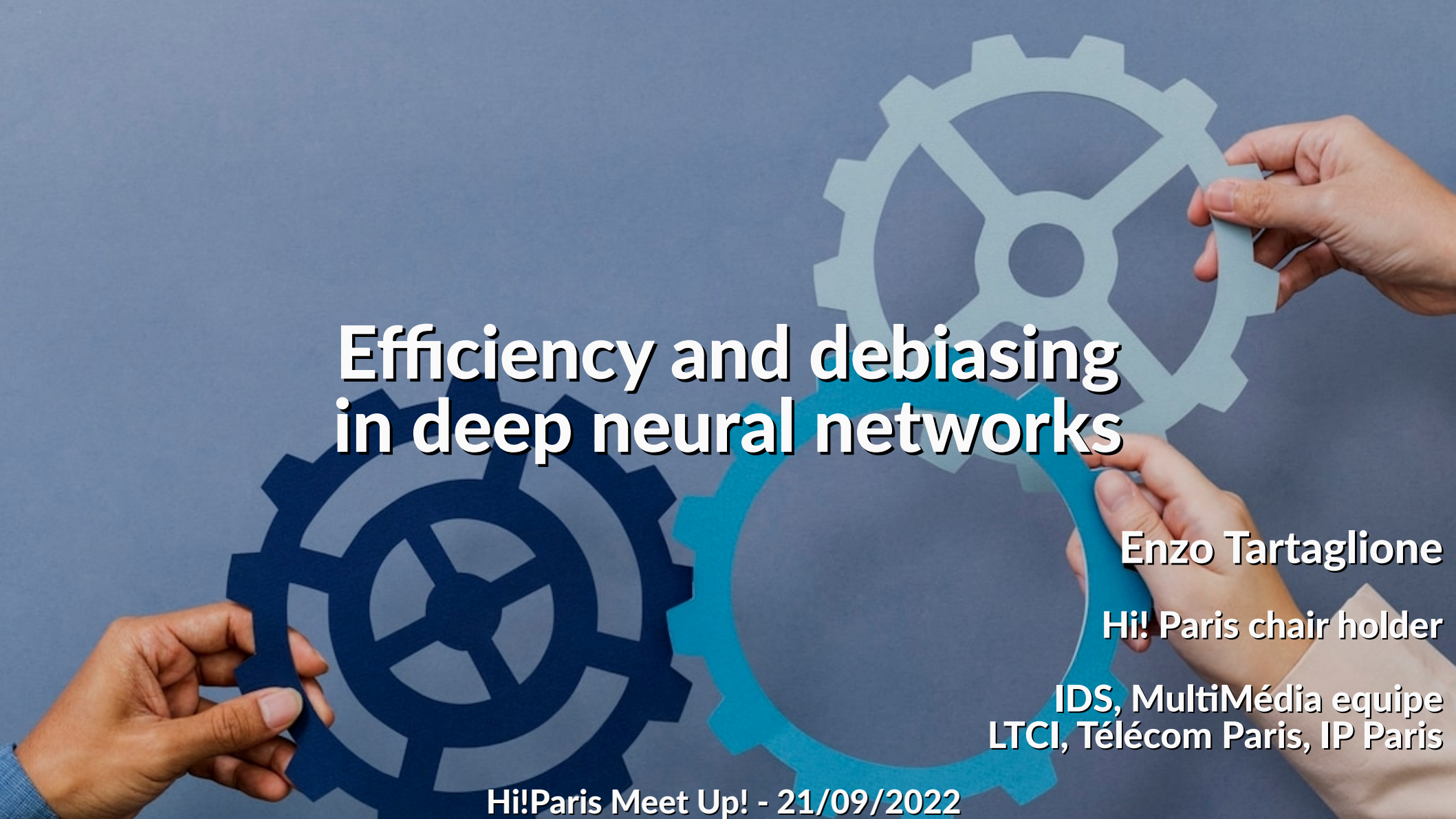


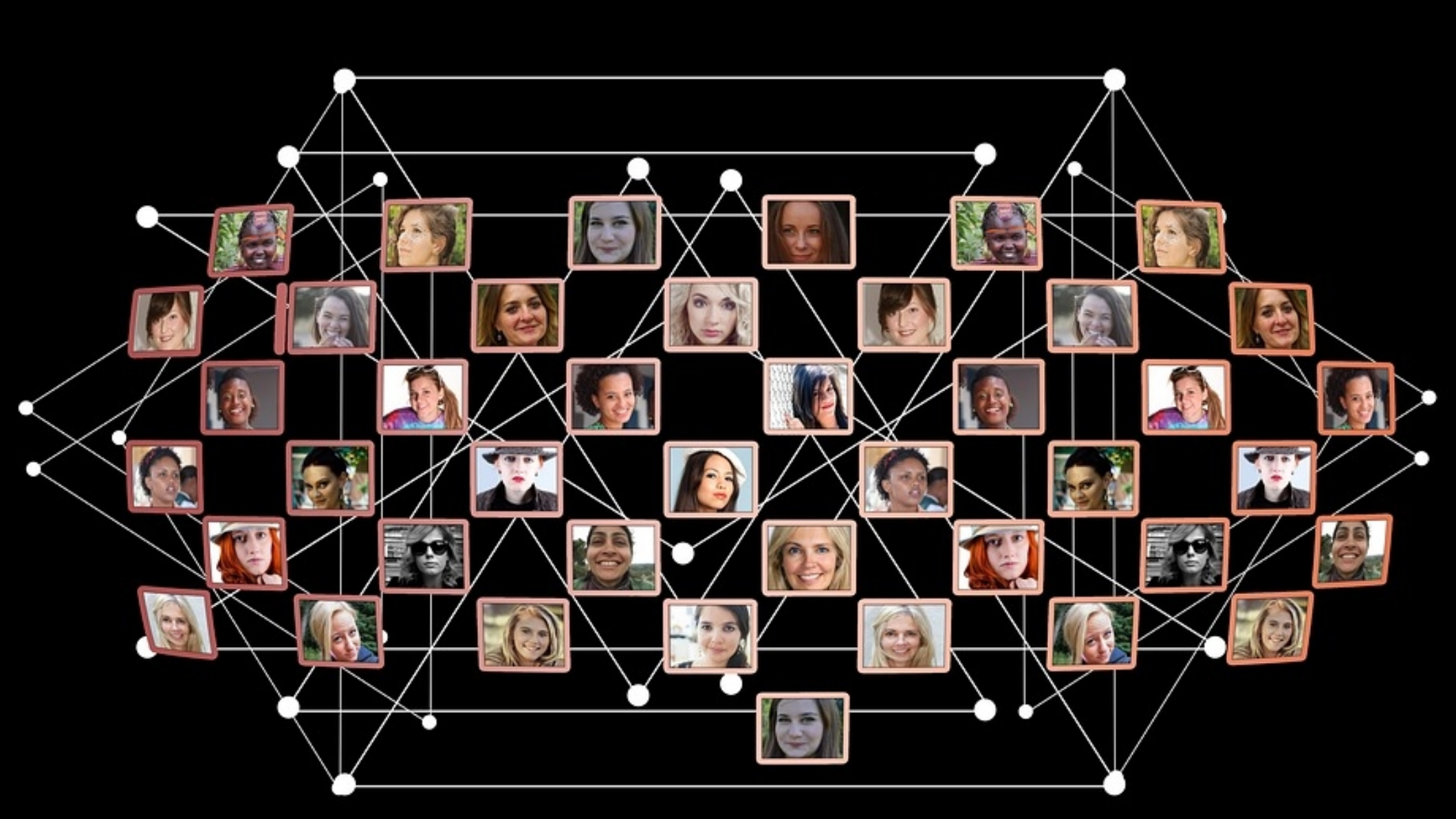
Efficiency and debiasing in deep neural networks

Enzo Tartaglione

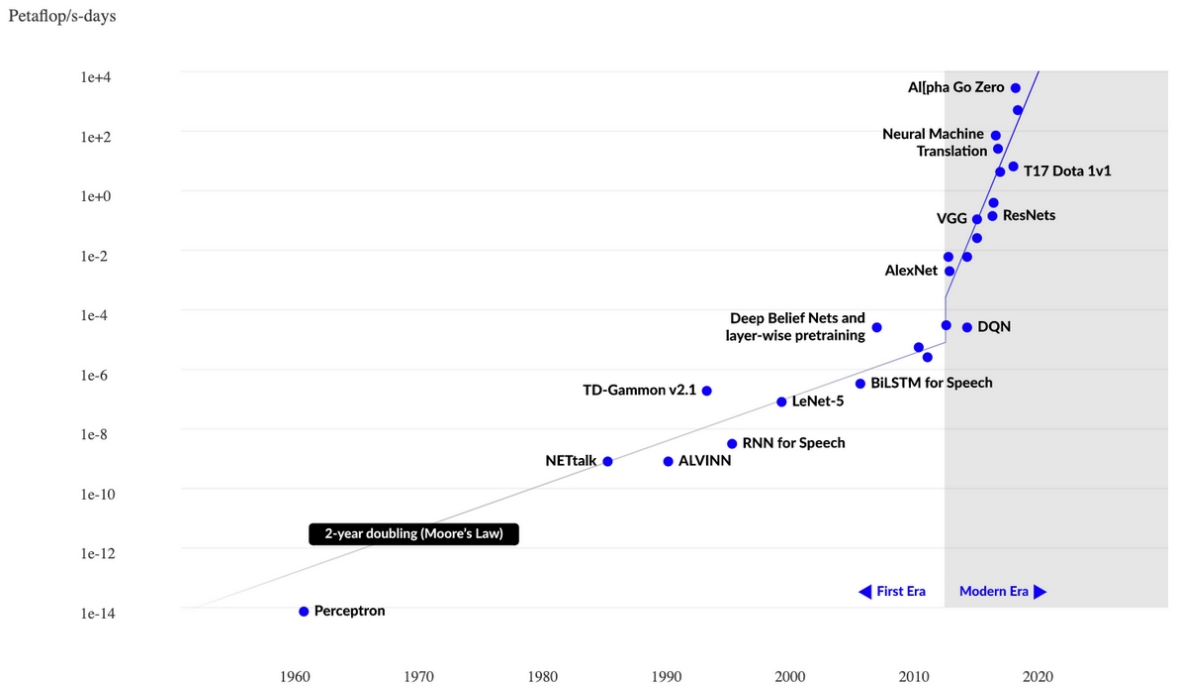
Hi! Paris chair holder

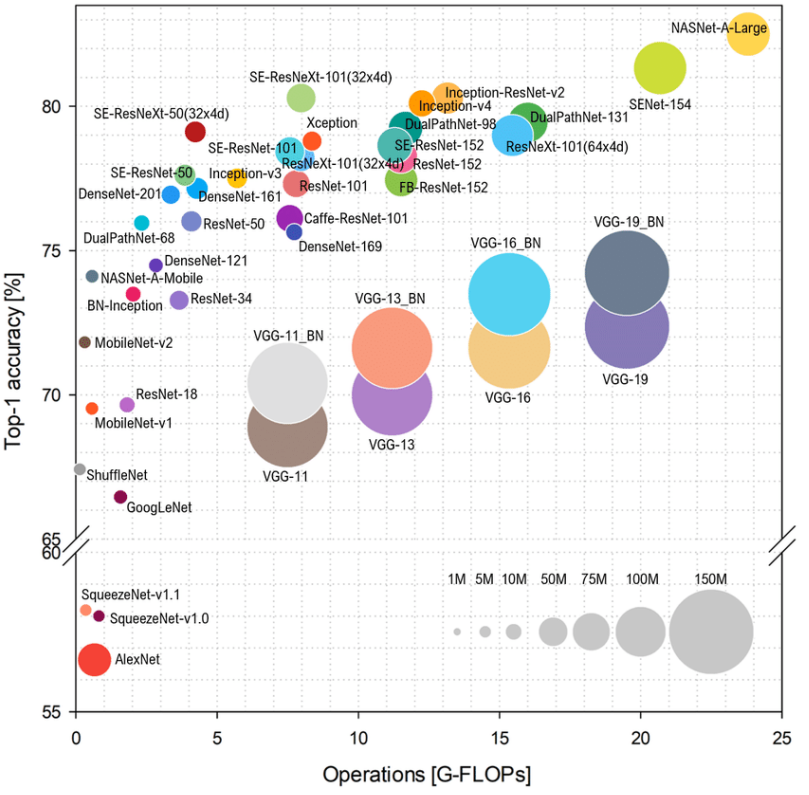
IDS, MultiMédia equipe
LTCI, Télécom Paris, IP Paris

Hi!Paris Meet Up! - 21/09/2022



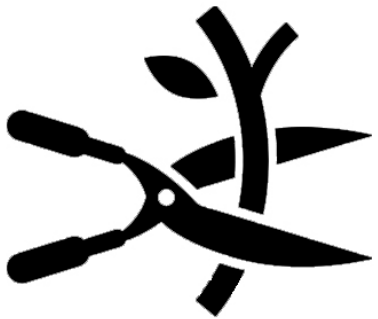

Compression





Left image from https://github.com/EIDOSLAB/ICIAP2021-T7-pruning
Right image from Bianco, Simone et al. Benchmark Analysis of Representative Deep Neural Network Architectures. IEEE Access. 6. 64270-64277. 10.1109/ACCESS.2018.2877890. (2018)

Sensitivity-based pruning



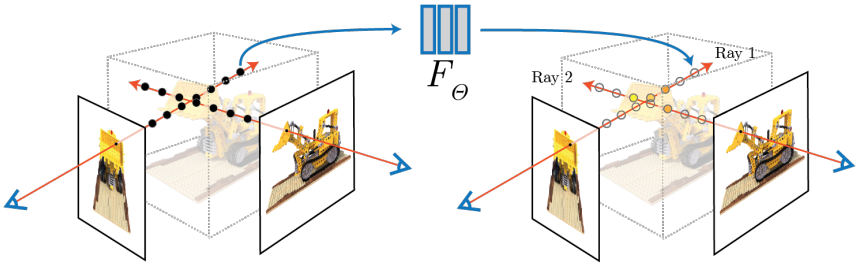
Not all the tiny branches are irrelevant.

We need to evaluate how much the pruning of a branch impacts on the performance of the model.

While training, we favor solutions where the trained neural network can be pruned the most.

Tartaglione, E. et al. Learning sparse neural networks via sensitivity-driven regularization. **NeurIPS (2018)**.
Bragagnolo, A. et al. "To update or not to update? Neurons at equilibrium in deep models." **NeurIPS (2022)**.
Tartaglione, E., et al. Loss-based sensitivity regularization: towards deep sparse neural networks. Neural Networks, 146, 230-237 (2022).
Tartaglione, E., et al. "Serene: Sensitivity-based regularization of neurons for structured sparsity in neural networks." IEEE Transactions on Neural Networks and Learning Systems (2021).

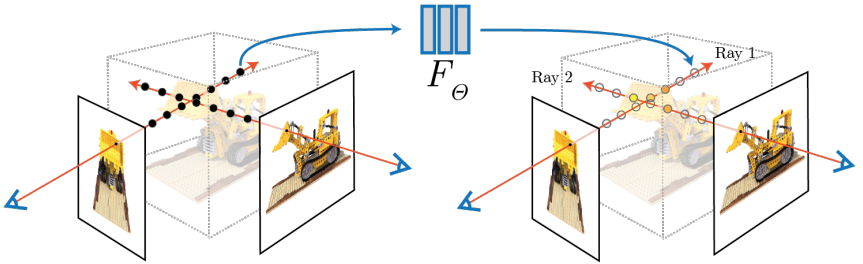
Some results on NeRF



Approach	Compress	Synthetic-NeRF PSNR [dB](↑)	Synthetic-NeRF SSIM (↑)	Synthetic-NeRF Size [MB](↓)	Synthetic-NSVF PSNR [dB](↑)	Synthetic-NSVF SSIM (↑)	Synthetic-NSVF Size [MB](↓)	Tanks&Temples PSNR [dB](↑)	Tanks&Temples SSIM (↑)	Tanks&Temples Size [MB](↓)
DVGO	-	31.92	0.957	160.09	35.42	0.979	104.12	28.26	0.909	106.48
	LOW	31.47	0.952	3.99	35.29	0.974	4.37	28.22	0.910	4.69
	HIGH	31.08	0.944	2.00	34.90	0.969	2.46	27.90	0.894	1.62
TensoRF	-	33.14	0.963	69.26	36.52	0.982	69.05	28.56	0.920	64.04
	LOW	33.26	0.962	11.47	36.44	0.982	11.60	28.50	0.916	9.99
	HIGH	32.81	0.956	7.94	36.14	0.978	8.52	28.24	0.907	6.70
Plenoxels	-	31.48	0.956	189.08	-	-	-	27.37	0.904	147.96
	LOW	31.52	0.952	91.77	-	-	-	27.66	0.909	102.26
	HIGH	30.97	0.944	54.68	-	-	-	27.34	0.896	85.47

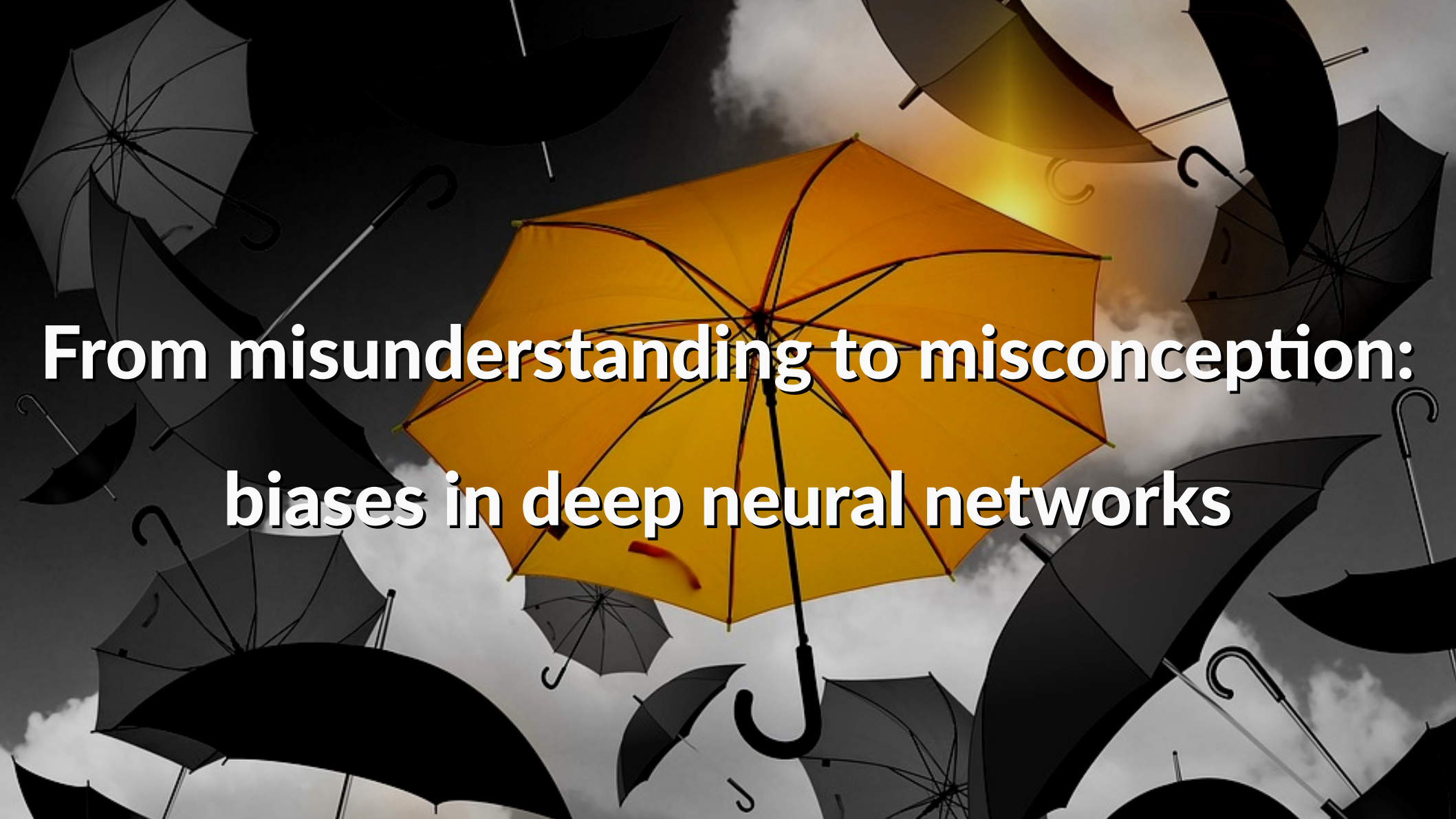
Deng, Chenxi and Tartaglione, Enzo. Compressing explicit voxel girid representations: fast NeRFs become also small. (2022)
Up-left image from Mildenhall, Ben et al. “NeRF: Representing Scenes as Neural Radiance Fields for View Synthesis.” ECCV (2020).

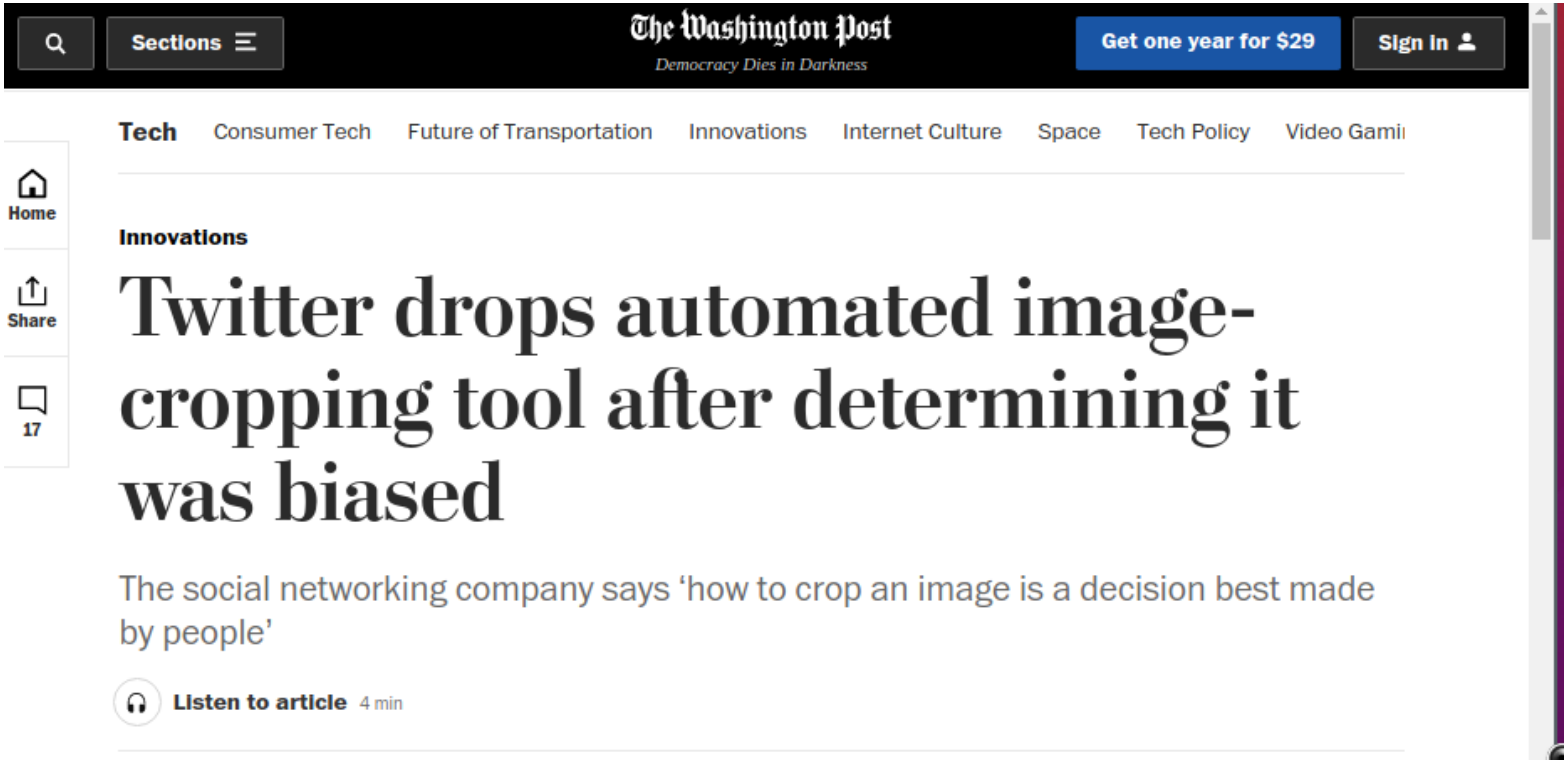
Some results on NeRF

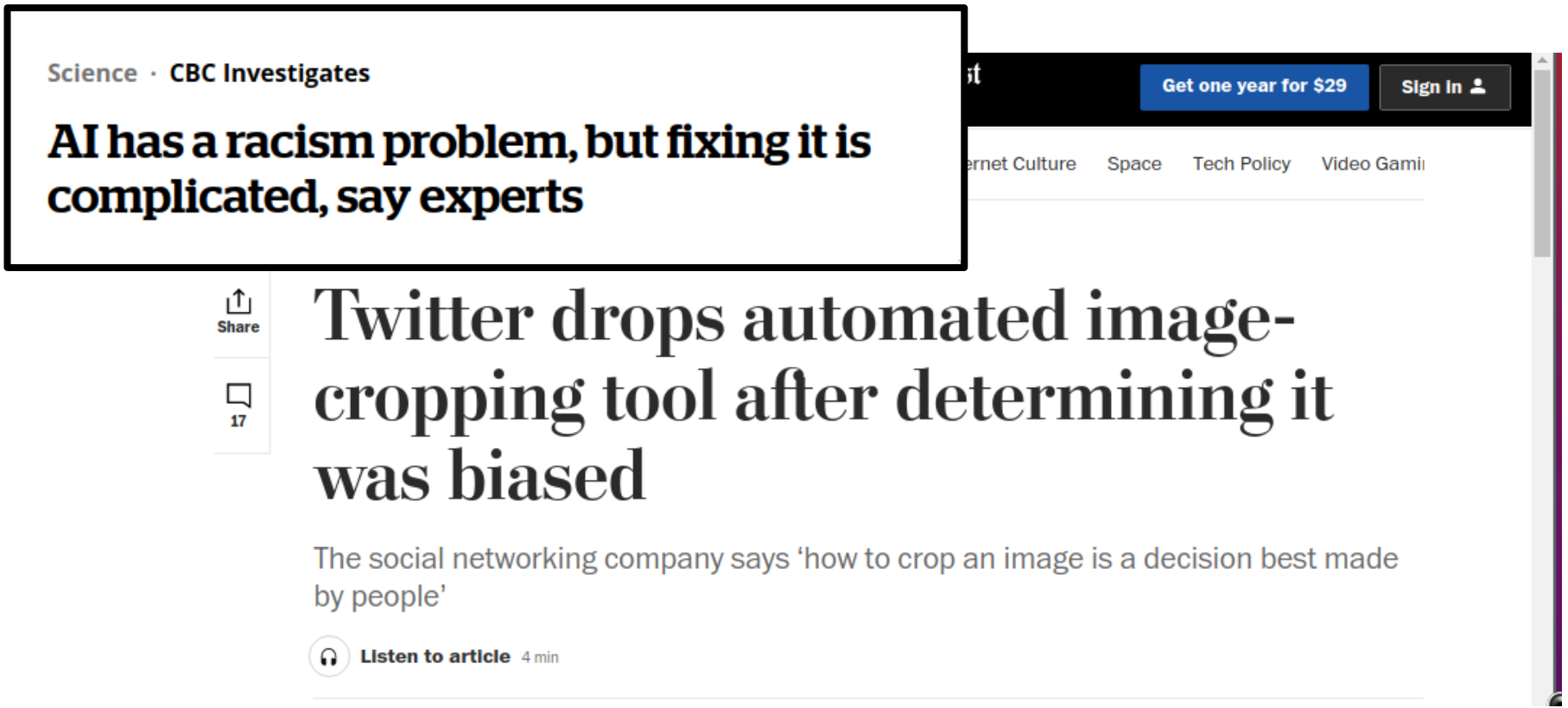


Approach	Compress	Synthetic-NeRF PSNR [dB](↑)	Synthetic-NeRF SSIM (↑)	Synthetic-NeRF Size [MB](↓)	Synthetic-NSVF PSNR [dB](↑)	Synthetic-NSVF SSIM (↑)	Synthetic-NSVF Size [MB](↓)	Tanks&Temples PSNR [dB](↑)	Tanks&Temples SSIM (↑)	Tanks&Temples Size [MB](↓)
DVGO	-	31.92	0.957	160.09	35.42	0.979	104.12	28.26	0.909	106.48
	LOW	31.47	0.952	3.99	35.29	0.974	4.37	28.22	0.910	4.69
	HIGH	31.08	0.944	2.00	34.90	0.969	2.46	27.90	0.894	1.62
TensoRF	-	33.14	0.963	69.26	36.52	0.982	69.05	28.56	0.920	64.04
	LOW	33.26	0.962	11.47	36.44	0.982	11.60	28.50	0.916	9.99
	HIGH	32.81	0.956	7.94	36.14	0.978	8.52	28.24	0.907	6.70
Plenoxels	-	31.48	0.956	189.08	-	-	-	27.37	0.904	147.96
	LOW	31.52	0.952	91.77	-	-	-	27.66	0.909	102.26
	HIGH	30.97	0.944	54.68	-	-	-	27.34	0.896	85.47

Deng, Chenxi and Tartaglione, Enzo. Compressing explicit voxel girid representations: fast NeRFs become also small. (2022)
Up-left image from Mildenhall, Ben et al. “NeRF: Representing Scenes as Neural Radiance Fields for View Synthesis.” ECCV (2020).


From misunderstanding to misconception:
biases in deep neural networks


Sections
The Washington Post
Democracy Dies in Darkness
Get one year for $29
Sign In
Tech
Consumer Tech
Future of Transportation
Innovations
Internet Culture
Space
Tech Policy
Video Gami
Home
Share
17
Innovations
Twitter drops automated image-cropping tool after determining it was biased
The social networking company says 'how to crop an image is a decision best made by people'
Listen to article
4 min



Science · CBC Investigates

AI has a racism problem, but fixing it is complicated, say experts

Get one year for $29

Sign In

ernet Culture Space Tech Policy Video Gami

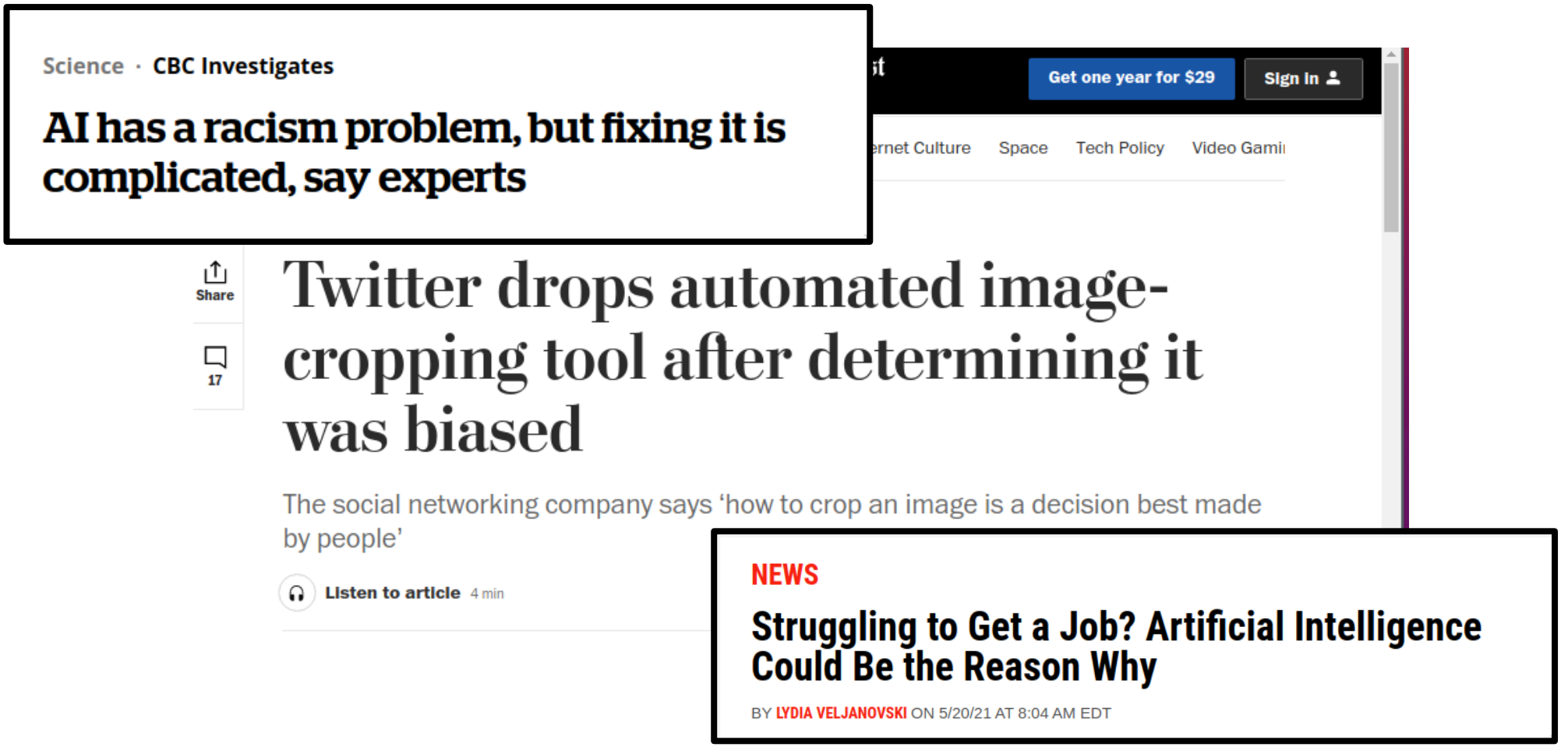
Share

17

Twitter drops automated image-cropping tool after determining it was biased

The social networking company says 'how to crop an image is a decision best made by people'

Listen to article 4 min



Science · CBC Investigates

AI has a racism problem, but fixing it is complicated, say experts

Get one year for $29

Sign In

ernet Culture Space Tech Policy Video Gami

Share

17

Twitter drops automated image-cropping tool after determining it was biased

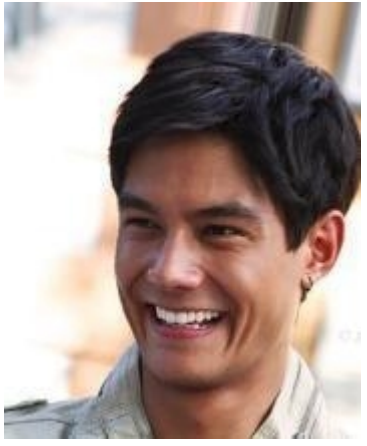
The social networking company says 'how to crop an image is a decision best made by people'

Listen to article 4 min

NEWS

Struggling to Get a Job? Artificial Intelligence Could Be the Reason Why

BY LYDIA VELJANOVSKI ON 5/20/21 AT 8:04 AM EDT

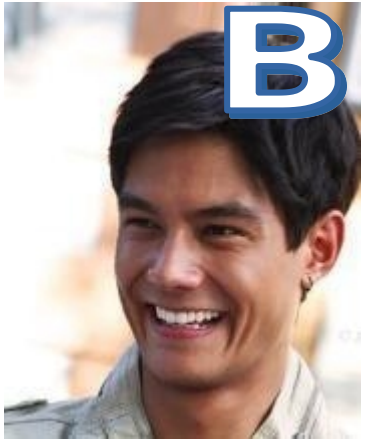


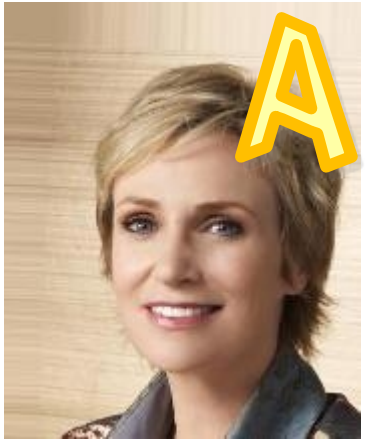

A


A


B


B


B

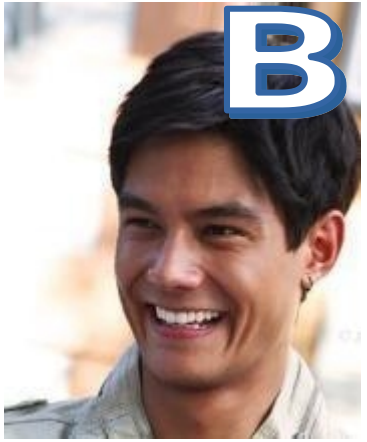

A


A


A


B


A


B


B

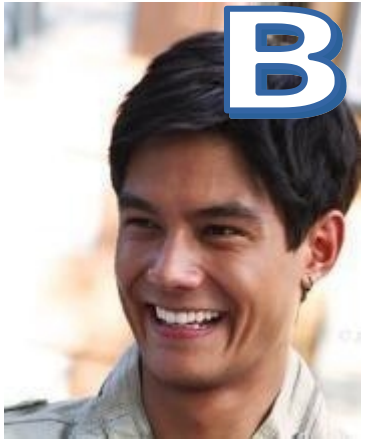

A

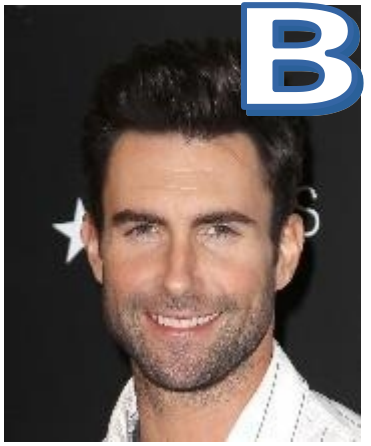

A


?


B


A

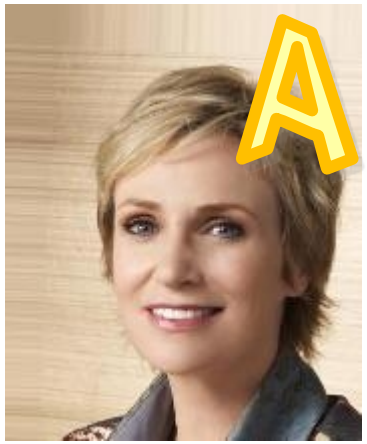

B


B

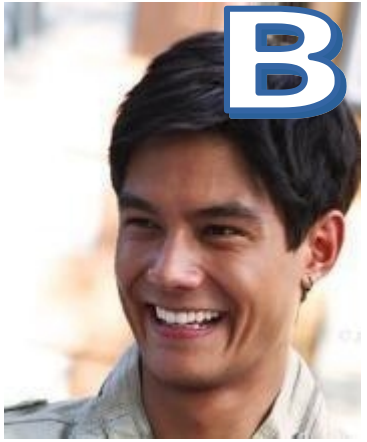

A


A


B


A


A


B

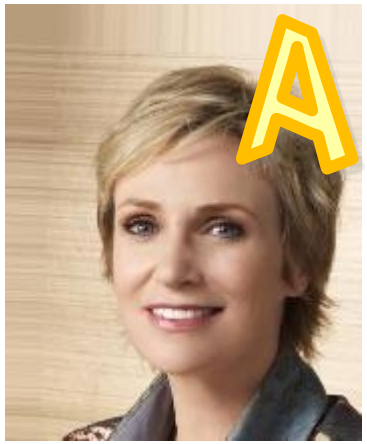

B


A

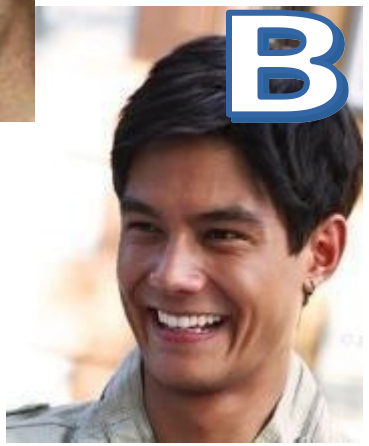

A

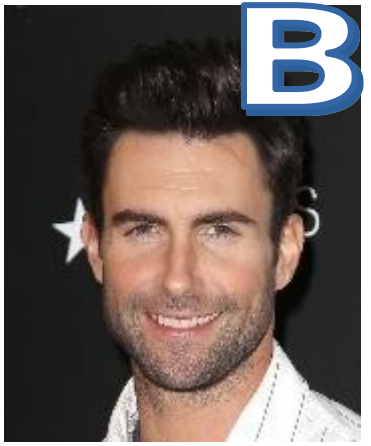

?


B


A


A


B

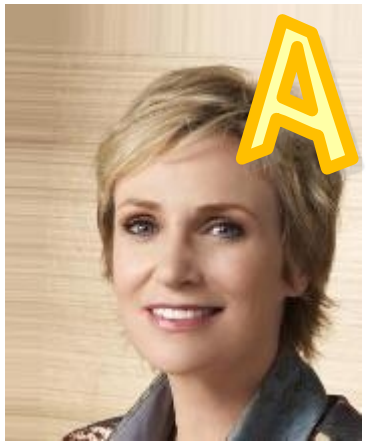

B


A

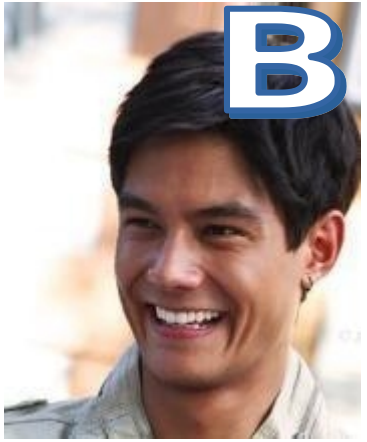

A

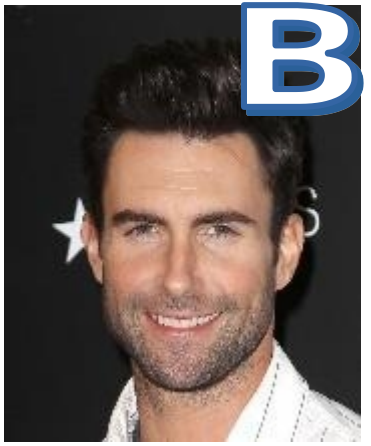

A


B


A


A


B


B

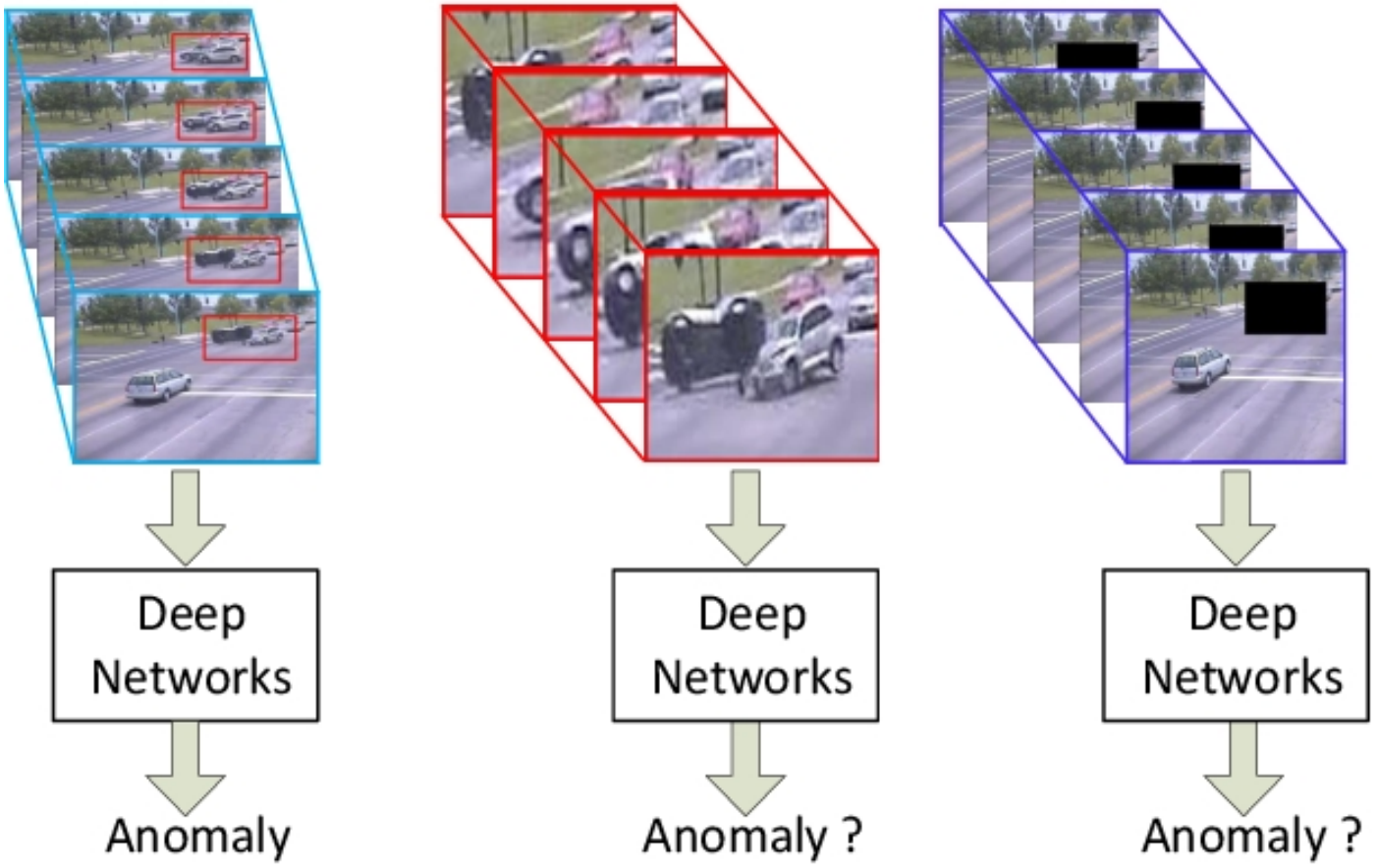
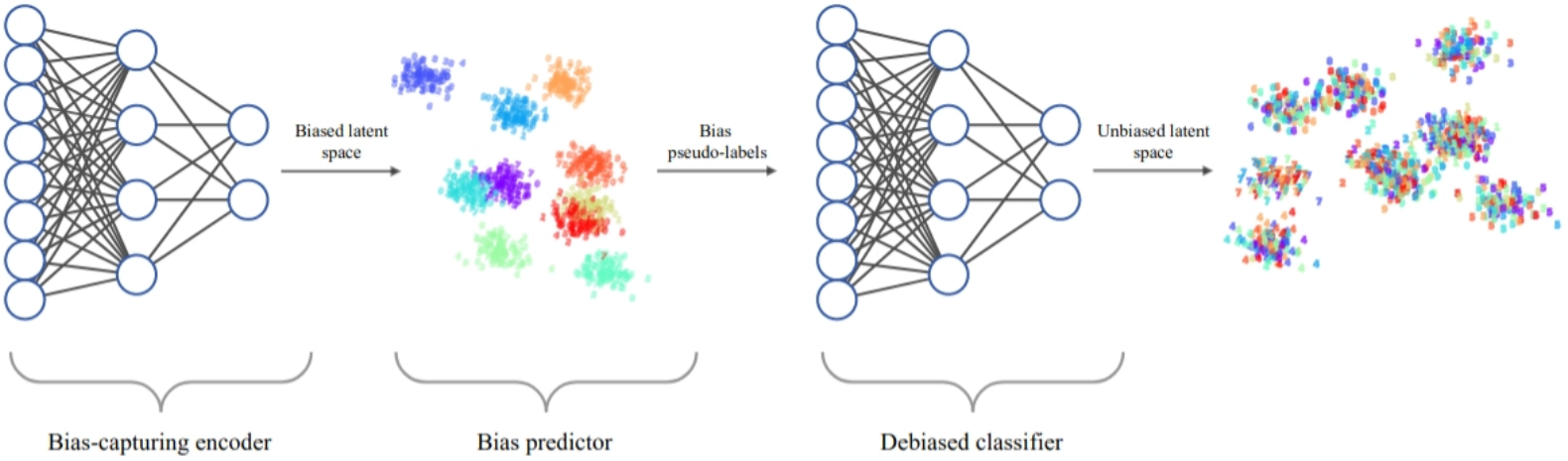


Image from Liu, Kun and Huadong Ma. “Exploring Background-bias for Anomaly Detection in Surveillance Videos.” Proceedings of the 27th ACM International Conference on Multimedia (2019):

Entangling and Disentangling features

During training, disentangle the biased features and entangle the unbiased ones.

We favor solutions where unbiased features are used in place of the biased ones.



Tartaglione, E. et al. End: Entangling and disentangling deep representations for bias correction. **CVPR (2021)**.
Barbano, C. A., et al. Bridging the gap between debiasing and privacy for deep learning. ICCV workshop (2021).
Tartaglione, E., et al. A non-discriminatory approach to ethical deep learning. In 2020 IEEE 19th International Conference on Trust, Security and Privacy in Computing and Communications (2020).

Enzo Tartaglione
enzo.tartaglione@telecom-paris.fr