FA21: CSCI P445

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**RF1: Feasibility Report**

1. **Product:**

For our product, we intend to use a Generative Adversarial Network (GaN) that can synthesize new aesthetic images (though research may lead us down a different path by which to accomplish what we want). We will train the GaN to achieve this by taking in a dataset of images and outputting a new, but unique image. To gather feedback for the GaN, we intend to create a web-based front end to crowdsource options on the GaN’s performance. Users will be able to go to the website, and will be presented with a sample image generated by one of several copies of the base GaN that we trained, and tell the server whether or not they find the image aesthetically pleasing, and then the algorithm will generate a new image for them to judge; the goal being that the GaN will increase the number of positive reviews it receives.

1. **Technical Feasibility:**

This would be a very difficult task if we didn’t have access to public libraries such as Tensorflow and Matplotlib. We intend to make this product using Python so we can take advantage of these libraries. Tensorflow greatly simplifies the process of creating neural networks. Without it, this project would probably be beyond the scope of what we could accomplish for this class. Matplotlib is very versatile and allows us to print out information about our neural network in the form of graphs. Using this will give us insight into how well our AI is performing, and give us an idea of what we may need to change to improve the accuracy of the model.

Two of the primary bottlenecks we’ve identified are, the time/storage necessary to train the neural network, and gathering enough feedback data in order to successfully train the neural network to generate images of the expected quality. We believe that by using a small sample set to train a few basic AI algorithms and then allowing the general public to offer feedback, that both these issues can be addressed.

1. **Social Feasibility:**

Our product will not be a replacement for artists as it is just a different mode of creating an image. At first glance, artists might see it as a replacement for them, but this is not the case. The AI will be able to copy images to synthesize a new image, but as the AI relies heavily on pre-existing art with which to train, it will likely lack the crucial creativity to be on the bleeding edge of artistic image creation.

Another issue that comes to mind is, will people be able to tell if the image the AI creates will be indistinguishably fake or you can tell if the AI created the image. For instance, will someone be able to give the AI a dataset of a celebrity and the AI will create a “deep fake” image of such celebrity? We do not know if the product will be able to do this or not but it is worthy to take into consideration.

The last issue to consider which is related to the last one mentioned is if someone can use the product to create indecent/NSFW images with the AI. We figure that if the AI will be able to do this, there is no real way of stopping someone from using it in that way. As the product will be free to use, anyone can use it. But it wouldn’t be a tool designed to create such things, any more than something like Photoshop, or similar software could also be used to create them. There stands no reason to believe that the system will be able to accomplish this any more efficiently than someone doing it by hand.

However, the latter two problems can be easily addressed as long as the input/source code is not available to the public, in the case that we decide not to go open source.

1. **Economic Feasibility:**

Our product will likely be used for research purposes, be free-use, and be open source so there won't be any economic benefit. Since the product won’t be adopted into any organization, there shouldn’t be any development costs. However, there might be a small cost of running the product as there will need to be a domain name purchased for the website and either the purchase of a small web server or purchase of a plan for hosting the website. Basically, the cost of running a website. This price can range anywhere from $2/month to $50+/month.

An issue may arise where someone may try to sell the images the AI creates. Whether they're trying to sell copyrighted or non-copyrighted images, with proper licensing, it should be on the user whether they sell the image or not and any legal issue that may arise will be on them.

1. **Scholarly Research:**

After some preliminary research, we have found some other projects that do things similar to what we want to create. A number of these projects are either open source or their teams available for contact which could be of use to us.

* Harold Cohen created AARON
  + AARON is one of the oldest AI systems that is still maintained. AARON is an AI that can draw and color original art.
* Nvidia GauGAN
  + Nvidia’s GauGAN AI allows the user to draw a really basic image of terrain, and the neural network outputs a very realistic-looking image based on the user’s drawing.
* Deep Dream Generator
  + The Deep Dream Generator AI takes two separate images and combines them into one. It can do this in multiple fashions such as taking the style from one and applying it to another or to one part of the image.
* Rutgers University's Art and Artificial Intelligence Laboratory
  + They made an AI that learns different styles of art and then has to create new art using a different style than the ones it was taught.
* Justin Johnson’s application of the paper *A Neural Algorithm of Artistic Style*
  + In this project, they made an AI that can take in a style image and another base image, and the AI will take the style from the first image and apply it to the second image.

1. **Alternative Solution:**

We chose to use GaN as it was recommended by the sponsor, and after looking at the other scholarly articles (as listed above), a lot of them also used GaN’s so it seemed like a good idea for us to take a similar approach as well. Alternative AI systems would be impractical to use given the vast amount of research that has been done with GaN’s. Since the system has been widely used, there is a lot of information regarding GaN’s.

Our goal with the project is to take the research and application that has been done and expand upon it by attempting to accomplish something new and unique.

1. **Project Risks:**

Some risks that might come with this project are:

People aren’t using the AI on the website to help it learn. It’s possible when we get the AI in a functioning state, there is no user input (or malicious user input) from the website to help direct the AI in the right direction when it comes to making aesthetically pleasing art.

The website goes down regularly so people can’t use it. Whatever we decide, whether it being our owned web server or a hosted one, the server can go down whether it be from bugs in the code, storage being full, or general maintenance issues. Making sure the website is up is crucial so users can interact with the network.

Issues causing time constraints or needing extensions on getting parts of the project done, whether it be from the sponsor or developer team members, may occur, which could lead to features not getting finished within the time restraints of the project if at all.