ELEGANT: Exchanging Latent Encodings with GAN for Transferring Multiple Face Attributes

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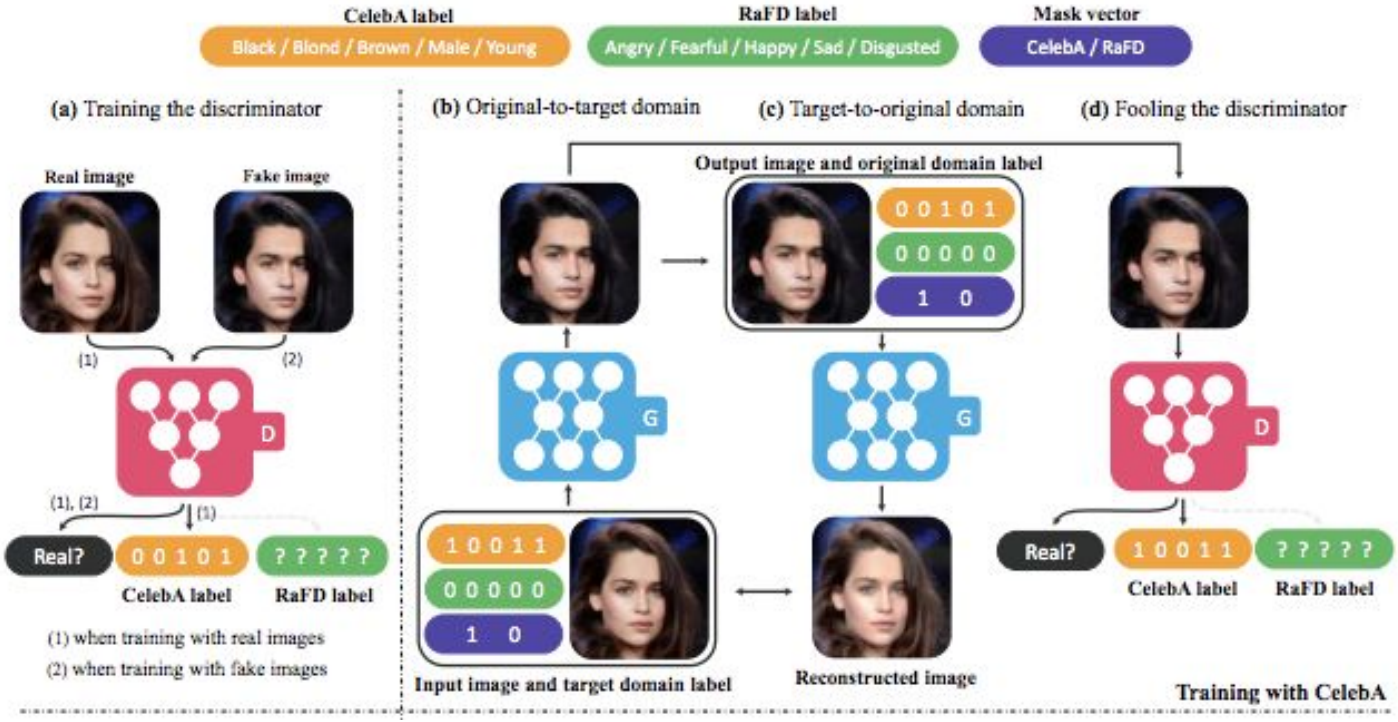
Limitation of previous work

StarGAN

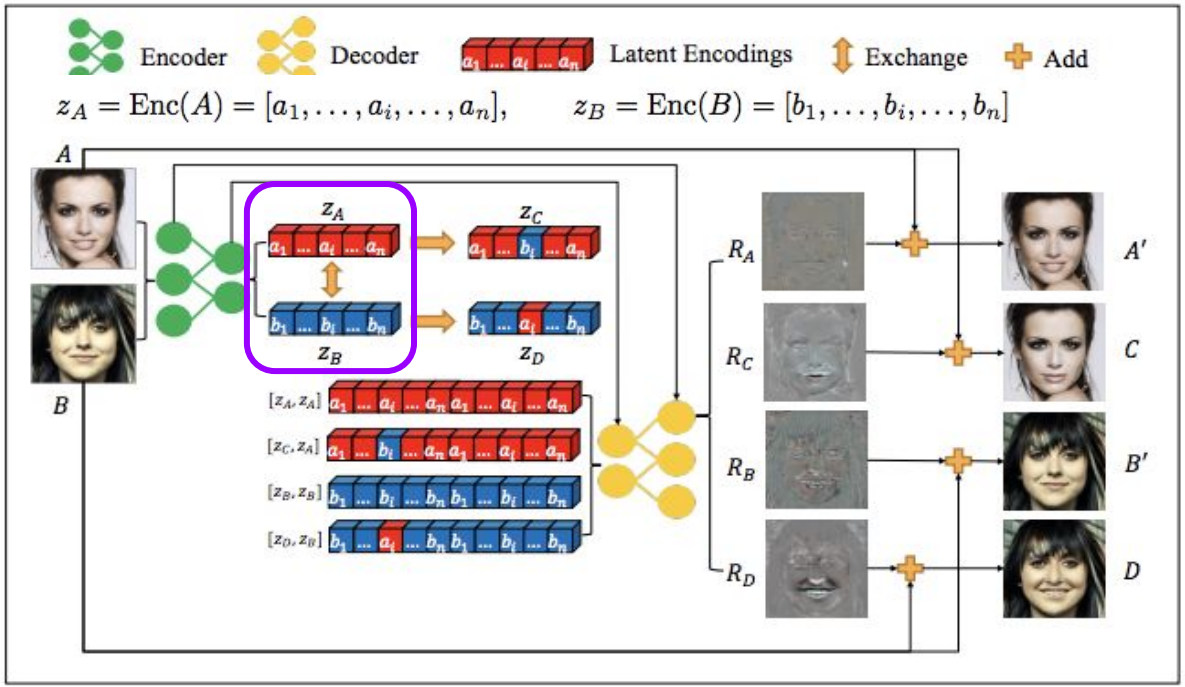


Limitation of previous works

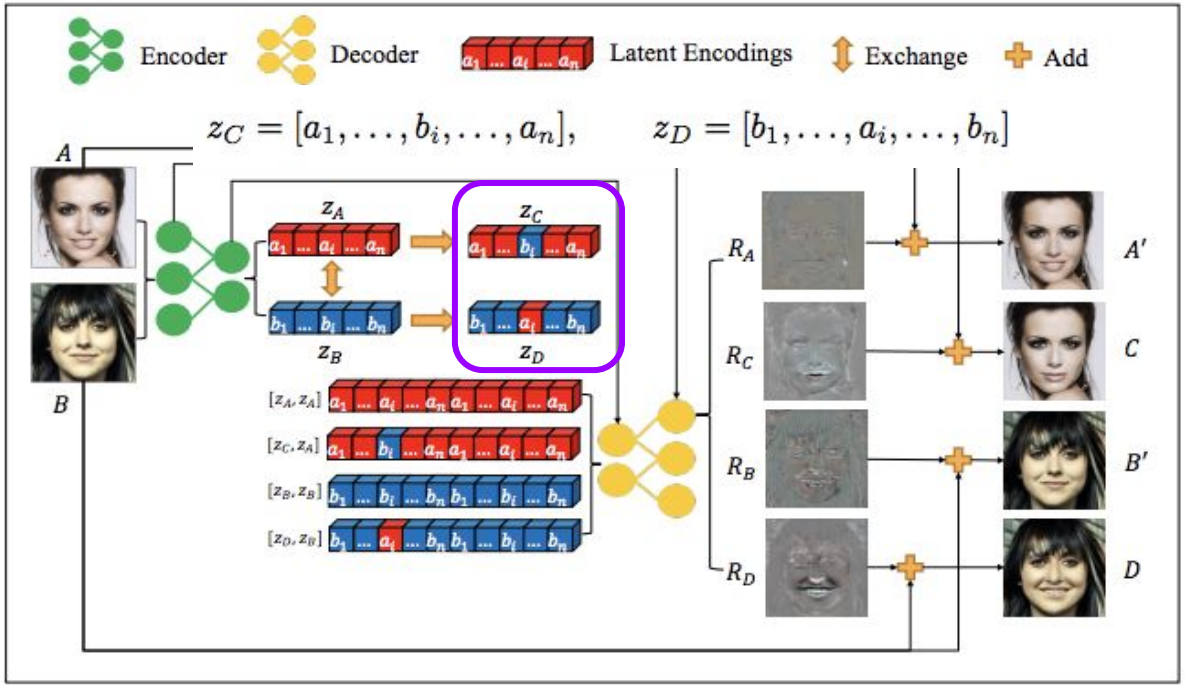
- Incapability of generating image by exemplars
- being unable to transfer multiple face attributes simultaneously
- low quality of generated images

Model overview

label x of Domain A - [x1, x2, …, 1, xi+1, … xn] / label y of Domain B - [y1, y2, …, 0, yi+1, … yn]

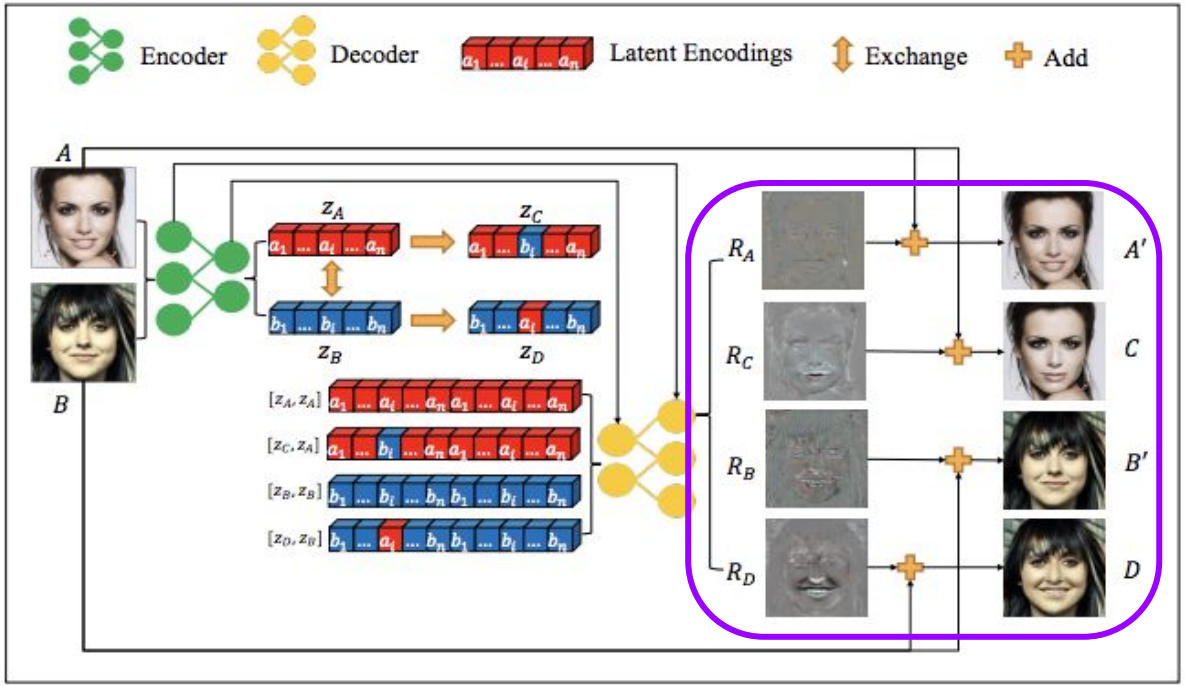


Model overview



Model overview

Residual learning - advantage in learning local attributes



Detailed Losses

$$Y^A = (y_1^A, \ldots, 1_i, \ldots, y_n^A) \quad Y^B = (y_1^B, \ldots, 0_i, \ldots, y_n^B)$$
$$Y^C = (y_1^A, \ldots, 0_i, \ldots, y_n^A) \quad Y^D = (y_1^B, \ldots, 1_i, \ldots, y_n^B)$$

D loss

$$\begin{aligned} L_{\mathrm{D}_1} = & -\mathbb{E}(\log(\mathrm{D}_1(A|Y^A))) - \mathbb{E}(\log(1-\mathrm{D}_1(C|Y^C))) \\ & -\mathbb{E}(\log(\mathrm{D}_1(B|Y^B))) - \mathbb{E}(\log(1-\mathrm{D}_1(D|Y^D))) \\ L_{\mathrm{D}_2} = & -\mathbb{E}(\log(\mathrm{D}_2(A|Y^A))) - \mathbb{E}(\log(1-\mathrm{D}_2(C|Y^C))) \\ & -\mathbb{E}(\log(\mathrm{D}_2(B|Y^B))) - \mathbb{E}(\log(1-\mathrm{D}_2(D|Y^D))) \end{aligned}$$

G loss

$$L_{reconstruction} = ||A - A'|| + ||B - B'||$$

$$\begin{aligned} L_{adv} = & -\mathbb{E}(\log(\mathrm{D}_1(C|Y^C))) - \mathbb{E}(\log(\mathrm{D}_1(D|Y^D))) \\ & -\mathbb{E}(\log(\mathrm{D}_2(C|Y^C))) - \mathbb{E}(\log(\mathrm{D}_2(D|Y^D))) \end{aligned}$$

Experiment latent space interpolation

Experiment comparison with baselines

Problem of Stargan and advantage of latent code

- Binary labeled transferring distorts other attribute (e.g. input [1, 0, 1] => [1, 1, ,1])
- Latent level feature exchanging does not influence to other attributes

Experiment comparison with baselines

Multiple attributes changing

ELEGANT

DNA-GAN