Final Project Progress Report

Definitions

Team name: ***Super Zoom***

Team members: ***Michael Litt, Peter Huson, Gabe Weedon, Mary Dong***

TA name: ***Haoze Zhang***

Project

- **What is your project idea?**

  We've decided to perform analysis and adversarial testing on the proSR model. Specifically, we want to answer the following questions by testing the model on the datasets we've collected.

  - What types of images does proSR perform well/poorly on?
  - What does it seem to pick up on? (DeepDream?)
  - How well does it generalize to other datasets?
  - What happens if we use other types of images (greyscale, alpha-channel)?
  - What happens if we put in an already full resolution image?
  - Portrait mode? (A part of the image is blurred, a part is sharp)

  Going forward, we also want to try "progressive" down- and upsampling, whereby we pass an image through the model, the pass the output through the model again, . . . , repeating that many, many times to see what we eventually end up with. This can show us whether the model is hallucinating the right or wrong things, and can give us a clearer sense of what the layers are picking up on.

- **What data have you collected?** Based on the list of questions we want to answer, we've narrowed down the data that we're planning to use to test proSR:

  - Interesting patterns (camera calibration pattern, checkerboard, stripes, etc.)
  - Blank image (solid color)
  - Alternating pixel images; salt and pepper images
  - Greyscale images
  - Cartoons
  - Custom images taken with a portrait-mode camera (some parts are blurred/LR; faces are sharp/HR)
  - Medical images

- **What software have you built or used?**

  We have set up the infrastructure for running, testing, and potentially tweaking the model. We've made a shared Github repo with our own test images and we also have a shared instance on GCP for testing the model. The testing pipeline is working on the 100 demo images in the proSR repo, and we were able to get the model to work with our own images.

  Going forward, we can focus on curating more interesting datasets, exploring other functionalities of the model (potentially turn-off auto downsampling), and perhaps retrain the model on another set of images.

- **What has each team member contributed thus far?**
  - **Mary:** Read the proSR paper, compiled a list of research questions we want to answer, helped brainstorm interesting test images, worked on this report.
  - **Michael:** Read the proSR paper and worked with team to plan approach going forward. Helped set up the VM instance. Added many test images to try to stump the net.
  - **Peter:** Configured the GCP instance, installed the proSR repository and performed testing of the network on the DIV2K dataset. Also ran testing of the network on our own images to evaluate adversarial cases.
  - **Gabe:** Read the ProSR paper and brainstormed ways of stress-testing the network, such as repeatedly running the output of the network back through to see if the result migrates. Worked on the report.
- **What intermediate results have you generated?** We've gotten some really interesting results on our own testing images. Here are two examples:

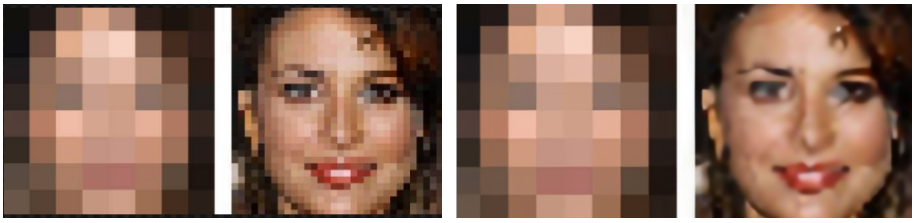

Figure 1: Left pair: input; right pair: output. Note that the model doesn't do anything to the very pixelated image, but smooths the image with more details.

Figure 2: Left image: input; right image: output. The model first downsampled then upsampled. If you zoom in, you can see that the more detailed parts of the image are blurred, but edges are preserved.

- **What problems have you faced or still have to consider?**

  One thing that is making if difficult to test adversarial cases on the network is image detail. While some images have very detailed features, others have very sparse details. This can likely be fixed by cautiously selecting only the specific parts of the image we want to observe the effect of up-sampling on.

  We also still need to incorporate the progressive learning approach of upsampling an image by 2x at multiple intervals, in order to slowly hallucinate incremental image detail rather than generating it all at once.

- **Is there anything that we can do to help? E.G., resources, equipment.**

  We're doing good for now!