Image Super Resolution using General Adversarial Network

CSCI-B657: Computer Vision
Spring 2019

Darshan Shinde (dshinde)
Virendra Wali (vwali)
Pei Yi Cheng(peicheng)

March 08,2019

1 Problem Statement

In many crime incidents, we have some security camera footage. But, quality of footage might be very poor which makes difficult to get information about the criminal. To resolve this problem, there exists many image quality improving algorithms [3],[4] (and many more). Out of which we are trying to re-implement the idea of increasing the resolution of low-resolution images using GAN proposed by [1].

Author claims that the low-resolution images which are artificially generated using bi-linear/bi-cubic down sampling or blurring using several different sized blur kernels used in other image super resolution techniques does not resembles to real-world low-resolution images properly (ignores the degradation process e.g., motion blur, compression artifacts, etc.) and hence leads to poor performance during test time. To alleviate this, author has proposed process of producing low-resolution images using High-to-Low GAN model. He concluded that this process of generating low-resolution image and using this for learning GAN model for generating higher resolution images outperforms all other previous technique. To support that he has provided numeric result of some experiment in comparison with other approaches. In this project, we are trying to perform same operation over different data sets and check whether this approach really outperforms other approaches or not. In addition to that we will try to improve the performance this approach by combining it with some other existing techniques.

2 Reading List

1. Adrian Bulat, Jing Yang, Georgios Tzimiropoulos: "To learn image super-resolution, use a GAN to learn how to do image degradation first". (ECCV 2018)

2. Heusel, M., Ramsauer, H., Unterthiner, T., Nessler, B., Hochreiter, S.: "Gans trained by a two time-scale update rule converge to a local nash equilibrium".(NIPS)

3. Jason Liu, Max Spero, Allan Raventos: "Super-Resolution on Image and Video using GAN".

4. Dong, C., Loy, C.C., He, K., Tang, X.: "Image super-resolution using deep convolutional networks". (IEEE TPAMI 2016)

5. Goodfellow, I., Pouget-Abadie, J., Mirza, M., Xu, B., Warde-Farley, D., Ozair, S., Courville, A., Bengio, Y.: "Generative adversarial nets". (NIPS. 2014) 2672–2680

3 Research plan and time-line

task	~Mar 3	~Mar 10	~Mar 17	~Mar 24	~Mar 31	~Apr 7	~Apr 14	~Apr 21	~Apr 28	~Apr 30
Write Project proposal										
Search for datasets										
Implement general GAN model										
Train GAN model for High-Low										
Generate actual paired dataset										
Implement GAN model for Low-High										
Train it on paired dataset										
Interim report (Mar 31)										
Experiment and Evaluation										
Optimization and Improvements										
Poster draft (Apr 19)										
Poster presentation (Apr 26)										
Final report and cod submission (Apr 30)										

4 Experiment plan and Evaluation Methodology

4.1 Data

We are planning to use following data sets for this project. We can add few more if required.

- Labeled Faces in the Wild: All images aligned with funneling
- FDDB: Face Detection Data Set and Benchmark: Original, unannotated set of images
- The 'Celebrity Together' Dataset1
- IMFDB: Indian Movie Face database

4.2 Evaluation metric

'For this experiment, and because there are no corresponding ground-truth HR images, besides visual results, we numerically assess the quality of the generated samples using the Frechet Inception Distance (FID) [2].' This is the same technique author has used in paper. For completeness, we will use PSNR results which are used in other techniques for comparing results.

4.3 Result comparison

Using the above mentioned data sets (different than what author has used for his experiment), we are planning to compare the results with some other state-of-art techniques like CycleGan [3], Low-to-High (trained on blur + bilinear) and Wavelet-SRNet [4] to evaluate the generalizability of this approach.

5 References

1. Adrian Bulat, Jing Yang, Georgios Tzimiropoulos: "To learn image super-resolution, use a GAN to learn howto do image degradation first". ECCV (2018)

2. Heusel, M., Ramsauer, H., Unterthiner, T., Nessler, B., Hochreiter, S.: "Gans trained by a two time-scale update rule converge to a local nash equilibrium".(NIPS 2017).

3. Zhu, J.Y., Park, T., Isola, P., Efros, A.A.: "Unpaired image-to-image translation using cycle-consistent adversarial networks".(ICCV 2017)

4. Huang, H., He, R., Sun, Z., Tan, T.: "Wavelet-srnet: A wavelet-based cnn for multiscale face super resolution". (ICCV 2017)