Pseudo Codes

Algorithm 1: Anime Face Generation

Given the *SFN* model $\boldsymbol{M_F}$, the anime face *generative* model $\boldsymbol{M_G}$, and a *quality* threshold $\boldsymbol{t}$.

Input: the gender attribute $\boldsymbol{g}$ ($male$ or $female$)

1. Initialize the iteration step $\boldsymbol{I}=0$;

Repeat

2. Generate a face image X_g using the model $\boldsymbol{M_G}$ on the condition $\boldsymbol{g}$;
3. Estimate the quality $\boldsymbol{q}$ of X_g with the model $\boldsymbol{M_F}$;
4. Update $\boldsymbol{I}=\boldsymbol{I}+1$;

Until: $\boldsymbol{q}>\boldsymbol{t}$ or $\boldsymbol{I}>10$

Output: the generated image X_g

Algorithm 2: Learning Process

Given three DNN backbones $\boldsymbol{M_R}$, $\boldsymbol{M_D}$, and $\boldsymbol{M_S}$, and anime face images $\boldsymbol{X}=\{X_{real}\}$ with *incomplete* labels $\boldsymbol{y}=\{y^g, y^s, y^q\}$ respectively corresponding to gender, style, and quality.

Step 1: Active Label Completion

1.1 Train three classifiers on each backbone with incomplete labels using Eq. (1);

1.2 Predict the missing labels of y^g and y^s by ensembling three classifiers;

1.3 Fill the original label set $\boldsymbol{y}$ with the prediction and form a complete label set $\boldsymbol{y}'$ except for unknown y^q;

Step 2: Anime GAN

2.1 Train an *SFN model* $\boldsymbol{M_F}$ with $\boldsymbol{y}'$ using Eq. (1);

2.2 Extract the last fully connected layer as style features s;

2.3 Train *GAN* models with $\{X_{real}, s, g\}$ using Eq. (2);

2.4 Generate fake images X_{fake} using the *generative* model $\boldsymbol{M_G}$;

Step 3: SFN Finetuning

3.1 Set the quality $y^q=1$ of images X_{real};

3.2 Manually annotate images X_{fake} with different quality $y^q=\{0, 0.5, 1\}$;

3.3 Finetune $\boldsymbol{M_F}$ with both X_{fake} and X_{real} of the quality label y^q using Eq. (1).

Output: the *SFN* model $\boldsymbol{M_F}$ and the anime face *generative* model $\boldsymbol{M_G}$