# (Optional) Automated Data Augmentation

Interested in mixing data augmentation techniques and automated augmentation policies? Take a look at the paper mentioned in the previous video!

RandAugment: Practical automated data augmentation with a reduced search space (Cubuk, Zoph, Shlens, and Le, 2019): <https://arxiv.org/abs/1909.13719>

# (Optional Notebook) Generative Teaching Networks

Please note that this is an optional notebook, meant to introduce more advanced concepts if you're up for a challenge, so don't worry if you don't completely follow! The first author of this work, Felipe Such, reviewed this notebook for you.

Click on [this link](https://colab.research.google.com/github/https-deeplearning-ai/GANs-Public/blob/master/C3W1_Generative_Teaching_Networks_(Optional).ipynb) to access the optional Colab notebook.

In this notebook, you'll be implementing a Generative Teaching Network (GTN), first introduced in [Generative Teaching Networks: Accelerating Neural Architecture Search by Learning to Generate Synthetic Training Data](https://arxiv.org/abs/1912.07768) (Such et al. 2019). Essentially, a GTN is composed of a generator (i.e. teacher), which produces synthetic data, and a student, which is trained on this data for some task. The key difference between GTNs and GANs is that GTN models work cooperatively (as opposed to adversarially).

# (Optional) Talking Heads

Fascinated by how you can use GANs to create talking heads and deepfakes? Take a look at the paper!

Few-Shot Adversarial Learning of Realistic Neural Talking Head Models (Zakharov, Shysheya, Burkov, and Lempitsky, 2019): <https://arxiv.org/abs/1905.08233>

# (Optional) De-identification

Curious to learn more about how you can de-identify (anonymize) a face while preserving essential facial attributes in order to conceal an identity? Check out this paper!

De-identification without losing faces (Li and Lyu, 2019): <https://arxiv.org/abs/1902.04202>

# (Optional) GAN Fingerprints

Concerned about distinguishing between real images and fake GAN generated images? See how GANs leave fingerprints!

Attributing Fake Images to GANs: Learning and Analyzing GAN Fingerprints (Yu, Davis, and Fritz, 2019): <https://arxiv.org/abs/1811.08180>

Works Cited

All of the resources cited in Course 3 Week 1, in one place. You are encouraged to explore these papers/sites if they interest you! There are many resources this week and much of it is recent research on emerging uses of GANs. They are listed in the order they appear in the lessons.

From the videos:

* Semantic Image Synthesis with Spatially-Adaptive Normalization (Park, Liu, Wang, and Zhu, 2019): <https://arxiv.org/abs/1903.07291>
* Photo-Realistic Single Image Super-Resolution Using a Generative Adversarial Network (Ledig et al., 2017): <https://arxiv.org/abs/1609.04802>
* Multimodal Unsupervised Image-to-Image Translation (Huang et al., 2018): <https://github.com/NVlabs/MUNIT>
* StackGAN: Text to Photo-realistic Image Synthesis with Stacked Generative Adversarial Networks (Zhang et al., 2017): <https://arxiv.org/abs/1612.03242>
* Few-Shot Adversarial Learning of Realistic Neural Talking Head Models (Zakharov, Shysheya, Burkov, and Lempitsky, 2019): <https://arxiv.org/abs/1905.08233>
* Snapchat: [https://www.snapchat.com](https://www.snapchat.com/)
* MaskGAN: Towards Diverse and Interactive Facial Image Manipulation (Lee, Liu, Wu, and Luo, 2020): <https://arxiv.org/abs/1907.11922>
* When AI generated paintings dance to music... (2019): <https://www.youtube.com/watch?v=85l961MmY8Y>
* Data Augmentation Generative Adversarial Networks (Antoniou, Storkey, and Edwards, 2018): <https://arxiv.org/abs/1711.04340>
* Training progression of StyleGAN on H&E tissue fragments (Zhou, 2019): <https://twitter.com/realSharonZhou/status/1182877446690852867>
* Establishing an evaluation metric to quantify climate change image realism (Sharon Zhou, Luccioni, Cosne, Bernstein, and Bengio, 2020): <https://iopscience.iop.org/article/10.1088/2632-2153/ab7657/meta>
* Deepfake example (2019): <https://en.wikipedia.org/wiki/File:Deepfake_example.gif>
* Introduction to adversarial robustness (Kolter and Madry): <https://adversarial-ml-tutorial.org/introduction/>
* Large Scale GAN Training for High Fidelity Natural Image Synthesis (Brock, Donahue, and Simonyan, 2019): <https://openreview.net/pdf?id=B1xsqj09Fm>
* GazeGAN - Unpaired Adversarial Image Generation for Gaze Estimation (Sela, Xu, He, Navalpakkam, and Lagun, 2017): <https://arxiv.org/abs/1711.09767>
* Data Augmentation using GANs for Speech Emotion Recognition (Chatziagapi et al., 2019): <https://pdfs.semanticscholar.org/395b/ea6f025e599db710893acb6321e2a1898a1f.pdf>
* GAN-based Synthetic Medical Image Augmentation for increased CNN Performance in Liver Lesion Classification (Frid-Adar et al., 2018): <https://arxiv.org/abs/1803.01229>
* GANsfer Learning: Combining labelled and unlabelled data for GAN based data augmentation (Bowles, Gunn, Hammers, and Rueckert, 2018): <https://arxiv.org/abs/1811.10669>
* Data augmentation using generative adversarial networks (CycleGAN) to improve generalizability in CT segmentation tasks (Sandfort, Yan, Pickhardt, and Summers, 2019): <https://www.nature.com/articles/s41598-019-52737-x/figures/3>
* De-identification without losing faces (Li and Lyu, 2019): <https://arxiv.org/abs/1902.04202>
* Privacy-Preserving Generative Deep Neural Networks Support Clinical Data Sharing (Beaulieu-Jones et al., 2019): <https://www.ahajournals.org/doi/epub/10.1161/CIRCOUTCOMES.118.005122>
* DeepPrivacy: A Generative Adversarial Network for Face Anonymization (Hukkelås, Mester, and Lindseth, 2019): <https://arxiv.org/abs/1909.04538>

From the notebook:

* GAIN: Missing Data Imputation using Generative Adversarial Nets (Yoon, Jordon, and van der Schaar, 2018): <https://arxiv.org/abs/1806.02920>
* Conditional Infilling GANs for Data Augmentation in Mammogram Classification (E. Wu, K. Wu, Cox, and Lotter, 2018): <https://link.springer.com/chapter/10.1007/978-3-030-00946-5_11>
* The Effectiveness of Data Augmentation in Image Classification using Deep Learning (Perez and Wang, 2017): <https://arxiv.org/abs/1712.04621>
* CIFAR-10 and CIFAR-100 Dataset; Learning Multiple Layers of Features from Tiny Images (Krizhevsky, 2009): <https://www.cs.toronto.edu/~kriz/learning-features-2009-TR.pdf>