AI for Visual Art

Guillaume Couairon

FACEBOOK AI

A bit about myself

PhD student at FAIR Paris

Thesis: text-driven image editing

Motivation

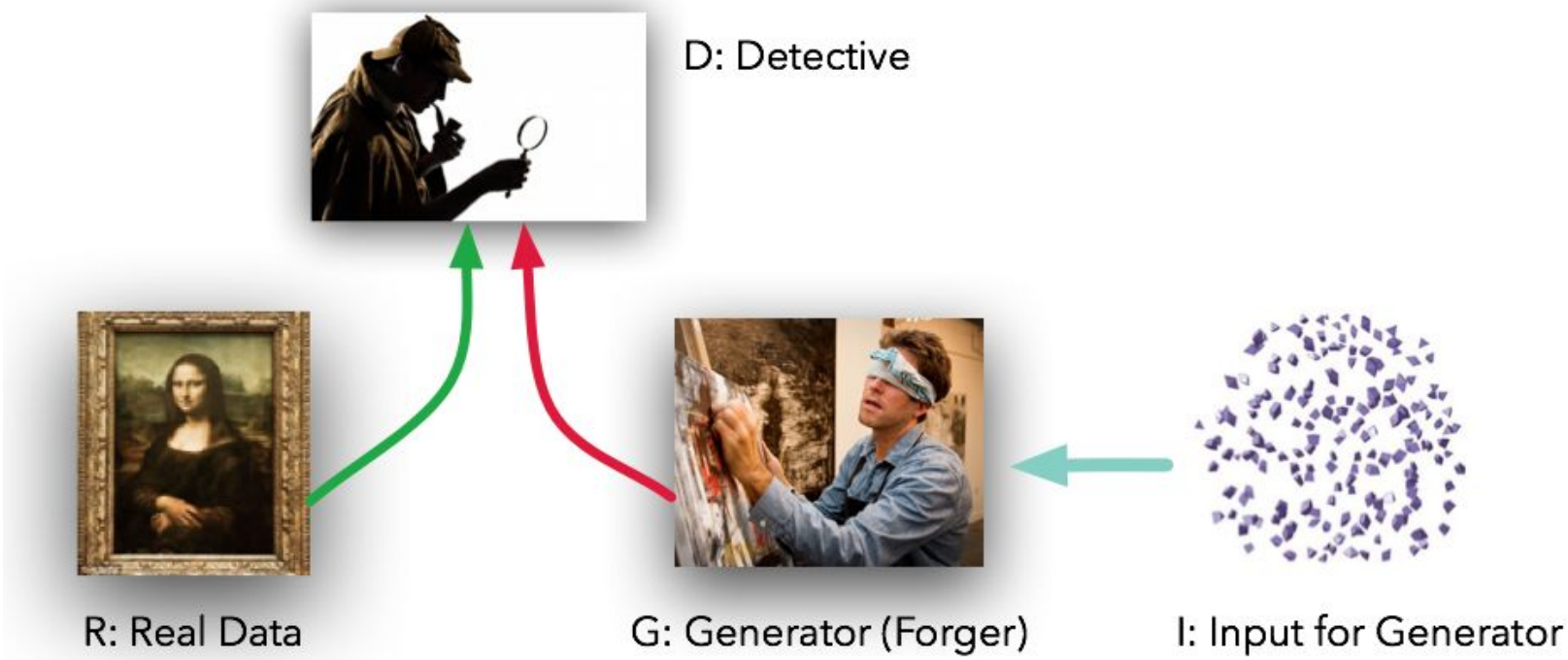
1) Empower artists with novel tools and techniques
2) Automate parts of the artwork creation pipeline
3) Find inspirational ideas
4) Create new ways to make art

Table of contents

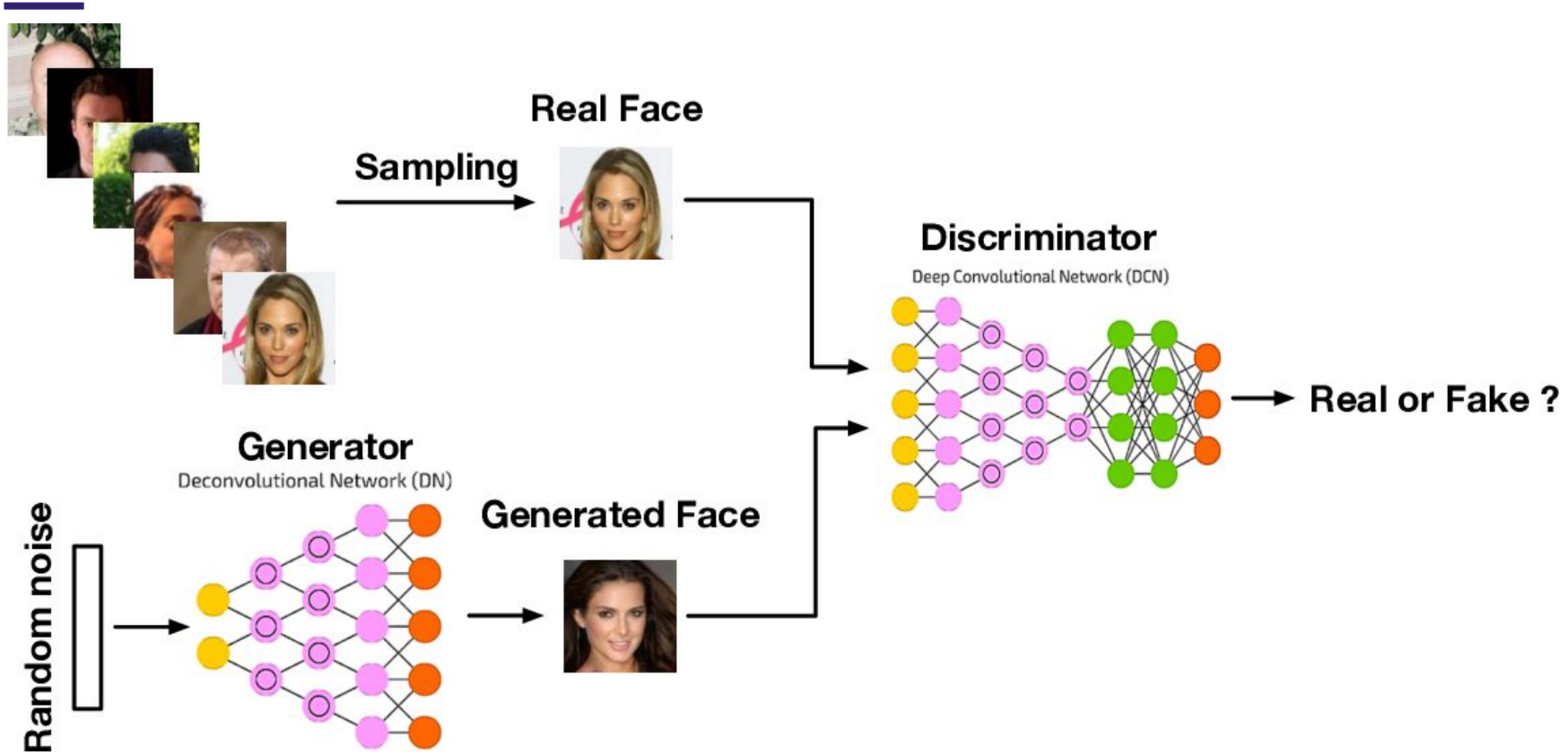
Generative Adversarial Networks

How can we generate images ?

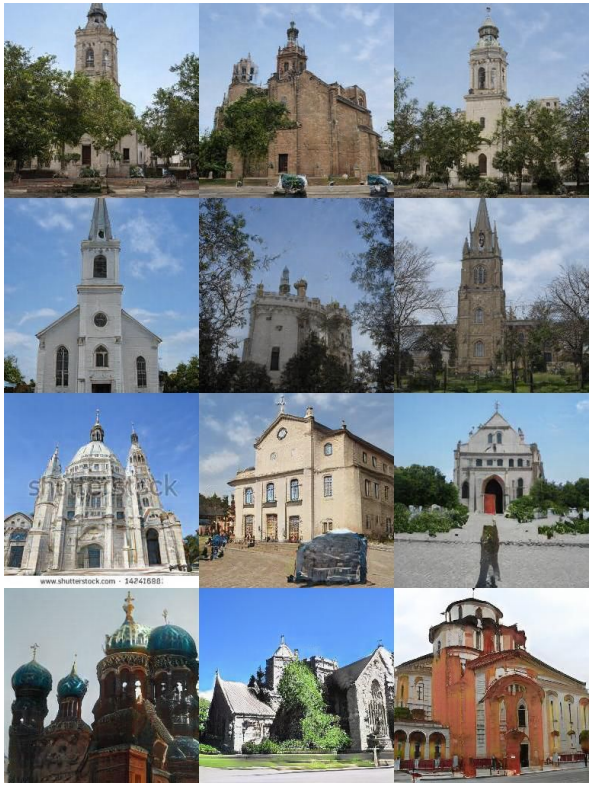
GAN idea


D: Detective
R: Real Data
G: Generator (Forger)
I: Input for Generator

Generative Adversarial Network



GAN examples



How to use image generators for art ?

Idea 1: Train to reproduce art images

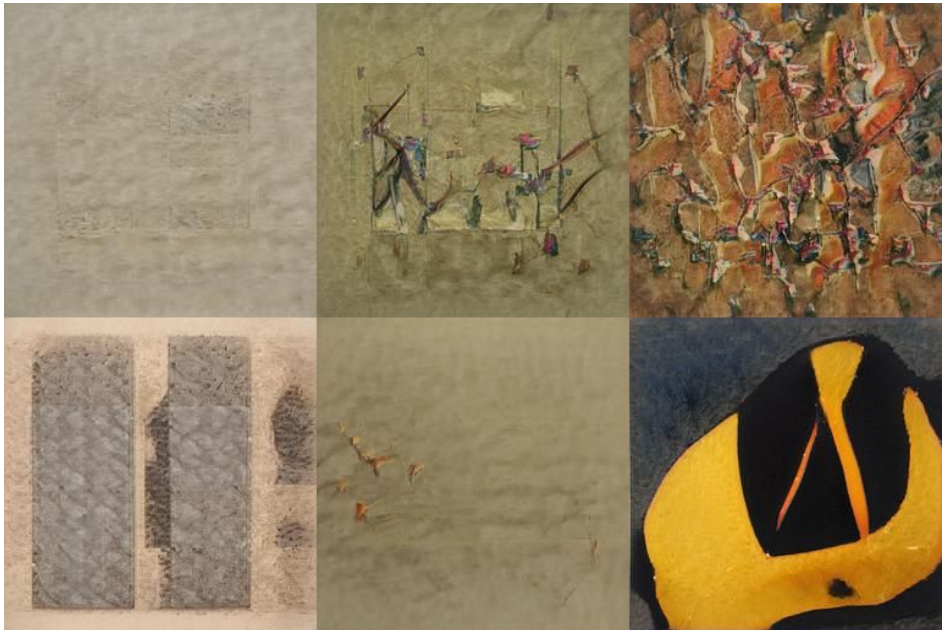
StyleGAN2 generator trained on WikiArt

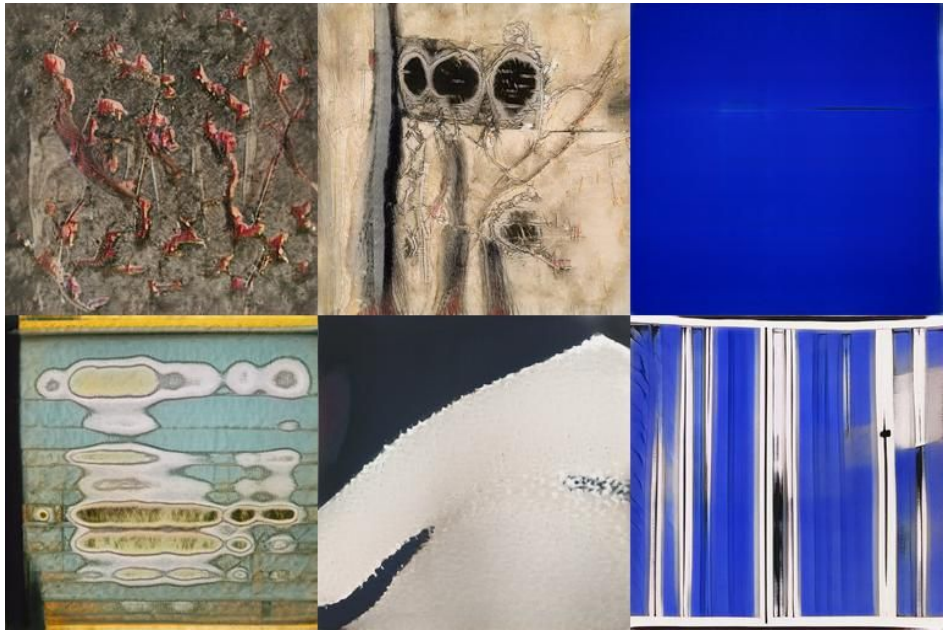
https://github.com/justinpinkney/awesome-pretrained-stylegan2

StyleGAN2 generator trained on Abstract Art

https://github.com/justinpinkney/awesome-pretrained-stylegan2

StyleGAN2 generator trained on Modern Art



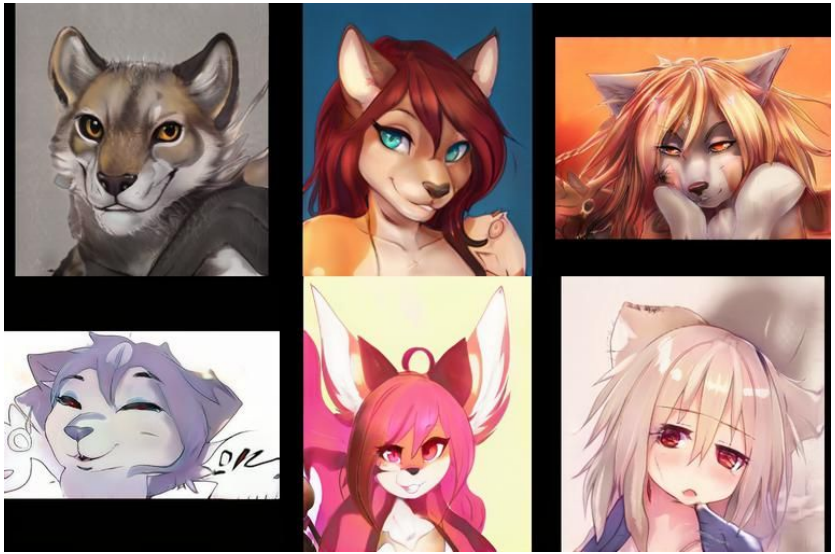


https://github.com/justinpinkney/awesome-pretrained-stylegan2

StyleGAN2 generator trained on Paintings

https://github.com/justinpinkney/awesome-pretrained-stylegan2

Other examples



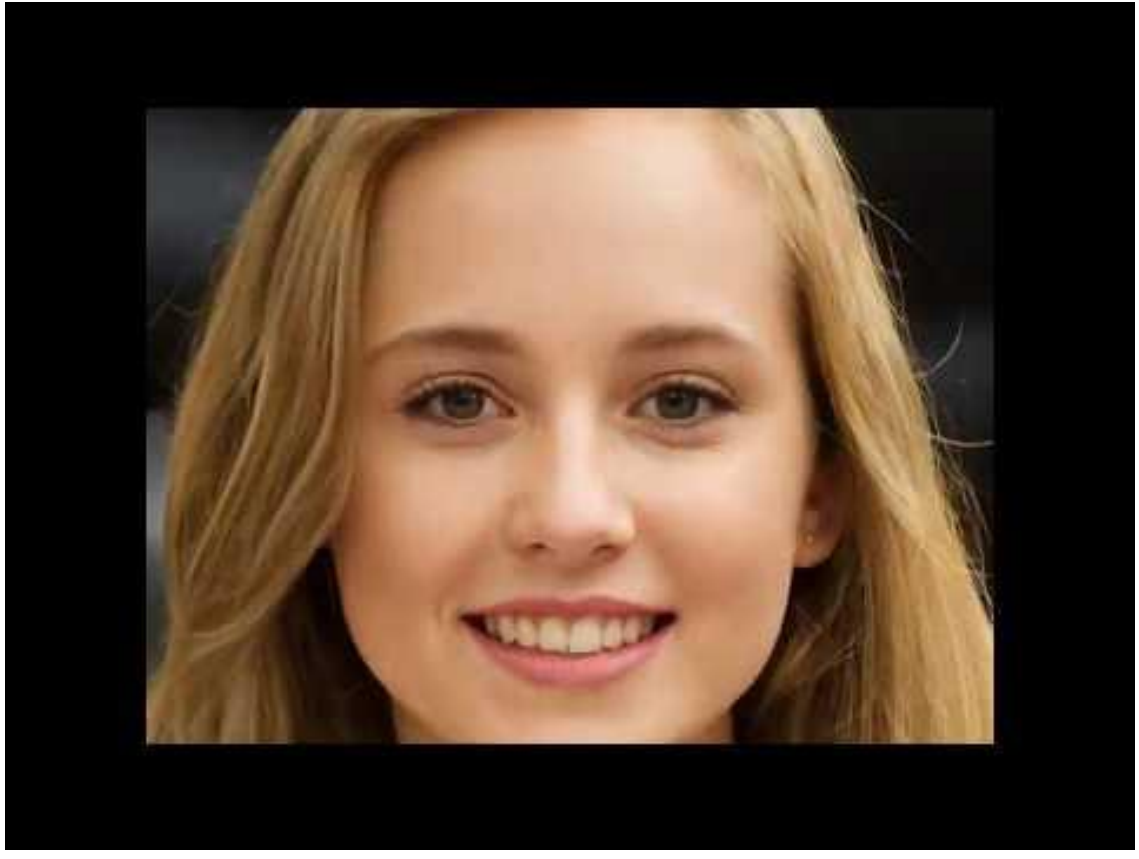
https://github.com/justinpinkney/awesome-pretrained-stylegan2

How to use image generators for art ?
Idea 2: Interpolation

z_1 $(1-t)*z_1 + t*z_2$ for $0 < t < 1$ z_2

Interpolation examples: StyleGAN3 beach

Interpolation examples: StyleGAN2 for faces



Combining the ideas

GANs limitations

- Work well on restricted domains but not so much in the real world
- Only able to imitate the input images
- Are not easily controllable

Style Transfer

Goal: apply the style of one image

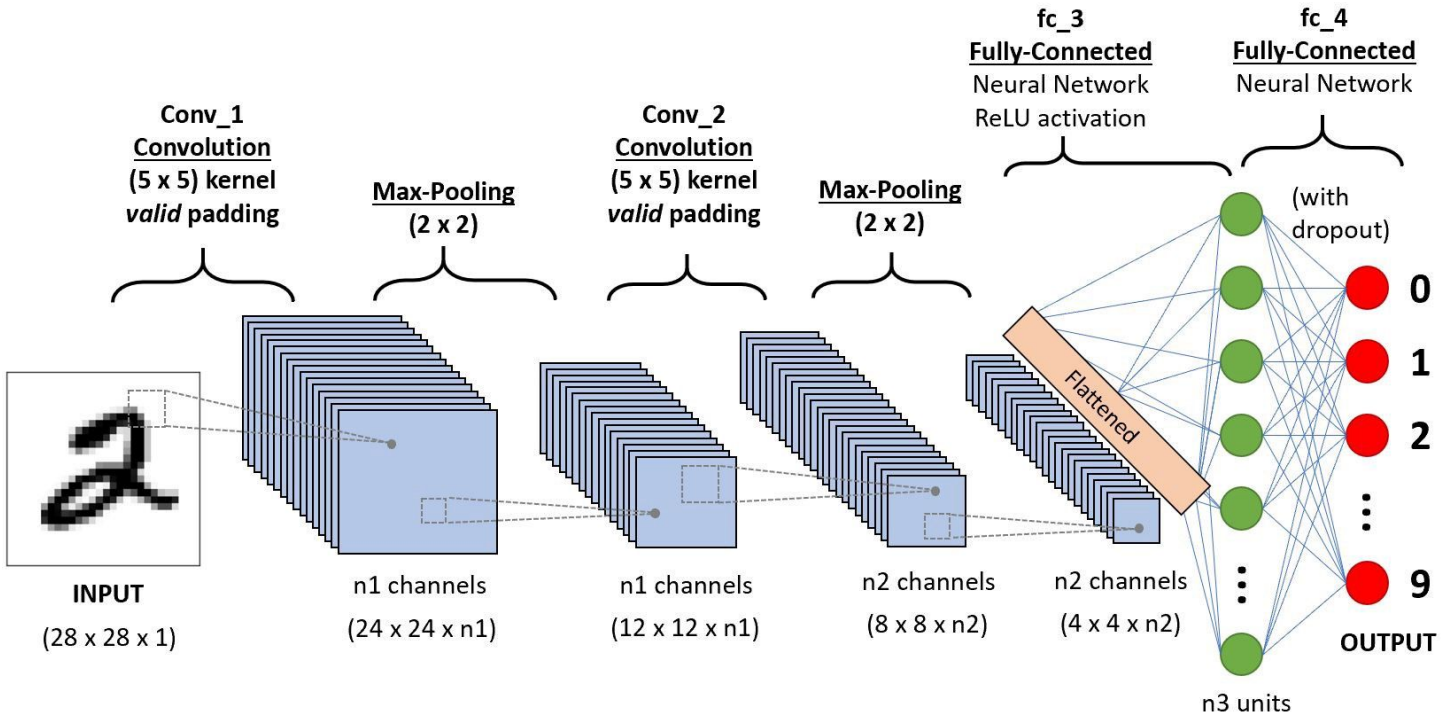
A neural algorithm of Artistic Style, Gatys et al., 2015, https://arxiv.org/abs/1508.06576

Ideas

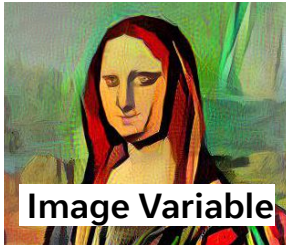
1) We want the high-level image organisation to be that of the original “content” image
2) We want the low-level image statistics to be that of the “style” image

Content Image | Style Image | Result

Deep convolutional neural network



Algorithm for Neural Style Transfer



Updated iteratively with gradient descent

Same high-level content (objects, semantics)

Produce similar low-level statistics (colors, patterns)

A few more examples

From Image to video

Can we apply the same algorithm to each frame of a video ?

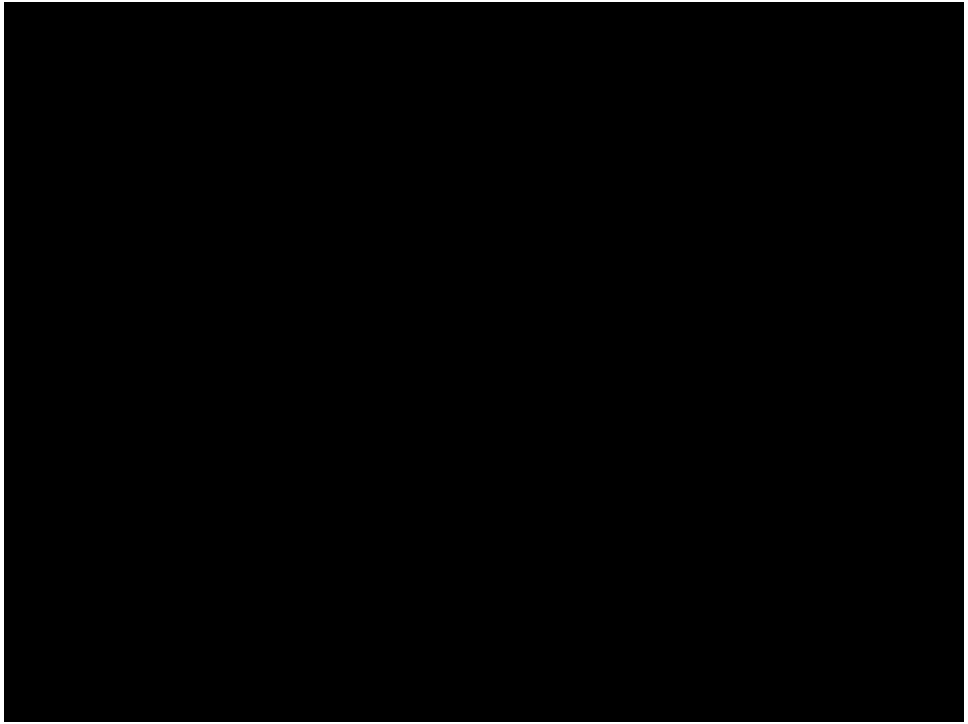


Image to video

We add a constraint that the image a a frame should not be too different from the previously computed image

From Image to Video

Deepdream

https://ai.googleblog.com/2015/06/inceptionism-going-deeper-into-neural.html

Deepdream

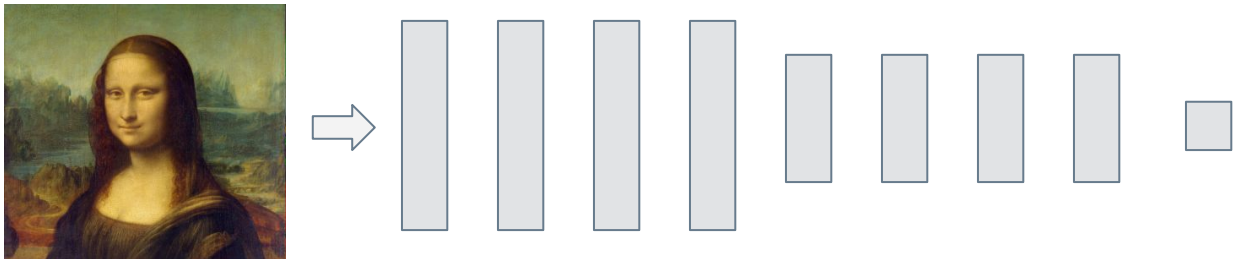
- Algorithm developed by Google Engineer Alexander Mordvintsev

- Question: What do neural networks learn ? What are the different neurons activated by ?

- A visualization tool that produces images that neural networks “like”.

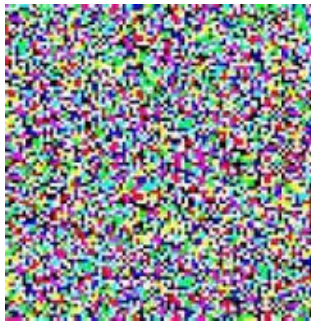
Deepdream

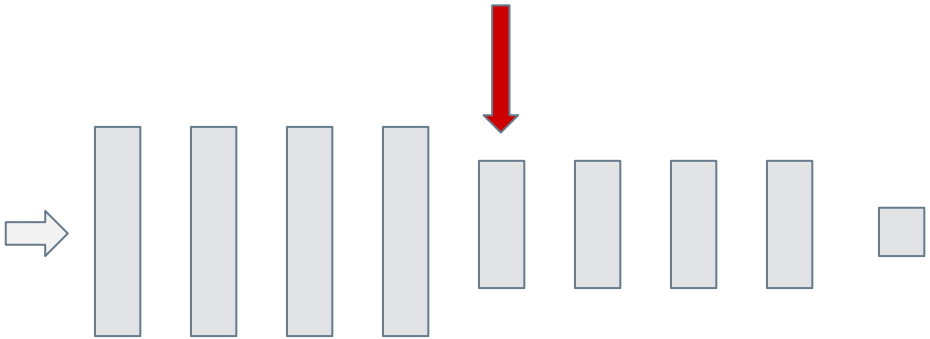
What images activate the neurons in these layers ?



Deepdream

Updated iteratively with gradient descent

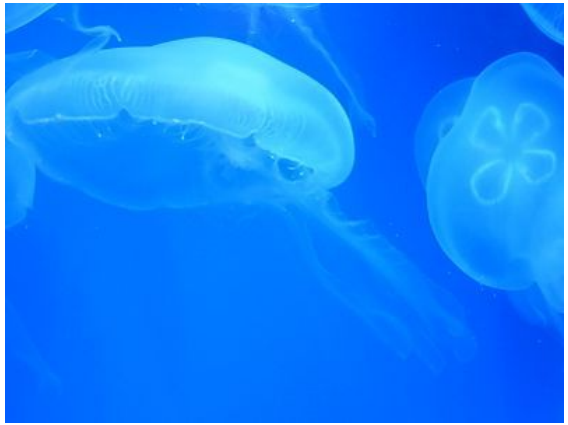




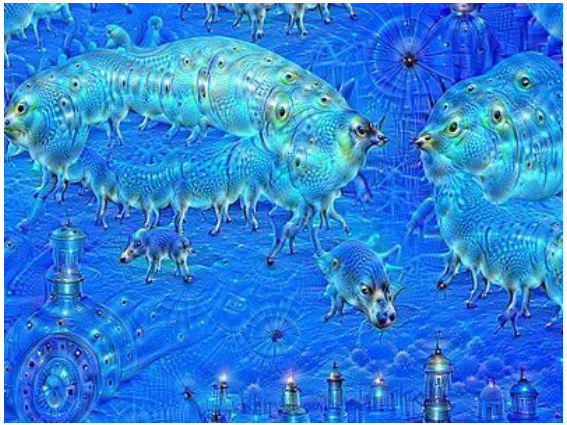
Deepdream

With a network trained to recognize dogs:

Initial Image



10 iterations

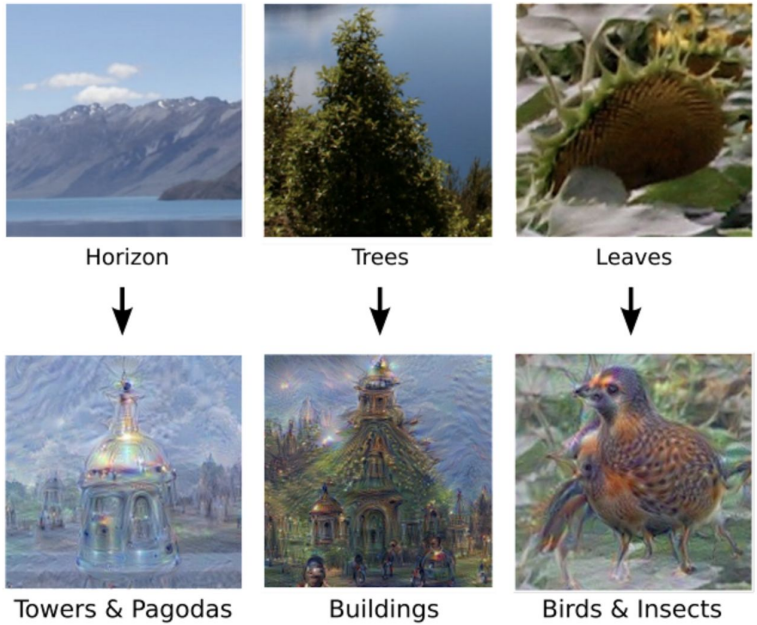


100 iterations

Deepdream video

DeepDream problems

1) The modified images have a typical shape that looks very unrealistic
2) Not very controllable: You can mostly analyze what a neural network do



VQGAN + CLIP

VQGAN + CLIP

We will associate the two ideas presented before:

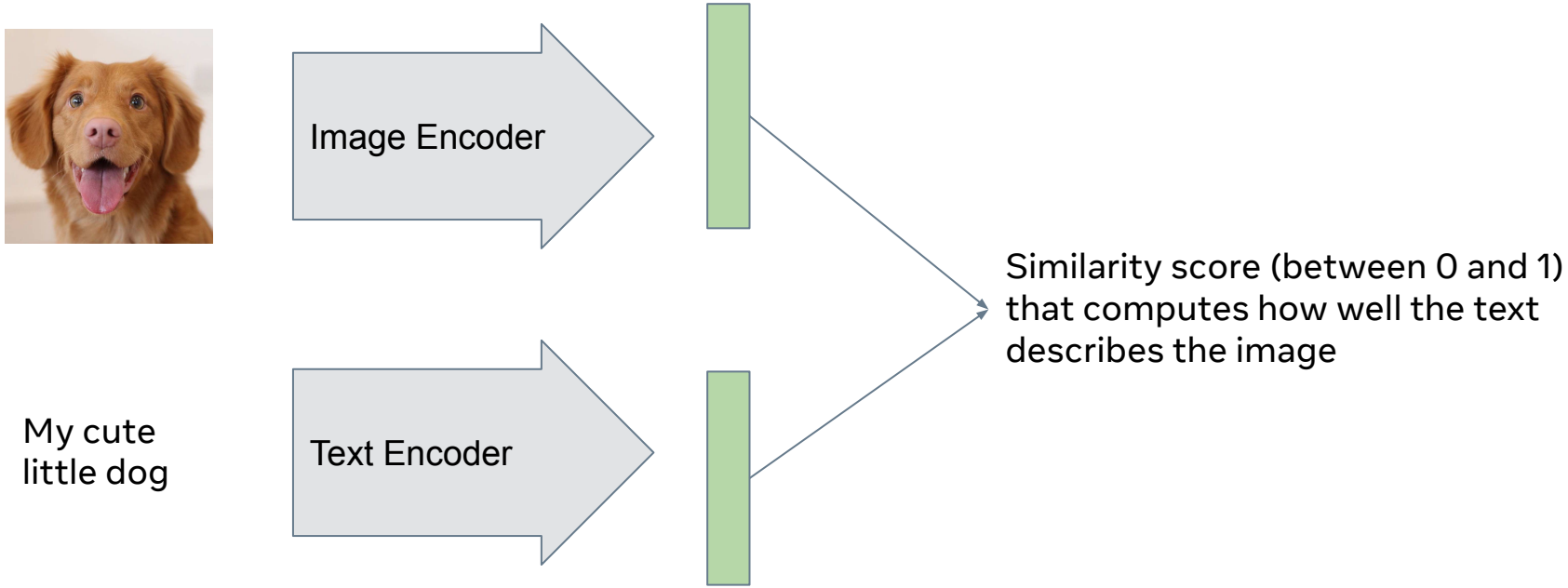
1) We use an image generator which is able to generate realistic images (VQGAN)
2) We will activate the layer of a network that learns semantic concepts

Advantages :

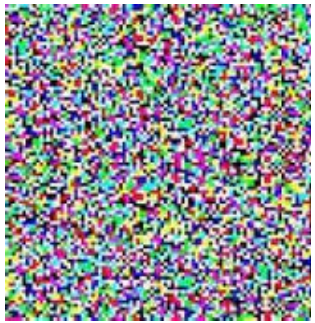
1) More natural Images with less artifacts
2) Controllable via natural language

CLIP

Idea: Learn an algorithm that can match text and images.



How to create an image corresponding to a text prompt



(Updated iteratively with gradient descent)

Image Encoder

Objective: Increase similarity score

Similarity score

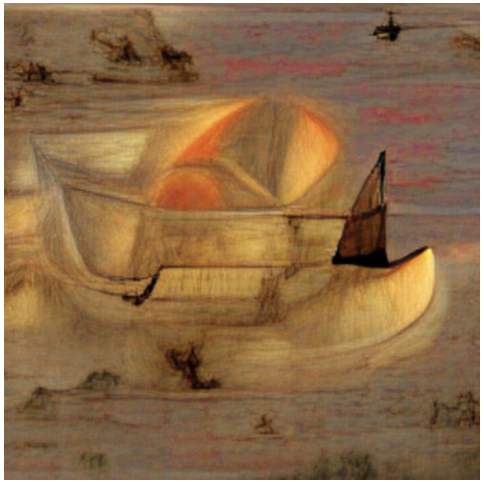
My cute little dog

Text Encoder

Examples

A car in the style of Picasso

Daft Punk street art



A boat at sunset in the style of Leonardo da Vinci

Going to video

- Same as with Neural Style Transfer: apply algorithm to each frame but don’t modify too much from previous frame
- You can also zoom in/out a little bit at each frame

Prompt: “Beautiful Nature”

Another video example

Conclusion

- With GANs, you can generate very realistic images provided that you have a training dataset
  - Artistic usage: By collecting your own dataset you can generate novel images and smoothly interpolate between images

- With Neural Style transfer, you can transfer the appearance (colors and textures) of an image to another image
  - Artistic usage: you can focus on creating a high-level artwork and fill in the details automatically from another image

- With Deepdream, you can create trippy versions of images by adding hallucinated content.
  - Artistic usage: Producing a variety of content with a unique “AI” texture

- With VQGAN + CLIP, you can create images that satisfy a given text prompt
  - Artistic usage: Endless combinations of concepts and styles to explore

Thank you
Questions ?

FACEBOOK AI

Schubert's Unfinished Symphony no8, powered by Huawei AI at Cadogan Hall, London (Finale part only)

Anakiin_EU 2 years ago (edited)

This doesn't sound like Schubert at all... Huawei ruined a timeless masterpiece

15 REPLY

peter owen 2 years ago

Schubert????????????????? My arse!

15 REPLY

View reply from Elise Quevedo

xiaoming 2 years ago

wondering if this orchestra is full of robots

3 REPLY