UM2ii Onboarding: AI Bootcamp

Introduction

AI is not only for engineers. AI is for everyone, regardless of your formal degree or eventual career goals. However, for someone new to the field of AI, the huge set of tools required to master AI can be quite overwhelming. You need to learn a new programming language, its syntax and the whole set of libraries required to apply AI algorithms to real-life datasets. It is hard to know where to start.

The goal of this bootcamp is to help solve this problem by providing an introduction to the field of **applied Artificial Intelligence** and iteratively introduce the concepts required to master the field of **applied Artificial Intelligence for medical imaging.** Note that "applied" AI focuses more on the application of AI techniques to a specific use case, rather than "theoretical" AI, which deals more with the underlying math and theory – our goal for UM2ii lab members are to be experts in *applying* AI in medical imaging (though having conceptual understanding of the theory is important).

By the end of this bootcamp, you will have demonstrated the basic skills to successfully begin working in AI research in medical imaging. The bootcamp consists of a) required readings and b) interactive Google Colab notebooks with self-grading tests. The skills and knowledge presented here are the minimum of what we expect you to demonstrate. If you are already proficient in these skills, the tests will be easily completed. If you are not proficient in these skills, this is an opportunity to self-study and practice based on online materials – note that this is a crucial skill since code and software for AI changes regularly and AI research necessarily requires continual 'self-study' of new code repositories.

NOTE: You will need to request access to the Google Drive folders and files for this bootcamp – if you have not received access within 1 day of requesting, please email Dr. Yi (pyi@som.umaryland.edu) and Dr. Parekh (vparekh@som.umaryland.edu).

Study Materials

We anticipate that prospective lab members will have a wide range of previous experiences and skills. Even for those with extensive experience in deep learning, some of you might be well-versed with PyTorch and not as familiar with TensorFlow (or vice versa). This is okay and we welcome you to use any deep learning framework that you are most comfortable with.

However, for those who are new to deep learning (or even coding), here are some starting materials to get you started:

1. **Introduction to Python:** This module is optional and for anyone who is new to programming. Going forward, every module assumes that you already know python and are comfortable working with python.
    a. [Kaggle] https://www.kaggle.com/learn/intro-to-programming
    b. [Codecademy] https://www.codecademy.com/
2. **Introduction to Deep Learning**
    a. **FastAI** (Recommended if you have no experience in DL)
        - Deep Learning course using fast.ai (we recommend this for anyone who has not had DL experience before – it's the most user-friendly way to start becoming an *applied* AI researcher): https://course.fast.ai/ **Tensorflow**
    b. **Tensorflow-Keras**
        - https://www.kaggle.com/learn/intro-to-deep-learning
        - https://www.kaggle.com/learn/computer-vision
    c. **PyTorch**
        - Quickstart — PyTorch Tutorials 1.12.0+cu102 documentation
        - Transfer Learning for Computer Vision Tutorial — PyTorch Tutorials 1.12.0+cu102 documentation

Bootcamp

The Bootcamp consists of two sections, each of which you must successfully complete prior to beginning to work on a research project with us:

1. **Required Readings & Video:** Please read/view the following videos/articles – refer back to these as you continue to learn and read (even beyond this Bootcamp), because they will form the foundation for your knowledge.
    a. JAMA Video on how a CNN works (very intuitive, high level):
    b. Chartrand G et al. Deep Learning: A Primer for Radiologists. Radiographics 2017 ('Bible' for DL concepts from technical and clinical perspectives)
    c. Cheng P et al. Deep Learning: An Update for Radiologists. Radiographics 2021 ('Sequel' to Chartrand et al. – newer concepts in DL relevant to radiology).
    d. Mongan J et al. Checklist for Artificial Intelligence in Medical Imaging (CLAIM). Radiol Artif Intell. 2020 (Checklist from RSNA with 'best practices' for how to organize and present AI research in a paper).
    e. Hosny et al. Artificial Intelligence in Radiology. Nature Reviews Cancer 2018. (Review paper w/ overview of Radiology imaging tasks and how AI can apply to them).

2. **Coding Modules:** The coding portion of the bootcamp is organized into four modules as follows:
    1. **Data Science**
    2. **Image Processing**
    3. **Conventional machine learning**
    4. **Deep learning**

Finished?

When you have completed the above, please send a share link to your Google Drive that has the completed Colab notebooks to the UM2ii Directors (Paul Yi and Vishwa Parekh) and Program Coordinator. We will then verify your completion, evaluate your notebooks, and follow-up with any questions we have.

After all that, congratulations! You have completed bootcamp and are ready to start embarking on AI research with the UM2ii lab.