



Deep Learning for Image Compression

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 - A. SRGAN
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Introduction to the project and its tasks

Our Goal : Provide information through slow networks

(ie. mobile networks in developing countries)

- Find a way to have a better image compression

Using Prediction, Colorization and Super Resolution to achieve it.

SRGAN

Generative Adversarial Networks (GANs): Engine and Applications (2017)

Anton Karazeev on <https://blog.statsbot.co/generative-adversarial-networks-gans-engine-and-applications-f96291965b47>

Photo-Realistic Single Image Super-Resolution Using a Generative Adversarial Network (2017)

Christian Ledig, Lucas Theis, Ferenc Huszar, Jose Caballero, Andrew Cunningham, Alejandro Acosta, Andrew Aitken, Alykhan Tejani, Johannes Totz, Zehan Wang, Wenzhe Shi Twitter

What is a Super Resolution?



Figure 1: Low resolution image.

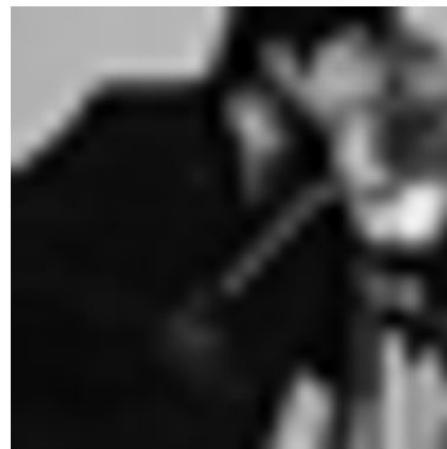
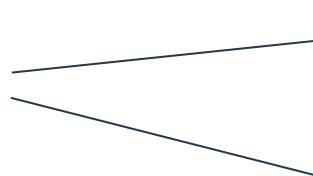
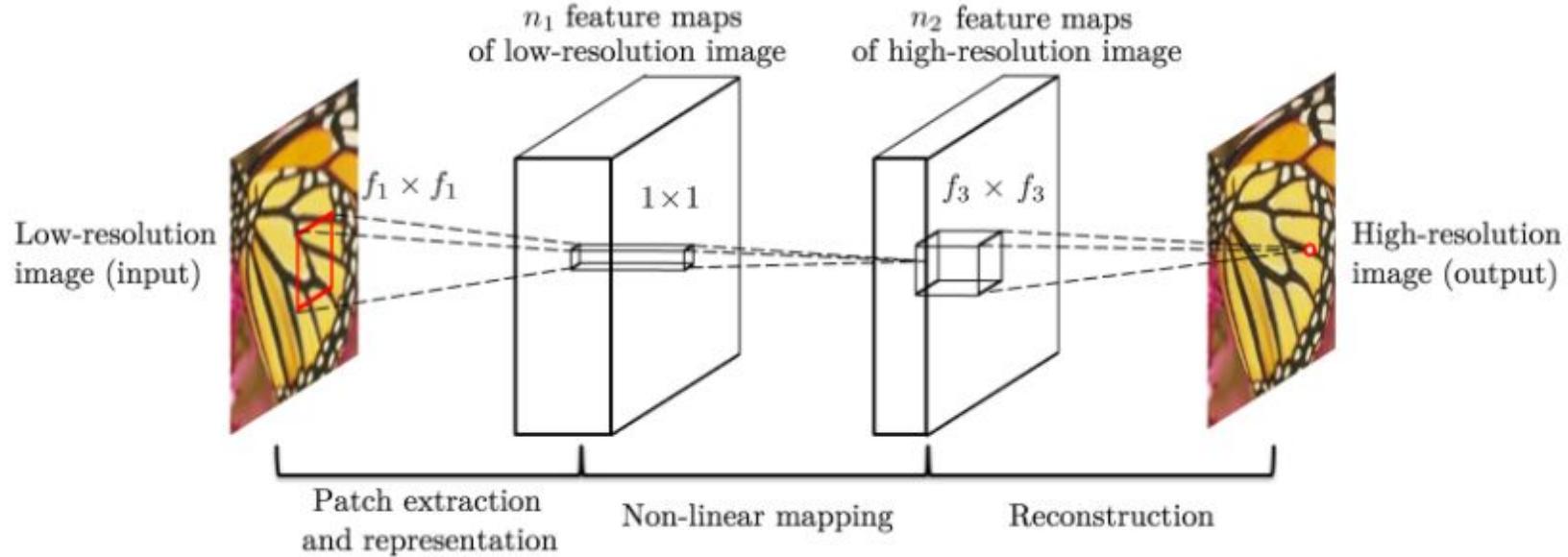


Figure 2: Interpolated low resolution image.

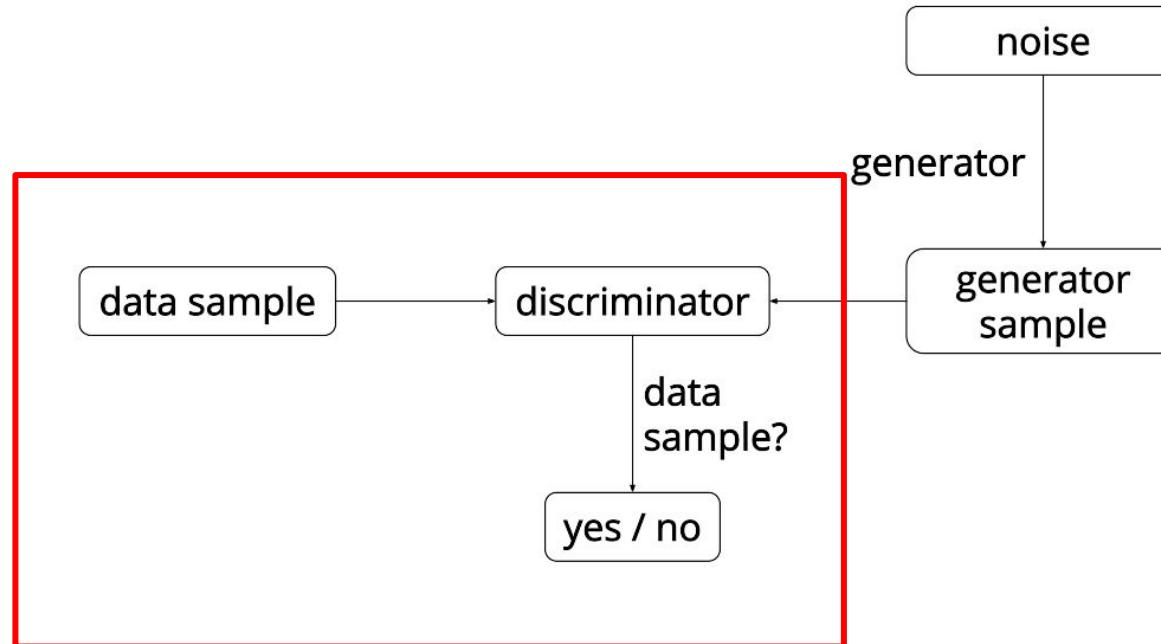


Figure 3: High resolution image

SRCNN?

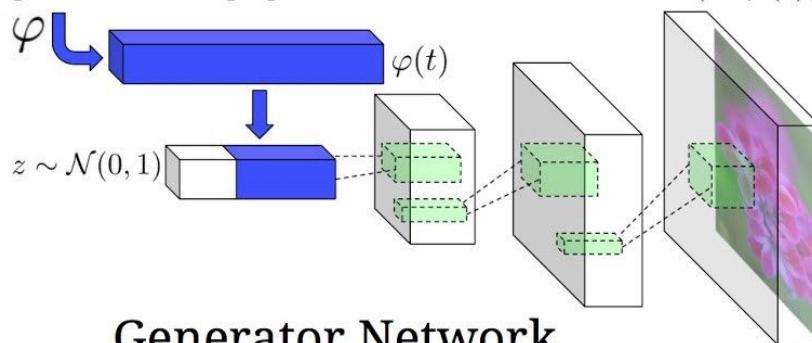


What is a GAN?



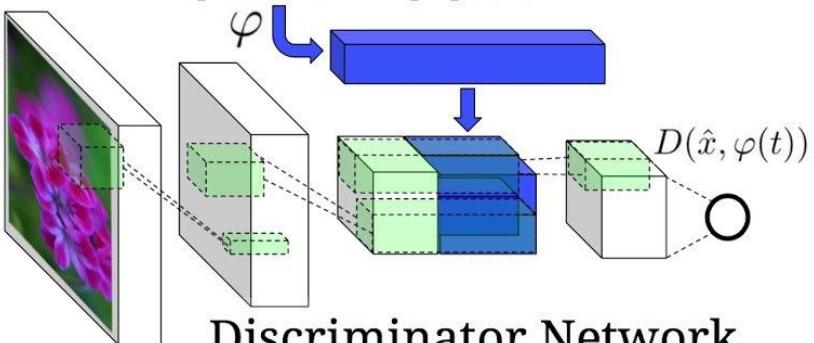
What is a GAN?

This flower has small, round violet petals with a dark purple center



Generator Network

This flower has small, round violet petals with a dark purple center



Discriminator Network

SRGAN

Implementation of "*Photo-Realistic Single Image Super-Resolution Using a Generative Adversarial Network*"

<https://arxiv.org/abs/1609.04802>

Zsdonghao

- Generator 36 Layers
- Discriminator 7 Layers

Training on Div2k (800 professional pictures)

Brade

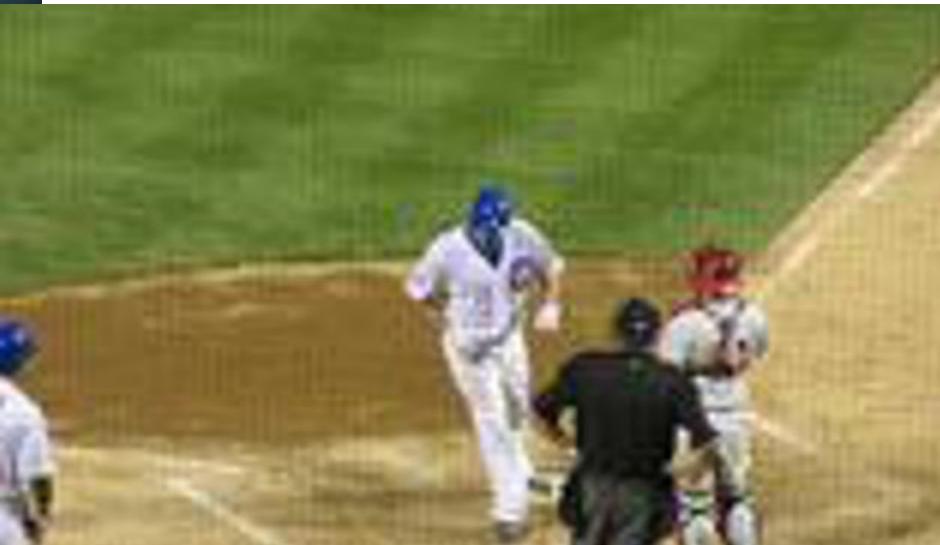
Pre-trained: RAISE Dataset (8156 high quality pictures)

Our: Training only on B&W faces (1520 small amateur pictures)

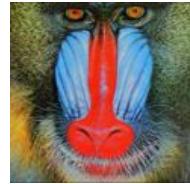
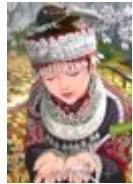
Zsdonghao



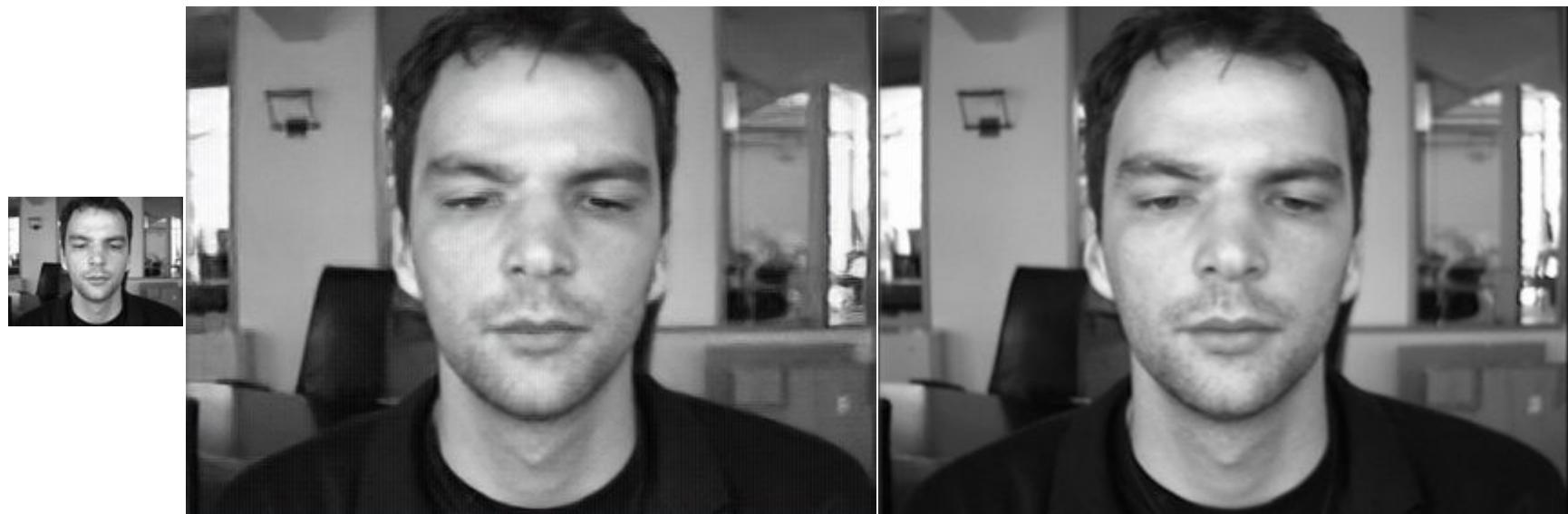




Brade's pre-trained model

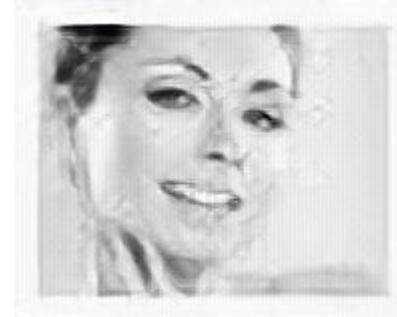


Our training (B&W faces)





2KB
50x40 px



60KB
200x160 px



Prediction

Generative Adversarial Networks (GANs): Engine and Applications (2017)

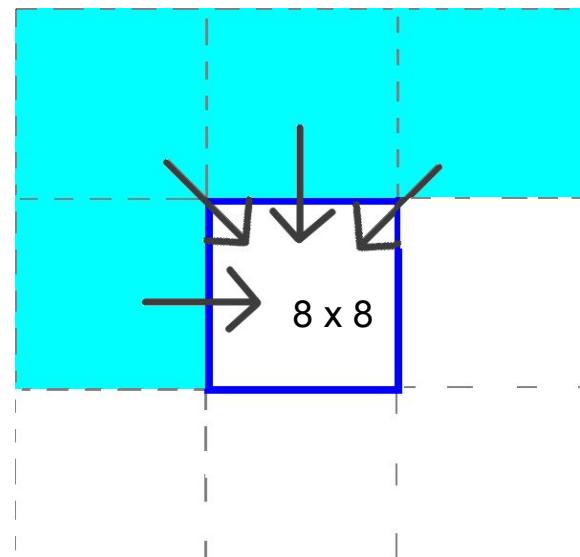
Anton Karazeev on <https://blog.statsbot.co/generative-adversarial-networks-gans-engine-and-applications-f96291965b47>

BPG Image format (2014)

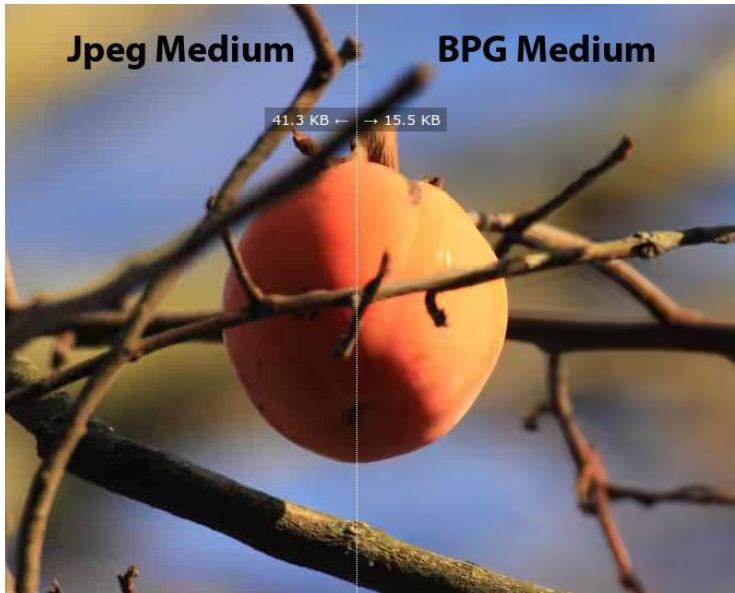
Fabrice Bellard on <https://bellard.org/bpg/>

Block per block prediction

- Network structure:
 - Inputs: the previous blocks (in blue)
 - Labels: block we want to predict
 - Output: predicted block
- We wrote: a script which divide images in blocks for the network's input
- Now: we just have to configure the SRGAN to include the prediction feature



BPG - (Better Portable Graphics)



- Invented by Fabrice Bellard in 2014
- The best current image compression standard
 - High compression ratio and low distortion.
 - Files are much smaller than JPEG for similar quality.
- A subset of the HEVC video compression standard
- Prediction for encode the downsized image

Colorization

Multiple hypothesis colorization and its application to image compression
Mohammad Haris Baig, Lorenzo Torresani

Colorful Image Colorization
Richard Zhang, Phillip Isola, Alexei A. Efros

Objective of the colorization



Original



Grayscale image

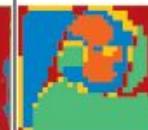
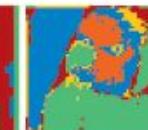
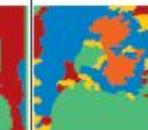


Recolorized image

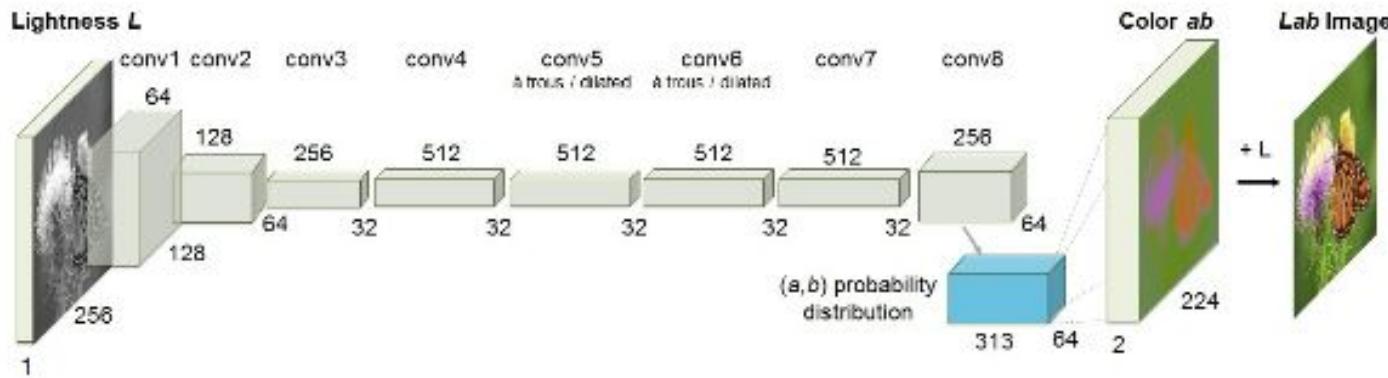
Low-cost colorization

- Input: grayscale image + some colors of the image
- Colorize hyperpixel created with segmentation using a 5-branch tree



Image	Oracle	Grid		Segmentation	
		Small	Large	Small	Large
		137	419	152	601
					

Zero-cost colorization



- Goal : Having realistic colors from a grayscale image
- Trained on more than 1 million images

Final result



Original

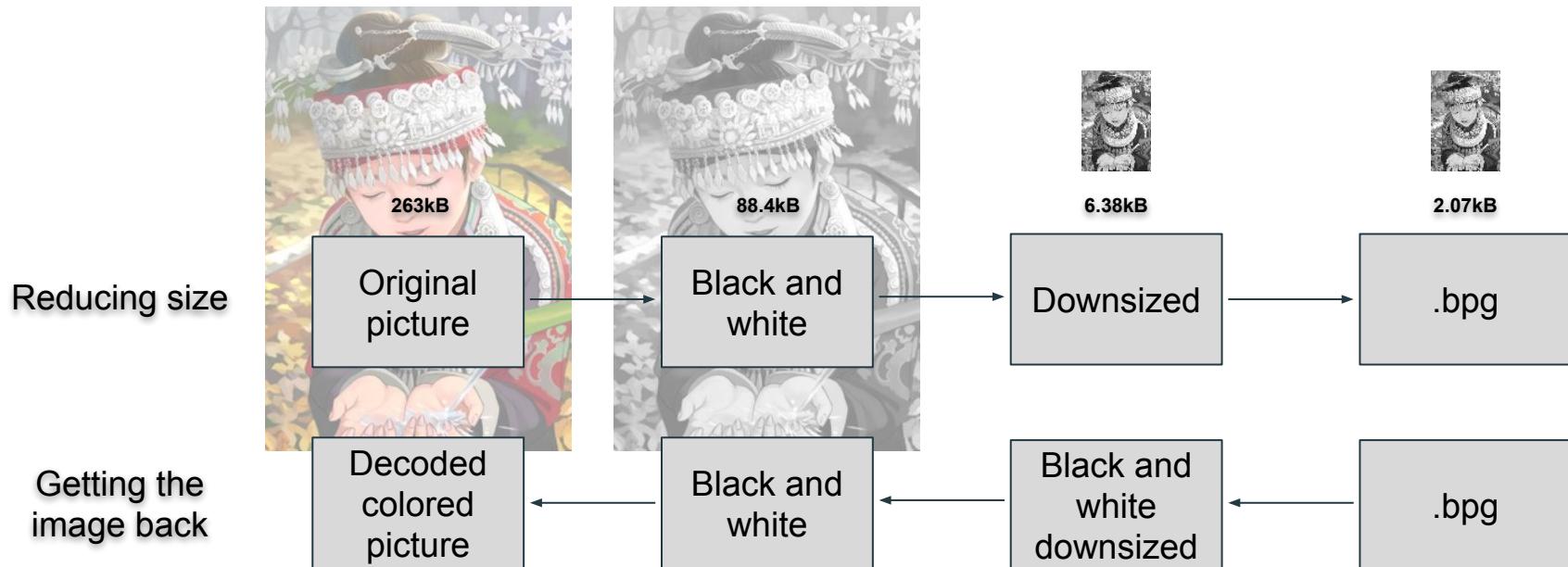


Recolorized



The final pipeline

Outline of the pipeline

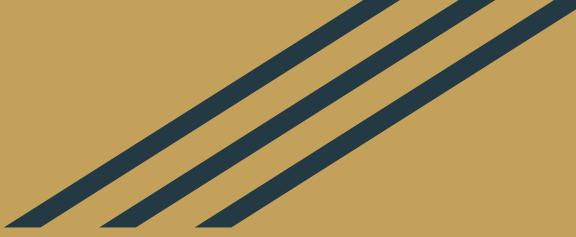








Demonstration



Finally, now what?

Today's limits

- Size of the trained neural networks (~300MB each) for a cell phone usage.
- Not applicable to artistic pictures (integrity not respected) for now.

Future possible leads

- Dataset more diverse to get better results?
- Downsize the height and width 2 times (instead of 4).
- Improve downsize (using convolution for example).