MATH089 Project 3 - Image Processing

Posted: 10/04/21

Due: 10/13/21, 11:55PM

1 Introduction

- Define a painting

- Elements of a painting

- Painting techniques

- Mathematical/coding representations of painting creation

- Synthetic paintings

2 Methods

2.1 Importing images

Importing images into Julia is possible through the `Images` module. For example, Fig. displays .

```
∴ using Images, FileIO, ImageIO
∴ pre="/home/student/courses/MATH089/paintings/";
∴ imA=load(pre*"Frida_Kahlo_96.png"); typeof(imA)

 Matrix{RGB{N0f8}}
∴ imB=load(pre*"Georges_Seurat_3.png");
∴ A = Float64.(Gray.(imA)); B = Float64.(Gray.(imB));
∴ imshow(A,cmap="gray");
∴
```
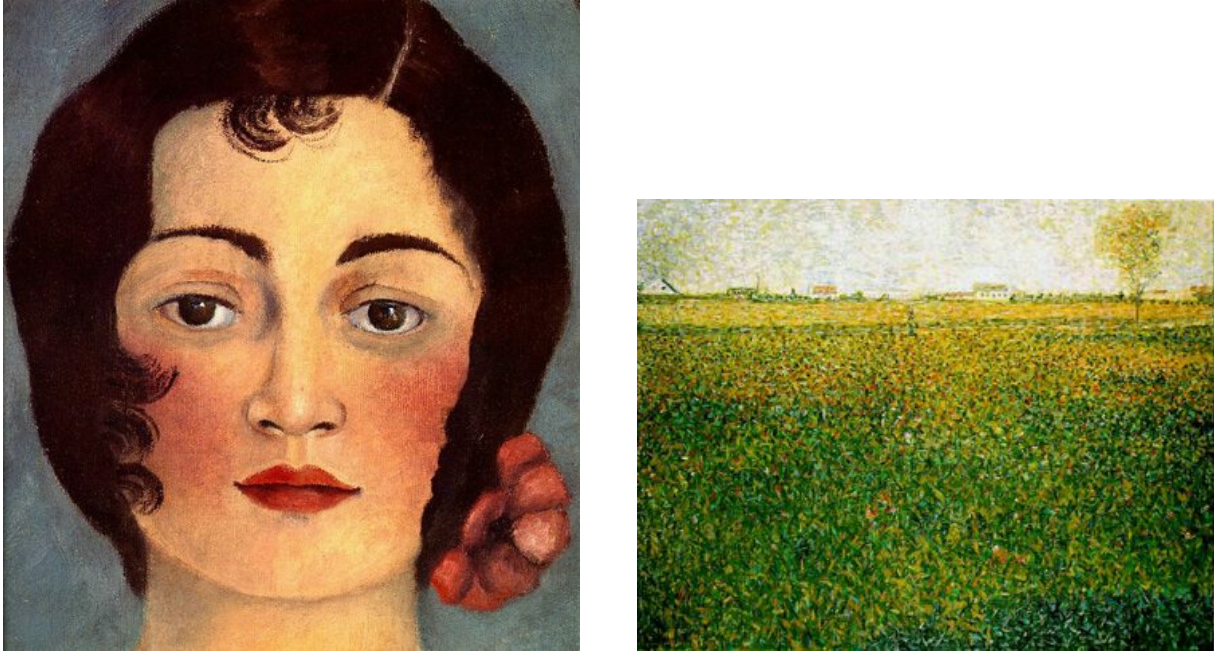
Figure 1. (Left) Self-portrait by Frida Kahlo (?1921). (Right) ?Country landscape by Georges Seurat (?1880).

2.2 Spatial correlation of picture elements (pixels)

The singular value decomposition (SVD) furnishes spatial correlation between pixels

$$\boldsymbol{U}\boldsymbol{\Sigma}\boldsymbol{V}^T = \boldsymbol{A}$$

with significance:

- $\boldsymbol{\Sigma} = \mathrm{diag}(\sigma_1, ..., \sigma_n)$

$$\boldsymbol{\Sigma} = \begin{bmatrix} \sigma_1 & & & \\ & \sigma_2 & & \\ & & \ddots & \\ & & & \sigma_n \end{bmatrix}$$

- $\boldsymbol{U}, \boldsymbol{V}$ contain the correlation patterns

```
∴ U,S,V=svd(A);
∴ [size(A) size(U) size(S) size(V)]
```

$$\begin{bmatrix} \begin{bmatrix} 484 \\ 430 \end{bmatrix} & \begin{bmatrix} 484 \\ 430 \end{bmatrix} & \begin{bmatrix} 430 \end{bmatrix} & \begin{bmatrix} 430 \\ 430 \end{bmatrix} \end{bmatrix} \tag{1}$$

```
∴ m,n=size(A)
```

$$\begin{bmatrix} 484 \\ 430 \end{bmatrix} \tag{2}$$

```
∴ figure(2);
  imshow(S[1]*U[1:m,1]*V[1:n,1]'+S[2]*U[1:m,2]*V[1:n,2]',cmap="gray");
∴
```

3 Results

4 Discussion