MAIS 202 FINAL PROJECT: DELIVERABLE 2

Preliminary Results: Artistic Animal Generator

1. **Problem Statement:** I am trying to generate synthetic images of animals (but at this moment only on dogs) and trying to do a style transfer on the generated image. For this deliverable, I am focusing on trying to make the generation of images work first.
2. **Data Preprocessing:** I am using the Stanford Dog Dataset. I used the images of the Pekinese breed specifically, with a total of 150 images. I formatted them into uniform 92x92x3 arrays, to make it 92x92 resolution with 3 color channels. Then I used TensorFlow Dataset to shuffle the data and divide it into training batch sizes. It is near the limit of what Google Colab can handle in terms of resolution. I am aware that my sample size is very small, and I will try to fix it for the next deliverable
3. **Machine Learning Model:**
    a. **Framework and tools used:** I have decided to stick with GAN, since it is the only model that can accomplish the task at hand. I have decided to use a Keras Sequential model, since it let me quickly define a linear stack of layers. I tried to follow the book Generative Deep Learning to build a Functional API model, but I was a bit overwhelmed for this deliverable.
    As for my hyper-parameters, and other settings for the model, I didn't really use any well-informed decision-making to choose them. It takes around 4 hours to train my GAN, and I just tried different settings to see what would change for the better or worse.
    b. **Description of validation methods:** It is quite hard to find an objective method to judge the results of a GAN. There is a few that exist, however I did not get to implement them for this deliverable. So, I will use manual human judging.
    c. **Challenges faced:** Implementing a GAN was way harder than I thought it would be, and the learning curve has been quite steep. There is still a lot I am unaware of, and which have been left unexplained in the book, including the underlying maths and some unexplained hyperparameters the book uses. Preprocessing data and training the GAN also takes a lot of time and makes learning much harder.

4. **Preliminary results:**

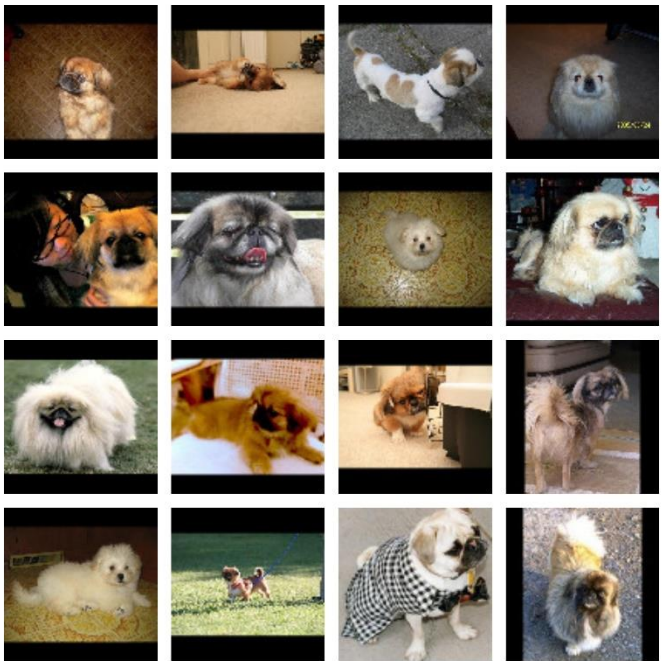

Figure 1: Sample of Pekinese images used

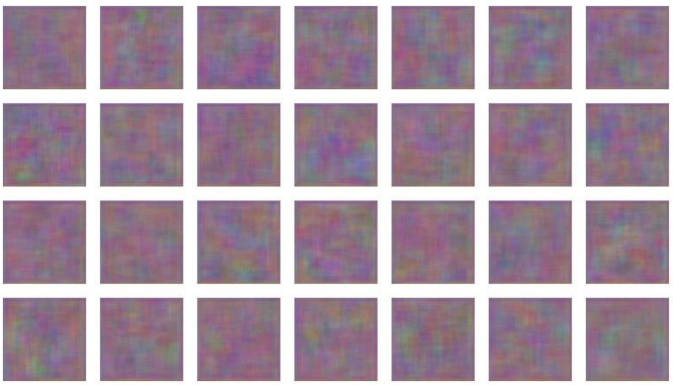

Figure 1:Results after 1 epoch

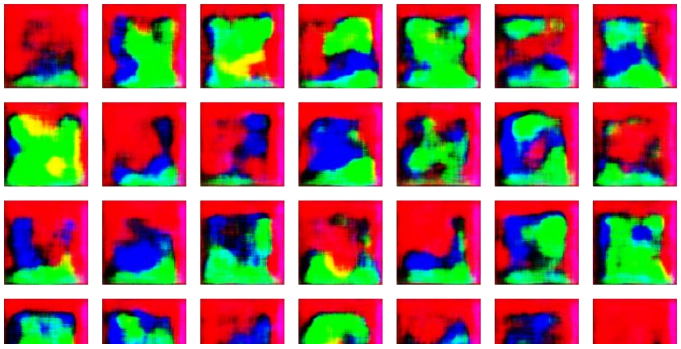

Figure 3: Results after 50 epochs

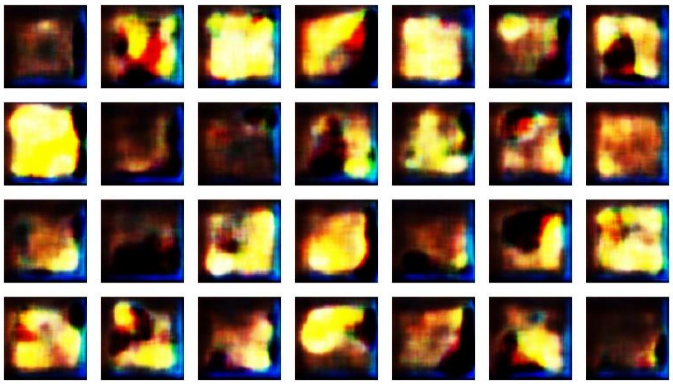

Figure 4: Results after 100 epochs

From the naked eye, it seems that the GAN is improving after each epoch. Starting from random noise, the images of each epoch are starting to form coherent shapes and colors. At the 100th epoch, 3rd row last column, I can kind of see the face of a Pekinese starting to form.

Although the results are still very muddy, I think with a larger sample size, more fine-tuning, and given more epochs to run, my project is feasible. I am also planning to implement more objective metrics to measure the success of the model, such as using the Frechet Inception Distance.

5. **Discussion:** I think I will stick with working with GAN. But instead of using Sequential model, I will try to implement my GAN using Functional API, since I can be more flexible with the fine-tuning. I think I can handle now with more experience under my belt. In parallel, I will try to see if I can implement a cycleGAN for the style-transfer part of project.

References:

Foster, David (2019). "Generative Deep Learning, Teaching Machines to Paint, Write, Compose and Play". https://github.com/davidADSP/GDL_code.