

Paired-D GAN for Semantic Image Synthesis

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MOTIVATION

Problem

Source image
Text description: This small bird has a blue crown and white belly
Synthesized image

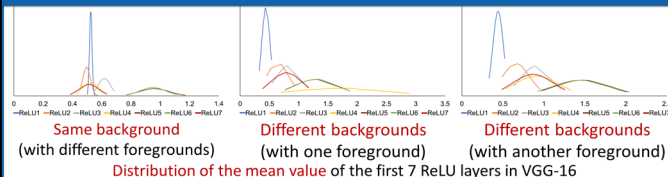
Applications

- Computer-aided design
- Intelligent image manipulation

Challenges

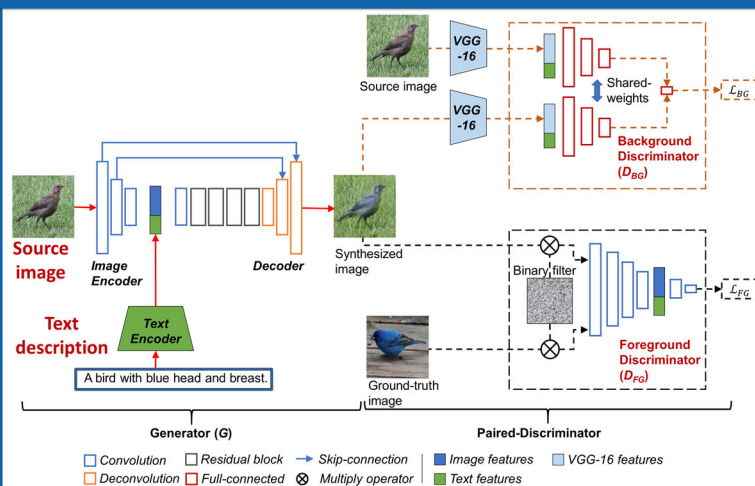
- Matching text description
- Retaining background in source image
- Synthesizing realistic images

KEY IDEAS



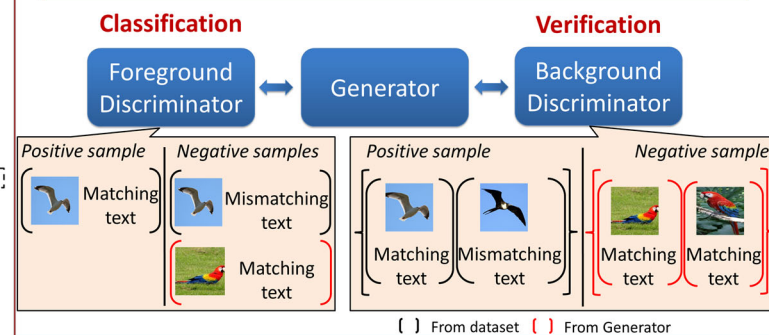
- ❖ Background: Low level features
 - ❖ Foreground: High level features
- Generator: different level of features for foreground and background
Pair of Discriminators: foreground/background judgement

PROPOSED METHOD



Adversarial learning

$$\text{Generator loss} = \text{Foreground loss} + \text{Background loss} + \text{Reconstruction loss}$$



EVALUATION METRICS

Inception score (IS)

Score

Foreground score (FGS)

Euclidean distance

Background score (BGS)

Euclidean distance

EXPERIMENTS

Quantitative comparison

Dataset	Caltech-200			Oxford-102		
	IS (↑)	FGS (↓)	BGS (↓)	IS (↑)	FGS (↓)	BGS (↓)
Paired-D GAN	6.39±0.18	17.26±0.21	9.03±0.06	4.41±0.08	8.81±0.08	8.87±0.04
Dong (ICCV'17)	5.56±0.14	18.60±0.09	11.83±0.06	4.03±0.11	9.71±0.11	9.47±0.14
Yang (ICLR'17)	5.92±1.04	18.34±0.14	--	3.49±0.04	10.32±0.09	--

Ablation study

Dataset	Caltech-200			Oxford-102		
	IS (↑)	FGS (↓)	BGS (↓)	IS (↑)	FGS (↓)	BGS (↓)
Ours	6.39±0.18	17.26±0.21	9.03±0.06	4.41±0.08	8.81±0.08	8.87±0.04
Ours (D _{FG} only)	5.83±0.19	16.74±0.12	11.89±0.08	4.21±0.07	8.52±0.13	10.02±0.08
Ours (D _{BG} only)	6.02±0.15	20.33±0.11	7.63±0.08	4.24±0.10	10.68±0.14	8.32±0.15

EXPERIMENTS

Paired-D GAN

Source image

This black bird has no other colors with a short bill.

A small brown bird with a brown crown has a white belly.

A black bird with a red head.

An orange bird with green wings and blue head.

This bird with a red head and breast and features grey wings.

Dong (ICCV'17)

Caltech-200 bird dataset

Paired-D GAN

Source image

The petals are white and the stamens are light yellow.

The light purple flower has a large number of small petals.

The petals of the flower have yellow and red stripes.

The petals have mixed colors of bright yellow and light green.

The flower shows reddish petals with yellow edges.

Dong (ICCV'17)

Oxford-102 flower dataset

CONCLUSION

GAN based end-to-end network for semantic image synthesis: ❖ Foreground discriminator: matching text description. ❖ Background discriminator: retaining background information.