Project B: Frequently Asked Questions
ECE1512 Digital Image Processing and Applications
Department of Electrical and Computer Engineering
University of Toronto
Winter 2021

Deadline: Monday, April 5, 5:00 PM EST.
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<center>**New Questions are highlighted in Blue**</center>

General Questions

Q. What is this FAQ about?
A. We are all going through a difficult time and, in our own way, trying our level best to keep up with things. To that end, this (ever-increasing) FAQ serves as a guide for helping you with Project B and answer any urgent questions which may arise. In the special case when you have a lot of deadlines or submissions coming up, this FAQ will try to throw light on (almost) all of your questions and concerns which you may have during the course of Project B. In case you have a question which is not listed in the FAQ then feel free to post it on the discussion board. We will try our best to address your queries and update this document so that it helps your classmates.

Q. Where/Whome should I ask my question?
A. In case you have a question, please check this FAQs page first. If you find your question not listed in this document then post it on the discussion board. Additionally, you can reach out to the TA directly at karush.suri@mail.utoronto.ca with **"Project-B"** as your subject line. The TA will respond to your queries as soon as possible. Please do not try to contact other members of the course staff directly.

Q. Do I need to submit the supplementary material?
A. It is highly encouraged that you submit additional material such as your code base, presentation slides, 1-page summary or a small video presentation. This will help the course staff get a much clear idea of the objective and contributions of your project. Supplementary material such as code base will highlight your ideas implemented as programs which are enough validation for the suitability of your method. Furthermore, supplementary material such as video presentation and 1-page summary will help you convey your ideas in a more articulate manner.

Q. What should I submit as part of the supplementary material?
A. A good `supplementary.zip` file must consist of code base packaged and initialized with a `README` document. Additionally, you could provide presentation slides, 1-page summary, video presentation, informal blog writeup, additional results or even ideas which you tried but did not work.

Q. What will be a good way to approach the Project?
A. The project consists of two types of questions- (1) which test your basic understanding about the subject and (2) which test your ability to improve image processing pipelines. A good way to approach the project would be to move sequentially (from (1) to (2)) since the questions build on themselves. In the unusual case when you find yourself thinking too much on a question, try to be brief and answer from a qualitative perspective. The emphasis of project is on you implementing your ideas coherently in Python and improving the algorithm by gaining intuition about its limitations.

Q. How will you grade our projects?
A. A grading breakdown for each task and its components is provided in the Project description. These grades correspond to the complete project.

Q. Can you talk about the presentations?
A. Presentations will primarily be based on your work on the project. Since the major component of project is on improvement of model's limitations and interpreting the results, your presentation should throw light on your contributions in the project. You must talk about what you infer from the results and how/why your method is a suitable scheme in light of understanding limitations of previous method. Try to convey most of the information from your slides so that it is easy for the audience to follow your thought process.

Q. What to do if I am struggling to infer results and implement any new ideas?
A. To infer the results correctly, try to understand what objective the task is trying to accomplish. This can be done by studying the starter code, looking at test images and trying to interpret the model's activations. Essentially it is a "hide-and-seek" problem wherein the answer is often in front of us but we tend to overlook and emphasize too much on the details. To implement new ideas, a good place to start would be by studying the baseline model. The model provided in the starter code is itself a good image recognition pipeline and motivated by prior works in literature. You could read up on these models and try to come up with some ideas. However, the emphasis is improving the model and not necessarily creating something new.

Q. The project description says that there are no GPU requirements. However, both tasks include training a deep learning model. Why is that the case?
A. The motivation behind training deep learning models is to equip you with the tools and techniques required in the contruction and improvement of image recognition frameworks. Training is an essential part of the model and cannot be overlooked simply because of its computational requirements. In the interest of time, you are only required to train models for a very low number of epochs as these architectures have already been modified for you. On a local CPU machine, your training times should be 16 minutes and 10 minutes for Task-1 and Task-2 respectively. These durations are nominal and do not enforce the usage of a GPU.

Q. I am in a different timezone and find it very difficult to collaborate on the project. What suggestions would you have for me?
A. Collaboration on projects is purely based out of choice. You can proceed with projects on your own. However, due to the graduate course load we strongly suggest students to form a group. In case you are having trouble collaborating with your teammate then this is something you should discuss with them at the earliest.

Q. Why is this project in PyTorch?
A. The idea behind this course is to provide you with a learning experience which would help you further in your industrial/academic role. Among many deep learning libraries, PyTorch has recently gained utility alongside Tensorflow. Primary reason for this growth is the elegant gradient computations in PyTorch provided by their autograd component. Project B provides you with a suitable opportunity to learn (or recapitulate) the PyTorch framework with the hope that it will be useful for your future roles.

Q. I am having difficulty accessing the Colab GPU. Would you have any suggestions?
A. Please cross-check the following-
1. Your folder is uploaded to your Google Drive.
2. The Colab notebook can access the folder using `drive.mount` command. If not then please refer to Colab documentation for this step.
3. The security code you copied and entered for validating your Google account is correct.
4. The GPU accelerator is turned on in the Runtime Environment.
5. All tensors and models are on the GPU memory.

Q. I would like to leave some suggestions/feedback for the course. Where/How can I do this?
A. The course staff would be more than happy to get your feedback on the course and improve it for future offerings. Towards the end of the term, the ACORN system will provide you with a course evaluation survey wherein you can leave comments and suggestions about the course. We would like to hear your views on improving the project framework.

Task-1

Q. Am I only supposed to implement the layers of the Xception architecture?
A. As the question states, you first need to implement the layers in the `init` function of the class with the exact hyperparameters mentioned in the Figure. Now you may call these layers in the `forward` function which is executed during the forward pass of the model. Note that any change in the layers or hyperameter values may not yield the same result, so please be careful while tuning the values.

Q. My validation accuracy and loss are not as good as the training ones. Is this normal behavior?
A. Your validation metrics are only a part of the model's performance. It is difficult to comment on the stability of the model just by comparing the metrics and their variation. As a hint, if your metrics are growing smoothly and close to the training metrics then your project is headed in the right direction.

Q. What kind of an explanation are you expecting for model predictions and class activations?
A. You should sufficiently explain the performance of the model (whether it is good or bad). In case the model is performing well, then comment on what are some of the reasons for its suitability. In case the model does not demonstrate optimal behavior, then highlight the limitations of the model in light of data and how can it be further improved.

Q. What kind of contributions are you looking for in a good project?
A. An ideal project should sufficiently address the limitations of the model by making use of tips and techniques requiring minimal training. Primary reason for this preference is that the utility of an architecture in a recognition pipeling increases if it is more efficient in terms of wallclock time and data samples. Among other contributions, the work could also throw light on good and bad test cases, their role in model's training and how can the model be made more robust to data outliers (for instance emotion classes which are not a part of the dataset).

Q. What do you mean by a small experiment?
A. The idea behind conducting a small experiment is for you to demonstrate and improve an understanding about the model's limitations. A small experiment should not consist of additional data or training time allotted to you for this task. Your implementation should ideally be a small function written in PyTorch. Results of the experiment should be presented in a concise manner with explanations linking the intuition of results to model's performance. Additionally, the description of the experiment could highlight its setup, details and limitations.

Q. The assignment description says that "Note that the emphasis is not on the improvement of metrics but on implementing your ideas in order to address the limitations of the model". Does that mean I will not loose points if my model's metrics are degraded?
A. The statement means that the primary emphasis is on implementing your ideas. If your small experiment is pragmatic and degrades the performance of your model only by a slight margin then it is fine. However, if your experiment significantly hinders the capability of the model then you may need to refine your approach. Ideally, your model should suitably retain the baseline performance which it demonstrates as per the previous parts of this task.

Q. Does the "channels" in diagram correspond to output channels?
A. Yes, these correspond to output channels of the Convolutional module.

Q. What would be a good way to debug my code?
A. Following is a list of good practices to debug your implementation of the architecture-
1. Make sure that the dimensions of your tensors are correct and do not cause any error. A good way to do this would be by monitoring their shape after every operation.
2. Print the output at intermediate levels to keep check of whether you are headed in the right direction or not.
3. Try training th model for 2-5 epochs first to see if your metrics are moving in the right direction.
4. Generally there can be 2 kinds of errors occuring PyTorch- (a) ones which come from your model and (b) ones which might be due to a bug in the starter code. If your code points you to a line which is not written by you but related to your model, then it is potentially an error due to dimensions of tensors being used by your model.

5. If you are certain (and by certain we mean **completely sure**) that the error is not on your part, then please reach out to the TA by answering the following 3 questions- (a) What version of Torch are you using? (b) Have you tried the code on your local machine? and (c) If your dimensions match, then what do you think is causing the error?

6. If you are using Colab for the project then please be aware that Colab uses a notebook environment. The project was primarily developed for a local machine usage so that you can complete it within the required time and in the absence of a GPU. Colab makes use of different environment variables which contain tensorflow-like broadcasting among tensors. The best setup for this project is a local machine with the requirements installed using the `requirements.txt` file. Using a virtual environment would additionally make things better for you.

Q. I am getting the following error in check.py- IndexError: Dimension out of range (expected to be in range of [-1, 0], but got 1)?
A. Use the following before self.probs = F.softmax(self.logits, dim=1)-
```
self.logits = self.logits.unsqueeze(0)
```

Task-2

Q. Am I supposed to use the variables created or can I create my own variables?
A. The variables provided to you are a guiding mechanism so that you can conveniently implement your layers in the block. Another reason why these variables are important is because the model is pretrained and will load weights provided in `model` directory. To make sure that the model correctly loads the weights, please only use the variables provided to you.

Q. How do I know whether my implementation is correct or not?
A. The model weights can only be loaded if you have implemented all the layers correctly. In case you are missing any hyperparameter values or layers then the model will not load and will definitely provide you with an error message. To avoid running into such issues, please carefully look at the diagrams and study the starter code provided to you.

Q. I am not sure how to implement the deconv layers. Any hints would be appreciated?
A. The `_make_deconv_layer` function takes inputs in the form of lists. Each element of the list denotes parameter values corresponding to each layers. If you pass the list and its values properly then you will complete it.

Q. I am stuck on the implementation part and just cannot get it to work. What should I do?
A. You are not stuck if you have spent more than a week on this task with no further progress.

Q. What kind of an explanation do you expect regarding emotion recognition in the presence of FAUs?
A. You should throw light on how and why FAUs help in better recognition of emotions based on the examples observed during implementation. A good comparison should highlight the limitations of approach adopted in Task-1 and emphasize the role of FAUs in Task-2. Examples and intuitive explanations would be the recipe for a good answer.

Q. Are we only supposed to read one paper? Even if we are a group of two?
A. Yes, you are supposed to read only one paper. If you are a group of two then you may read the same paper. Your final answers would be constructed from the interpretations of each of the two members which will demonstrate your combined understanding. If you believe that one of the members contributed more towards a particular answer then please mention it in the contributions section of your report. If this is not the case then it is implicitly assumed that both members contributed equally to these answers. Our expectations will be higher in the case of equal contributions.

Q. My experiment does not demonstrate improved performance but addresses the limitations of the model. What should I do?
A. This is okay. As long as your implementation is pragmatic and aims to address the limitations of the model then you can proceed with the experiment. The ultimate goal is to not achieve state-of-the-art performance but only to

gain intuition of how it may be achieved.

Q. I am getting the following error in network.py- NameError: name 'BasicBlock' is not defined?
A. The solution is quite simple, you could comment/remove the lines which are making use of the `BasicBlock` term. Initially we were planning to give a shallow model which would make use of the `BasicBlock` but we ended up giving the ResNet-50 which makes use of the `BottleNeck` block. It turns out that we forgot to remove these lines from the file.

Q. That was a very long FAQ. Am I done now?
A. Yes this is the last question of this FAQ. All the best for your project!

In case you have any questions which are not listed in this FAQ then please post them on the discussion board or contact the T.A. via email with "Project-B" as the subject line.

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