Generative Face Completion

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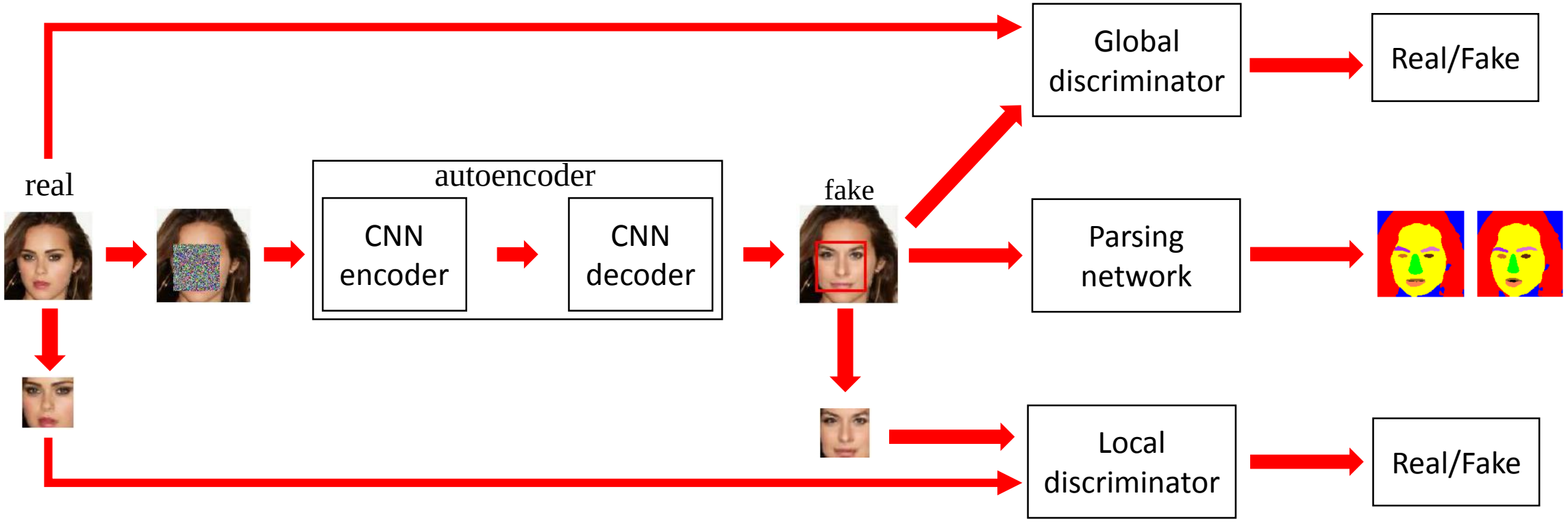
Abstract

- Object : missing pixels in arbitrary shapes ➔ generate realistic face completion results
- Method : directly generates missing regions based on a neural network
- Train : combine a reconstruction loss, two adversarial losses and a semantic parsing loss

Framework


real
autoencoder
CNN encoder
CNN decoder
fake
Global discriminator
Real/Fake
Parsing network
Local discriminator
Real/Fake

Generator

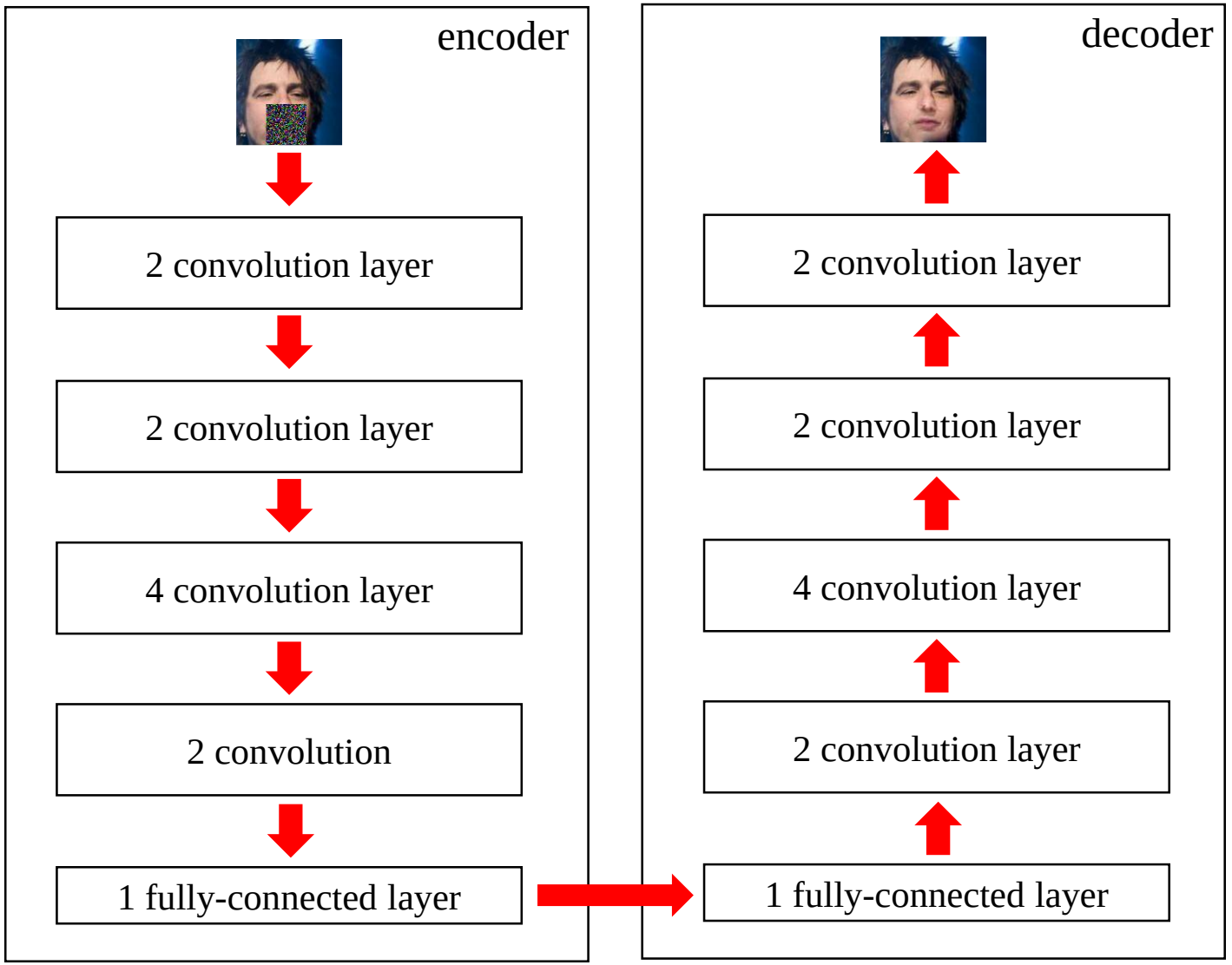
- Input : face masked with randomly selected square region

- Encoder layer : convolution layer + ReLU + max-pooling
- Decoder layer : convolution layer + ReLU +unpooling layer

- Object function :

$$L_r = \min_{\mathcal{G}} \varepsilon_{z \sim P_z(z)} [\log(1 - \mathcal{D}(\mathcal{G}(z)))]$$

  - z is noise variables
  - $\mathcal{G}$ is Generator model
  - $\mathcal{D}$ is Discriminator model

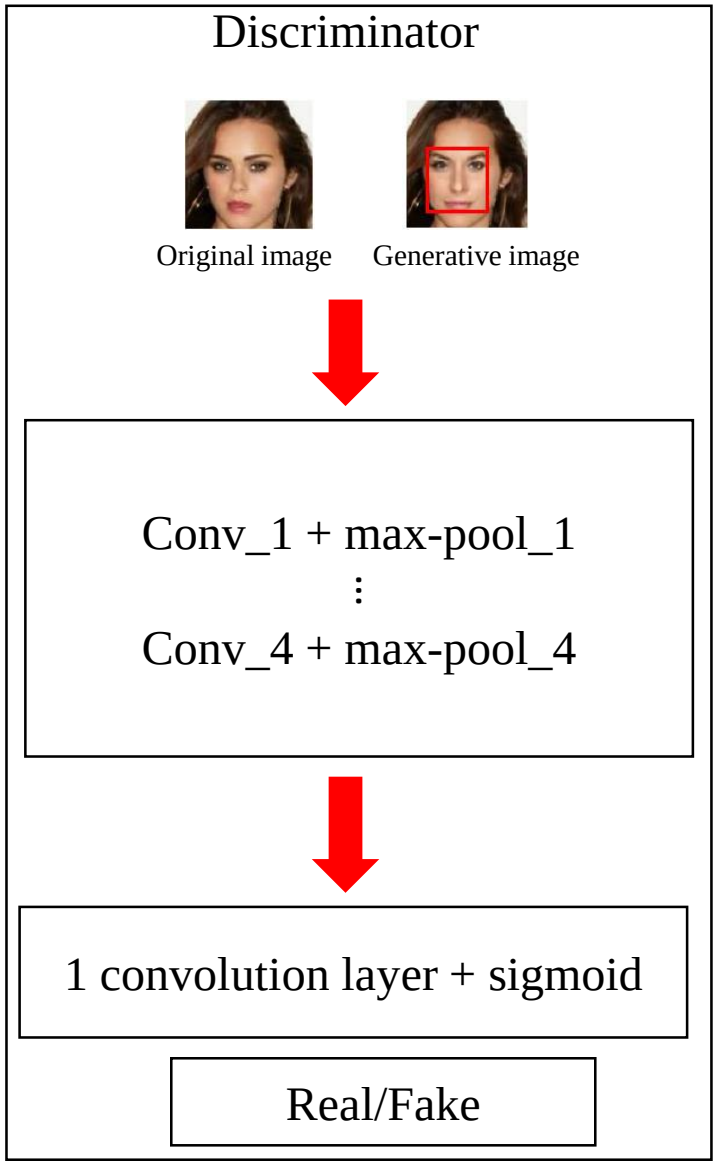


Discriminator

- Global discriminator input : all original image (Real) and all generative image (Fake)
- Local discriminator input : missing region original image (Real) and missing region generative image (Fake)
- Object function :

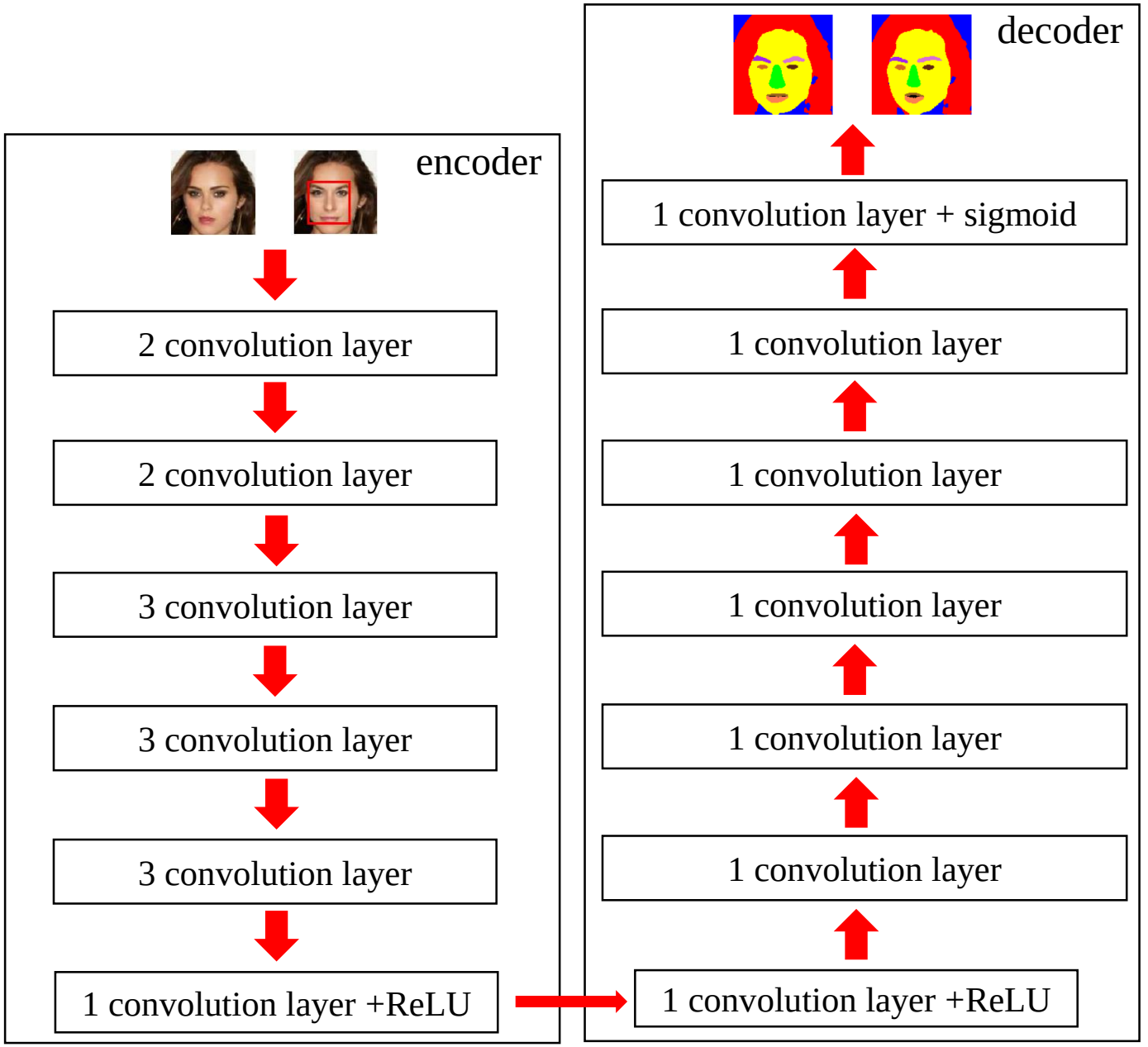
$$L_{a_i} = \min_{\mathcal{G}} \max_{\mathcal{D}} \varepsilon_{x \sim P_{data}(x)} [log\mathcal{D}(x)] + \varepsilon_{z \sim P_z(z)} [\log(1 - \mathcal{D}(\mathcal{G}(z)))]$$

  - x is real data
  - z is noise variables
  - $\mathcal{G}$ is Generator model
  - $\mathcal{D}$ is Discriminator model



Parsing network

- Input : original image and generative image
- Encoder layer : convolution layer + ReLU + max-pooling
- Decoder layer : convolution layer + ReLU + dropout layer +unpooling layer
- Object function : cross-entropy



Overall Loss Function

- $L = L_r + \lambda_1 L_{a_1} + \lambda_2 L_{a_2} + \lambda_3 L_p$
- L_{a_1} 為local discriminator object function
- L_{a_2} 為global discriminator object function

- $\lambda_1 = 300$, $\lambda_2 = 300$, $\lambda_3 = 0.005$

References

- J. Yang, B. Price, S. Cohen, H. Lee, and M.-H. Yang. Object contour detection with a fully convolutional encoder-decoder network. In CVPR, 2016.
- J. Long, E. Shelhamer, and T. Darrell. Fully convolutional networks for semantic segmentation. In CVPR, 2015.