Neural interface project --- getting started

Introduction videos/course to Deep Learning

1. Here is a YouTube video about "backpropagation" from 3Blue1Brown:https://www.youtube.com/playlist?list=PLZHQObOWTQDNU6R1_67000Dx_ZCJB-3pi This video can bring you into the deep learning world and give you a basic understanding of some key terms in deep learning.

2. An online deep learning course: https://cs231n.github.io/. This is an online free course developed by Stanford University. This course focuses more on convolutional neural networks (CNNs). Prof. Hauck's suggestions are:
    a. Take this course somewhere between our real coursework at UW and a YouTube video.
    b. Try to spend some time figuring out the concepts/math expressions, but no need to carefully go through each unknown stuff. Some of them will make sense with a second look.

3. This 1 hour YouTube video can give you an introduction to Recurrent neural networks(RNNs). This is a lecture from MIT 6.S191. I learned the basics of RNN from this video. https://www.youtube.com/watch?v=qjrad0V0uJE&t=2647s

HLS4ML (High-level synthesis for machine learning). HLS4ML is a python package that allows us to convert a deep learning model to HLS version and eventually load it into an FPGA.

1. Here is the home page of HLS4ML https://fastmachinelearning.org/hls4ml/. You can find more detailed information on this page.

2. HLS4ML tutorial: https://github.com/fastmachinelearning/hls4ml-tutorial You can launch the notebook from this git repo and this tutorial will give you a more intuitive understanding of HLS4ML flow.

3. Here is a ~10mins YouTube video that I personally feel is very helpful to understand the HLS4ML flow: https://www.youtube.com/watch?v=FFUyRQukGvM

Neural information

1. Sleep spindles are transient low frequency, roughly around 12-15 Hz, rare EEG signals that primarily occur during sleep. They are also believed to contribute to learn, but lack of mechanistic understanding.

2. The goal of this project aims to interact with primates' sleep spindles by using FPGAs, which will give neuroscientists potential opportunities to further understand how sleep spindle contributes to learn

3. Going a step further, our goal is to load the LFADs model into FPGA. LFADs is an RNN variational autoencoder that takes spike data as input and predicts the firing rates.

4. Original TF1.5 LFADs is developed by https://github.com/tensorflow/models/tree/master/research/lfads

5. For our purpose, TF2+Keras LFADs is developed by tndm/lfads.py at main · HennigLab/tndm (github.com)

Please feel free to reach out to me (xliu1626@uw.edu) if you have any questions or need any help.