Rethinking Distortion-Perception Trade-off in Super-Resolution

Introduction:

Image super-resolution (SR) aims to produce high-resolution (HR) images from a low-resolution (LR) input. To evaluate how various SR methods perform, either distortion metrics (by measuring the discrepancy between HR and ground-truth (GT) images) or perception metrics (measure the pure perceptual quality of images) are adopted. However, the well-known distortion-perception trade-off [1] points out that it can be inherently contradictory for distortion and perception measurements. As a result, traditional distortion metrics such as PSNR, SSIM [2] become less trusted in current SR research. An example of the trade-off is shown in Fig. 1.

Fig. 1. Given HR outputs from different SR models, the trade-off between distortion and perception metrics can lead to contradictory evaluation results.

Nevertheless, in many situations, it is desired that the fidelity of SR models can be measured, i.e. how they deviate from the GT references. In this project, you will re-investigate this trade-off in a more precise manner and explore a distortion metric that more faithfully measures the fidelity of SR models.

What you will do:

- Test state-of-the-art SR models to produce varying SR outputs covering different perception and distortion levels.
- Develop displaying interface to compare SR results with ground truths, and collect human judgements on fidelity changes.
- Explore image distortion metrics that more reliably evaluate the faithfulness of SR models.

What you will learn:

- Cutting-edge technologies of SR methods.
- Subjective experiments to collect user opinions.
- Varying image metrics that are used to quantify image processing systems.

[1] Yochai Blau, and Tomer Michaeli. "The perception-distortion tradeoff." In Proceedings of the IEEE conference on computer vision and pattern recognition, pp. 6228-6237. 2018.

[2] Zhou Wang, Alan C. Bovik, Hamid R. Sheikh, and Eero P. Simoncelli. "Image quality assessment: from error visibility to structural similarity." *IEEE transactions on image processing* 13, no. 4 (2004): 600-612.