AGE PROGRESSION/REGRESSION BY CONDITIONAL ADVERSARIAL AUTOENCODER

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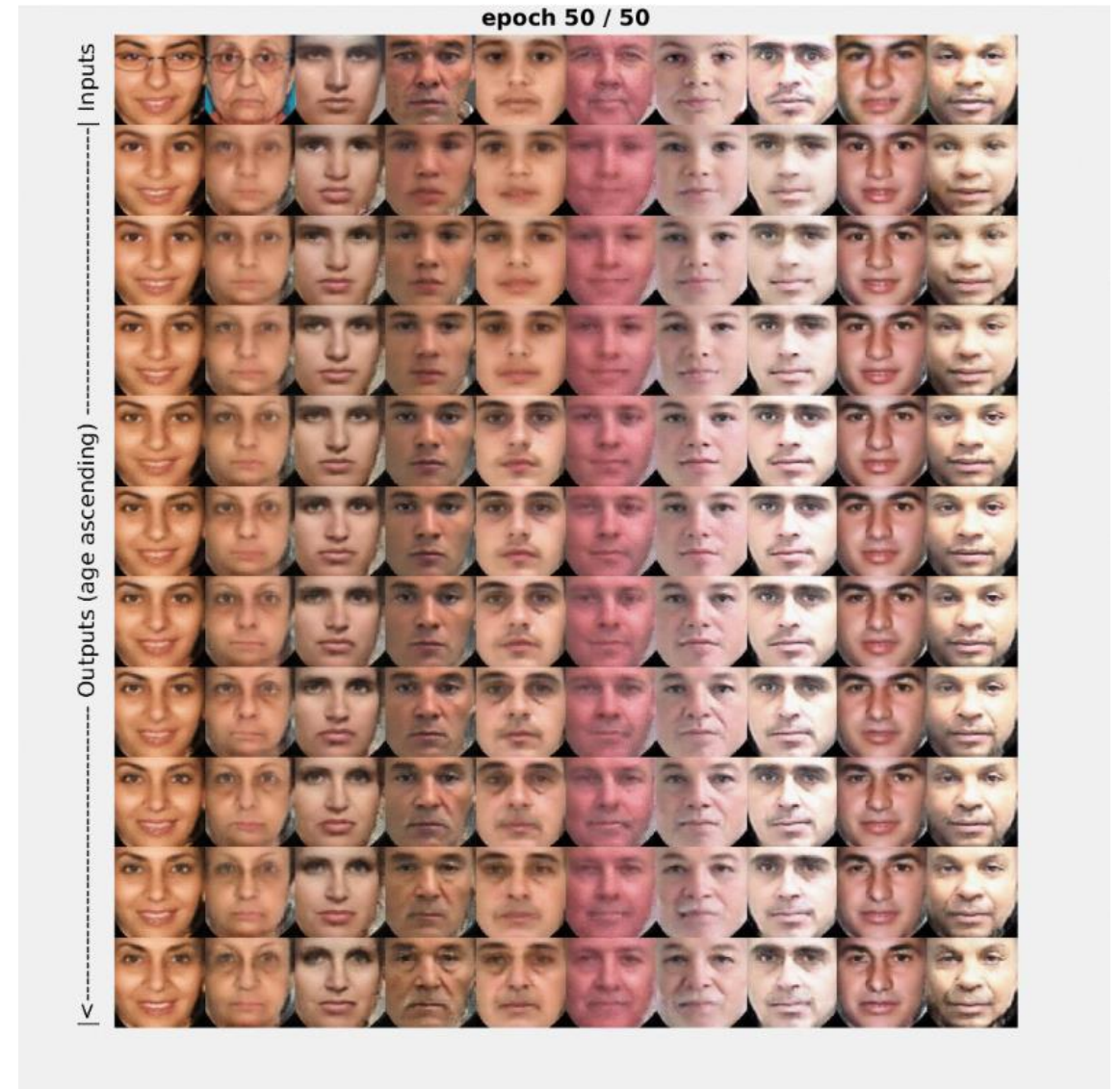
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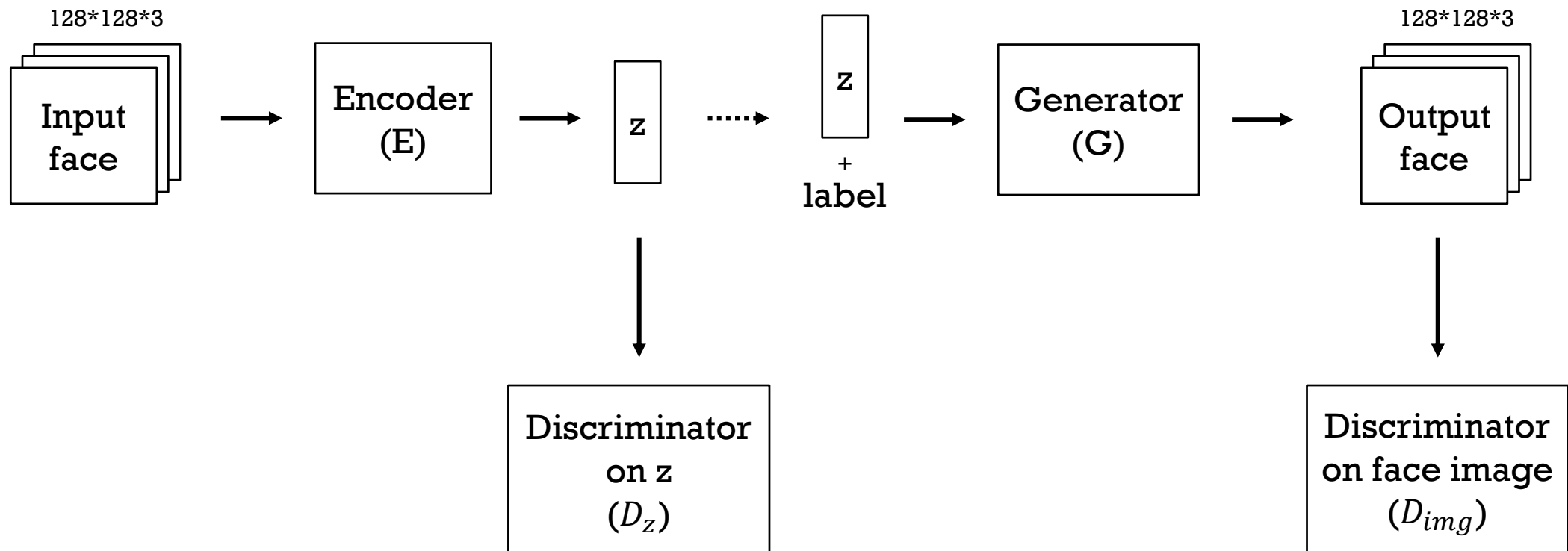
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INTRODUCTION

- Objection：Generate plausible face images of age progression/regression

- Dataset(implementation)：UTKFace
  - ✓ Total images：23,708 face images(with annotations of age and gender)
  - ✓ Divide the age into ten categories：0-5, 6-10, 11-15, 16-20, 21-30, 31-40, 41-50, 51-60, 61-70, 70up
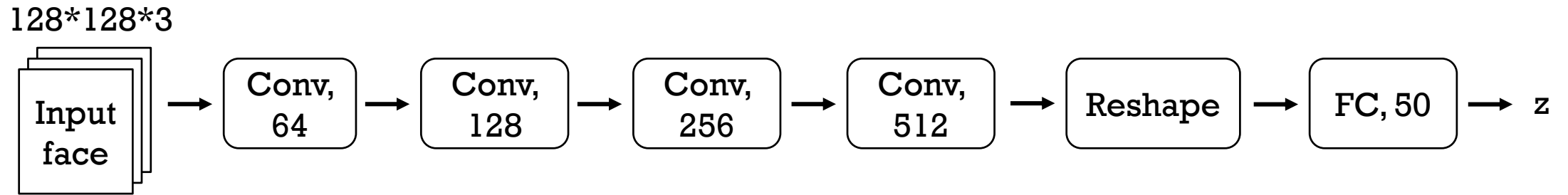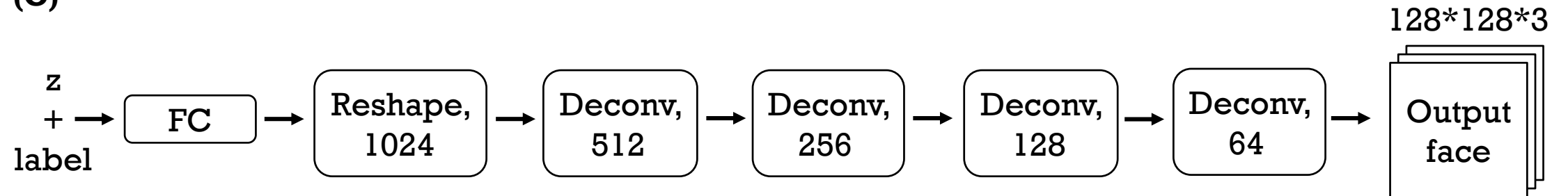
ARCHITECTURE-(1/3)

128*128*3

Input face → Encoder (E) → z ······→ z + label → Generator (G) → Output face

128*128*3

z → Discriminator on z (D_z)

Output face → Discriminator on face image (D_{img})

ARCHITECTURE-(2/3)

Encoder:
(E)

128*128*3

Input face → Conv, 64 → Conv, 128 → Conv, 256 → Conv, 512 → Reshape → FC, 50 → z

Generator:
(G)

z + label → FC → Reshape, 1024 → Deconv, 512 → Deconv, 256 → Deconv, 128 → Deconv, 64 → Output face

128*128*3

ARCHITECTURE-(3/3)

Discriminator on z:
$$(D_z)$$

P(z)：Prior distribution(uniform)

z
or ⟶ FC, 64 ⟶ FC, 32 ⟶ FC, 16 ⟶ FC, 1
P(z)

Discriminator on face image:
$$(D_{img})$$

128*128*3

| Input/ Output face | ⟶ | Conv, 16 + label | ⟶ | Conv, 32 | ⟶ | Conv, 64 | ⟶ | Conv, 128 | ⟶ | Reshape | ⟶ | FC, 1024 | ⟶ | FC, 1 |

OBJECTIVE FUNCTION

Coefficients λ and γ balance the smoothness and high resolution

$\mathcal{L}(\cdot,\cdot)$: L_2 norm

l : label of age

$TV(\cdot)$: total variation

$p(z)$: prior distribution(uniform)

$z^*{\sim}p(z)$: random sampling process from p(z)
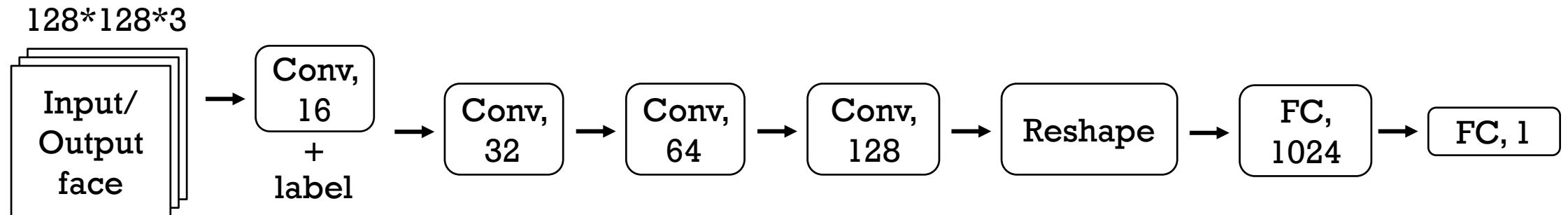
$$\min_{E,G} \max_{D_z,D_{img}} \lambda\mathcal{L}\big(x, G(E(x),l)\big)$$

$$+\gamma TV\big(G(E(x),l)\big)$$

$$+\mathbb{E}_{z^*{\sim}p(z)}\big[logD_z(z^*)\big]$$

$$+\mathbb{E}_{x{\sim}p_{data}(x)}\Big[\log\big(1 - D_z(E(x))\big)\Big]$$

$$+\mathbb{E}_{x,l{\sim}p_{data}(x,l)}\big[logD_{img}(x,l)\big]$$

$$+\mathbb{E}_{x,l{\sim}p_{data}(x,l)}\big[\log(1 - D_{img}(G(E(x),l))\big]$$

REFERENCE

- **[1]** Adversarial autoencoders. In *International Conference on Learning Representations*, 2016.

- **[2]** Generative adversarial nets. In *Advances in Neural Information Processing Systems*, pages 2672–2680, 2014.

- **[3]** Conditional generative adversarial nets. *arXiv preprint arXiv:1411.1784*, 2014.