CS635: Assignment #3 – Fun with Learning

**Out:** February 22, 2023
**Due:** March 10, 2023, 12:29pm

**Objective**

The objective of this assignment is for you to get your feed wet with some deep learning tools. Google Colab ([http://colab.research.google.com](http://colab.research.google.com)) offers simple ready-to-go deep learning environments (python based). PyTorch and TensorFlow are other popular frameworks but a bit more involved for a 2 week assignment. In this assignment, you will use a pretrained depth-from-image network to improve your photometric stereo assignment output.

In particular, take a look at:

(*)

[https://colab.research.google.com/github/pytorch/pytorch.github.io/blob/master/assets/hub/intelisl_midas_v2.ipynb#scrollTo=afraid-intervention](https://colab.research.google.com/github/pytorch/pytorch.github.io/blob/master/assets/hub/intelisl_midas_v2.ipynb#scrollTo=afraid-intervention)

which is a Colab setup/implementation, pretrained, of the paper:


[https://github.com/isl-org/MiDaS](https://github.com/isl-org/MiDaS)
[https://pytorch.org/hub/intelisl_midas_v2/](https://pytorch.org/hub/intelisl_midas_v2/)

**Detailed Description**

**Step 0 – Setup MIDAS on Colab (10%)**

Follow the instructions (*) and perform test runs on Colab during MIDAS. Test images are provided.

**Step 1 -- Photometric Stereo Depth Inference (10%)**

Use the previous assignment to obtain at least one set of photometric stereo images and surface depth inferences (having 2-3 scenes each with a set of photometric stereo images would be better, but you need at least one). Then obtain the corresponding depth values using MIDAS. You can also obtain sample results using

[https://huggingface.co/spaces/pytorch/MiDaS](https://huggingface.co/spaces/pytorch/MiDaS)

To quickly determine if your images/scene is compatible with MIDAS. For example, I placed an image of “Buddha” in MIDAS and reasonable depth values where returned.
Step 2 -- Combining Both Inferences (60%)

You will observe that most likely MIDAS will give you global relative depth void of the intricate details photometric stereo can provide. However, MIDAS might be globally more correct and/or at least hopefully with less global deformations. The task is to somehow “combine” the two inferences.

Please think of a way to combine both inferences and be ready to discuss the pro/con of your combination method. For example, a naïve method is to perform a linear interpolation between the two. This does not however actually “combine” the two but rather just allows you to smoothly switch from one set of depth values to another.

Recall “photogeometric stereo” combined geometric stereo with photometric stereo. In this case, you have both at image-resolution. But, the MIDAS depth values are not very detailed. There is not a unique way to combine the two, so each of you might have a different methodology.

Step 3 -- Demonstration (20%)

In this step, you should be able to easily switch between the “MIDAS depth values”, “your photometric stereo depth values”, and “your improved/combined depth values”, and discuss the pros/cons.

Please note that you could just use https://huggingface.co/spaces/pytorch/MiDaS to get your MIDAS depth values but using Colab gives you a programming environment (python) where you can probably implement your combination method. Further, the setup to use in collab is quite trivial.

During your demo session, I will use the provided zip-file to grade your program. Your grade will be influenced by how well your particular solution works, by the presentation and usability of your program, and by how well you complete the assignment requirements.

In this assignment, you may collaborate only to help with the mechanics of the assignment. Everybody must use their own images however! Practically speaking, this means that nobody should have the same pictures or results.

If you have questions, please come see me ASAP – do not wait until the last moment. Have fun and good luck!