Deep Generative Adversarial Compression Artifact Removal
Leonardo Galteri, Lorenzo Seidenari, Marco Bertini, Alberto Del Bimbo
{leonardo.galteri,lorenzo.seidenari,marco.bertini,alberto.delbimbo}@unifi.it

Method
A residual network is used to reconstruct compressed images:

- **Strided Convolution** to reduce feature map size.
- **Nearest Neighbor Upsampling**.

We use a **sub-patch discriminator** to reduce mosquito noise in the output.

- 128 x 128 patches are split into smaller 16x16 sub-patches, concatenated with correspondent input sub-patches and processed by the discriminator.

We minimize the objectives:

\[ l_G = \frac{1}{W \cdot H} \sum_{x=1}^{W} \sum_{y=1}^{H} (\phi(t^{HQ})_{x,y} - \phi(t^{LR})_{x,y})^2 + \lambda \left( -\log(D_{\phi}(t^{HQ}|I^{LR})) \right) \]

\[ l_D = -\log \left( D_{\phi}(t^{HQ}|I^{LR}) \right) + \log \left( 1 - D_{\phi}(t^{LR}|I^{LR}) \right) \]

Overview
- Compression algorithms are used to reduce the dimension of media files to lower storage requirements and transmission time, but artifacts are often introduced.
- These effects make images less pleasant for the human eye and also lead to decreased performance for computer vision algorithms, such as object detectors.
- We propose a feed-forward fully convolutional residual network trained using a Generative Adversarial Network framework implementing a novel sub-patch discriminator.

Related Work
- **Generative Adversarial Networks (GAN)**: Goodfellow et al. [1] introduce the GAN framework in which a generative model competes with a discriminative adversarial in a two player min-max game.
- **AR-CNN**: Dong et al. [2] are the first to propose a compact and efficient CNN for compression artifact reduction.
- **SRGAN**: Ledig et al. [3] propose a Super Resolution model able to perform large image upscaling with photo-realistic details based on a GAN framework and residual networks.

Subjective Evaluation
- Ten viewers were recruited for subjective evaluation of image quality, following a DSIS setup.

<table>
<thead>
<tr>
<th>Method</th>
<th>MOS</th>
<th>Std. Dev.</th>
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<tbody>
<tr>
<td>SSIM</td>
<td>49.51</td>
<td>22.72</td>
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<tr>
<td>GAN</td>
<td>68.32</td>
<td>20.75</td>
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Error Correlation
There is a correlation between feature map error and Average Precision drop per class. In our GAN approach this correlation is lower, meaning that objects appearance is improved in terms of content understanding.

Qualitative Results

Results
Object Detection Performance on PASCAL VOC 2007

Bibliography