Super resolution Using different methods

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Topic: Generative model for super resolution using computer vision technique and a Generative Adversarial Network

Motivation: Higher-resolution imaging data is always desirable to people interested in improving the understanding of the surface information, whereas the resolution is usually limited by many factors such as the availability of the equipment, the system storage standards, etc. Super resolution restoration aims to estimate images at a higher resolution than before, which has been found useful in many field such as face recognition, landscape scale restoration, etc. Previous studies have found the great power of computer vision technique and generative adversarial network in image restoration. So our study aim to implement and explore the above two cutting-edge techniques on top of the previous studies.

1) **First task**
We will first explore a computer vision technique to train a generative model [1].
We will do geometric registration, ML registration and some other registration methods on the image, and then train a generative model based on that.

2) **Second task**
If we have time, we would further explore and compare the result of more modern super resolution method -- Generative Adversarial Network [2]. The basic idea is to take low and high(original) resolution pictures and then train a discriminator and generator at same time. The generator takes a low resolution image, and generative a relatively high resolution super-resolved image. The discriminator takes the super-resolved image generated by the generator, and the original image as input, and trying to discriminate between the two. In the training process, the generator will generate more and more real and high resolution image to “fool” the discriminator.

3) **Further elaboration**
Since the GAN model might be very sensitive and not easy to train. We might try different design choice for the two neural networks, also explore more reasonable and stable loss functions for the GAN models.

Approach: We will use python for the first method of super resolution. And will use tensorflow or pytorch to train the Generative Adversarial Network.

Reference:
[1] https://arxiv.org/pdf/1609.04802.pdf
[2] https://www.robots.ox.ac.uk/~vgg/publications/2003/Capel03/capel03.pdf