Can Machine Learning Be Used To Create Graphic Art?

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INTRODUCTION

Can computers simulate the human creative process?

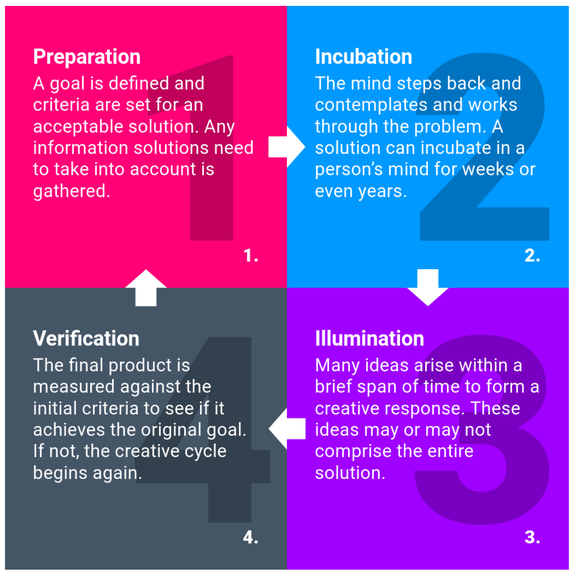
Imagine a computer that can solve the world's problems without any guidance from a human. This research attempts to take humanity one step closer to that reality by creating a program that uses machine learning and artificial intelligence to teach computers how to create graphic art. By creating art, this research merges the fields of math and science with the creative fields of art, music, and writing.

To accomplish this task, the first step was to research current and past projects that strive to create art as well as the human creative process. Based off of these findings, a machine learning algorithm was designed to create digital art from scratch.

BACKGROUND AND SIGNIFICANCE

The human creative process

In 1926, researcher Graham Wallas proposed a model detailing the process in which humans develop and create creative work and ideas. It has four stages, as follows[1]:



Creativity adapted for computers

While machine learning has been studied for decades, it wasn't until very recently that machine learning was combined with art. Some artists have used machine learning to transform photos into the styles of famous painters and extend paintings beyond the bounds of their original frames[2, 3]. Google has entered the field with DeepDream, which modifies images based on what it sees, and Magenta[4]. Magenta is a part of the TensorFlow project that sets out to harness machine learning to create any type of art, including paintings, music, and literature[5].

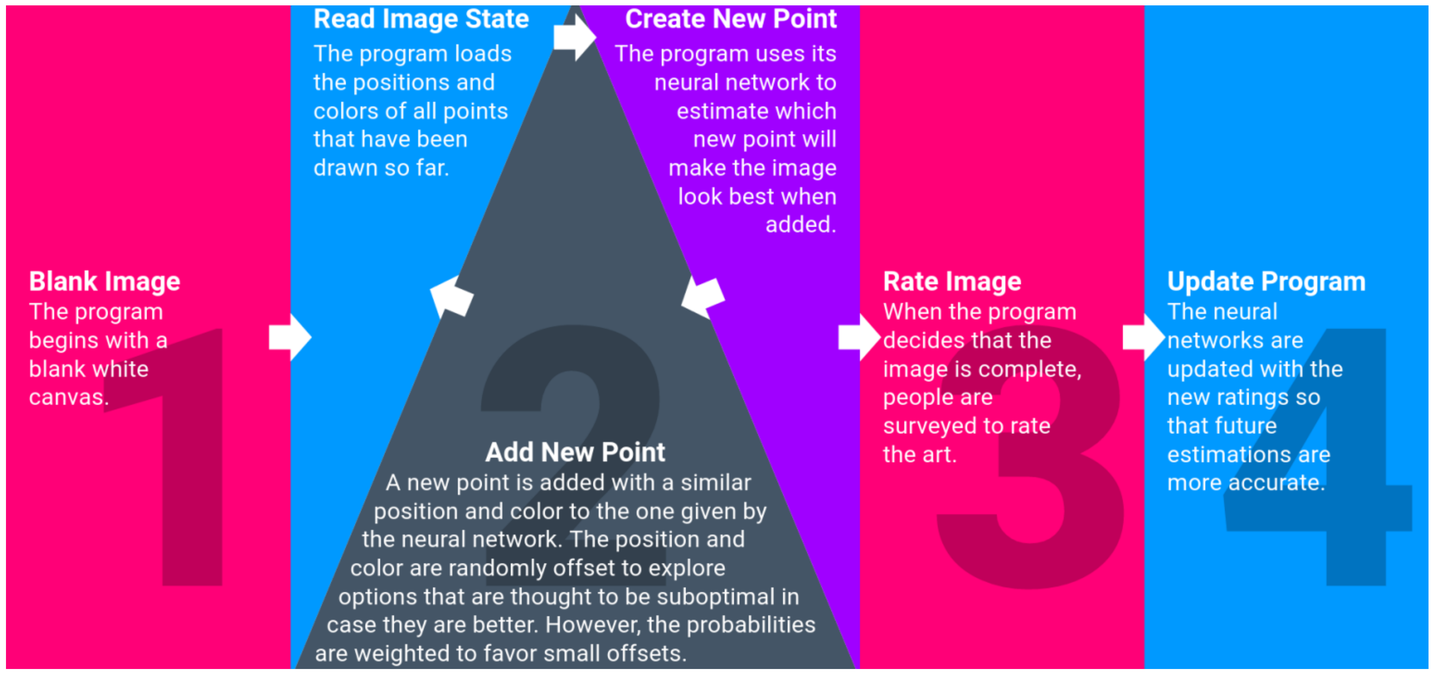
An image created using Magenta.

How our project is unique

Unlike many of the aforementioned projects, this research focuses on creating a program that thinks for itself rather than relying on outside sources to perform creative work (such as mimicking an artist's style).

PROGRAM DESIGN

Our program uses reinforcement learning and neural networks to learn how to create art. This is how we designed our program to work[7]:



FUTURE STEPS

While the original plan was to create a program based off of this design and test it in the real world, the task remains unfinished as the program was difficult to complete within our limited time frame. Here are the proposed steps moving forward:

1. Create the program in Python

a. Write the program in Python using TensorFlow to manage the neural network
b. Finish the the program and review the code with others to ensure that it is written properly

2. Test the program

a. A group of people would rate each art piece
b. The survey asks 4 sets of questions on different aspects of the art piece. Specifically, we plan on asking how well space, structure, color, and pattern are utilized.
c. Each set of questions would ask whether or not each aspect should be changed and how.
   i. For example, for space the questions would be:
      1. "Space: How well is the space utilized? Space is defined as the element of art by which positive and negative areas are defined or a sense of depth achieved in a work of art[6]."
      2. "Space: Do you think the art piece is too cluttered or too spread out?"
d. The average rating would be submitted to the program
e. After many iterations we would be able to tell if the program is learning from the reviews or continuing to make random decisions

REFINING THE ALGORITHM

Since reinforcement learning algorithms are slow and require a long time to produce accurate results, the program needs to be sped up in order to be tested in a reasonable amount of time. Here are two ways it can be improved:

1. Update neural network after every few art pieces are created and reviewed, allowing multiple art pieces to be created before they are all reviewed at once. This eliminates the need to wait for a review before creating a new art piece, increasing efficiency.
2. Create a model that replicates reviewers based on their feedback and can be used to predict what reviewers will think of art pieces. Once it becomes accurate enough, it can replace reviewers altogether. This would eliminate the need to wait for reviews, vastly speeding up the process.

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