Diffusion Image Prior
Supplementary materials

1. Algorithm to Solve Eq. (1)

Given a degraded image y and a mapping g induced by a pre-trained diffusion. We aim to solve the optimization objective:

$$z^* = \arg\min_z \|g(z) - y\|^2, \quad \text{with} \quad x^* = g(z^*), \qquad (1)$$

We adopt a similar strategy to that proposed in [1] however in contrast to [1], no specific degradation model is assumed. Rather, the focus is solely on reconstructing the original degraded image. The details of the algorithm are provided in Algorithm 1. Similarly to [1], we set $\delta t = 100$.

Algorithm 1 Algorithm to Solve Eq. (1)

Require: Degraded image y, learning rate η, step size δt, threshold ϵ, diffusion steps T.
Ensure: Return $\tilde{z}$

Initialize $z \sim \mathcal{N}(\mathbf{0}, \mathbf{I})$, $\hat{x}_0 = \mathbf{0}$
while $\|\hat{x}_0 - y\| > \epsilon$ **do**
  $t = T$, $z_T = z$
  while $t > 0$ **do**
    $\hat{x}_0 = (z_t - \sqrt{1-\bar{\alpha}_t}\epsilon_\theta(z_t, t))/\sqrt{\bar{\alpha}_t}$
    $z_{t-\delta t} = \sqrt{\bar{\alpha}_{t-\delta t}}\hat{x}_0 + \sqrt{1-\bar{\alpha}_{t-\delta t}} \cdot \frac{z_t - \sqrt{\bar{\alpha}_t}\hat{x}_0}{\sqrt{1-\bar{\alpha}_t}}$
    $t \leftarrow t - \delta t$
  end while
  $z \leftarrow z - \eta \nabla_z \|\hat{x}_0 - y\|$
end while
return z

2. Additional Visual Comparisons

We include additional visual comparisons in Figure 1.

References

[1] Hamadi Chihaoui, Abdelhak Lemkhenter, and Paolo Favaro. Blind image restoration via fast diffusion inversion. *arXiv preprint arXiv:2405.19572*, 2024. 1

[2] Jie Xiao, Ruili Feng, Han Zhang, Zhiheng Liu, Zhantao Yang, Yurui Zhu, Xueyang Fu, Kai Zhu, Yu Liu, and Zheng-Jun Zha. Dreamclean: Restoring clean image using deep diffusion prior. In *The Twelfth International Conference on Learning Representations*, 2024. 2

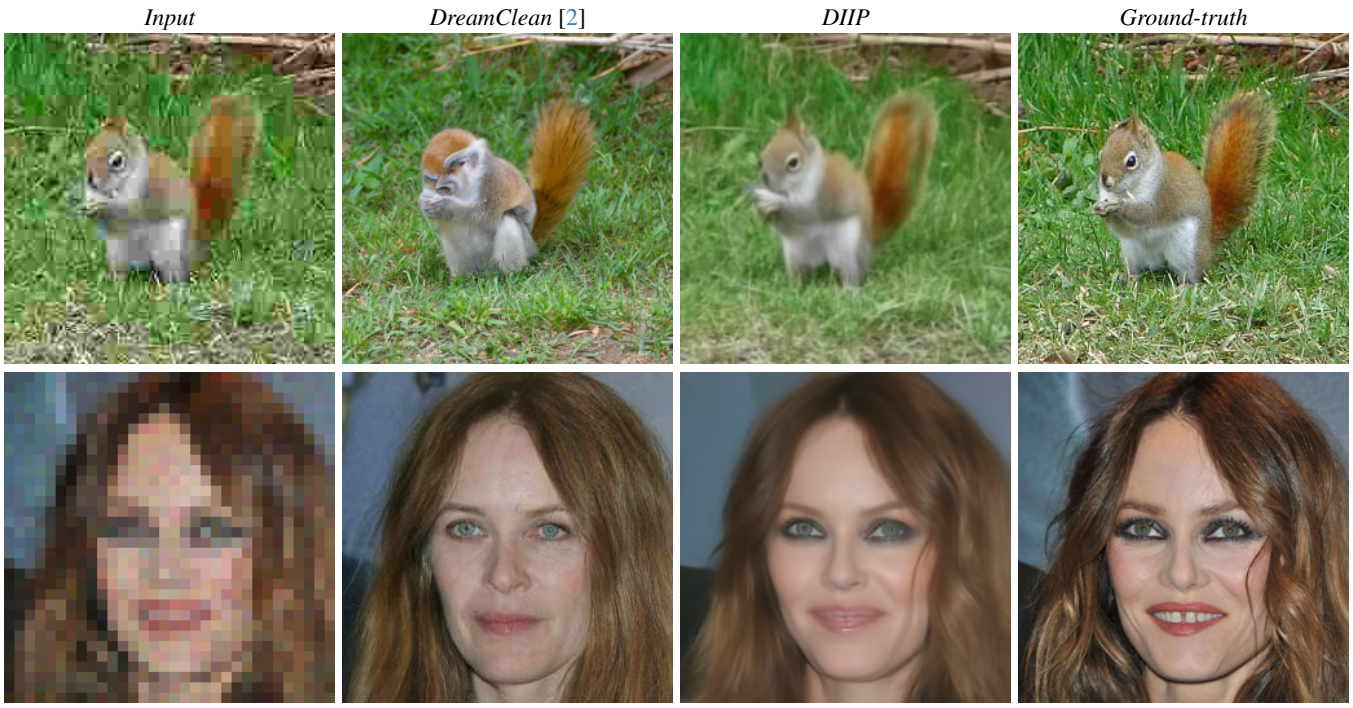

Figure 1. Visual comparisons . Top: JPEG de-artifacting. Bottom: superresolution ($\times 4$).