

## Assignment 2

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Github link: <https://github.com/diwakaryalpi/AI-Assignment2>

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### How it Works:

Monalisa image has been provided as input for the python program. Algorithm uses a set of semi-transparent rectangles to mimic Monalisa's image. Each rectangle has been represented by 4 vertices  $(x_0, y_0)$ ,  $(x_0, y_1)$ ,  $(x_1, y_0)$ ,  $(x_1, y_1)$  and a color of  $(r, g, b)$ . This algorithm tries to put rectangles to mimic the original Monalisa's image. It repeats this process, adding *one shape at a time*. We can change the population size from 50 to 200 as per need.

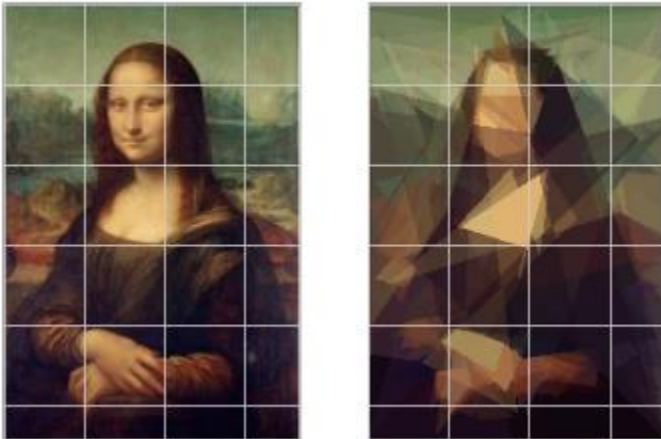
### Important Components:

- **Fitness function:** This is an important component that is required to measure how well the mimic picture is matching with Monalisa's image. I am using only 3 main colors Red, Green and Blue. The values of the individual colors are changed to get different colors.
- **Selection:** The Monalisa picture is divided into different sections. These selected areas are used to reproduce the picture.
- **Genetic operation:** I have implemented the crossover of two individual and mutation of a single individuals.

### Results and Analysis:

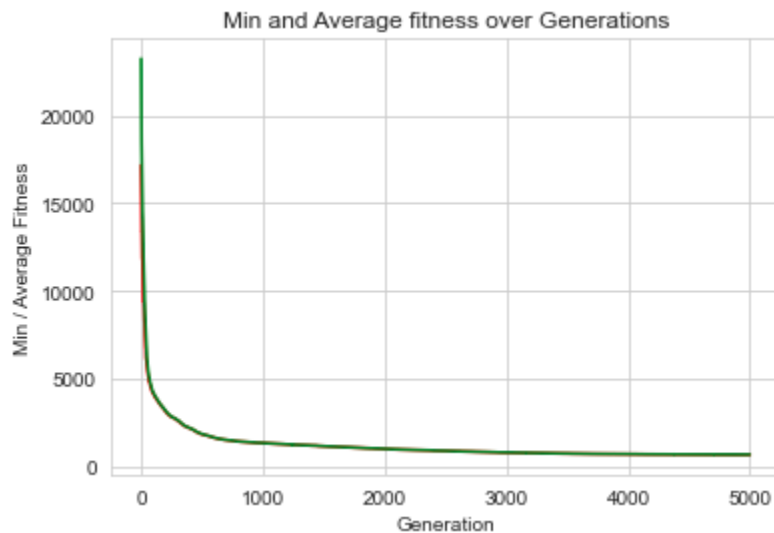
I have implemented using different images, one image is normal Monalisa's image and the other image is closeup of Monalisa (just the head part). In both the cases a graph has been plotted with Minimum/Average fitness on Y-axis and Generation on X-axis.

After 5000 Generations

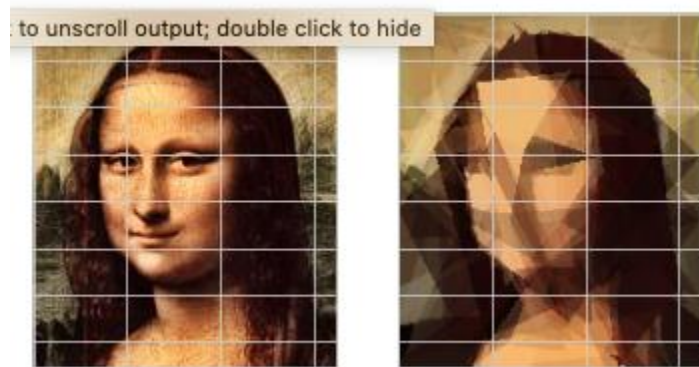


In Genetic Algorithm, the population size is an important parameter which directly influences the ability to search an optimum solution in the search space. While working on the program the probability of crossover is set as 0.9, probability of mutation rate is set as 0.5 and crowding factor for crossover and mutation is set as 10.0

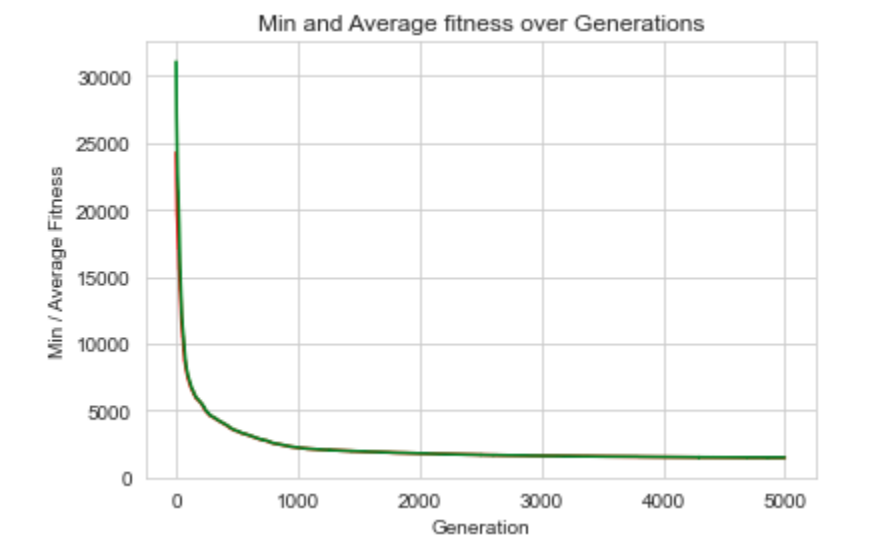
The below curve shows the convergence and the Best Score = 666.52



The below image is closeup of Monalisa image that I have tried to mimic using the transparent rectangles.



The Best Score = 1467.36 in the below case is more when compared to the previous case. If the best score is close to 0 better is the convergence with the original image. So the convergence in the above case is better than this image.



Here are few observations, when the whole image is considered since there are lot of colors involved, we can see the figure vaguely whereas in the 2<sup>nd</sup> case since we are considering the closeup of Monalisa we can see that there is better clarity of the mimicked object in the 1<sup>st</sup> case when compared to the 2<sup>nd</sup> picture.