Evolutionary Algorithm REPORT

Artificial intelligence - Assignment II

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INTRODUCTION

A genetic algorithm implemented in JAVA that takes an input image 512x512 pixels and the computational artist generate an output image with the help of squares.

POPULATION

- **Population size:** **The population size is set to a constant value of 50.**
- **Genes count:** **Each chromosome contains 5000 genes.**
- **Gene Structure:** **Each instance of a Gene class has a point (x, y) representing its position in the XY coordinate. It also contains a color variable, that contains RGB integer value and most importantly, two arrays x_array and y_array containing all the XY points inside the circle of radius 100 pixels and our (x, y) point as the center of that circle. Only those points will be added to x_array and y_array whose color matches the color of our center point or the one which are transparent.**
- **Data production:** **In the start of the algorithm, random data is generated and the (x, y) points of a single gene is drawn using circles of diameter 18 pixels and their respective x_array and y_array points are drawn using a square of height 9 pixels inside a 512x512 frame. These shapes are given random colors (taken from the image).**

ALGORITHM

- **Points generation:** This is the most important part of our algorithm. The function getPoints() takes the x, y values and color as the arguments and return a list of (x, y) points. It takes our point and makes a circle of specified size around it and get the (x, y) points that lie inside its area. If they are inside the circle and those point has the same color as our gene, we add them to our x_array and y_array respectively. Thus, we extend our lists with points that are close and have same color.

- **Fitness function:** The fitness function uses a nested loop. The outer loop loops through all the genes with in the chromosome and the inner loop iterates through the x_array and y_array arrays of our points. We find the RGB integer value of the color for each corresponding (x, y) pair in the x_array and y_array. Then we calculate the RGB value of those points in original image. Their absolute difference is calculated and added to the total. The variable total is returned at the end.

- **Selection function:** The selection function simply sort the chromosomes in the ascending order according to their fitness value and selects the items from the starting index upto a given range and the population list is updated.

- **Crossover function:** It takes a mate chromosome as an argument. Then it splits our chromosome and the mate chromosome in two parts and the two chromosomes are merged together.

- **Mutation function:** It makes a copy of the chromosome. Then it takes a random gene from that list, preferably the one whose color does not match the color of corresponding point inside the real image. Then, this gene is assigned random (x, y) points and its color is set to color of these points in the original image. Then we call our getPoints() function to get the (x, y) points near it. The whole process is repeated twice. Finally this chromosome is added to the population.

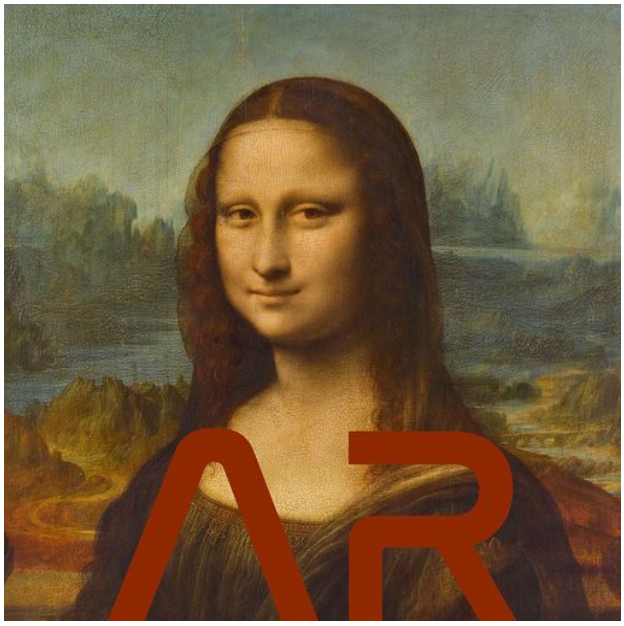
- **Drawing:** The (x, y) points of a single gene is drawn using circles of diameter 18 pixels and their respective x_array and y_array points are drawn using a square of height 9 pixels inside a 512x512 frame All these shapes 60% opaque.

HOW TO USE INPUT IMAGES

1. Download any Java IDE, preferably Intellij IDEA and import the project.
2. Copy the image to the project directory. On line # 19, enter the file name along with its extension in the following way.

Now you are ready to run the program.

EXAMPLE OUTPUTS



What's artistic in these images?

- I tried to generate an output with a certain degree of independence from real visual references.
- Transparency and edge manipulation can be observed.
- Color harmony is maintained, there are half light and bright areas in the image, preserving the color balance.
- We can easily identify the focal point in both images.
- Figures and objects are in the right proportion and their is a symmetry in shapes and colors.