

Neural Information
Processing Systems
Foundation



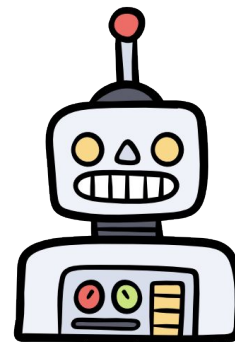
Text-Adaptive Generative Adversarial Networks: Manipulating Images with Natural Language

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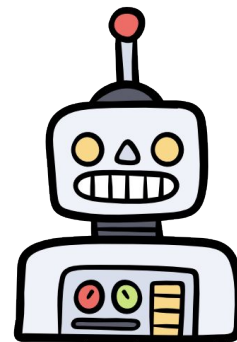
Seoul, South Korea

Manipulating Images with Natural Language



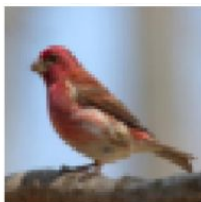
Manipulating Images with Natural Language

This small bird has a *blue* crown and *white* belly.

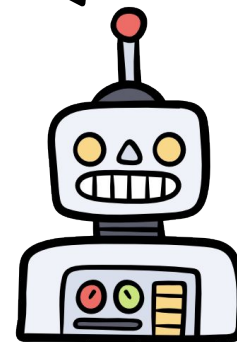


Manipulating Images with Natural Language

This small bird has a *blue crown* and *white belly*.



Processing...
Here it is.

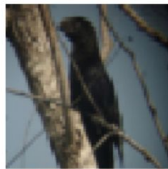


Related Work

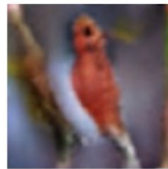
- Existing methods rely heavily on sentence embedding vectors
- They fail to preserve text-irrelevant contents (e.g. background)
- Coarse multi-modal modeling is not enough for the disentanglement

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

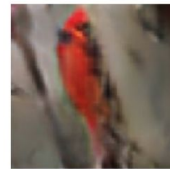
This small bird has a **blue crown** and **white belly**.



Original



[Reed et al.,
2016]



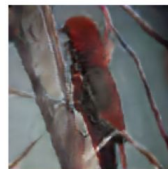
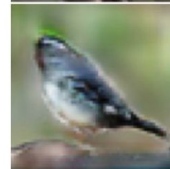
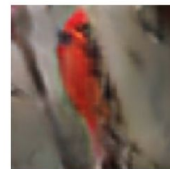
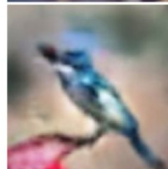
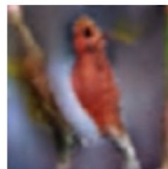
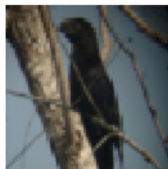
[Dong et al.,
2017]

Contribution

- Our key idea is word-level local discriminators for fine-grained training
- Our method effectively changes visual attributes while preserving text-irrelevant contents

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

This small bird has a **blue crown** and **white belly**.



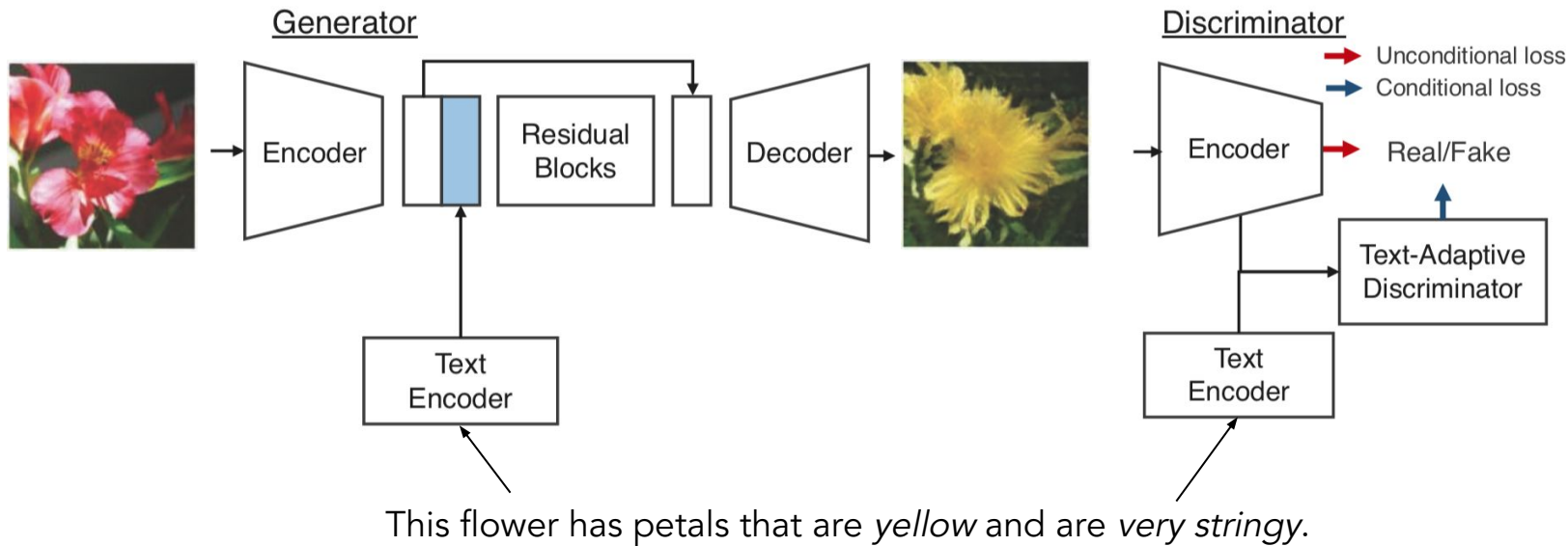
Original

[Reed et al.,
2016]

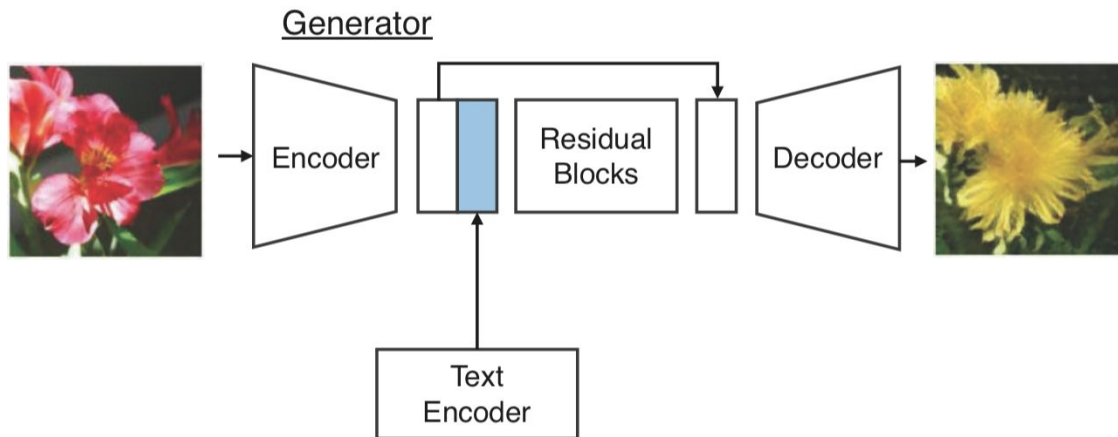
[Dong et al.,
2017]

Ours

Overview of TAGAN



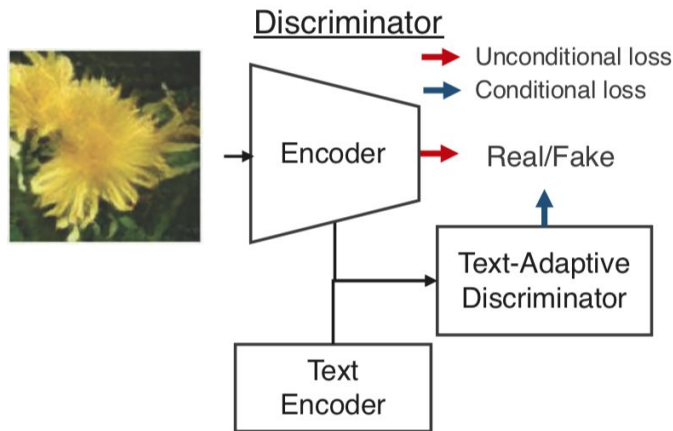
Generator



This flower has petals that are *yellow* and are *very stringy*.

To preserve original contents,
we add a reconstruction loss: $L_{rec} = \|\mathbf{x} - G(\mathbf{x}, \mathbf{t})\|$

Discriminator



The discriminator consists of

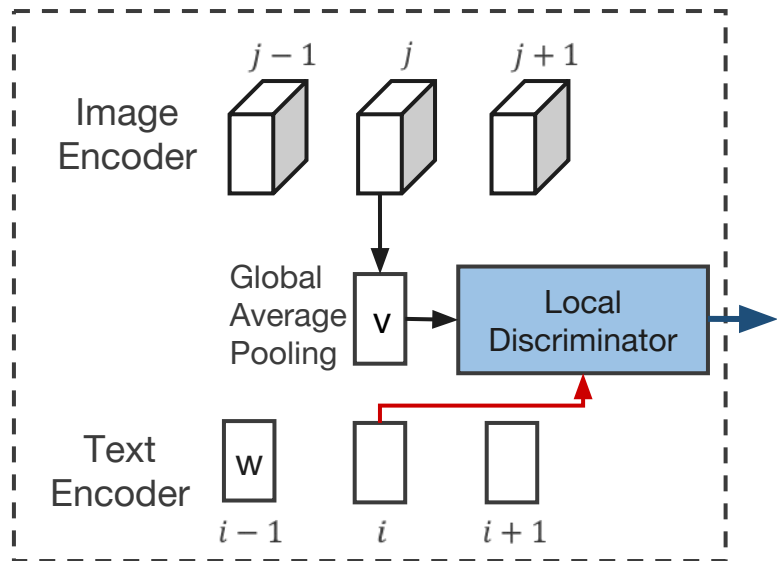
1. Unconditional discriminator
→ Make image realistic
2. Text-adaptive discriminator
→ Make image match the text

This flower has petals that are *yellow* and are *very stringy*.

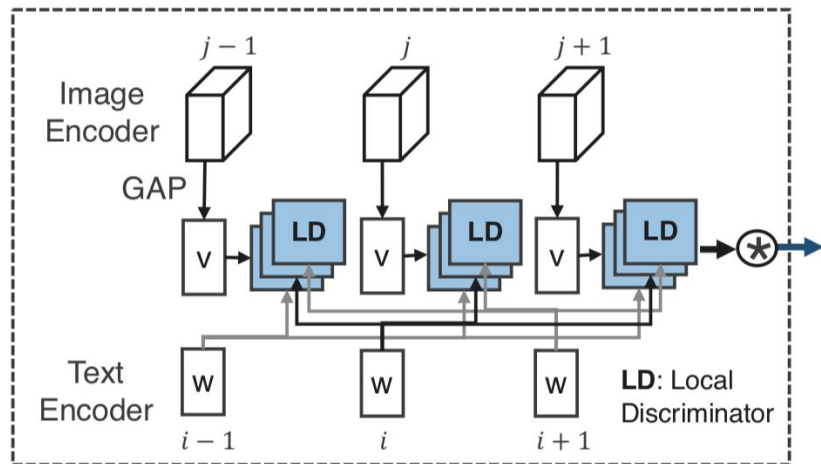
Text-Adaptive Discriminator

1. Compute local discriminator scores

$$f_{\mathbf{w}_i}(\mathbf{v}) = \sigma(\underbrace{\mathbf{W}(\mathbf{w}_i)}_{\text{text}} \cdot \underbrace{\mathbf{v}}_{\text{image}} + \underbrace{\mathbf{b}(\mathbf{w}_i)}_{\text{text}})$$



Text-Adaptive Discriminator



1. Compute local discriminator scores

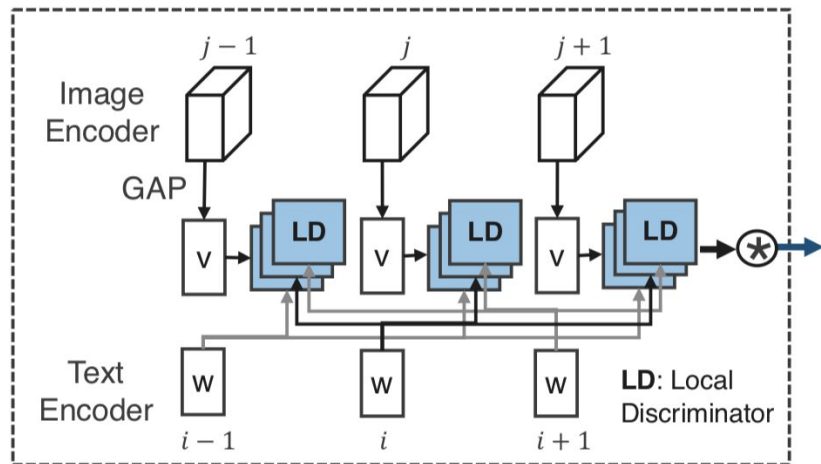
$$f_{\mathbf{w}_i}(\mathbf{v}) = \sigma(\mathbf{W}(\mathbf{w}_i) \cdot \mathbf{v} + \mathbf{b}(\mathbf{w}_i))$$

2. Compute text/image attentions

α_i : softmax weight for word i

β_{ij} : softmax weight for word i ,
and image feature level j

Text-Adaptive Discriminator



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$$f_{\mathbf{w}_i}(\mathbf{v}) = \sigma(\mathbf{W}(\mathbf{w}_i) \cdot \mathbf{v} + \mathbf{b}(\mathbf{w}_i))$$

2. Compute text/image attentions

α_i : softmax weight for word i

β_{ij} : softmax weight for word i ,
and image feature level j

3. Aggregate the scores with attentions

$$D(\mathbf{x}, \mathbf{t}) = \prod_{i=1}^T \left[\sum_j \beta_{ij} f_{\mathbf{w}_i, j}(\mathbf{v}_j) \right]^{\alpha_i}$$

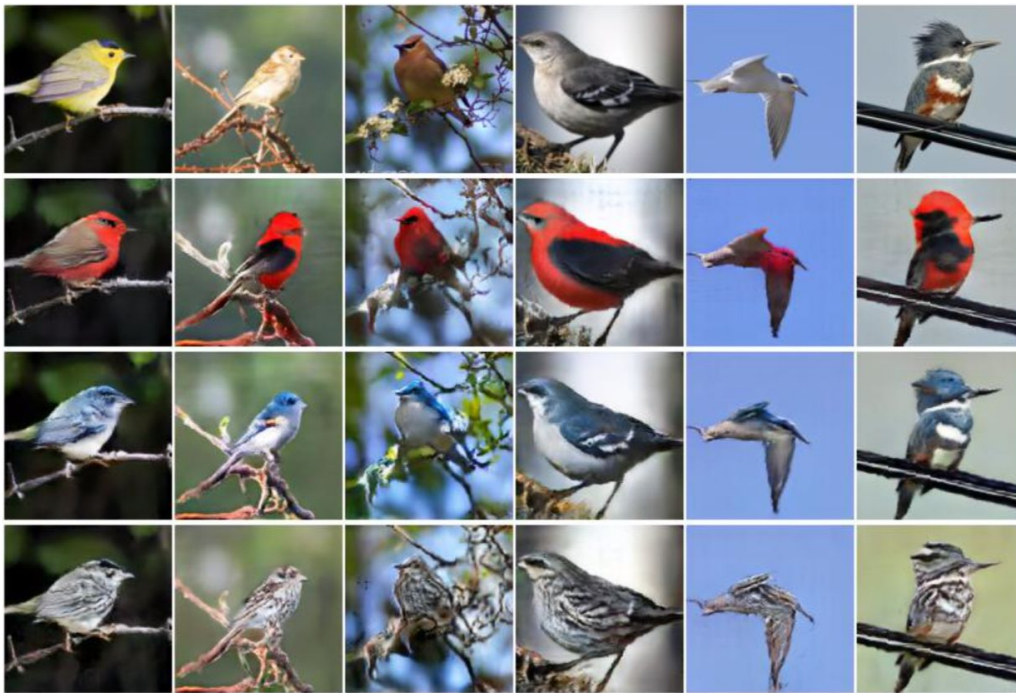
Manipulation Results on CUB-200

Original

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

This bird has **wings that are blue** and has a **white belly**.

A small bird with **white base** and **black stripes** throughout its belly, head, and feathers.



Manipulation Results on Oxford-102

Original



The petals are **white** and the stamens are **light yellow**.



The petals of the flower have **yellow and red stripes**.



This flower has petals of **pink and white color** with **yellow stamens**.



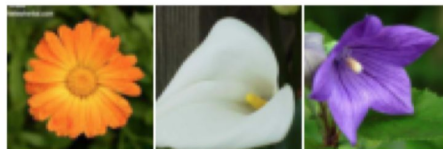
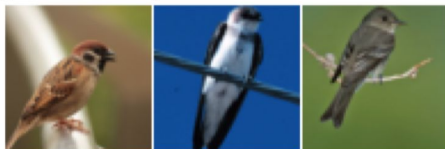
Gazania
Wikipedia

Qualitative Comparison

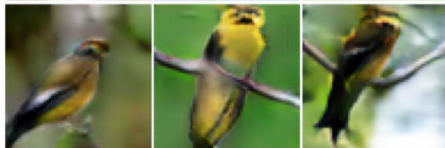
This is a **black bird** with **gray and white wings** and a **bright yellow belly and chest**.

This flower has **petals that are white** and has **patches of yellow**.

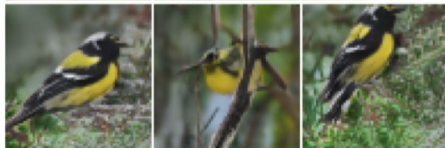
Original



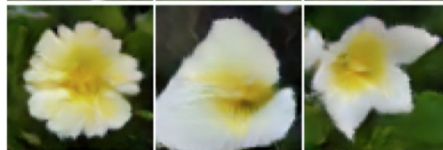
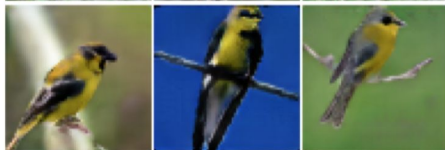
[Dong et al., 2017]



[Xu et al., 2018]



Ours



Conclusion

- We propose a Text-Adaptive Generative Adversarial Network (TAGAN)
- Our method disentangles and manipulates fine-grained visual attributes
- Our method outperforms existing methods on CUB-200 and Oxford-102

Please visit our poster (#126) for more information



<https://github.com/woozzu/tagan>