

CS 351

Triangle Genome Project

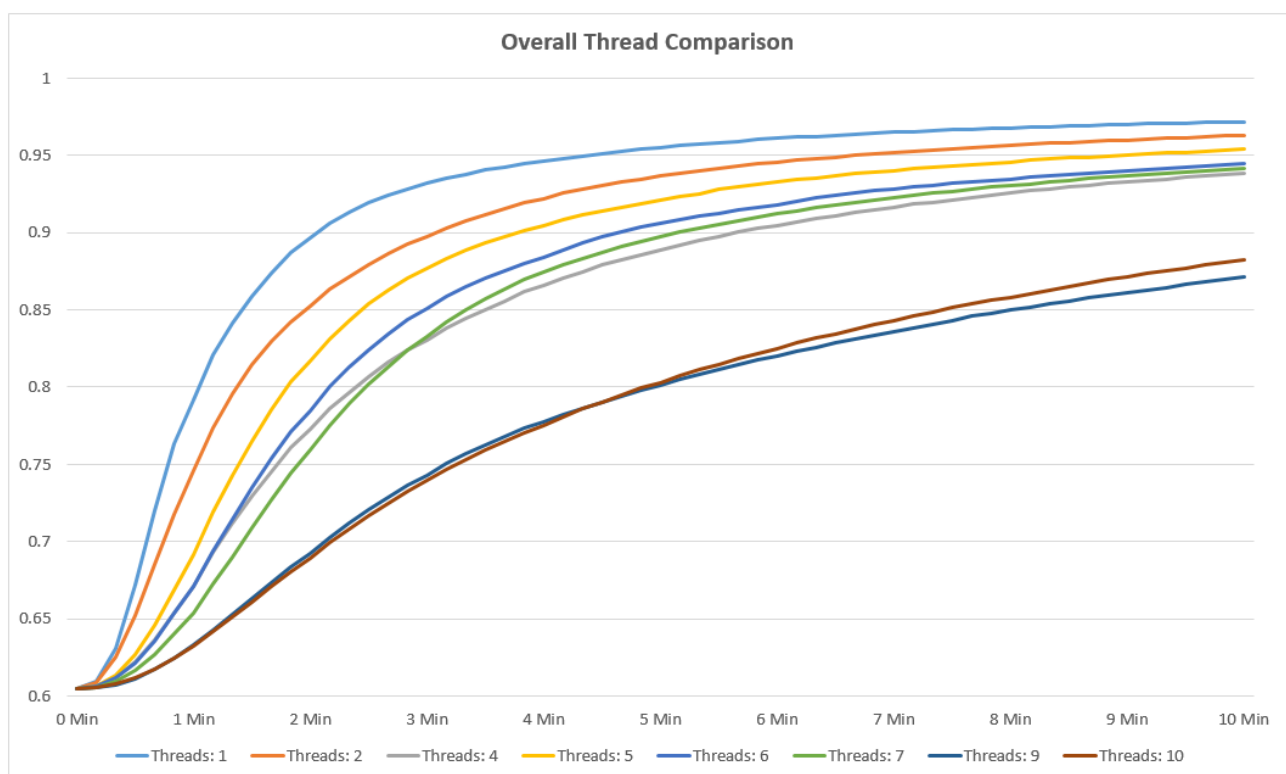
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## About

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

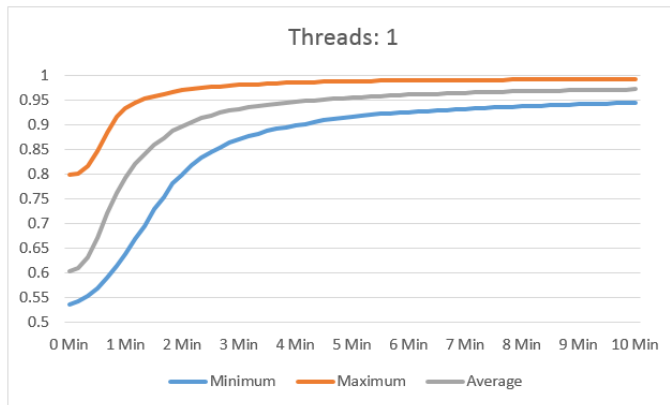
In order to test which combination of threads was the most suitable for the TGP project it underwent a series of test. Each thread combination would try to recreate five different images five times each. Our thread combination size consisted of {1, 2, 4, 5, 6, 7, 9, 10}. Once this was completed, the 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

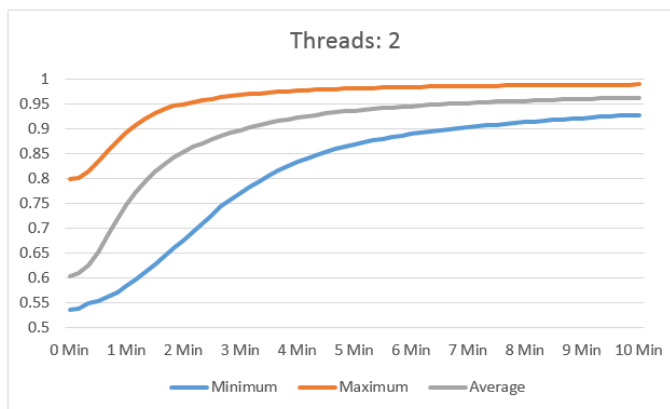
We found that one thread utilizing one tribe had the fastest, and highest quality of results by reaching an average fitness of 0.9717 within ten minutes. Below each thread is graphed individually along with its maximum fitness graph as well as its minimum fitness graph.

### Threads: 1



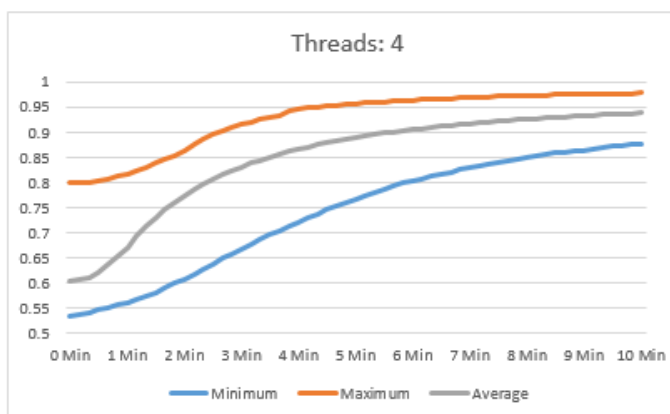
Minimum: 0.9445  
Maximum: 0.9920  
Average: 0.9717

### Threads: 2



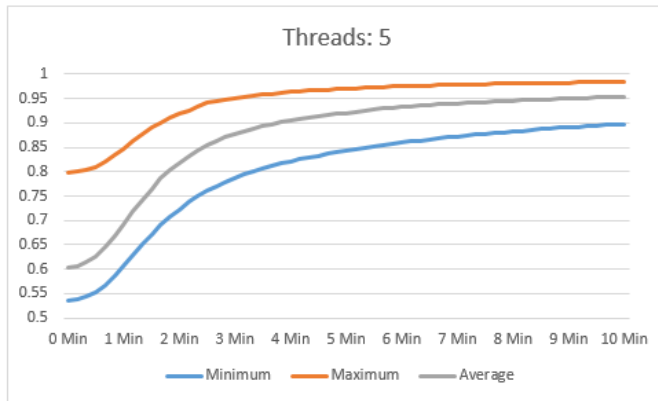
Minimum: 0.9278  
Maximum: 0.9890  
Average: 0.9628

### Threads: 4



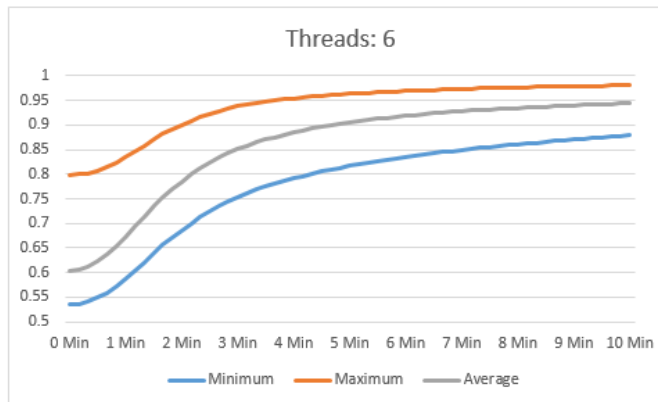
Minimum: 0.8765  
Maximum: 0.9775  
Average: 0.9383

### Threads: 5



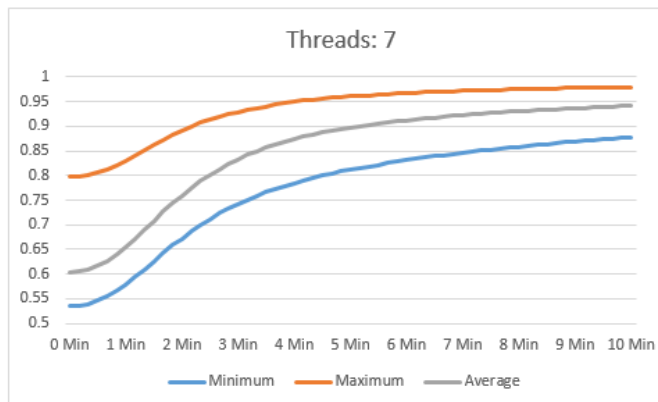
Minimum: 0.8981  
Maximum: 0.9841  
Average: 0.9537

### Threads: 6



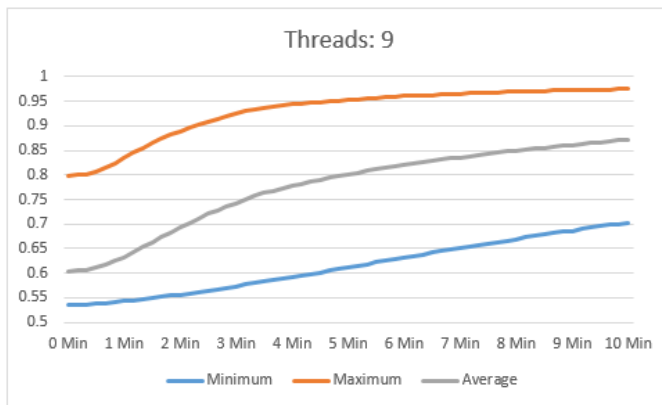
Minimum: 0.8792  
Maximum: 0.9807  
Average: 0.9445

### Threads: 7



Minimum: 0.8772  
Maximum: 0.9797  
Average: 0.9415

Threads: 9

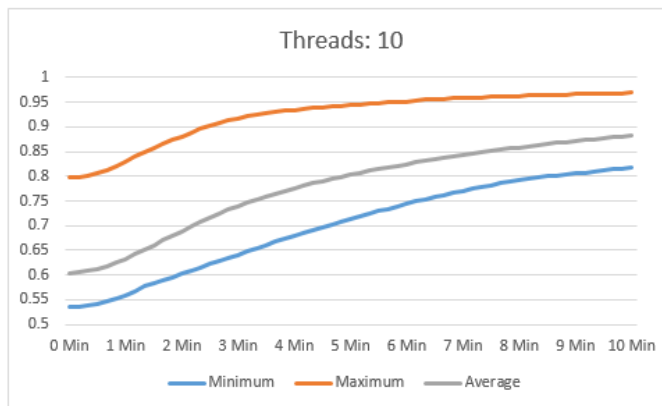


Minimum: 0.7025

Maximum: 0.9751

Average: 0.8714

Threads: 10



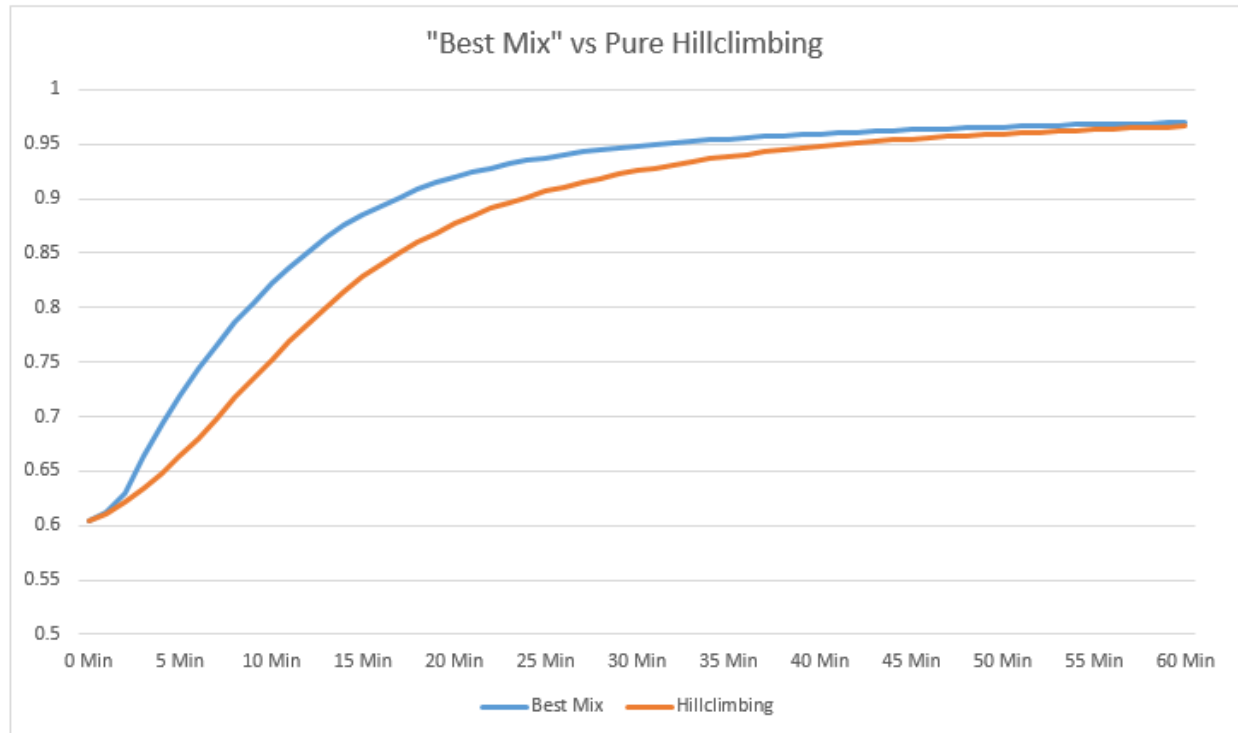
Minimum: 0.8169

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 HillClimbing. We also selected one thread to run the same images over the course of one hour relying only on HillClimbing. 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 HillClimbing. Specifically at minute 60, "Best Mix" had an fitness greater than HillClimbing by 0.0036.

## Example Output

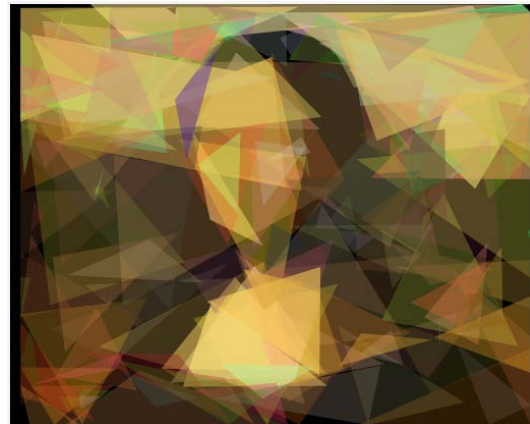
During this additional analysis, both algorithm ratios were tasked to recreate the Mona Lisa from a 512x413 png file. Seen below is the Mona Lisa and the two recreated images side by side (Not to scale in order to compare images side by side):



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

