Goal

- Reproduce *A Neural Algorithm of Artistic Style*
  (https://www.cv-foundation.org/openaccess/content_
  cvpr_2016/papers/Gatys_Image_Style_Transfer_CVPR_
  2016_paper.pdf)

  > *Here we use image representations derived from
  > CNN optimised for object recognition, which make
  > high level image information explicit. We introduce
  > A Neural Algorithm of Artistic Style that can
  > separate and recombine the image content and
  > style of natural images. The algorithm allows us to
  > produce new images of high perceptual quality that
  > combine the content of an arbitrary photograph
  > with the appearance of numerous well known
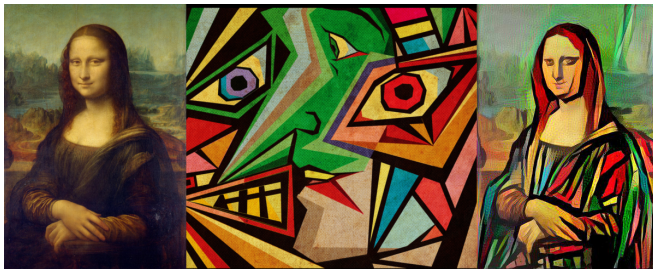 > artworks.*

Goal

Figure – Your expected result.

Algorithmic components

- A style image $\mathbf{a}$ and a content image $\mathbf{p}$.
- A pre-trained CNN from which you will retrieve feature maps (F^l).
- Two losses :
  - A content loss.
  - A style loss.
- A random initial image $\mathbf{x}_0$.

Style Loss Function

Let G be the Gram matrix

$$G_{ij}^l = \sum_k F_{ik}^l F_{jk}^l,$$

where l denotes the layer, F_{ik} the kth element of the ith vectorized feature map.

Let's call A^l and X^l the respective Gram matrix of $\mathbf{a}$ and $\mathbf{x}$, then the contribution of layer l to the total loss is :

$$E_l = \frac{1}{4N_l^2 M_l^2} \sum_{i,j} \left(X_{ij}^l - A_{ij}^l \right)^2,$$

and the total style loss is :

$$\mathcal{L}_{\text{style}}(\mathbf{a}, \mathbf{x}) = \sum_{l=0}^{L} E_l$$

Content Loss Function

A content loss function : corresponding to the MSE loss between feature representations (F and P) of images $\mathbf{x}$ and $\mathbf{p}$

$$\frac{1}{2} \sum_{i,j} \left(F_{ij}^l - P_{ij}^l \right)^2.$$

The network is trained by weighting and summing the two losses.

For the pros

- Investigate the difference when starting with a randomly initialized network.
- Generalize the algorithm to multiple styles.
- Play with the different layers used for extracting the features.
- **BE CREATIVE !**

GOOD LUCK !