Final Project: Meal Nutrition Analysis **CSCE 633**
Due: 11.59pm on December 5, 2024

Instructions for final project submission

a) You will need to provide your code for your solution - and you will use Kaggle for your submissions
b) You will need to provide an IEEE-style written report
c) You will need to prepare a 10 minute recorded presentation of your project
d) Create a **single zip** and submit it on **CANVAS**. Please note – you may need to be careful with how the presentation is recorded and submitted – please check early with us on alternatives, if you need one - such as a google drive link.
e) You may have teams of up to 3 students for this project.

We will use a nutrition dataset collected in a research study. This dataset contains breakfast and lunch information, data on motion, and photographs of meals, across over 40 participants and up to 10 days (note not all participants had 10 full days of data). Our goal is to build a multimodal model to estimate the calories of the lunches consumed from the sensing data, photographs, micro gut health, demographics, and the data from the breakfasts.

Inside the "Final Project" data you will find 3 files named '[modality]_train.csv' and 1 file named 'label_train.csv' , each file contains data or labels collected for the participants. Use them to develop your estimation model. Then, you will use the model to predict lunch calories using the 3 files named '[modality]_test.csv'.

15% of your grade: Presentation – an 8-10 minute presentation in which you provide an introduction and background, a clear description of your methods, how you tested your project and how you evaluated the final results, and concluded that your project is successful. **DO NOT GO OVER TIME.**

15% of your grade: Written Report – at least 4 pages in the IEEE format linked on Canvas. The paper must include an introduction (including citations on the problem space), your methods (including citations you used to come up with your approach), your experiments and results, a section on implementation, which details which team member completed which portion of work, and conclusion.

70% of your grade: Code – broken down by the following % (adding up to 100) - to receive full marks on code you must beat the benchmark performance on Kaggle.

(a) (20%) Data preprocessing: Preprocess each modality appropriately. For example: the length of some modalities is variable but most models required fixed-length input; some modalities are categorical whereas others are continuous numerical.

(b) (10%) Data preparation: Creating a multimodal dataset by merging all data modalities and labels and saving to a DataLoader (https://pytorch.org/tutorials/beginner/basics/data_tutorial.html).

(c) (30%) Multimodal model implementation: Implement a multimodal model which encodes at least two data modalities into a joint embedding and predicts label of interest from the joint embedding. Your are required to use Pytorch for model implementation.

(d) (15%) Model training: Declare root mean square relative error (RMSRE) as loss function and appropriate optimizer. Train the model and print the training curve, where the x-axis is the training epochs, and the y-axis is the training performance (RMSRE).

$$RMSRE = \sqrt{\frac{1}{N}\sum_{i=1}^{N}(\frac{\hat{y}_i - y_i}{y_i})^2}$$

(e) (25%) Result analysis: Finetune the hyperparameters and use the best trained model predict on the test set ('[modality]_test.csv'). Organize your predictions according to Kaggle's submission instruction. You MUST beat the benchmark on Kaggle to receive full mark on this portion.