SemaFor: UNINA Subteam

Luisa Verdoliva, Giovanni Poggi
Image Processing Research Group (GRIP)
University Federico II of Naples
Naples, ITALY

High-level Description

- We applied a supervised learning-based approach:

    - CNN architecture: Resnet50 where we avoid down-sampling after the first convolutional layer and pooling

    - Two relevant augmentation operations:
        - a blurring operation applied with a probability of 50% and σ in [0.0, 3.0],
        - a JPEG compression applied with a probability of 50% and QF in [30, 100].

    - Input data analysis: Cropped patches during training, whole image in test (no resizing)

    - https://github.com/grip-unina/GANimageDetection

[1] Gragnaniello et al. "Are GAN generated images easy to detect? A critical analysis of the state-of-the-art" IEEE ICME 2021

Training dataset (1)

- We use the ProGAN training-set provided in [2] with:
  - 362K real images extracted from the LSUN dataset, and
  - 362K generated images obtained by 20 ProGAN models (each trained on a different LSUN object category).
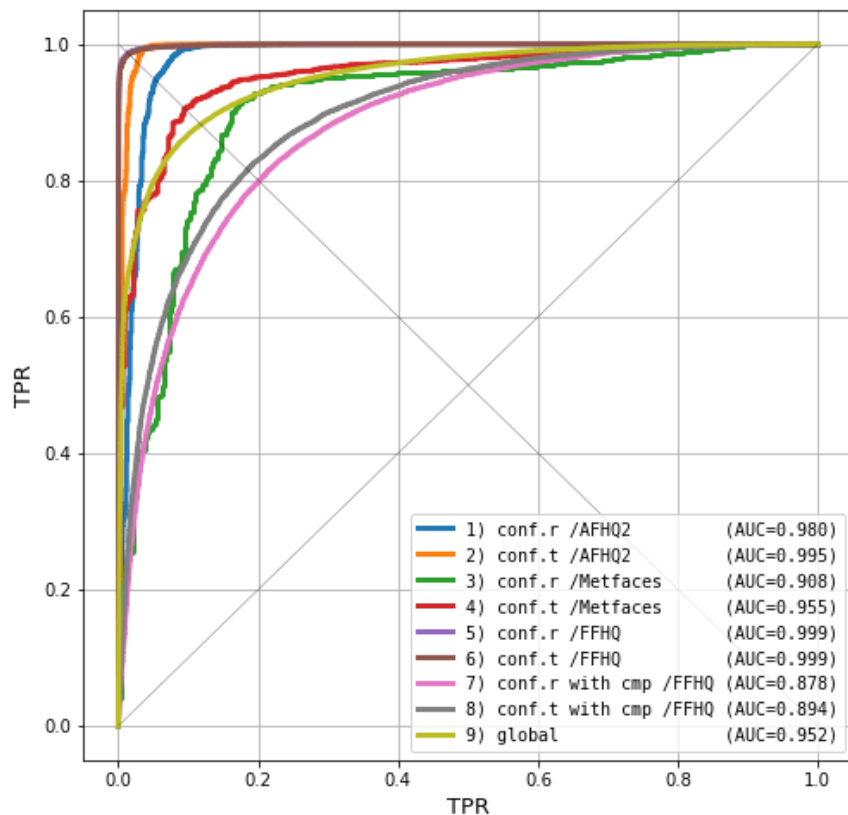
Real

Fake

[2] Wang et al. "CNN-generated images are surprisingly easy to spot...for now" IEEE CVPR, 2020
https://github.com/peterwang512/CNNDetection

Results using ProGAN training-set
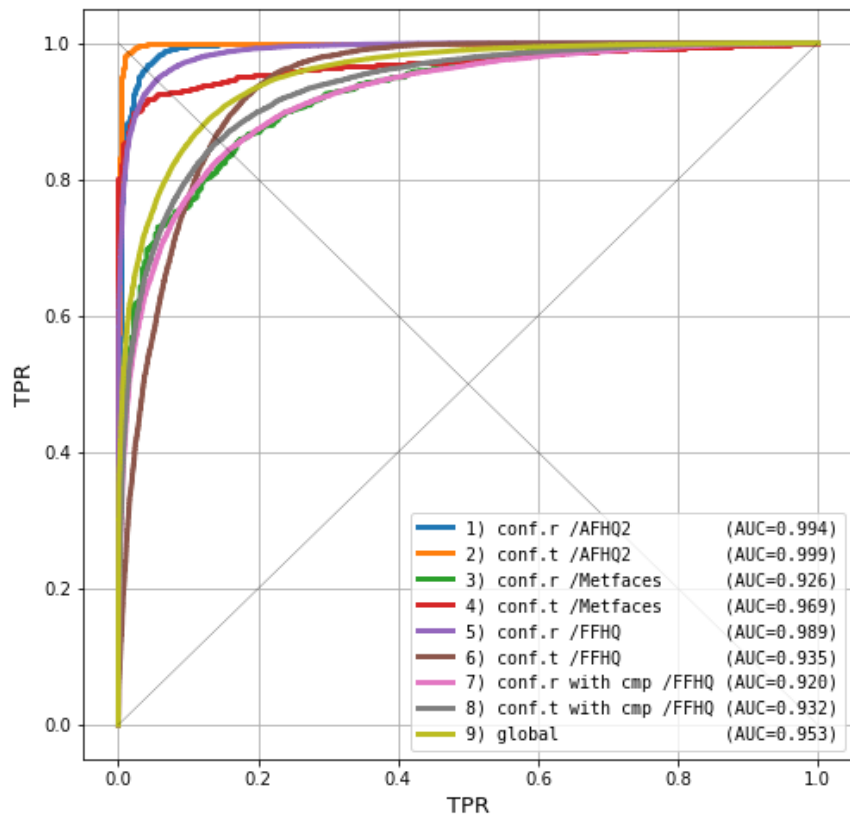
Training dataset (2)

- We extended the training-set including also StyleGAN2 images (we did not use images reported in the blacklists):
  - 720K images generated by 23 StyleGAN2 models [3].
  - real images from different public datasets reported in the following table:

Dataset	Image Size	#Images	Dataset	Image Size	#Images
LSUN cat	256x256	120000	AFHQ2 dog	512x512	4700
LSUN church	256x256	120000	AFHQ2 wild	512x512	4700
LSUN hourse	256x256	120000	AnimalWeb	512x512	14100
LSUN car	512x512	120000	BreCaHAD	512x512	1800
AFHQ2 cat	512x512	4700	FFHQ-U	1024x1024	28800
			MetFaces-U	1024x1024	14100

[3] Synthetic StyleGAN2 images
http://www.grip.unina.it/download/gan_detection_training/

Results using ProGAN/StyleGAN2 training-set

Legend:
1) conf.r /AFHQ2 (AUC=0.994)
2) conf.t /AFHQ2 (AUC=0.999)
3) conf.r /Metfaces (AUC=0.926)
4) conf.t /Metfaces (AUC=0.969)
5) conf.r /FFHQ (AUC=0.989)
6) conf.t /FFHQ (AUC=0.935)
7) conf.r with cmp /FFHQ (AUC=0.920)
8) conf.t with cmp /FFHQ (AUC=0.932)
9) global (AUC=0.953)

Test set

- **conf. r / AFHQ2**: afhq-v2-test vs StyleGAN3_r_afhqv2
- **conf. t / AFHQ2**: afhq-v2-test vs StyleGAN3 _t_afhqv2
- **conf. r / Metfaces**: Metfaces-in-the-wild-test vs StyleGAN3 _r_metfacesu
- **conf. t / Metfaces**: Metfaces-in-the-wild-test vs StyleGAN3 _t_metfacesu
- **conf. r / FFHQ**: FFHQ-in-the-wild-20k vs StyleGAN3 _r_no_compression
- **conf. t / FFHQ**: FFHQ-in-the-wild-20k vs StyleGAN3 _t_no_compression
- **conf. r with cmp/ FFHQ**: FFHQ-in-the-wild-20k vs StyleGAN3 _r_compression
- **conf. t with cmp/ FFHQ**: FFHQ-in-the-wild-20k vs StyleGAN3_t_compression
- **global**: all data mixed together