

Machine learning introduction

Part II – Deep Neural Networks

2 - The Generative Adversarial Networks

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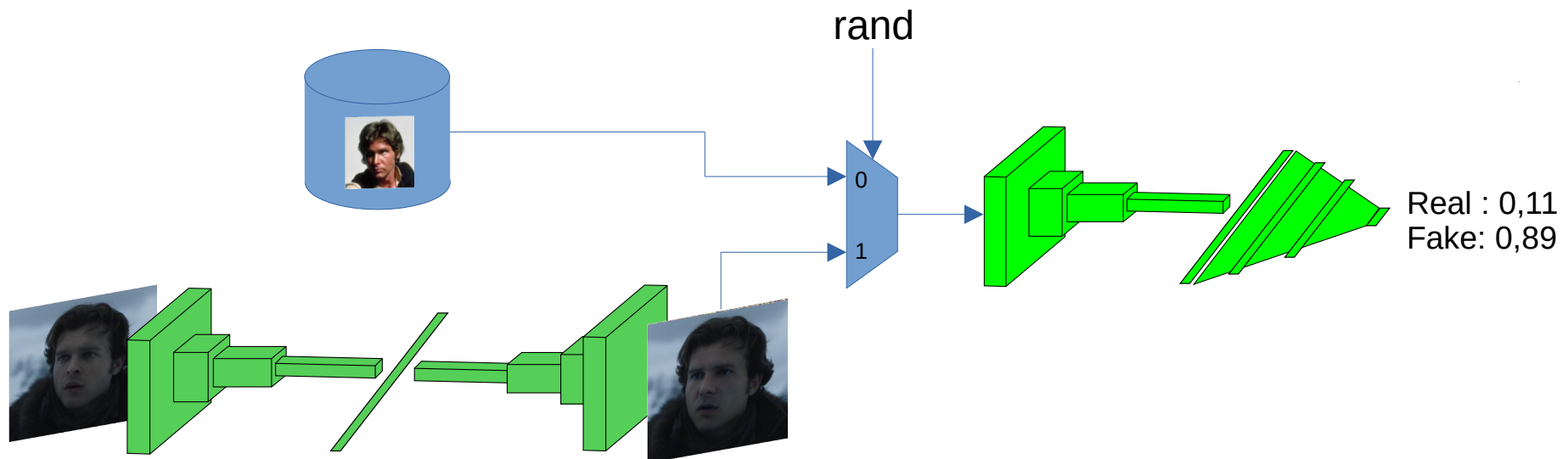
Part II-2 : the generative adversarial networks

- **GANs**
 - Generative Adversarial Networks
 - Couples of networks
 - A first network learns to mislead the second network
 - The second networks learns to recognize a generated images from real ones
 - The loss functions are opposite: mutual improvements
 - The second networks finds features separating fake and true images
 - First network correct fake images to make them more realistic

Part II-2 : the generative adversarial networks

- GANs

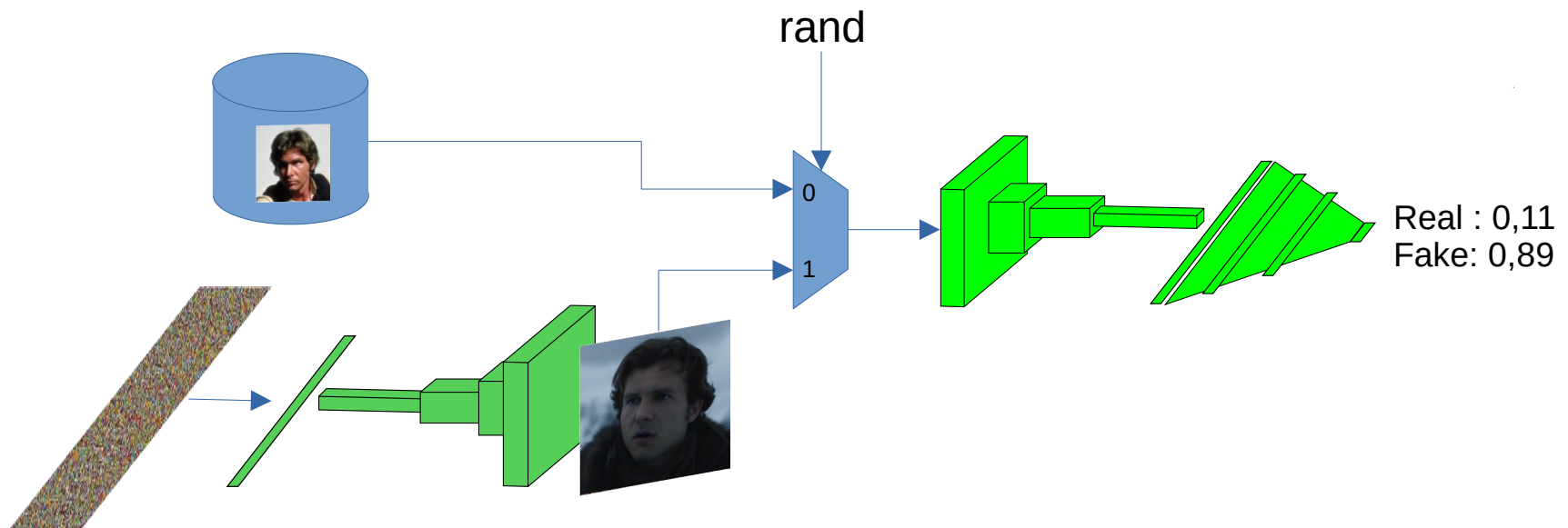
- GANS to improve an encoder-decoder network
 - An encoder-decoder to improve
 - A database of real images
 - A discriminator network learning to recognize fake from real images



Part II-2 : the generative adversarial networks

- **GANs**

- GANS to generate original data (images, text, sound...)
 - A decoder (only) network
 - A random vector generator
 - A database of true image
 - A discriminator network



Part II-2 : the generative adversarial networks

- GANs
 - Generative GANs: a rapid evolution



Generative Adversarial Networks (GANs): An Overview of Theoretical Model, Evaluation Metrics, and Recent Developments Preprint, Pegah et al., 2020

Part II-2 : the generative adversarial networks

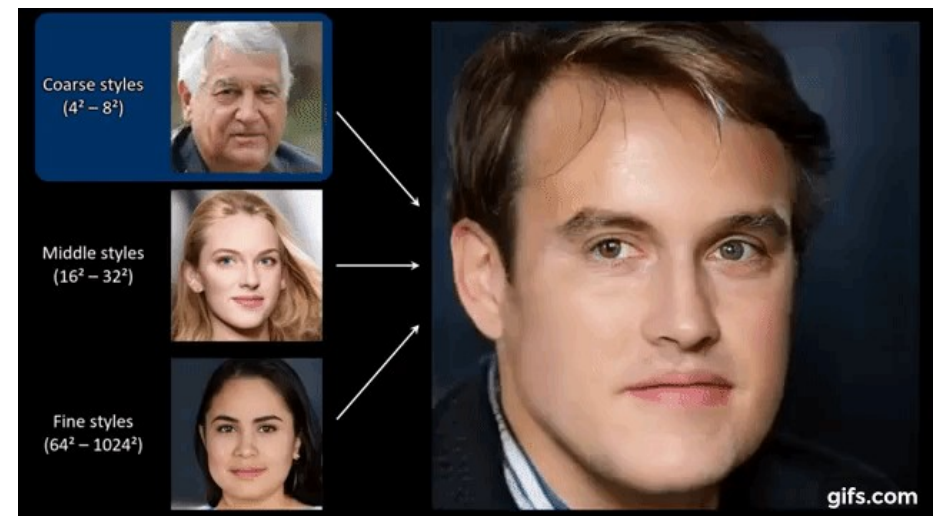
- GANs

- Generative GANs: The latent space

- The input of the network defines a space of possible input vector. This space is called 'latent space' → each 'point' of this space can generate an image



Unsupervised Representation Learning with Deep Convolutional Generative Adversarial Networks



- It is possible to interpolate between points
 - Input vectors can be added, subtracted, merged...

Part II-2 : the generative adversarial networks

- GANs
 - Generative GANs: not always perfect...

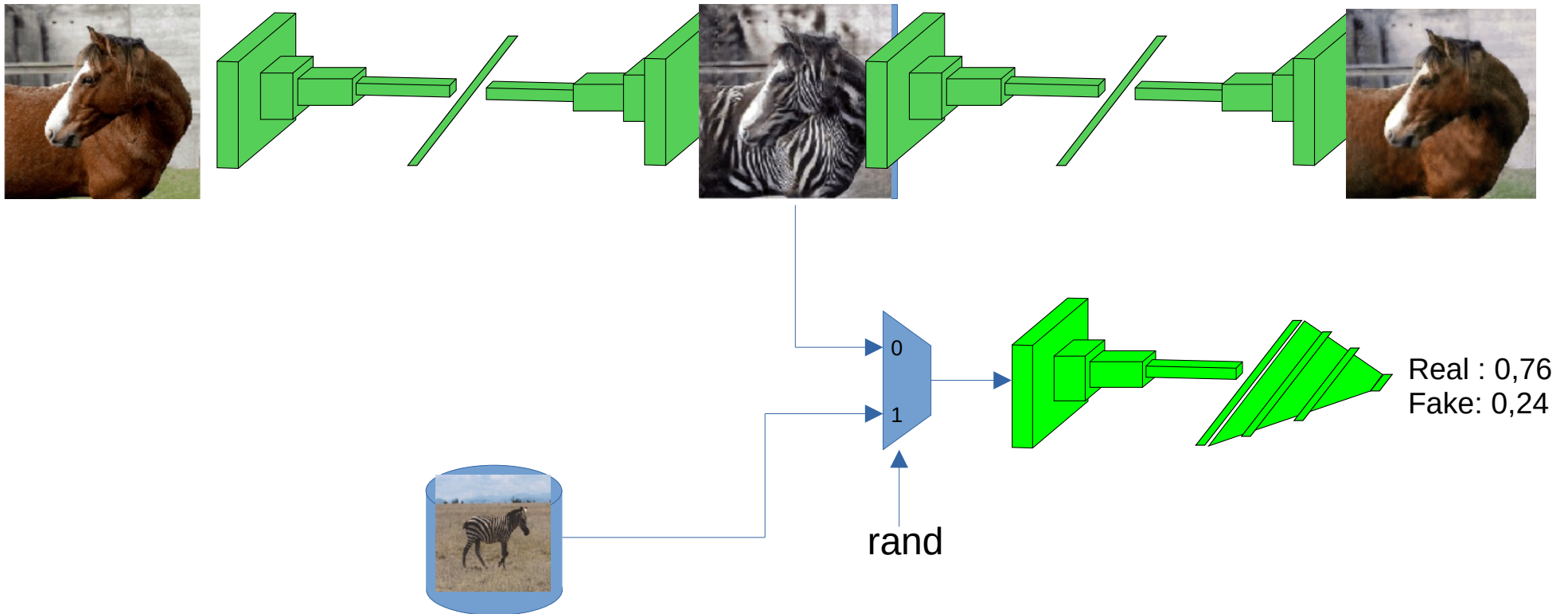


No One Can Escape: A General Approach to Detect Tampered and Generated Image, Zhang et al., 2019

Part II-2 : the generative adversarial networks

- Improved GANs:

- Cycle GANs :



Part II-2 : the generative adversarial networks

- Improved GANs

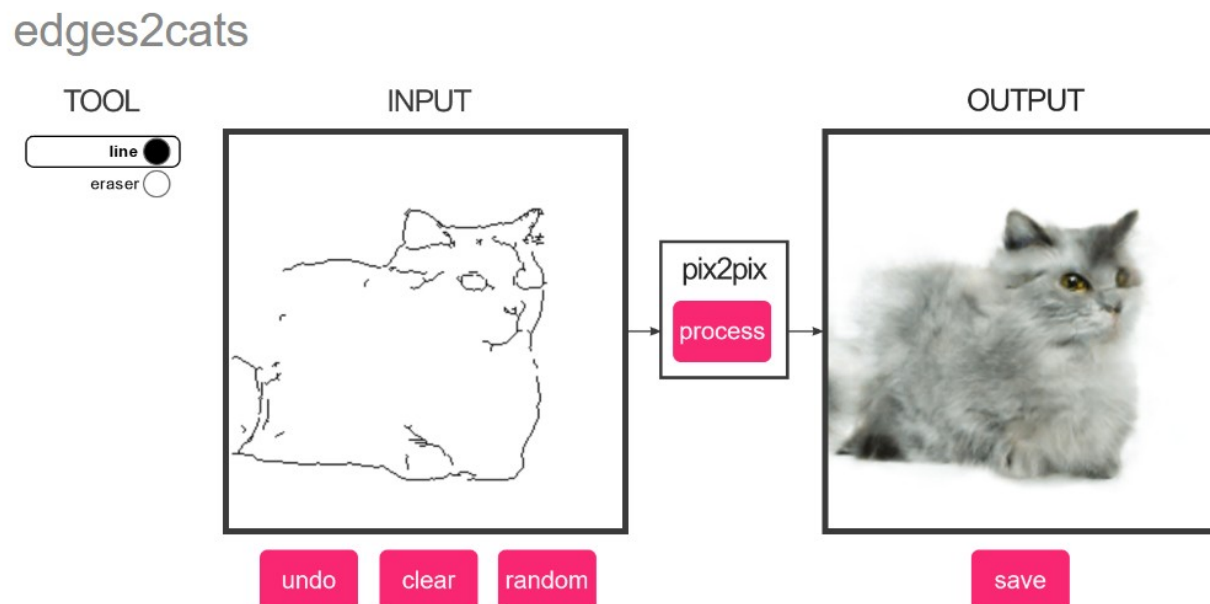
- Cycle GANs :



Part II-2 : the generative adversarial networks

- **Improved GANs**

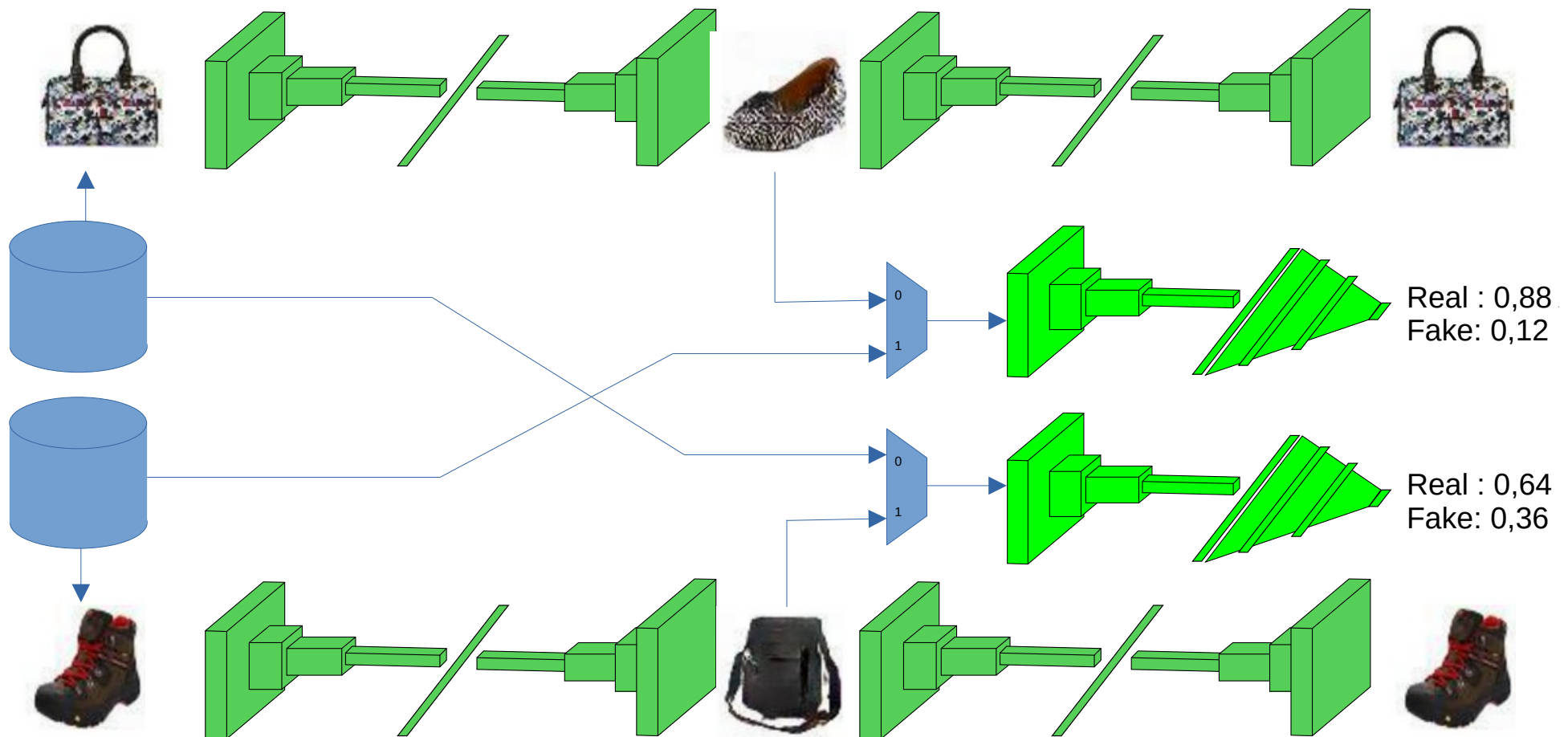
- Conditional GANs : Input data are added to the latent vector
 - Requires a dataset of pairs data/images for training
 - Generator generate image from a vector [latent ; data]
 - Discriminator learn to recognize data/image pairs from data/generated pairs



Part II-2 : the generative adversarial networks

- Improved GANs

- Disco GANs (Discover Cross-Domain Relations GAN) :



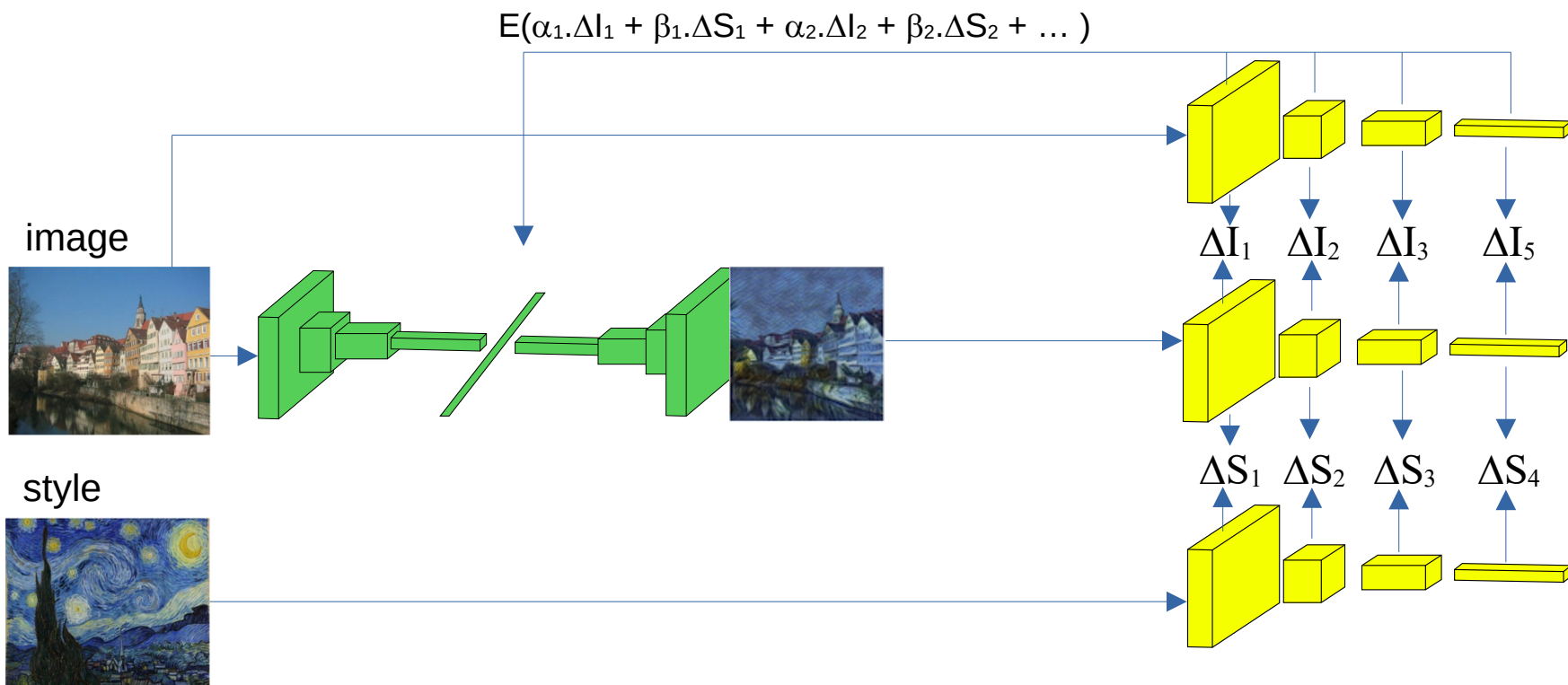
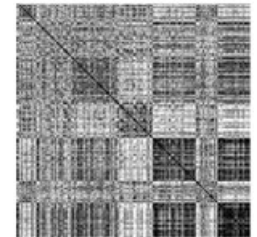
Part II-2 : the generative adversarial networks

- **Improved GANs**

- **Transfert style GAN :**

- Trained encoder networks (without fully connected)
 - Minimize image and style differences (Gram matrix)

$$g_{k_1, k_2} = Y_{k_1} \times Y_{k_2}$$



Part II-2 : the generative adversarial networks

- Improved GANs
 - Transfert style GAN



https://www.tensorflow.org/lite/examples/style_transfer/overview