ADVERSARIAL SEGMENTATION LOSS FOR SKETCH COLORIZATION

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INTRODUCTION

- We introduce a new method for **generating color images from sketches** or edge maps.
- Current methods either **require some form of additional user-guidance** or are limited to the "paired" translation approach.
- We argue that **segmentation information could provide valuable guidance** for sketch colorization.
- We propose to leverage semantic image segmentation to **create an additional adversarial loss function.**

Our method;

1. can be integrated to any GAN model.
2. not limited to datasets that contain segmentation labels.
3. can be trained for unpaired translation tasks.

- We show the effectiveness of our method on **four different datasets** spanning **scene level indoor, outdoor, and children book illustration** images using qualitative, quantitative and user study analysis.

MODEL

Our model consists of **a baseline GAN**, a **panoptic segmentation network (Seg)** and **two discriminators (D_M and D_B).**

We designed three variants of our model;

1. **Multi Class**: The first variant utilizes the full segmentation map of an image where all foreground and background classes – a total of 135 classes– are considered.
2. **Binary**: As a higher level of abstraction, grouping objects only as background and foreground may yield sufficient information.
3. **Both**: Finally, our third variant is the union of the above two.
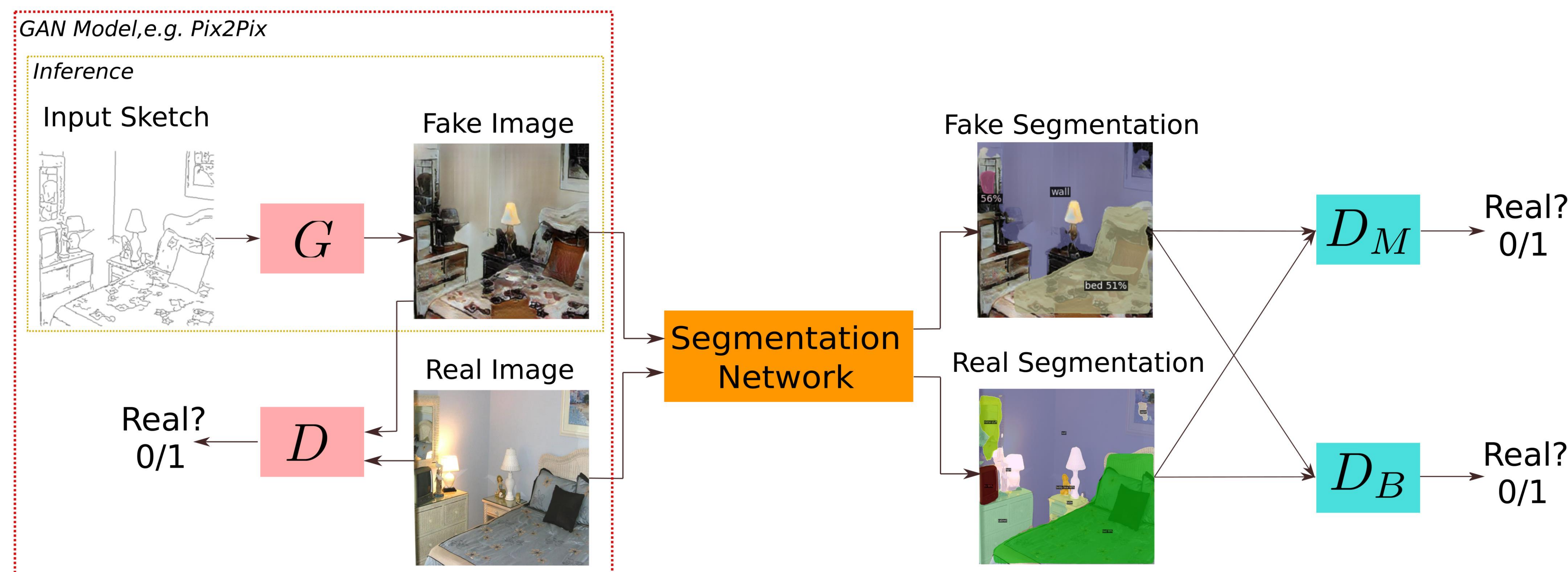
DATASETS

We evaluated our models on **four challenging datasets**.

Bedroom images from the Ade20k indoor dataset. **Children's book illustrations** by Axel Scheffler. **Elephant and Sheep images** curated by us from the COCO dataset.

Edge images are extracted using the HED [18] method.

- **Our code, pretrained models and the scripts are available in https://github.com/giddyyupp/AdvSegLoss**

EXPERIMENTS

- **Adversarial Segmentation Loss** affected the results of paired and unpaired cases differently.
- Segmentation guidance **closed the gap between unpaired and paired training results.**
- **Limitation: Elephant and sheep results lack realism, even using paired training scheme.**

Dataset	Unpaired				Paired				
	CycleGAN	+AdvSegLoss (Multi-class)	+AdvSegLoss (Binary)	+AdvSegLoss (Both)	AutoPainter	Pix2Pix	+AdvSegLoss (Multi-class)	+AdvSegLoss (Binary)	+AdvSegLoss (Both)
Bedroom	113.1	111.7	**87.1**	93.2	206.8	100.5	100.0	**95.1**	110.1
Illustration	213.6	206.9	204.8	**189.4**	272.0	180.0	176.9	178.0	**175.7**
Elephant	126.4	103.9	**91.9**	116.9	155.1	83.5	85.8	**78.8**	82.8
Sheep	209.3	207.2	236.1	**196.8**	233.1	157.0	159.9	162.0	**150.5**

Input | GT | Baseline | AdvSegLoss (Multi-class) | AdvSegLoss (Binary) | AdvSegLoss (Both)

ACKNOWLEDGEMENTS