Image Colorization using DCGANs

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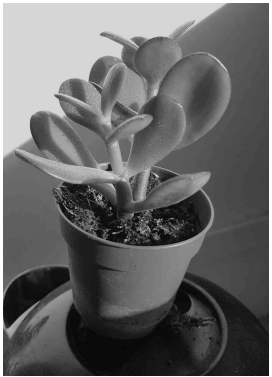
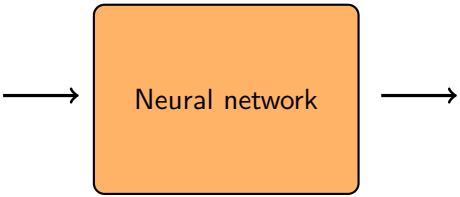
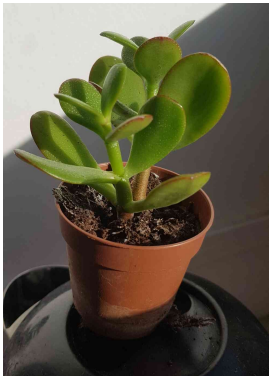
The image colorization problem



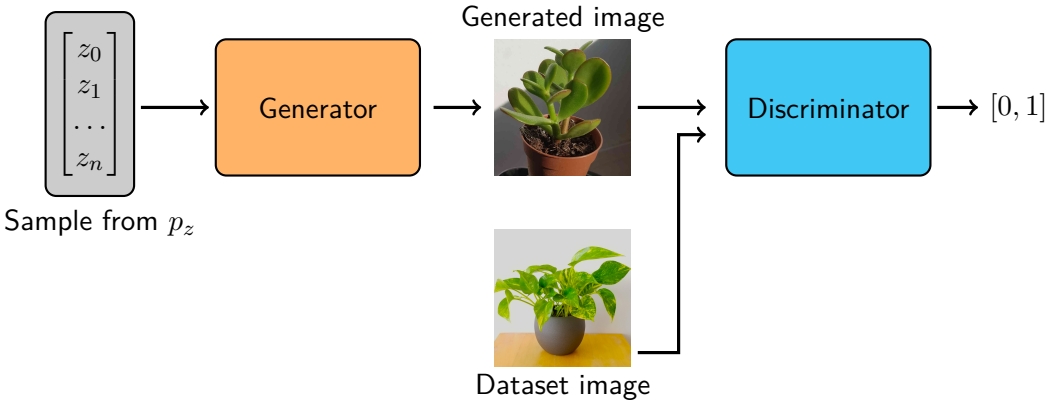
Grayscale image





Colorized image

Generative Adversarial Networks (GANs)



Generative Adversarial Networks (GANs)

Generation

- The generator G_{θ_G} takes a random noise vector z as input and outputs an image $G_{\theta_G}(z)$.
- The discriminator D_{θ_D} takes an image x as input and outputs a probability $D_{\theta_D}(x)$ that the image is real.
- Minimax game problem:

$$\min_{\theta_G} \max_{\theta_D} V(G_{\theta_G}, D_{\theta_D}) = \min_{\theta_G} \max_{\theta_D} \mathbb{E}_x[\log D_{\theta_D}(x)] + \mathbb{E}_z[\log(1 - D_{\theta_D}(G_{\theta_G}(z)))] \tag{1}$$

Generative Adversarial Networks (GANs)

Image colorization

Change the generator to fit the colorization problem using conditional GANs:

- Replace the noise vector z by a grayscale image z.
- The generator G_{θ_G} takes a grayscale image z as input and outputs a colorized image $G_{\theta_G}(z)$.
- The discriminator receives both the colorized image and the grayscale image (condition) as input, and outputs a probability $D_{\theta_D}(x|z)$ that the image is real.

References

1. Goodfellow, I., Pouget-Abadie, J., Mirza, M., Xu, B., Warde-Farley, D., Ozair, S., ... & Bengio, Y. (2014). Generative adversarial nets. *Advances in neural information processing systems*, 27.
2. Nazeri, Kamyar, Eric Ng, and Mehran Ebrahimi. "Image colorization using generative adversarial networks." *Articulated Motion and Deformable Objects: 10th International Conference, AMDO 2018, Palma de Mallorca, Spain, July 12-13, 2018, Proceedings 10*. Springer International Publishing, 2018.
3. Anwar, Saeed, et al. "Image colorization: A survey and dataset." *Information Fusion* (2024): 102720.