CP-GAN: Caption to Image using Generative Adversarial Network

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Introduction

- **Background**
- Generative Adversarial Networks (GANs) are powerful generative models introduced by (Goodfellow et al.) and can be trained on as little data as a single image
- In this project, a caption-to-image generation framework is proposed which translates text descriptions to photo-realistic images , thus allowing written languages to potentially benefit from this technology..
- Main aim is to generate realistic and caption-consistent images from given natural language descriptions.
- Due to its practical applications, caption-to-image synthesis is active research topic .

Objectives

- To increase the performance of the model and quality of images generation and to reduce modality gap between caption and image which is not achieved in previous frameworks.
- Conditioned on the caption, the proposed CPGAN model synthesizes images that are semantically consistent with the corresponding captions.
- To reduce computational cost

Methodology & Study Area

- Given an image-caption pair, we need to find a common space for both modalities, so that we can minimize the modality gap and obtain visually-grounded embedding.
- We developed target aware discriminator that significantly improves the image quality and caption-image semantic consistency, and helps to convergence of generator without adding more networks.
- Developed CP-GAN which generated synthesizes images and help to find caption and image features more effectively.
- To reduce noise in the caption which affect the performace we add extra layer which reduce noise and provide generator with less noise data which help to get quality image of 256 *256 resolution.
- Data augmentation helps to stablize the model

Model Architectures

Image Encoder

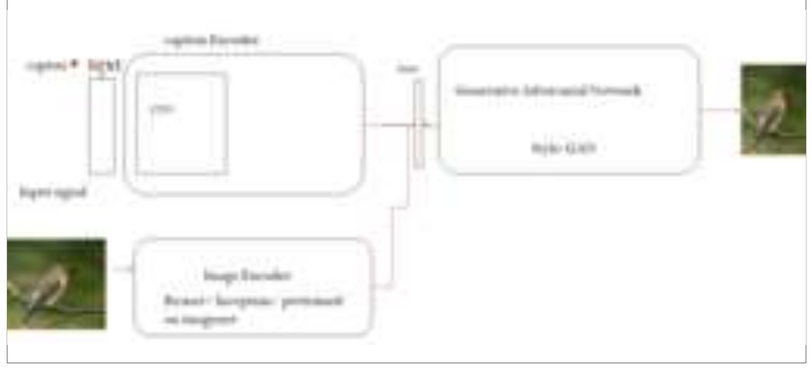
- We have used Inception-v3 architecture model pretrained on image-net to extract visual features.
- to extract visual features a layer will be employed to convert the visual feature to a common space of visual and caption embedding.

Caption Encoder

- Inspired by the character-based text embedding architecture and caption-visual cross-modal embedding learning , a multi-layer CNN will be used.
- First Sentence features are transformed into word features
- . Conventional generator predicts an initial image with a rough shape and few details from sentence feature
- This stage can be repeated multiple times to retrieve more precise information and generate a high-resolution image with more fine-grained details.

GAN Model

- Our method considers the interaction between each word and the whole generated image
- StackGAN generate photo-realistic high-resolution images with two stages.
- Stage-I GAN sketches the primitive shape and basic colors of the object conditioned on the given text description, and draws the background layout from a random noise vector, yielding. a low-resolution image. Stage-II GAN corrects defects in the low-resolution image from Stage-I and completes details of the object by reading the text description again, producing a high-resolution photo-realistic image.



Result

Models	CUB-IS ↑	CUB-FID ↓
AttnGAN	4.36	23.98
DM-GAN	4.75	16.09
CP-GAN (Proposed)	7.39	10.82

, .Dataset and Evaluation metrics

- Datasets CUB commonly-used dataset in the field of Text to Image.
- CUB is a fine-grained bird dataset that contains 11,788 bird images belonging to 200 categories.
- Each image in both datasets has 10 text descriptions collected .
- Evaluation metrics will be used are inception score and Frechet inception distance

Conclusion

we proposed a novel caption to image Generative Adversarial Networks (CP-GAN) for caption-to-image generation tasks which is able to directly synthesize more realistic and text-image semantic consistent images without stacking architecture and extra networks. Moreover, our target-aware discriminator composed significantly improves the image quality and caption mage semantic consistency, and accelerate the convergence of generator. Result show that our proposed CP-GAN significantly outperforms other model on the CUB dataset

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