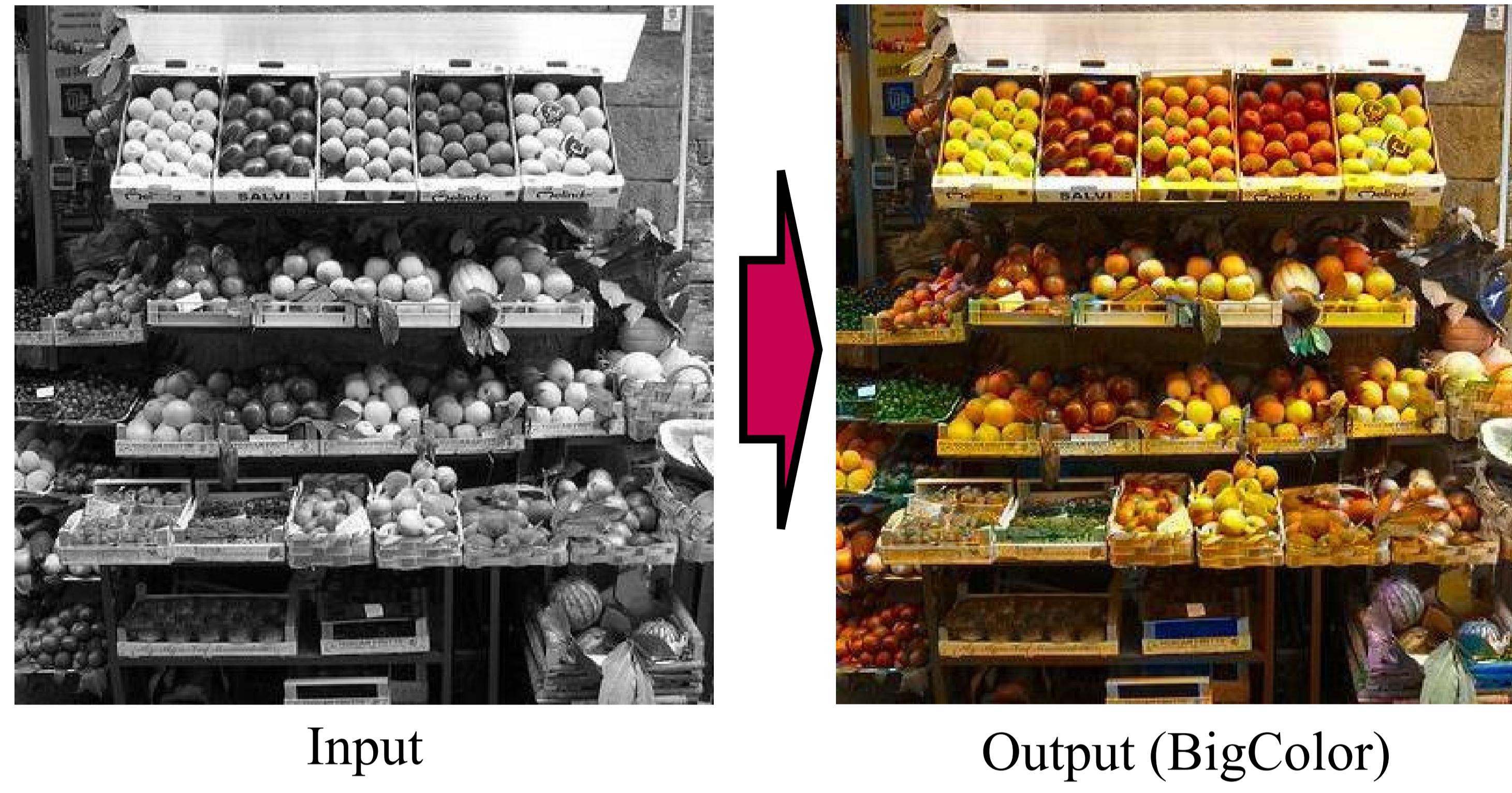


# BigColor: Colorization using a Generative Color Prior for Natural Images

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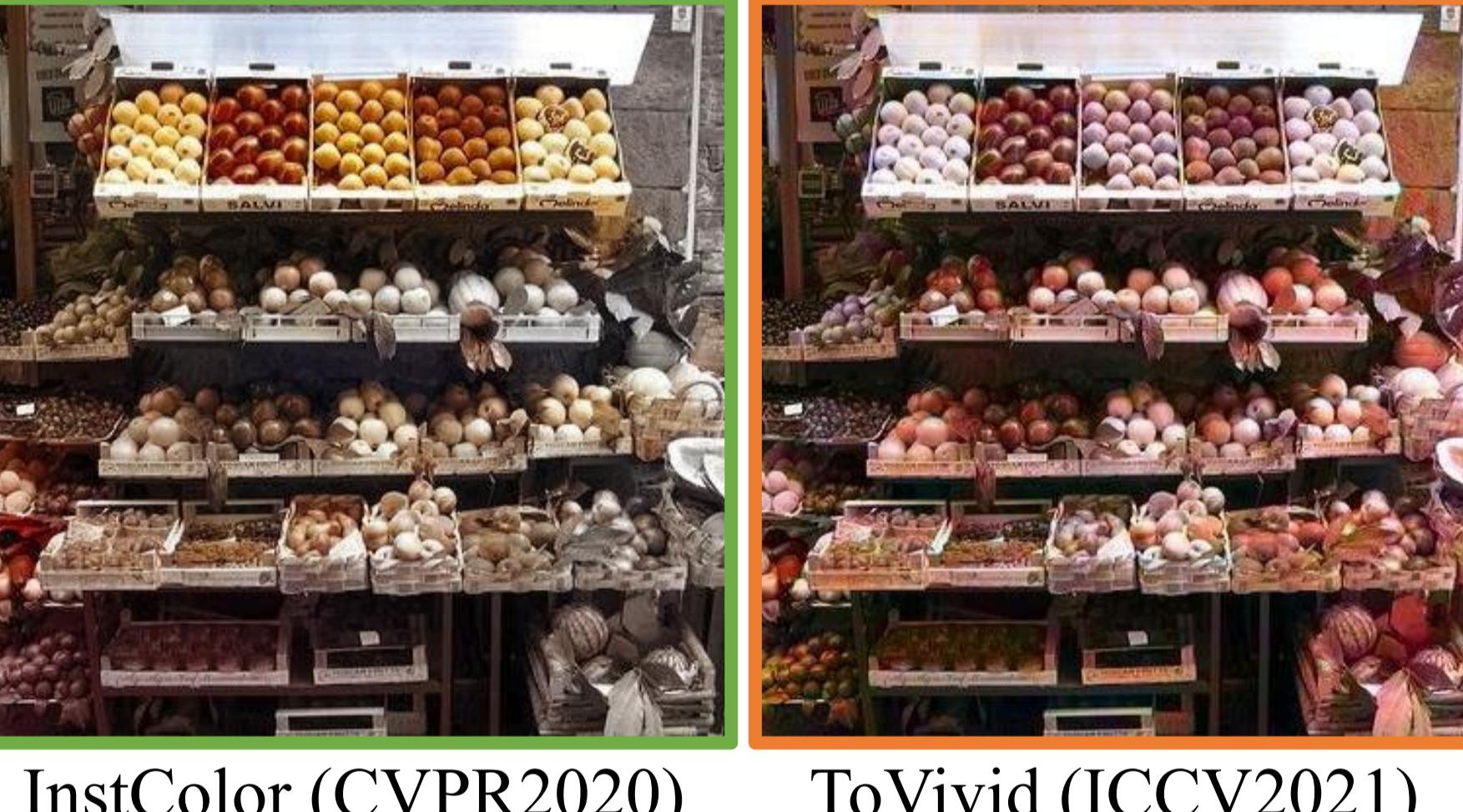
## Automatic Colorization

- Estimating a color image from a grayscale image.
- Multiple possible solutions due to the ill-posedness.



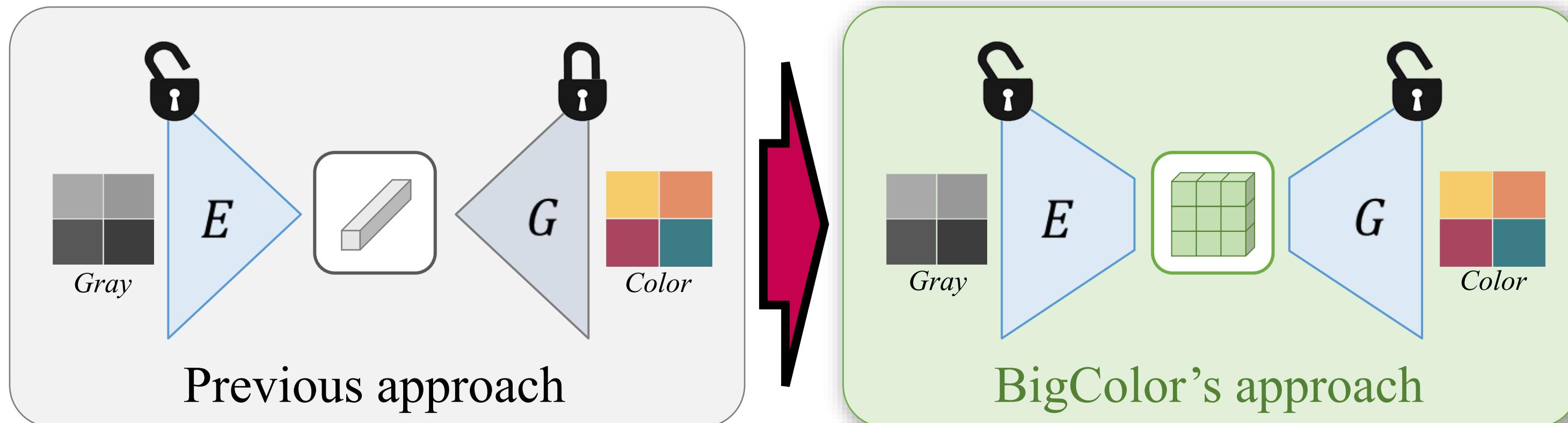
## Challenges in Previous Methods

Desaturated color results  
(Regression loss-based method)



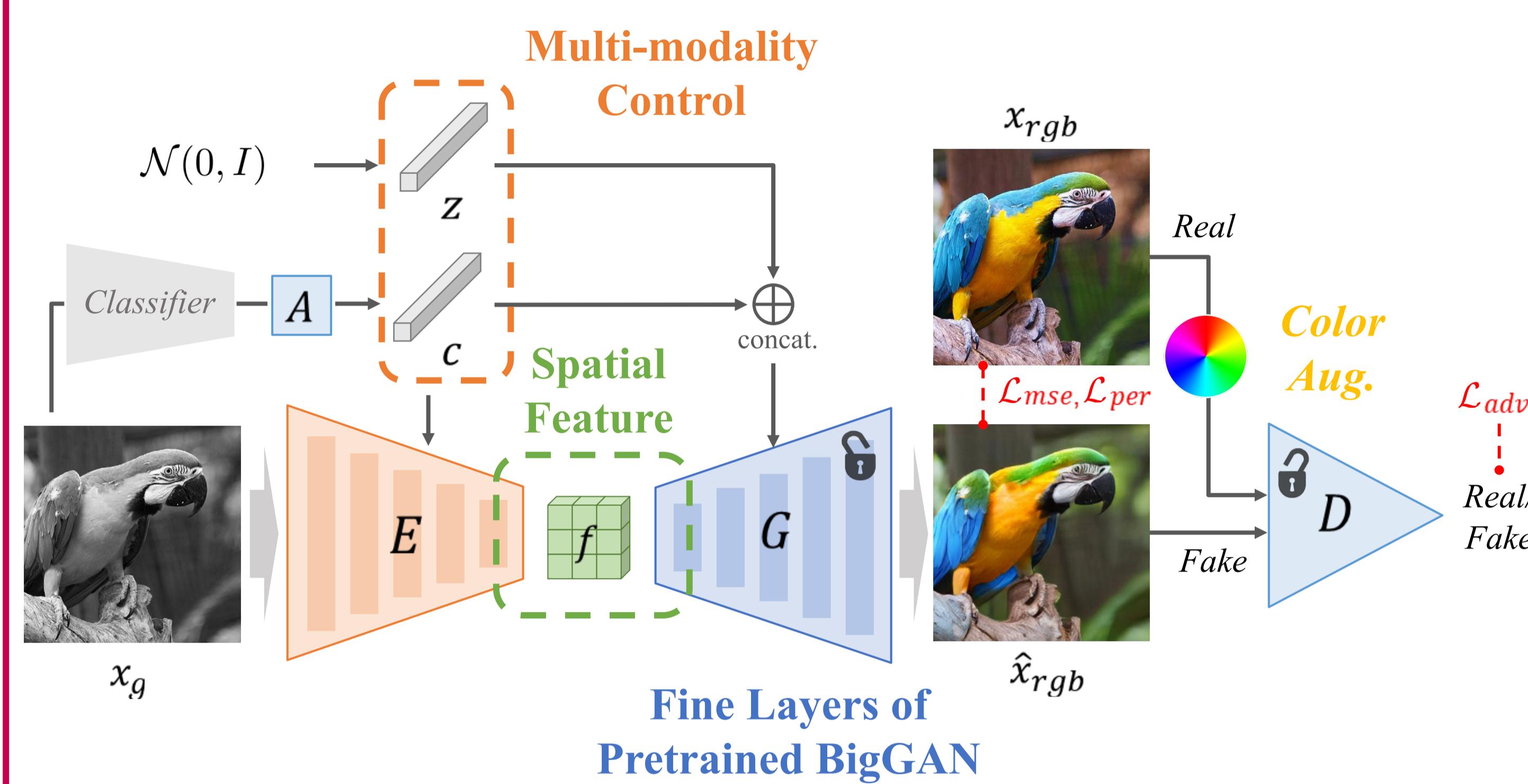
## Key Idea

- Spatial latent code effectively transfers complex structure info.
- Joint training of encoder-generator enables to learn a generative color prior for estimating vivid and natural colors.



## Methods

### Framework Overview



- **Generator** consisting of fine layers of a Pretrained BigGAN generator for leveraging a generative prior.
- **Spatial feature** as a latent code instead of a spatially-flattened code in the original latent space to enlarge the representation space of a generator.
- **Multi-modality** using a random code  $z$  and a class vector  $c$  estimated by an off-the-shelf classifier or be specified by a user.
- **Color augmentation** for improving color vividness and naturalness.

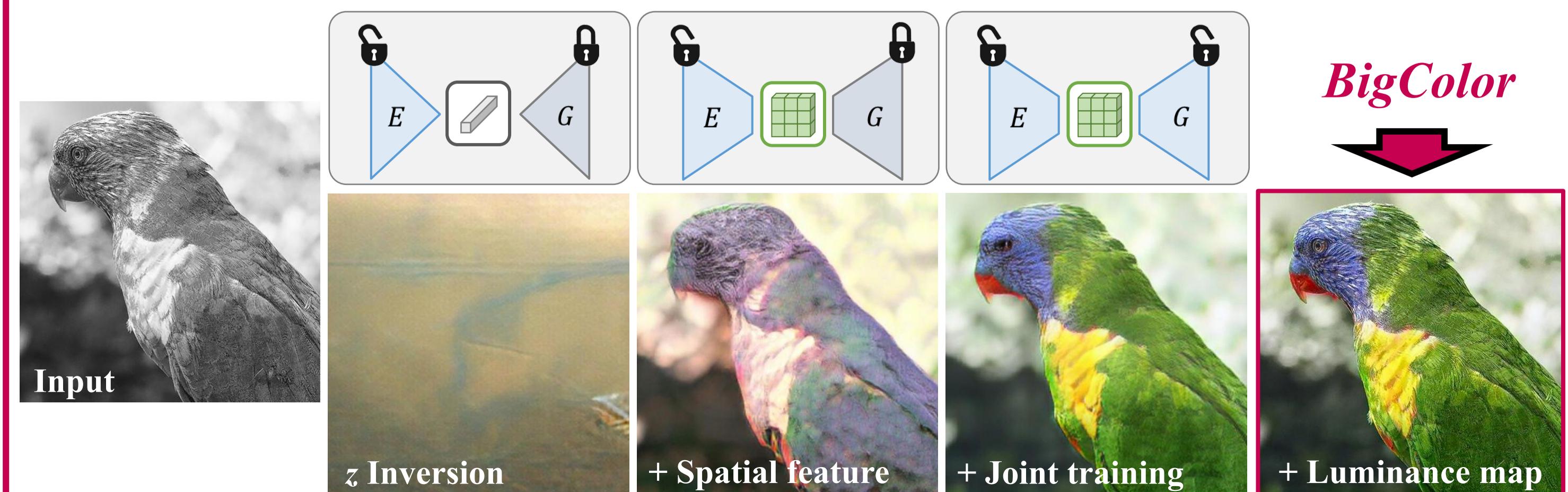
### Objective Function

$L^G$  for the encoder-generator and  $L_{adv}^D$  for the discriminator:

$$\begin{aligned} \mathcal{L}^G &= \mathcal{L}_{mse}^G + \lambda_{per} \mathcal{L}_{per}^G + \lambda_{adv} \mathcal{L}_{adv}^G \\ \mathcal{L}_{adv}^D &= -\min(0, -1 + D(x_{rgb}, c)) + \min(0, -1 - D(\hat{x}_{rgb}, c)) \end{aligned}$$

$L_{mse}$  and  $L_{per}$ : an MSE reconstruction loss and a perceptual loss.  
 $L_{adv}^G$  and  $L_{adv}^D$ : GAN hinge losses for adversarial training.

## Progressive Results



## Results

### Multi-modal Solutions using Random Code $z$



### Multi-modal Solutions using Class Vector $c$



### Real Black-and-White Photo Colorization



## Comparisons with Previous Methods

### Quantitative Comparisons

	Colorful ↑	FID ↓	Classification ↑
CIC	33.036	11.322	69.976
ChromaGAN	26.266	8.209	70.374
InstColor	25.507	7.890	68.422
DeOldify	23.793	3.487	72.364
ColTran	34.485	3.793	67.210
ToVivid	35.128	4.078	73.816
BigColor (w/o Aug.)	36.157	1.288	76.302
BigColor (w/ Aug.)	40.006	1.243	<b>76.516</b>

Color Vividness

Color Naturalness

**Large Margin!**

### Qualitative Comparisons

