ECGAN

Edge Guided GANs with Contrastive Learning for Semantic Image Synthesis

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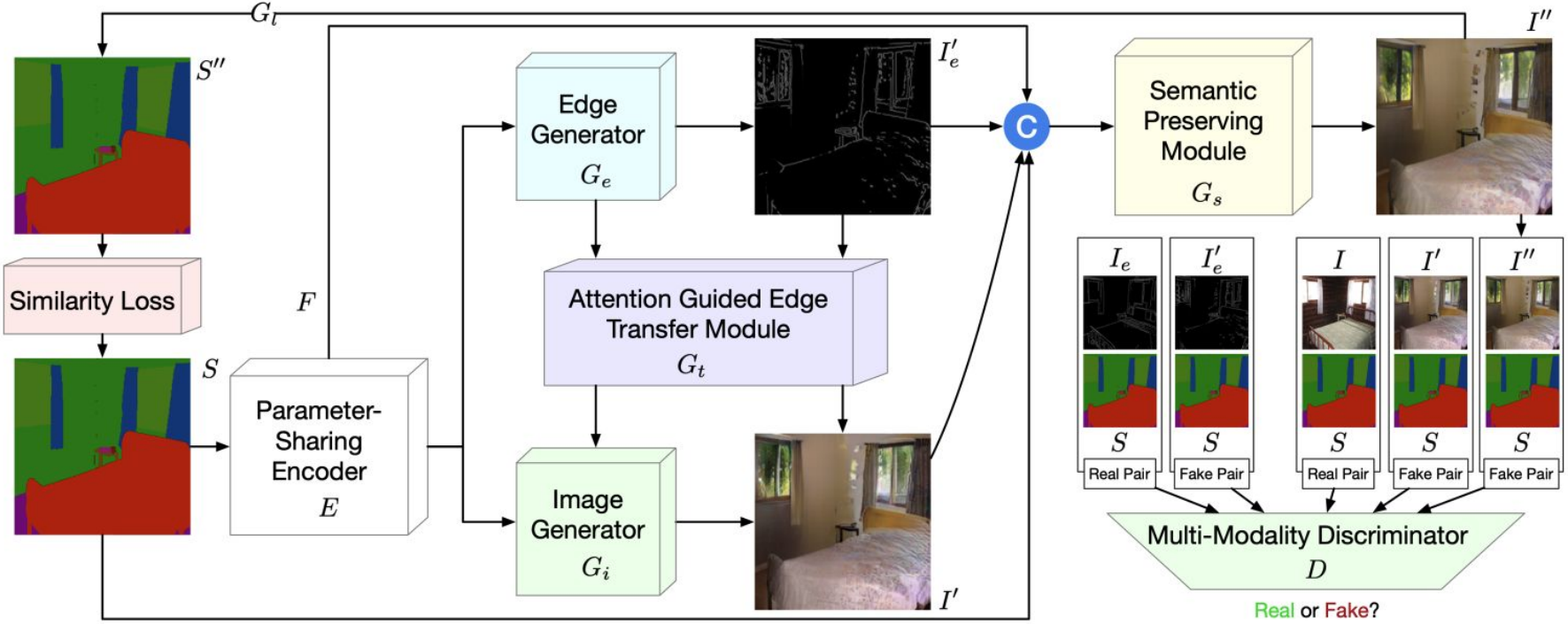
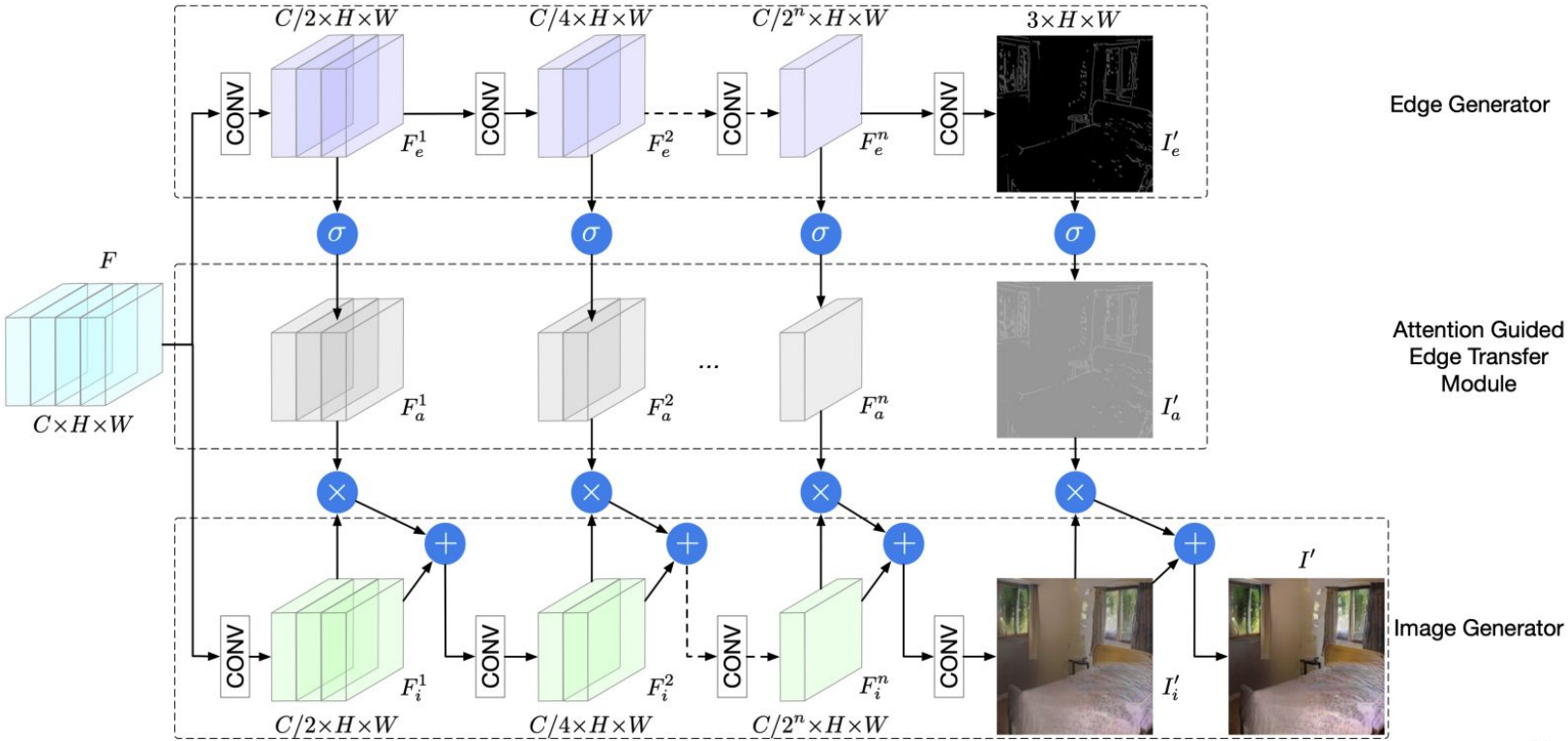
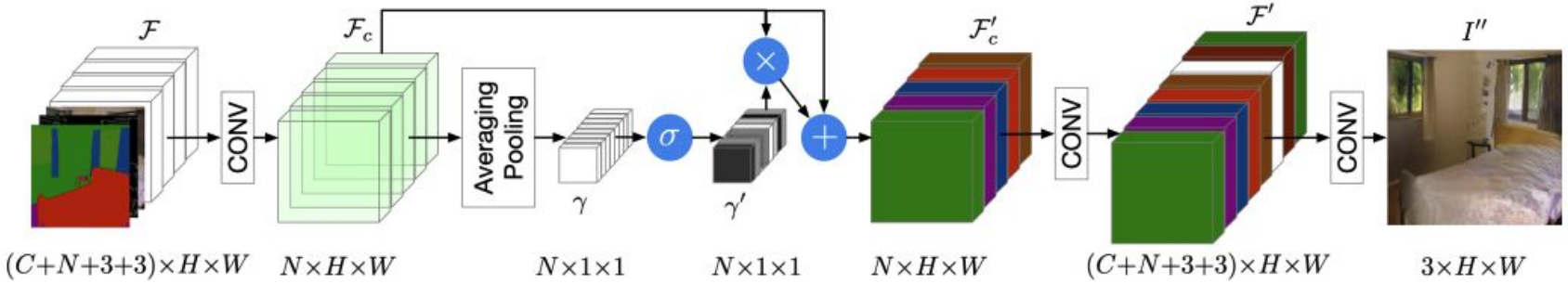
Framework Overview



Ge + Gt + Gi


$C/2\times H\times W$
$C/4\times H\times W$
$C/2^n\times H\times W$
$3\times H\times W$
CONV
F_e^1
F_e^2
F_e^n
I'_e
Edge Generator
σ
F
$C\times H\times W$
F_a^1
F_a^2
...
F_a^n
I'_a
Attention Guided Edge Transfer Module
$\times$
+
F_i^1
F_i^2
F_i^n
I'
I'_i
Image Generator

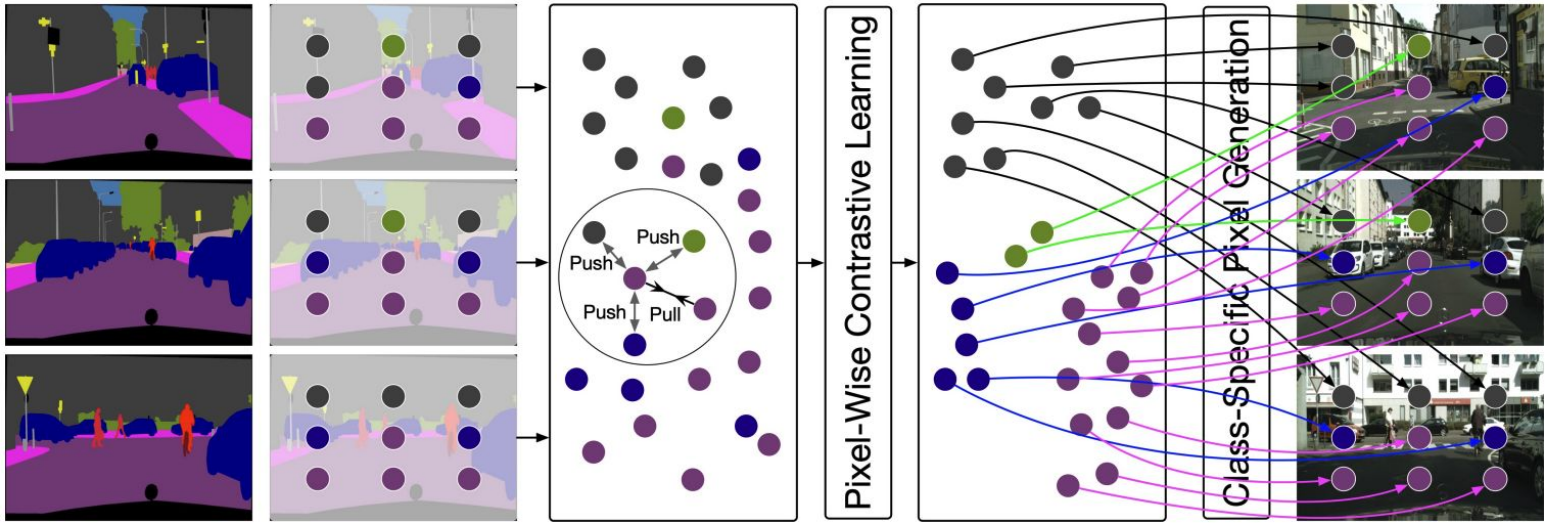
Gs + Gl



For Gl was used pretrained model, which output passed to Similarity Loss function

$$\mathcal{L}_{sim}(S, S'') = -\frac{1}{M^2}\sum_{m=1}^{M^2}(a_m \log a''_m + (1-a_m)\log(1-a''_m))$$

Pixel-Wise Contrastive Learning



$$\mathcal{L}_i = \frac{1}{|P_i|} \sum_{i_+ \in P_i} -\log \frac{\exp(i \cdot i_+ / \tau)}{\exp(i \cdot i_+ / \tau) + \sum_{i_- \in N_i} \exp(i \cdot i_- / \tau)}$$

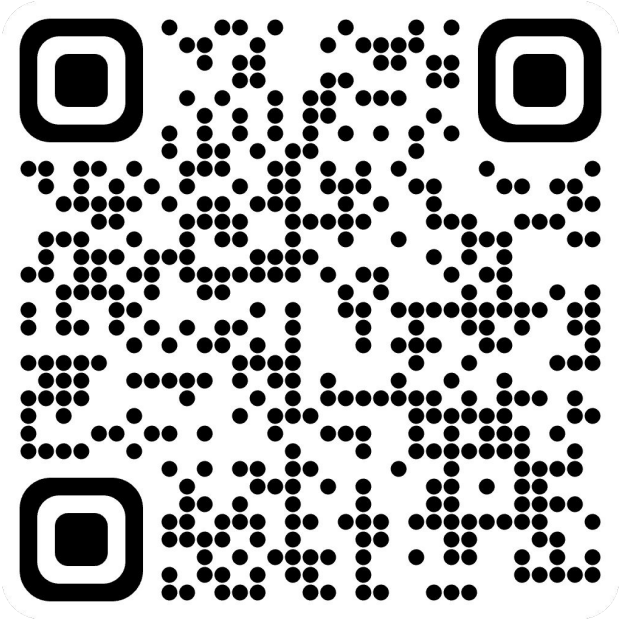
Losses

$$\min_G \max_D \mathcal{L} = \lambda_c \underbrace{\left(\mathcal{L}_{\mathrm{CGAN}}(G_e, D) + \mathcal{L}_{\mathrm{CGAN}}(G_i, G_s, D)\right)}_{\text{Multi-Modality Adversarial Loss}} + \lambda_s \underbrace{\mathcal{L}_{sim}(S, S') + \mathcal{L}_{sim}(S, S'')}_{\text{Similarity Loss}}$$
$$+ \lambda_l \underbrace{\mathcal{L}_i + \mathcal{L}_{L_1}}_{\text{Contrastive Learning Loss}} + \lambda_f \underbrace{\left(\mathcal{L}_f(I_e, I'_e) + \mathcal{L}_f(I, I') + \lambda \mathcal{L}_f(I, I'')\right)}_{\text{Discriminator Feature Matching Loss}}$$
$$+ \lambda_p \underbrace{\left(\mathcal{L}_p(I_e, I'_e) + \mathcal{L}_p(I, I') + \lambda \mathcal{L}_p(I, I'')\right)}_{\text{Perceptual Loss}},$$

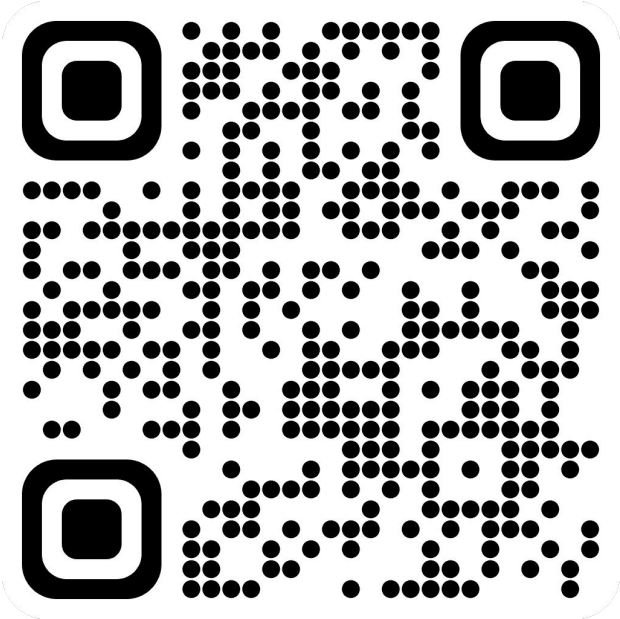
$$\mathcal{L}_{\mathrm{CGAN}}(G_e, D) = \mathbb{E}_{S, I_e}\left[\log D(S, I_e)\right] + \mathbb{E}_{S, I'_e}\left[\log(1 - D(S, I'_e))\right],$$

$$\mathcal{L}_{\mathrm{CGAN}}(G_i, G_s, D) = (\lambda + 1)\mathbb{E}_{S, I}\left[\log D(S, I)\right] + \mathbb{E}_{S, I'}\left[\log(1 - D(S, I'))\right] + \lambda \mathbb{E}_{S, I''}\left[\log(1 - D(S, I''))\right],$$

Results:



GitHub:



Thank you for your attention!