Artificial Intelligence
Assignment 2

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How it works?

Program takes input image, and fills initial population with new empty images. Then among the population program searches for two best images - images with least difference between this image and input image. In the new population goes these two best images and their children. Then all the modifications happen inside the mutation function. A number of pieces of text “Alisa” of random color is written inside the pictures in random places. All these repeat until the difference between current best image and input image becomes less or equal than 1000 or until the number of generations becomes 5000.

To run the code you need to put ***Alisa_Martyanova_AI_Assignment2.py*** file with ***Inkfree.ttf*** file and input image called ***input.png*** in one directory and just run python script. (code uses font “Ink free”, so I also attach “Inkfree.ttf” file)

In general algorithm works for 70 mins.

Basic functions:

- selection

```
# selection function
def selection(population):
    global best
    global second_best
    global best_fitness

    #find best individual
    for individual in population:
        current_fitness = fitness_func(individual)

        if best is None or fitness_func(individual) <= best_fitness:
            second_best = best
            best = individual
            best_fitness = current_fitness

    # creating new population
    new_population = list()

    new_population.append(best)
    new_population.append(second_best)

    population.remove(best)
    if second_best in population:
        population.remove(second_best)

    # filling new population
    for individual in population:
        new_population.append(mutation(deepcopy(crossover(best, second_best))))

    return new_population
```

- fitness function

Fitness is based on the difference between image from population and input image. Difference is calculated as **root mean square difference.**

```
# fitness function (root mean square difference)
def fitness_func(image):
    rms = ImageChops.difference(image, input_image)
    histogram = rms.histogram()
    squares = (value * ((index % 256) ** 2) for index, value in enumerate(histogram))
    squares_sum = numpy.sum(squares)
    answer = squares_sum / float(512 * 512)

    return int(answer)
```

- mutation

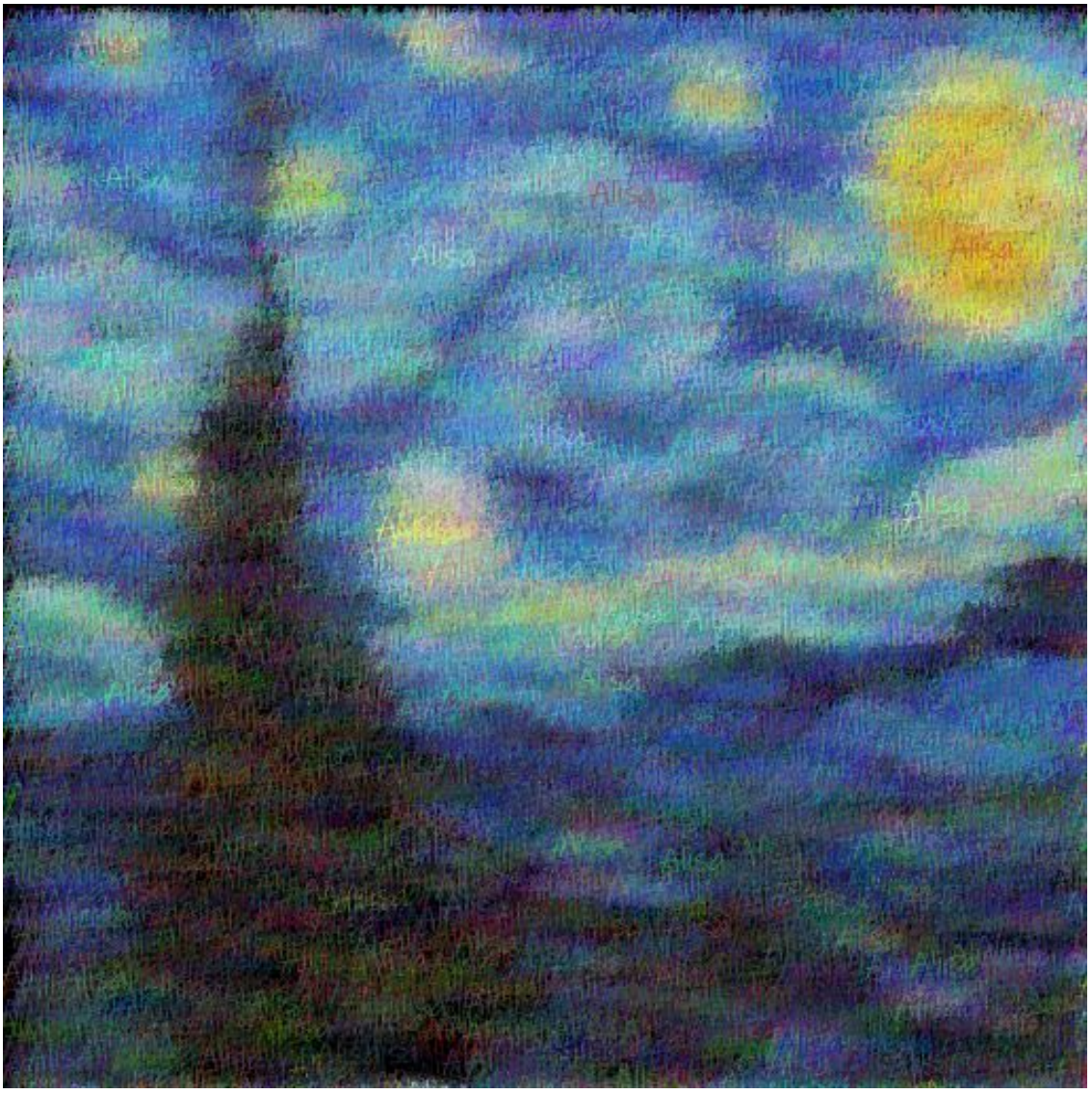
A number of pieces of text “Alisa” of random color is written inside the pictures in random places.

```
# mutation function
def mutation(image):
    txt = "Alisa"
    fontsize = 16
    font = ImageFont.truetype("Inkfree.ttf", fontsize)
    canva = ImageDraw.Draw(image)

    for i in range(0, 3):
        color = numpy.random.randint(0, 256, 3)
        color = (color[0], color[1], color[2], 255)
        x = random.randint(-3, 508)
        y = random.randint(-3, 508)

        canva.text((x,y), txt, fill = color, font = font)

    return image
```

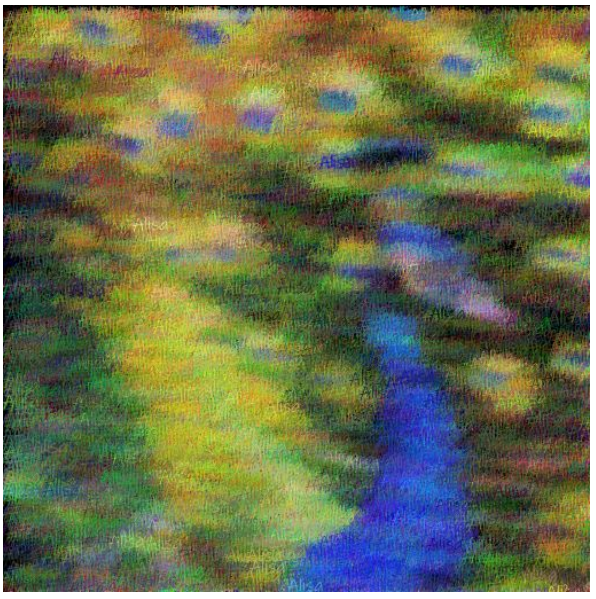
- crossover

```
# crossover function - blending two images
def crossover(image1, image2):
    return Image.blend(image1, image2, 0.5)
```

Output examples



some more examples



Some thoughts about art

First of all, needs to say what is art for me. I can define art as a visual representation of something that was seen or of human imagination. Art is expression of some feelings and emotions.

Is the output image of my program an art? It is quite controversial question. From one side it is not. Program does not think, does not express anything, it just works by one algorithm. But from another side, output of the program is a visual representation of input. It is like when artists draw a landscape they draw it from what they see, trying to represent something similar to what they have in front of their eyes. And my program works in such a way. It looks at input image and tries to draw something that will be similar. And it draws quite good. All the shapes and colors are selected quite accurately. Output pictures seem to me as they are drawn in canvas with oil. From this point of view I can call it art.