# CS 351

Triangle Genome Project

Justin Hall, George Boujaoude

About

This version of the Triangle Genome Project was written by Justin Hall and George Boujaoude. This data has been compiled to show an overall comparison of how well different thread combinations could produce an image. The Triangle Genome Project (TGP) contains a hierarchy consisting of an overall population. This population is then responsible of differing amount of tribes, in the case of this paper, the smallest amount of tribes consisted of one tribe while the largest amount contained ten tribes. Each tribe then contains two thousand to ten thousand genomes at any time. One genome is capable of closely recreating an image that is fed through the TGP.

Summary of Testing

In order to test which combination of threads was the most suitable for the TGP project it underwent a series of test. Each thread combination would try to recreate five different images five times each. Our thread combination size consisted of {1, 2, 4, 5, 6, 7, 9, 10}. Once this was completed, the average fitness of those twenty five runs was graphed and compared to the other thread combinations. The fitness is measured from a scale of 0 to 1, where 1 is considered to be identical to the original image. Below is a graph of our results:
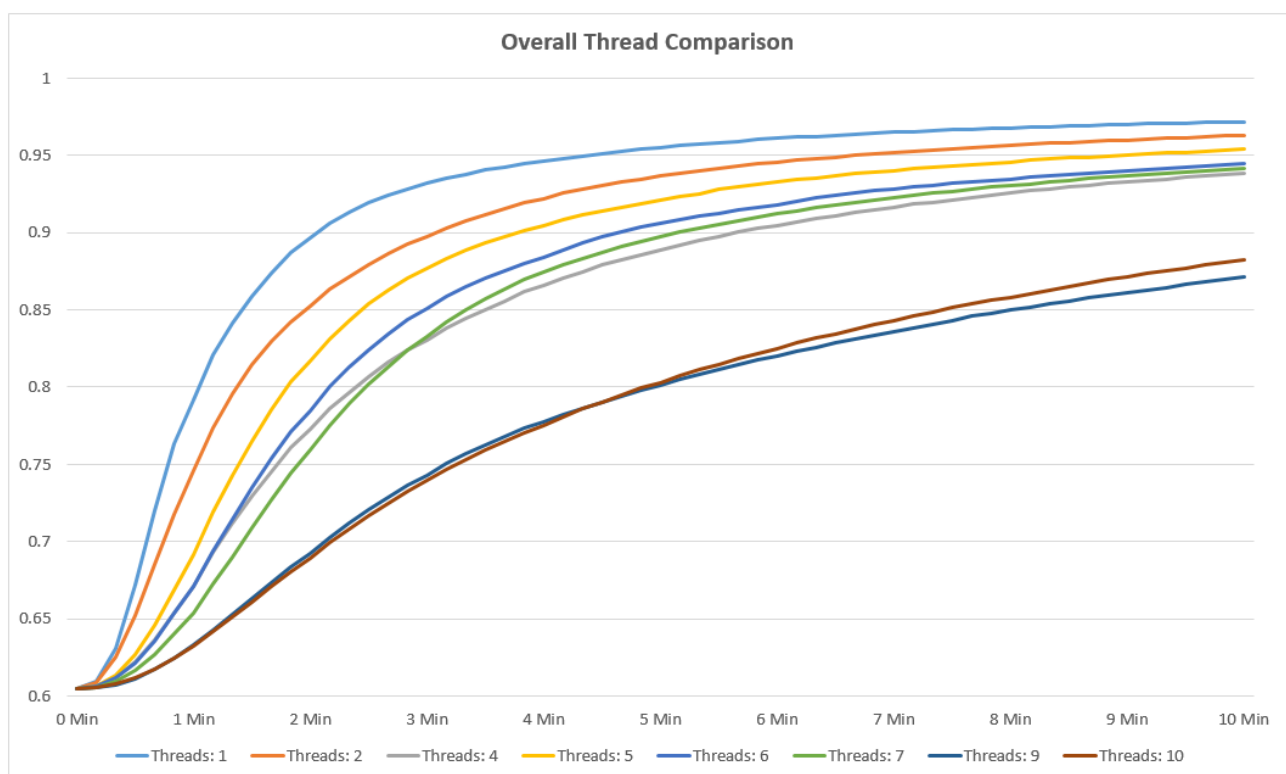
Breakdown

We found that one thread utilizing one tribe had the fastest, and highest quality of results by reaching an average fitness of 0.9717 within ten minutes. Below each thread is graphed individually along with its maximum fitness graph as well as its minimum fitness graph.
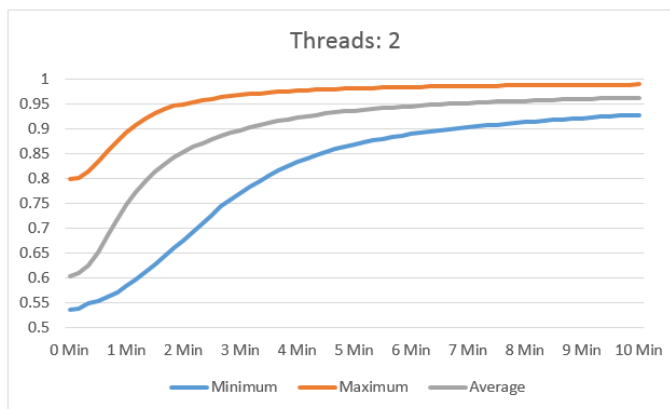
Threads: 1
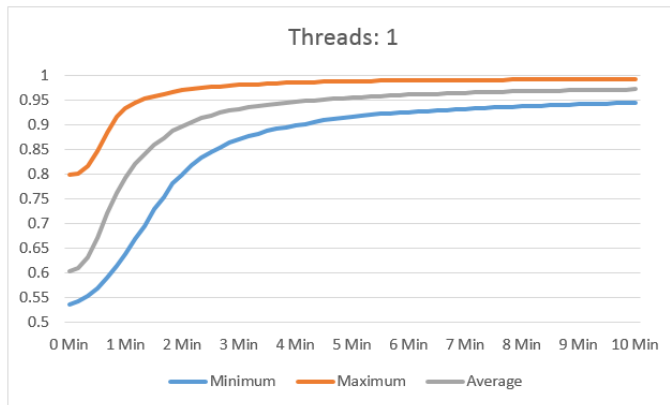
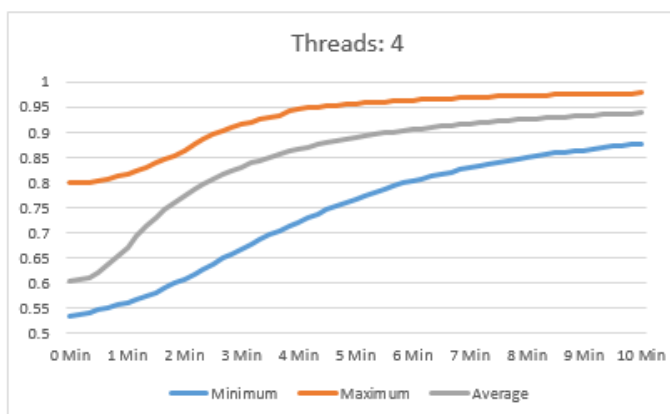Minimum: 0.9445
Maximum: 0.9920
Average: 0.9717

Threads: 2

Minimum: 0.9278
Maximum: 0.9890
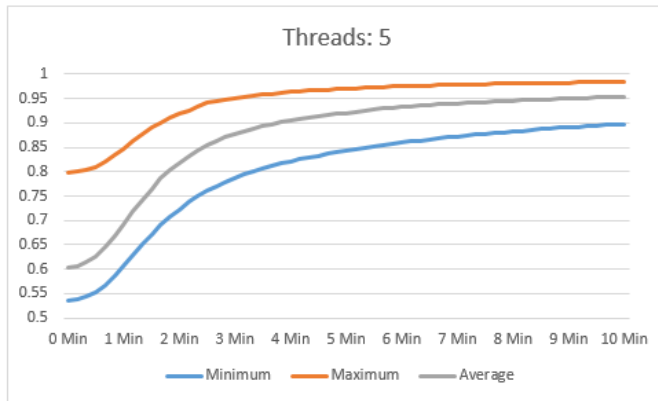Average: 0.9628

Threads: 4
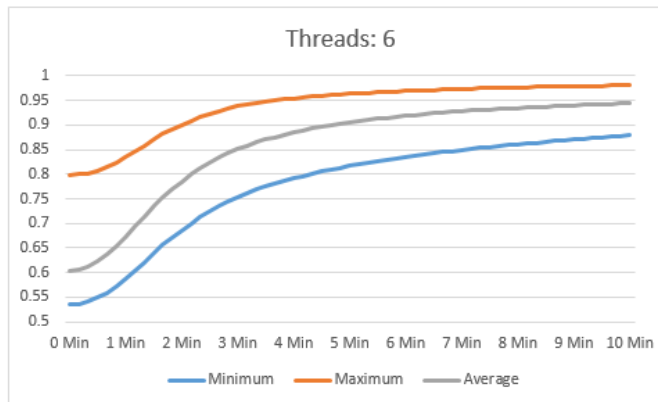

Minimum: 0.8765
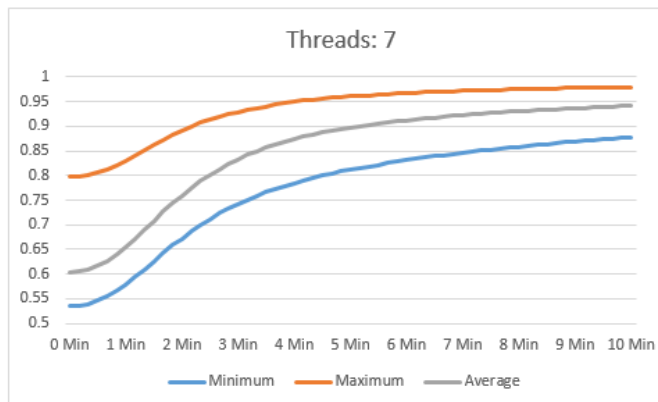Maximum: 0.9775
Average: 0.9383

Threads: 5

Minimum: 0.8981
Maximum: 0.9841
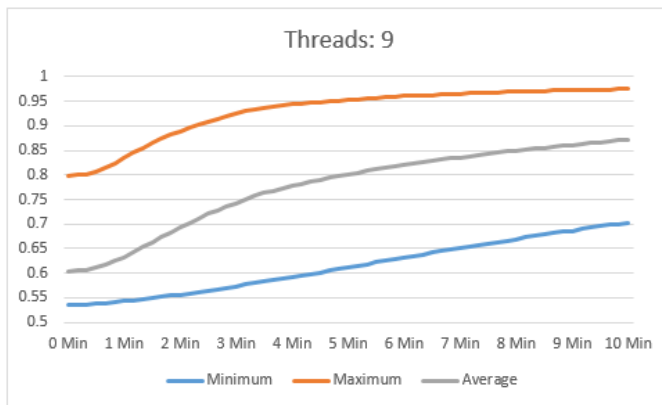Average: 0.9537

Threads: 6

Minimum: 0.8792
Maximum: 0.9807
Average: 0.9445

Threads: 7

Minimum: 0.8772
Maximum: 0.9797
Average: 0.9415
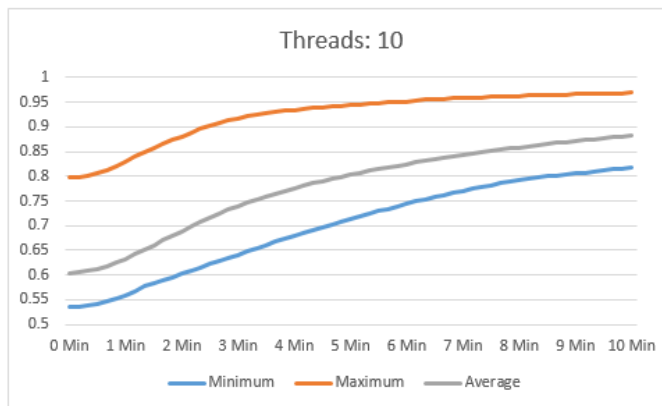
Threads: 9

Minimum: 0.7025
Maximum: 0.9751
Average: 0.8714

Threads: 10

Minimum: 0.8169
Maximum: 0.9689
Average: 0.8823

Further Analysis:

Upon reviewing the given information, it was found that a thread of one utilizing one tribe was the most efficient result. In, further analysis we selected one thread to run Images 1-5 over the course of one hour utilizing our best mix of crossover and Hill Climbing. We also selected one thread to run the same images over the course of one hour relying only on Hill Climbing. Below are the results:
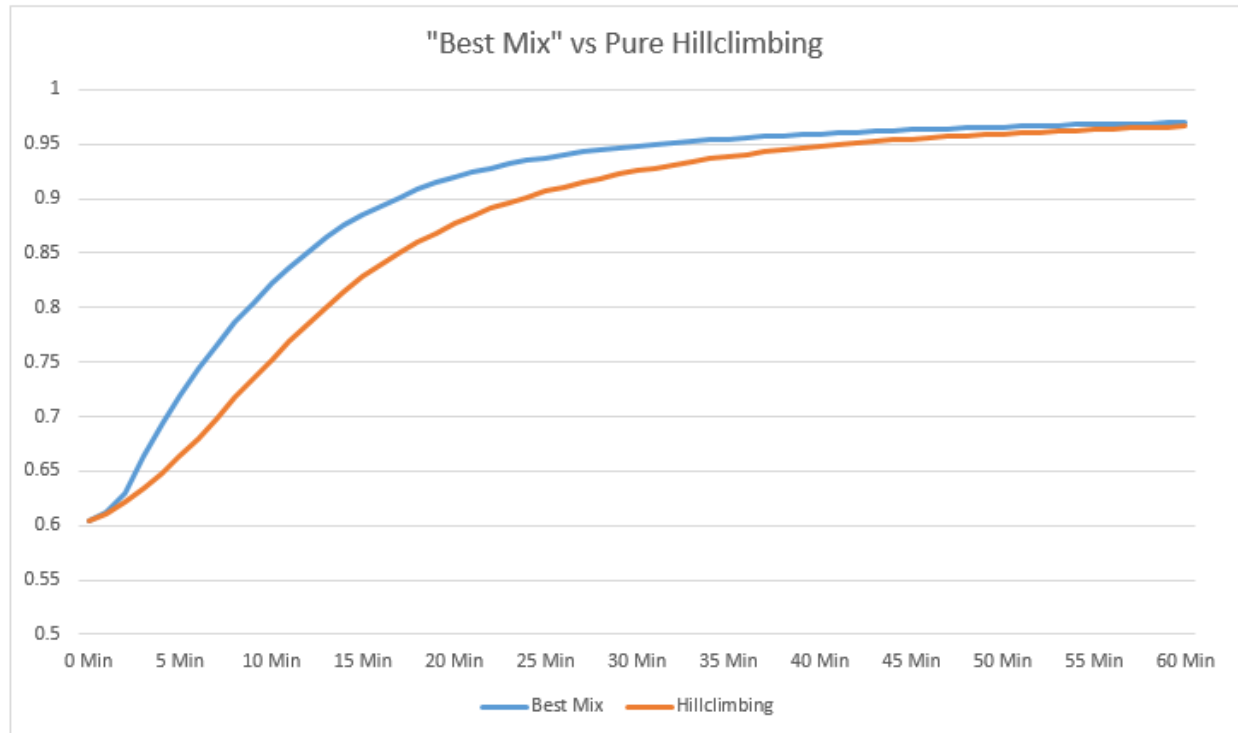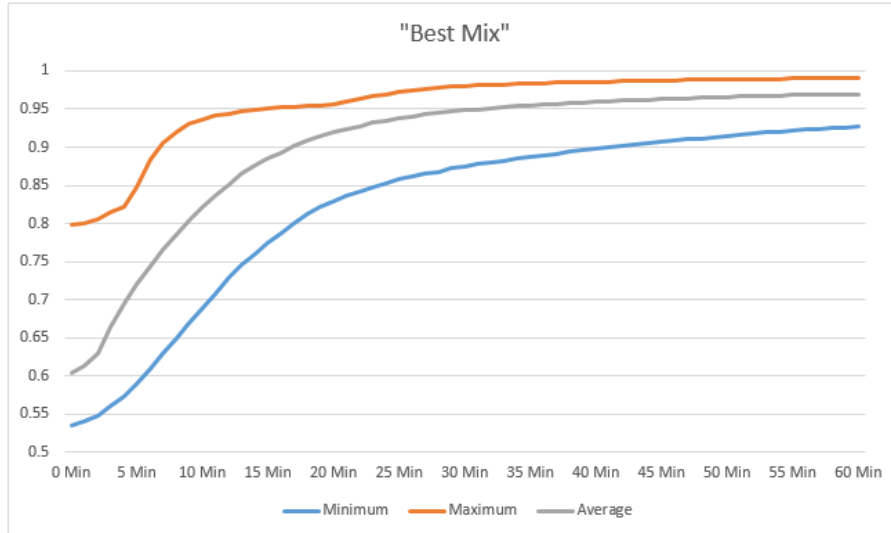

This graph shows that "Best Mix" on average tends to grow quicker, however it slows down and is eventually caught up by Hill Climbing. Specifically at minute 60, "Best Mix" had a fitness greater than Hill Climbing by 0.0036.
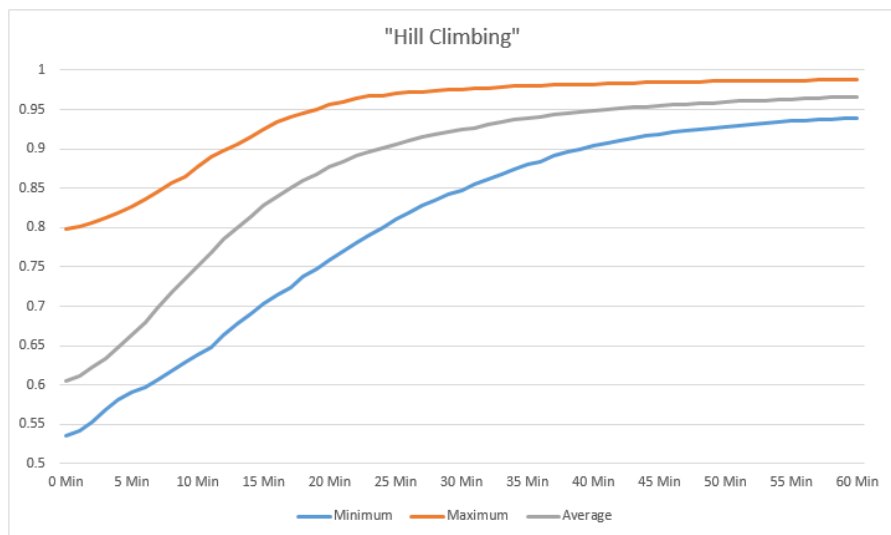
Breakdown

Below is the minimum, maximum, and average plotted for both Best Mix and Hill Climbing

Best Mix

Minimum: 0.9269
Maximum: 0.9905
Average: 0.9697

Hill Climbing

Minimum: 0.9392
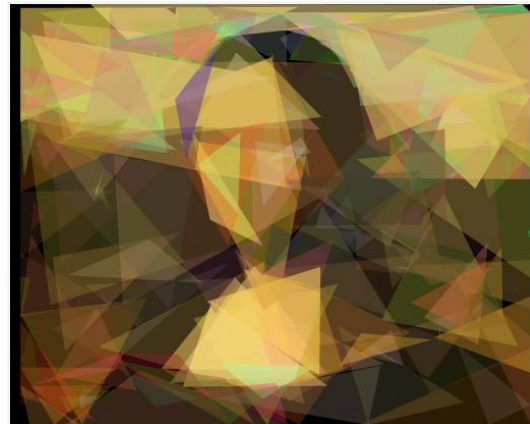Maximum: 0.9877
Average: 0.96638

Example Output

During this additional analysis, both algorithm ratios were tasked to recreate the Mona Lisa from a 512x413 png file. Seen below is the Mona Lisa and the two recreated images side by side (Not to scale in order to compare images side by side):

Mona Lisa

Mona Lisa using "Best Mix"

Mona Lisa using "HillClimbing"

Additional Images

Some of our favorite images that we encountered during the development of The Triangle Genome Project.

Piet Mondrian 250x188   Fitness of 0.9669

Great Wave of Kanagawa 250x172   Fitness 0.9798