

Capstone Development (DS-5999)

## Project Proposal

Please answer the following questions to help guide you in scoping out your Capstone project. Each answer should be about a paragraph for questions 3-7.

1. Who are you working with on this problem? This could be a company, a faculty member, research group, etc. If it is just you, that’s fine, just say “NA” here.

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1. Will you need to meet with me during the semester? If you said “NA” above, the answer to this question is “Yes.” Not meeting with me requires that some other faculty member or practitioner is volunteering to provide mentoring and/or oversight. If you say “No” here, please let me know who this person is who will perform this task. It is perfectly fine for you to meet with both me and someone else if you prefer that, and you can change your mind later.   
   I can provide the following:
   1. Accountability on timelines, planning and meeting deadlines.
   2. Help in how to solve difficult logical coding/analysis challenges.
   3. Assist in formulating and calibrating metrics that effectively communicate results.
   4. Scoping out your problem and ensuring it is not too big or too small.
   5. Anything having to do with analytics, statistics, and classification/regression ML tasks.
   6. I will be of less help in the following areas: Image recognition, NLP as well as specifics in deep learning.

**Yes, I will meet with Prof. Yuankai biweekly about image recognition and classification with deep learning on Wednesday at 10am and also biweekly meet with you to talk about my timing and planning, deadlines and so on.**

1. Describe the problem you are solving. Be sure to include why this problem is unique or novel. If you are working in a research group or team, be sure to detail your precise contribution in relation to what the whole group is doing.

**I want to design a new deep learning architecture to predict or annotate unlabeled medical images, because there are millions of unlabeled medical images generated in hospitals waiting for annotations before they can be downstream analyzed, but manually labeling them is too time consuming. Also, sometimes, the labels or classes that we want to predict are not in the pretrained models or some of them are not. At this time, we come across zero-shot, one-shot or few-shot transfer learning. There are some pretrained medical image deep learning models. I want to embed them into current N-shot transfer learning architecture then apply them into MedMNIST image dataset because current N-shot learning is trained on ImgaeNet which is far off medical fields.**

1. Describe the data you need for your project. Be as detailed as you can be here – even including key column names you require is encouraged.   
   ***NOTE: You should be sure that you have the necessary access to this data before the beginning of the semester. Access to data is a key point of delay in these projects!***

**The data I will use is called MedMNIST v2:** [**https://medmnist.com/**](https://medmnist.com/) **. It’s a collection of 12 MNIST-Like biomedical dataset. It included 12 2D datasets and 6 3D datasets.**

**All these datasets are pre-processed and standardized into small size of 28 \* 28 (2D) and 28\*28\*28 (3D). Each dataset is split into balanced training, validation, and test set.**

**Table

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**A picture containing text, bedclothes

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**The above plot is the image data I downloaded and printed in my jupyter lab.**

1. Describe your approach or primary task. What are you going to do with the data above to answer the question above?

**My first primary task is to investigate the framework of clip models (Contrastive Language-Image Pre-Training), then find suitable colon or other generalized medical image pretrained .pt files, finally employ this found one into clip models. We then test our new embedded zero-shot classification models on this dataset and test our prediction with ground true labels.**

1. Describe what you have done so far, along with an estimate of how much time you have invested in this project already.

**I have reviewed three essential papers, the first one is how a group of people use multi-stage pipeline to segment and classify colon images:** [**https://arxiv.org/pdf/2108.11195.pdf**](https://arxiv.org/pdf/2108.11195.pdf) **;**

**The second one is** [**https://arxiv.org/pdf/2103.00020.pdf**](https://arxiv.org/pdf/2103.00020.pdf) **: clip model results**

**The third one is** [**https://arxiv.org/pdf/2110.14795.pdf**](https://arxiv.org/pdf/2110.14795.pdf) **which describe database MedMNIST and their deep learning models like AutoML, auto-sklearn, and Auto Keras, their performance on these benchmark datasets.**

**I have also installed the package medmnist on my computer, downloaded the one 2D dataset and one 3D dataset and ran a simple Convolutional Neural Network on them and evaluated the results, got 98.1% on train set, 93.6% on test set.**

**I also fully decomposed, tested, implemented zero-shot clip model on one decent test dataset: food101.**

1. Describe what you think will be the biggest challenges you will face in executing this project. Identify 1-3 challenges.

**The first biggest challenge I will face is that I must fully review and understand the implantation codes of zero-shot clip models.**

**The second challenge is how I embed a totally new pretrained medical model into the existing clip model. There should be a lot of bugs and incompatibility with this new pretrained models.**

**The third challenge is I don’t have any medical domain knowledge, so sometimes it’s hard for me to understand each detail of medical images and don’t have too many interests in it.**

You should simply download this file, save a copy for yourself, and insert your answers above. You may use images or plots if they are helpful to answer the questions.