Study Materials for REU Student on Multi-modal Machine Learning Applications

Research Objective: The goal of this material is to help a REU student to familiarize themselves with Linux, python programming language, setting up a deep learning environment for multi-modal machine learning applications. Below is a tentative schedule for one such application related to developing a Chatbot for recommending diet and exercise based on recipe, calories, and calendar data.

Timeline	Agenda
Week 1	**Introduction to Linux, Docker, Python** At the end of week 1, the REU student should be able to use a linux computer, set up a deep learning environment and familiarize with basic python programming language.
Week 2	**Introduction to Machine learning, Coding Exercises** At the end of week 2, the REU student can differentiate between classification and regression problems and implement both of them. Besides, the students familiarize and practice data pre-processing steps such as windowing, filtering, noise removal, and so on.
Week 3 - 4	**Introduction to Deep learning, Pytorch** In week 3 & 4, the students will start implementing and practicing various deep learning algorithms to get a better understanding of deep learning optimization, the effect of hyper-parameter tuning, and overfitting.
Week 5	**Identifying Research Topic** Week 5 focuses on identifying a research problem. It involves reading state of the art research papers, discussing the merits and demerits of the research, and finally identifying research gaps.
Week 6	**Literature Survey, Researching Datasets, Data Collection** Upon identifying research gaps, the student now formulates their research problem while performing literature review. Besides, to better understand the feasibility for implementing the proposed solution, the student identifies various data sources, visualizes various data sources to better understand the datasets.
Week 7 - 8	**Chatbot Implementation - Basic functionality with toy examples, Data Collection** Week 7 & 8 concentrates on the actual implementation of the proposed solution, first with a toy dataset (to check if the implementation works)

	followed by implementation with real datasets.
Week 9	**Chatbot Implementation - advanced functionality with NLP, Deep learning** In week 9, the student is expected to implement advanced features to the proposed solution for the research problem. The idea is to provide a solution to each of the research tasks to address the overall objective.
Week 10	**Refining Chatbot** Week 10 would provide the REU student to perfect the final work, and prepare the final report and presentation.

Related Links:

1. Papers
    a. [Step Up Life: A Context Aware Health Assistant](#)
    b. [Darwin: Convolutional Neural Network based Intelligent Health Assistant](#)
    c. [A Process Evaluation Examining the Performance, Adherence, and Acceptability of a Physical Activity and Diet Artificial Intelligence Virtual Health Assistant](#)
    d. [Recipe1M+: A Dataset for Learning Cross-Modal Embeddings for Cooking Recipes and Food Images](#)
    e. [A Process Evaluation Examining the Performance, Adherence, and Acceptability of a Physical Activity and Diet Artificial Intelligence Virtual Health Assistant](#)
    f. [SmartDiet - Personal Wellbeing Assistant and Diet Planner Mobile Service](#)
    g. [SLOWBot (chatbot) Lifestyle Assistant](#)
    h. [MOPET: A context-aware and user-adaptive wearable system for fitness training](#)
    i. [A Mobile Health and Fitness Companion Demonstrator (Practice)](#)
2. Data Set Collection
    a. [Calories Dataset](#)
    b. [Recipes DataSet](#)
3. Coding Information
    a. [Final version of chatbot](#)
    b. [ML Tutorial](#)
    c. [Depression/Mental Health](#)
    d. Opening JSON File: [link](#) | [link](#)
    e. Github Links for Recommendation Systems: [link](#) | [link](#) | [link](#) | [link](#)
4. Additional Information
    a. [How to read food data labels](#)
    b. [Using an app to lose weight](#)
    c. [how to write a PhD pitch](#)
    d. List of calories/exercise: [link](#) | [link](#)
    e. [Convert calendars to different time zones](#)
    f. How different factors affect weight loss/gain: [link](#) | [link](#) | [link](#)