Final Project Proposal - Spring 2023

Please read the instructions and all the questions before starting the proposal. It will give you a better idea on how to structure your responses.

In this survey you will provide details on the final project for this course. Please answer all the information below. Let us know if you have any questions. We will be happy to answer small questions about the project that help you narrow down your scope. We will not answer in-depth technical questions until your proposal is submitted and approved.

You will be allowed to have small changes in the scope of your project (e.g., changing the dataset but working on the same project, or changing your proposed architecture). This needs to be approved by the instructor and will not require a resubmit of your proposal. These changes will be allowed until the end of March. However, a larger change of scope (e.g., changing your topic) will require a resubmit of your proposal and will only be allowed until before Spring Break.

Some questions require you to enter some reference (e.g., pointing to a website with the link to the data repository is sufficient). You can enter a numeric reference to the citation (e.g., "The data can be found here [1]."). There will a question at the end of the survey for you to enter your references (e.g., "[1] PPG Heart Beat for Cognitive Fatigue Prediction Dataset, https://www.kaggle.com/datasets/canaria/5-gamers").

sponnur@ncsu.edu Switch account

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The name and photo associated with your Google account will be recorded when you upload files and submit this form. Your email is not part of your response.

* Required

Select your team. Make sure it matches the ID in the Project Teams spreadsheet. *

Team 48

Provide a title. *

3D Brain Tumor Segmentation

Provide a brief overview for your project. Include a brief motivation and an overview of what your inference tasks are. You will have a chance to describe your data and methodology later. *Cite your references.* *

We propose a deep learning based approach to identify and localize the brain tumors using MRI Scans. Segmentation of brain tumors in MRI scans is a challenging task due to the complex anatomical structure of the brain and the variability in tumor size, shape, and location. Automated segmentation methods can assist radiologists in detecting and quantifying tumors, providing a valuable tool for diagnosis and treatment planning. http://braintumorsegmentation.org/ (BraTS - 2021)

What type of machine learning task is this? *

- (●) Supervised learning
- ( ) Unsupervised learning
- ( ) Semi-supervised learning
- ( ) Reinforcement learning
- ( ) Other

Does this project overlap with a graded project or funded research for any of your teammates? You don't need to list any overlap with volunteered (unpaid or ungraded) activities. *

- ○ Yes
- ◉ No

If so, please identify which teammate has this overlap, the course or activity that it overlaps with, and explain how the project for this course goes beyond (or differentiates) from the other activities.

Your answer

Describe the source of your data. What are the inputs? What is the format of the inputs (e.g., images or raw text, sequences, etc.)? What are the desired outputs? *Cite your references.* *

Source - http://braintumorsegmentation.org/ (BraTS - 2021) , Input - Images (3D Cubes) , Output - Segmentation Masks (3D Cubes)

Are you able to get full access to this data? *

- ◉ Yes
- ○ No
- ○ Maybe

Are you or a collaborator putting together this dataset this semester? *

- ○ Yes
- ◉ No

How big is this dataset in bytes? *

- ○ 0-100MB
- ○ 100MB-1GB
- ○ 1GB-10GB
- ◉ >10GB

How many samples for training? *

- ○ 0-100
- ○ 100-1k
- ◉ 1k-10k
- ○ 10k-100k
- ○ 100k-1M
- ○ >1M

How many samples for testing? *

- ○ 0-100
- ◉ 100-1k
- ○ 1k-10k
- ○ 10k-100k
- ○ 100k-1M
- ○ >1M

What architectural components do you anticipate having in your model? *

- ☐ MLP (i.e., standard layers of neurons fully connected between layers)
- ☑ CNN
- ☐ RNN
- ☐ GAN
- ☐ AE
- ☐ BNN
- ☐ GNN
- ☑ Transformer
- ☐ Other:

If you are using other architectural components, please briefly describe them here.

Your answer

Are you planning to use transfer learning? *

- ○ Yes
- ◉ No

How many trainable parameters (i.e., don't count those parameters that are part of frozen layers) do you expect to have? *

- ○ 1-1k
- ○ 1k-10k
- ○ 10k-100k
- ○ 100k-1M
- ◉ >1M

You need to have some type of baseline for your project. Describing where your baseline is coming from. For example, it could be some results from existing paper or some pre-existing models available online? You could also use a standard model as a baseline with some simple transfer learning (e.g., using a standard ResNet50 without additional regularization). *Cite your references.* *

V-Net (https://arxiv.org/abs/1606.04797)

Explain the main differences between your proposed model and the baseline. How are your differentiating your project form this existing baseline? If you choose a standard model as a baseline then you should make sure that you explain how this beyond what you would do with standard transfer learning. *

We want to explore the use of self attention and representation learning in contrast to convolution based representation learning. We would try to use transformers to represent the high dimensional images from which we decode segmentation mask.

Describe your model selection and evaluation schemes. What metrics are you using? No need to provide formulas for the metrics. How are you splitting the training, validation and testing datasets? *

Model - Exploring standard transformer encoders
Evaluation - Dice Score / Jaccard Similarity
Dataset - Planning to split the training set in the ratio of 70 / 15 / 15 for the post split training , testing and validation sets keeping the class balance in mind

What type of computing resources are you planning to use? *

- [x] Free online (e.g., Google Colab, AWS or IBM Cloud)
- [x] Personal laptop or desktop
- [ ] Research lab computer
- [x] NC State VCL or HPC
- [ ] Paid cloud computing
- [ ] Other

Do you anticipate having any issues with accessing computing resources? *

- ○ Yes
- ◉ No

If so, what issues do you anticipate with computing resources?

Your answer

Please indicate any concerns (if any) that you may have about this project?

Your answer

You are welcome to upload a figure if that helps with the description of your data or your project in any way. This is not required. Make sure that there is a caption in the image explaining what is being displayed.

Add file

Add your references here. You should have at least three citations from the previous questions (motivation, dataset and baseline). *

As an example, your entry here should look like this:

[1] A. Krizhevsky et al, "ImageNet Classification with Deep Convolutional Neural Networks," NIPS 2012.
[2] PPG Heart Beat for Cognitive Fatigue Prediction Dataset, https://www.kaggle.com/datasets/canaria/5-gamers

[1] https://arxiv.org/abs/2107.02314, "The RSNA-ASNR-MICCAI BraTS 2021 Benchmark on Brain Tumor Segmentation and Radiogenomic Classification"
[2] https://arxiv.org/abs/1606.04797. "V-Net: Fully Convolutional Neural Networks for Volumetric Medical Image Segmentation"
[3] https://arxiv.org/abs/2010.11929, "An Image is Worth 16x16 Words: Transformers for Image Recognition at Scale"

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