented in sciences nationally and individuals with disabilities. Please visit the Notice of NIH's Interest in Diversity. Please email Prof. Nancy Gauvin (Email: nancy.gauvin@pitt.edu) if you would like to request this support. Due date is July 31, 2023.

Organizers

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Oracle for Research

Date

TBD