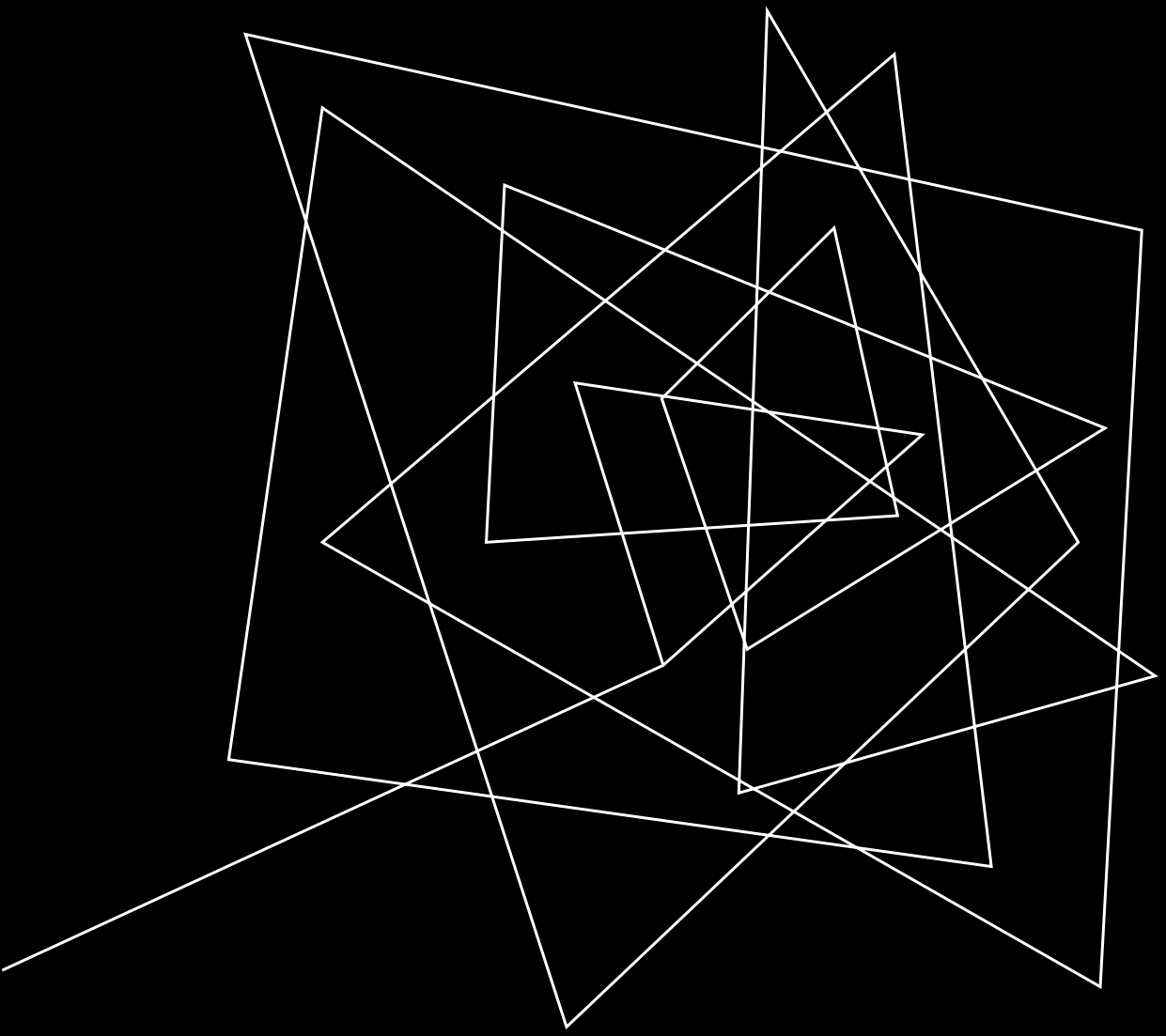
ENVIRONMENT-BASED TRANSFORMATION OF OUTDOOR IMAGES USING NEURAL NETWORKS

AGENDA

- Image-to-Image Translation
- The key Papers
- Training and Testing
- Comparing the Generated Images
- Conducting a Public Survey
- Results and Conclusion



A BRIEF INTRODUCTION:

“In this Project we have trained 37 models based on four papers dealing with Image-to-Image translation problem. Our Goal is to translate an image from one season to the other three seasons. We tested the models on unseen data and generated the outputs. To compare which network works best we conducted a Public Survey and asked participants to rate the images. By using the opinion of our participants, we will conclude which is the better network”

IMAGE TRANSLATION

IMAGE TO IMAGE TRANSLATION: EXAMPLE










IMAGE TO IMAGE TRANSLATION: EXAMPLE

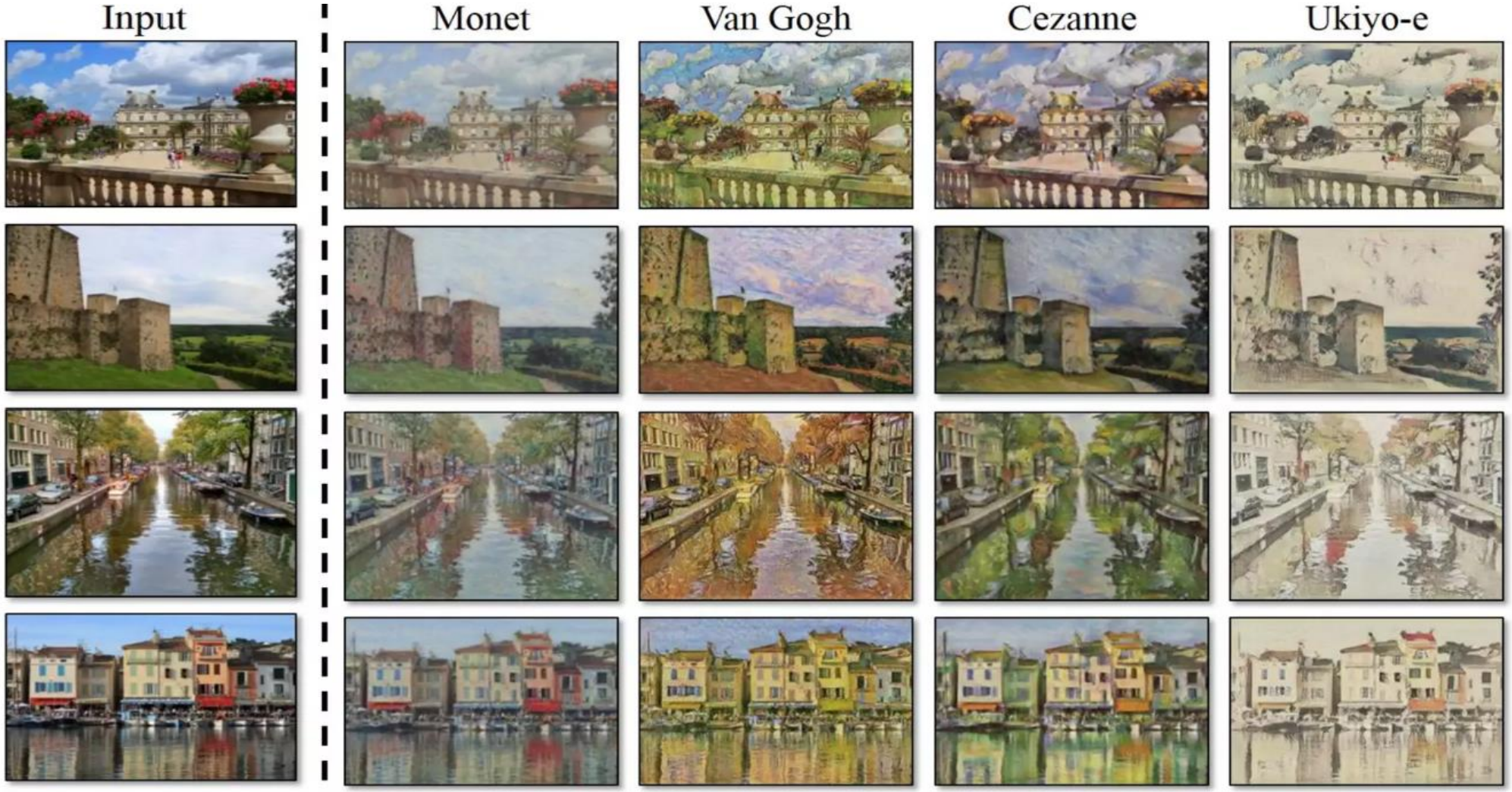


IMAGE TO IMAGE TRANSLATION: SEASONS

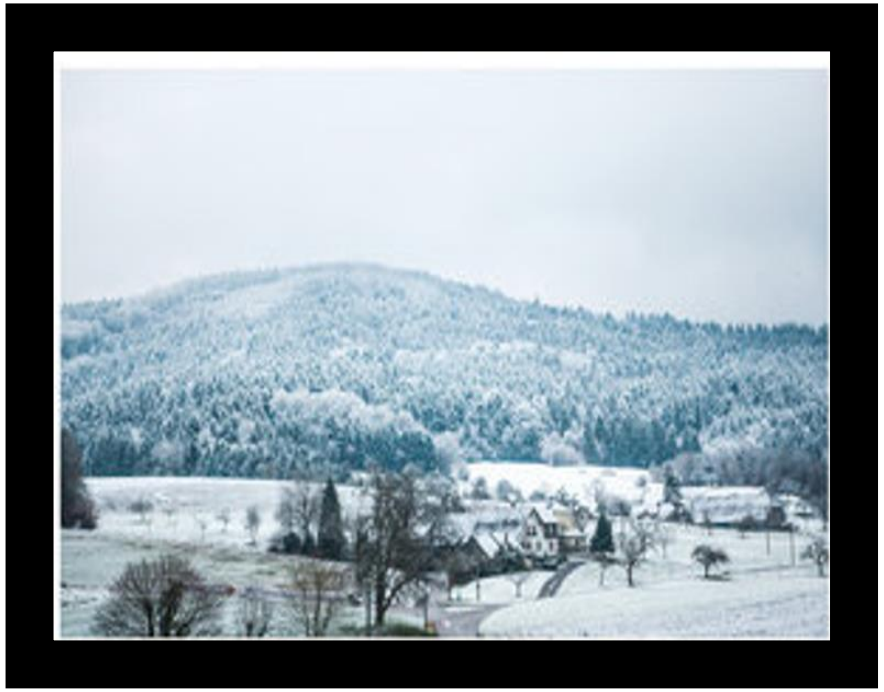
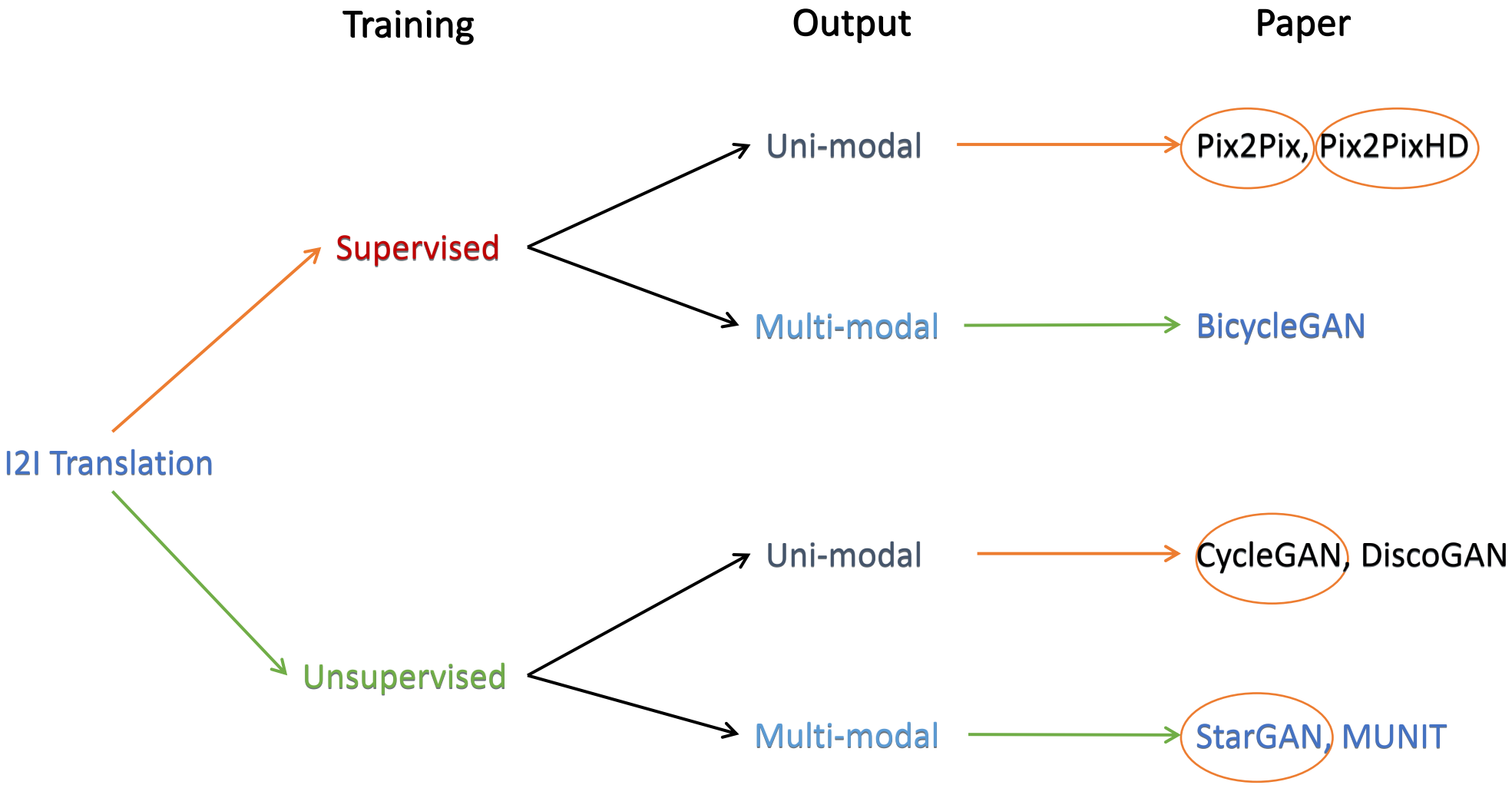
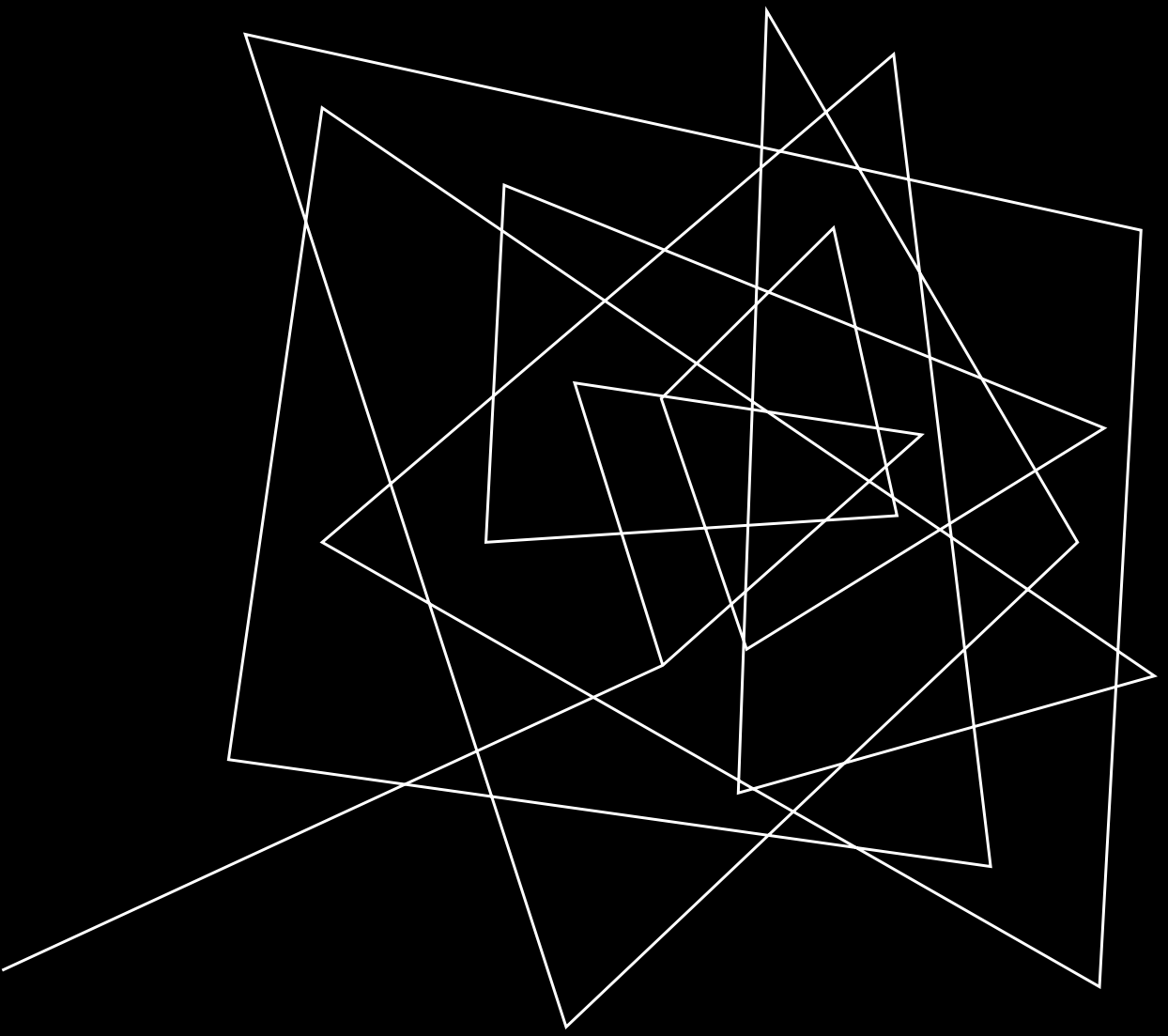


IMAGE TO IMAGE TRANSLATION USING GAN APPROACHES





THE NETWORKS

“We will briefly look into the network architectures. We will also see the generated images by the network on our test data”

SUPERVISED MODEL DATASET

For Supervised Models we need a Paired Dataset

Single-View Place Recognition under Seasonal Changes

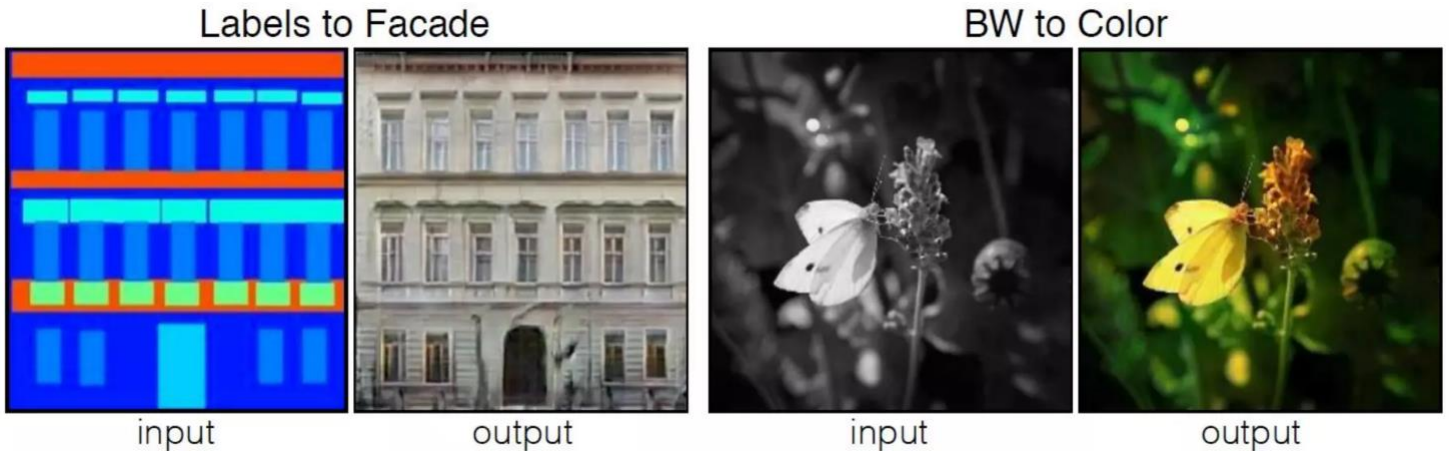
SUPERVISED MODEL 1

Image-to-Image Translation with Conditional Adversarial Networks

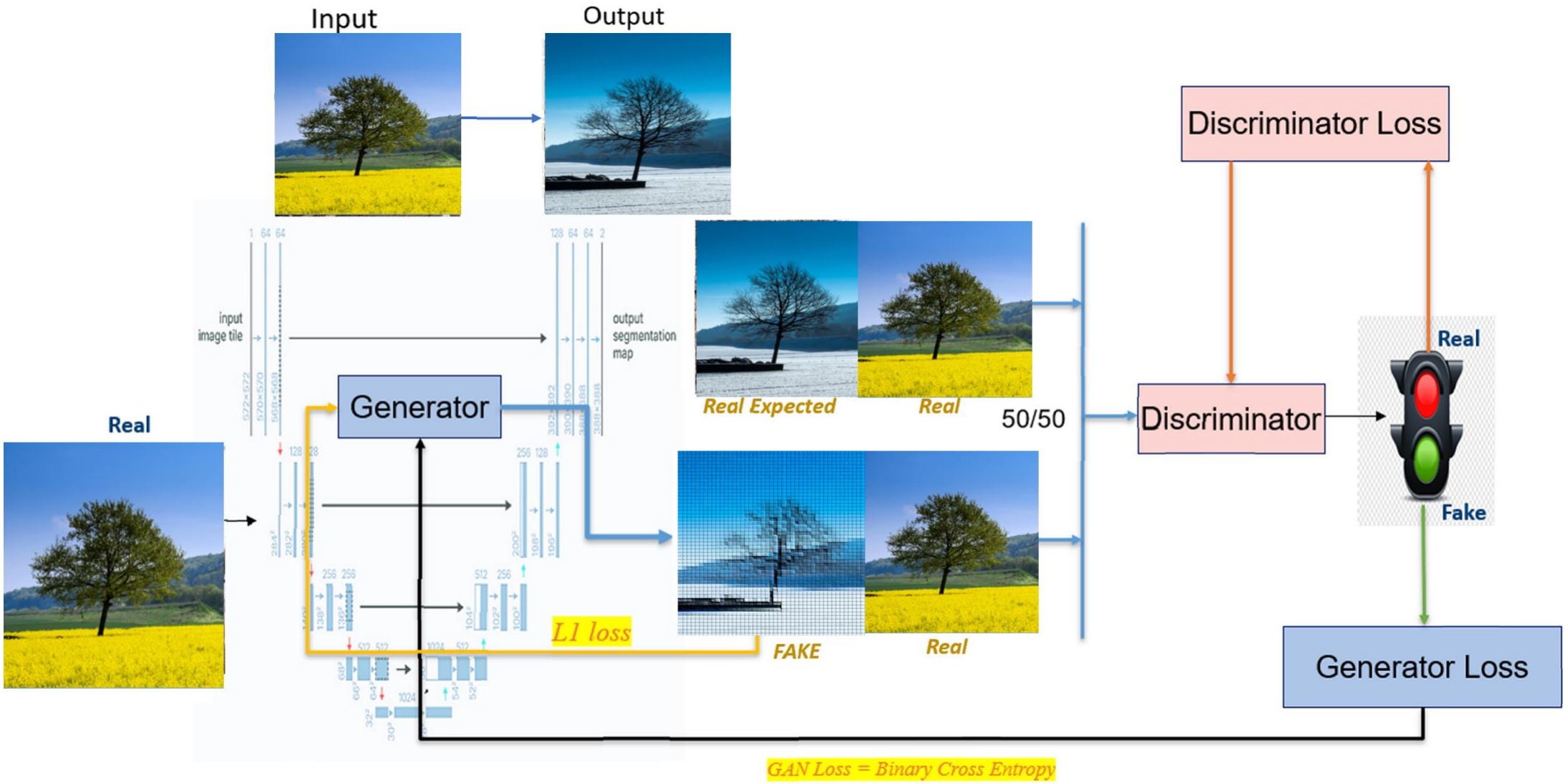
PIX2PIX

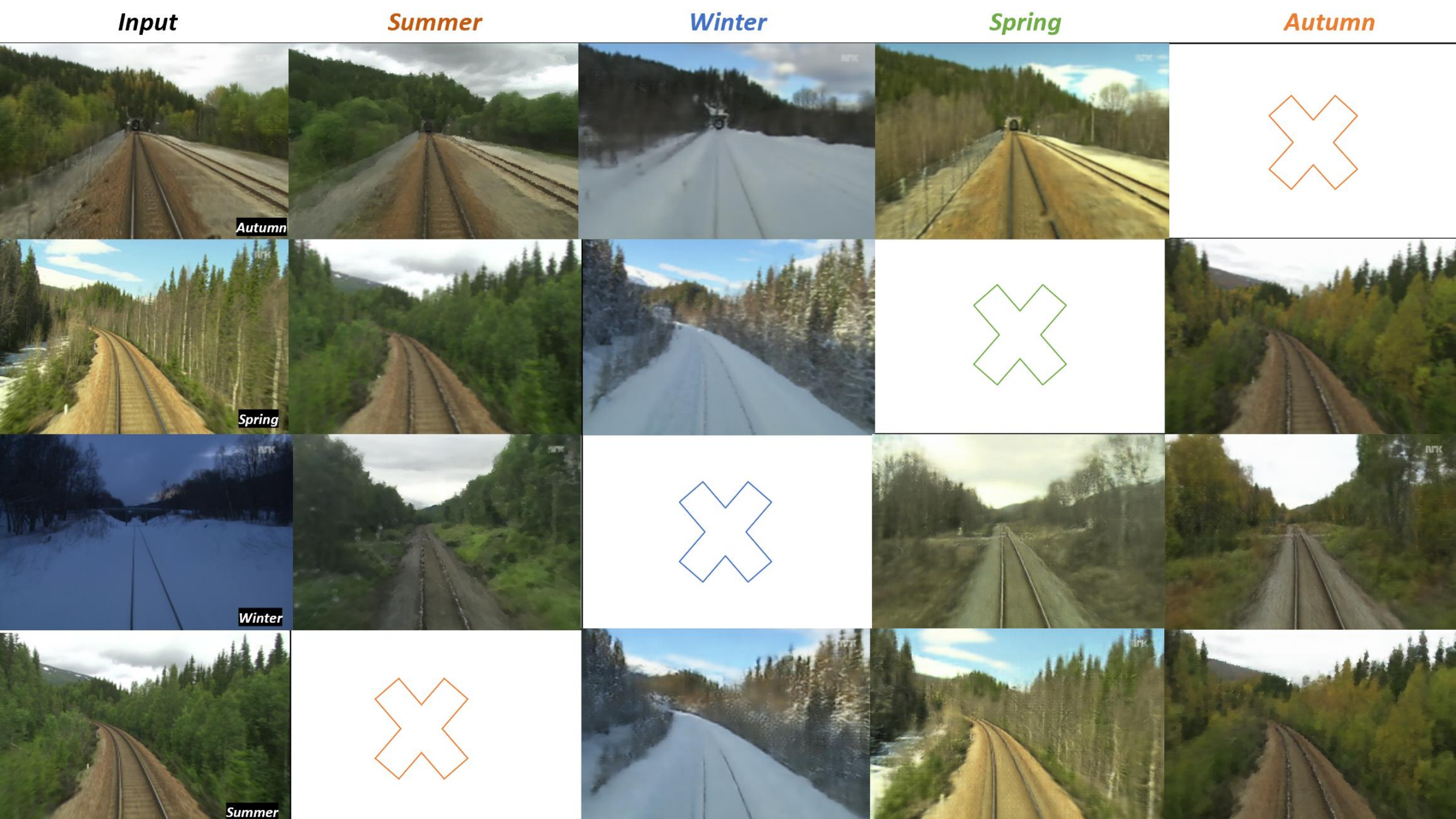
Phillip Isola, Jun-Yan Zhu, Tinghui Zhou, Alexei A. Efros

Conference on Computer Vision and Pattern Recognition 2016



THE PIX2PIX NETWORK




Input
Summer
Winter
Spring
Autumn
Autumn
Spring
Winter
Summer

THE PIX2PIX NETWORK TEST





SUPERVISED MODEL 2

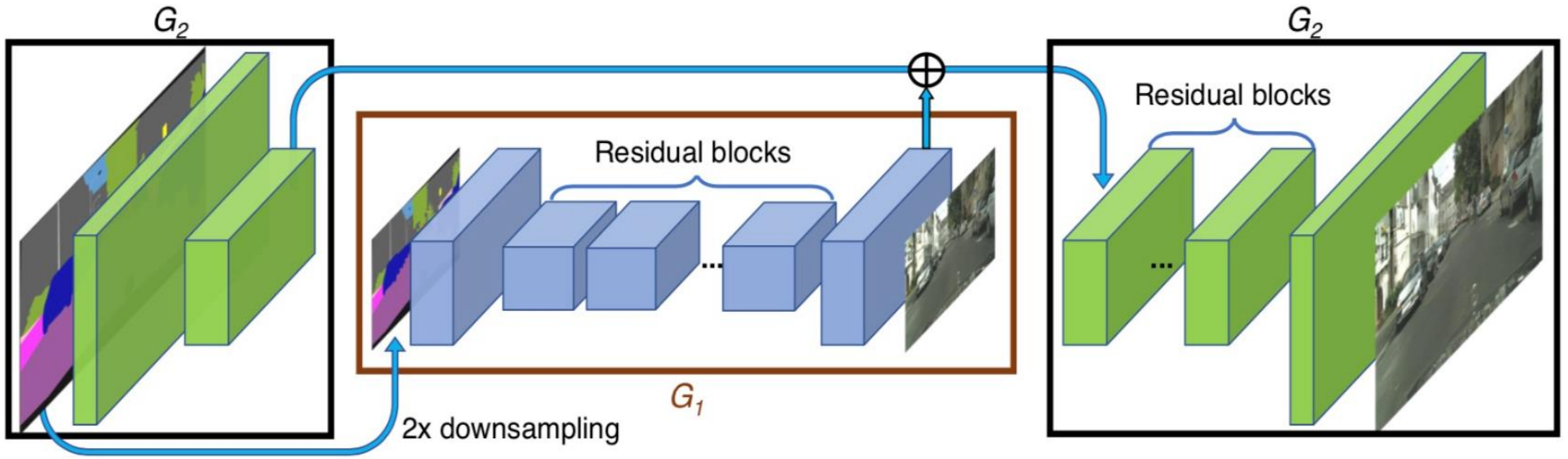
High-Resolution Image Synthesis and Semantic Manipulation with Conditional GANs

PIX2PIXHD

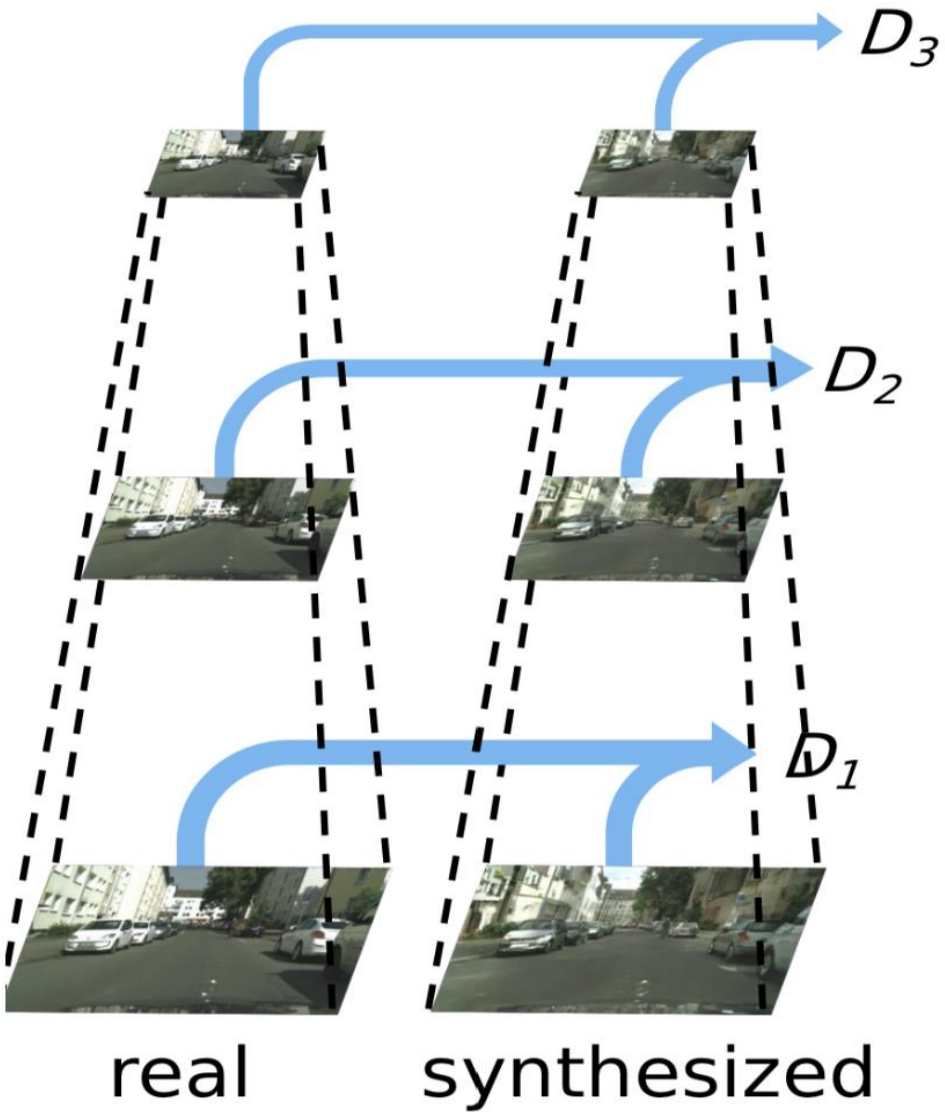
Ting-Chun Wang , Ming-Yu Liu , Jun-Yan Zhu , Andrew Tao, Jan Kautz, Bryan Catanzaro

Conference on Computer Vision and Pattern Recognition 2017

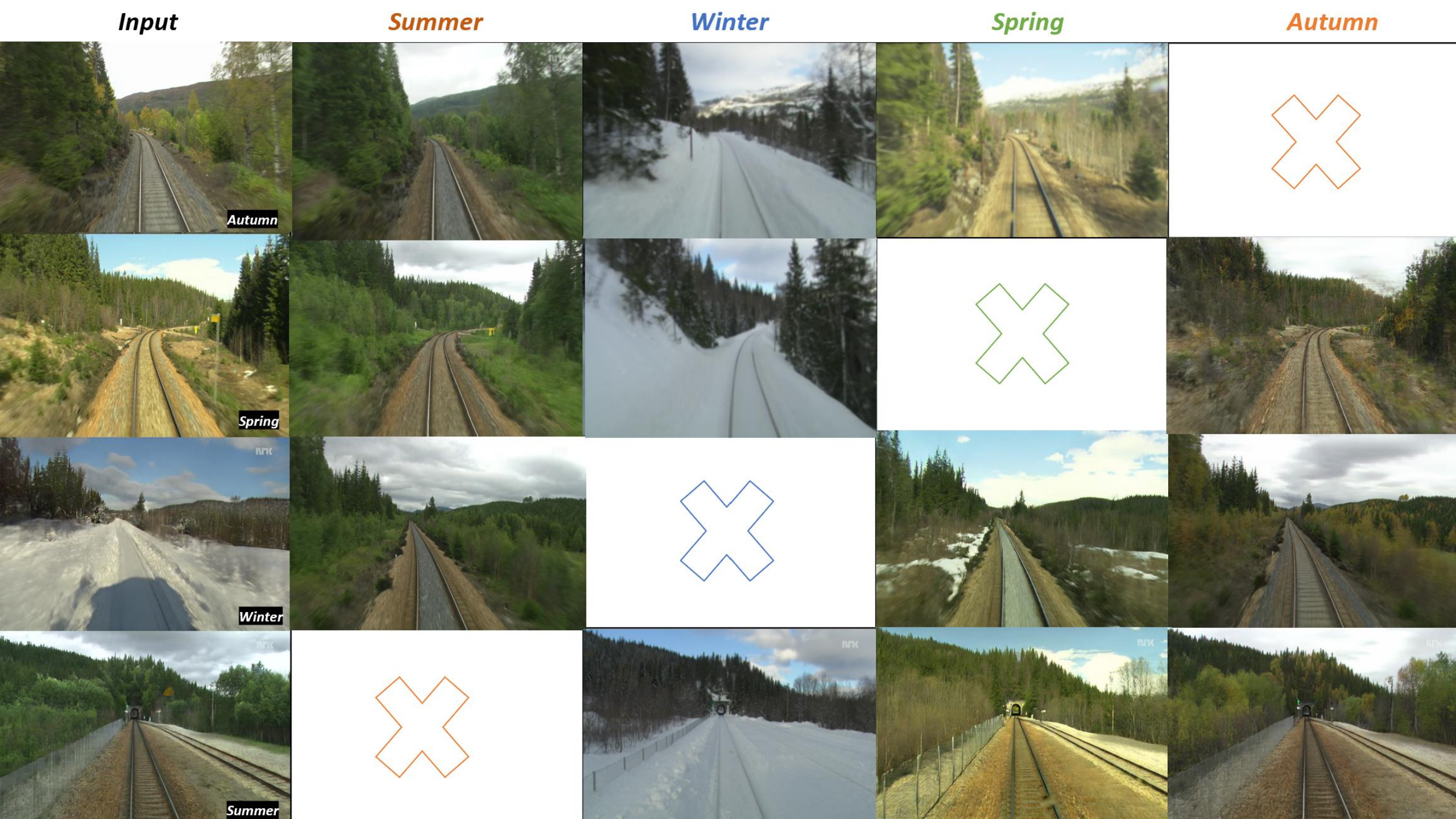
THE PIX2PIXHD NETWORK



THE PIX2PIXHD NETWORK



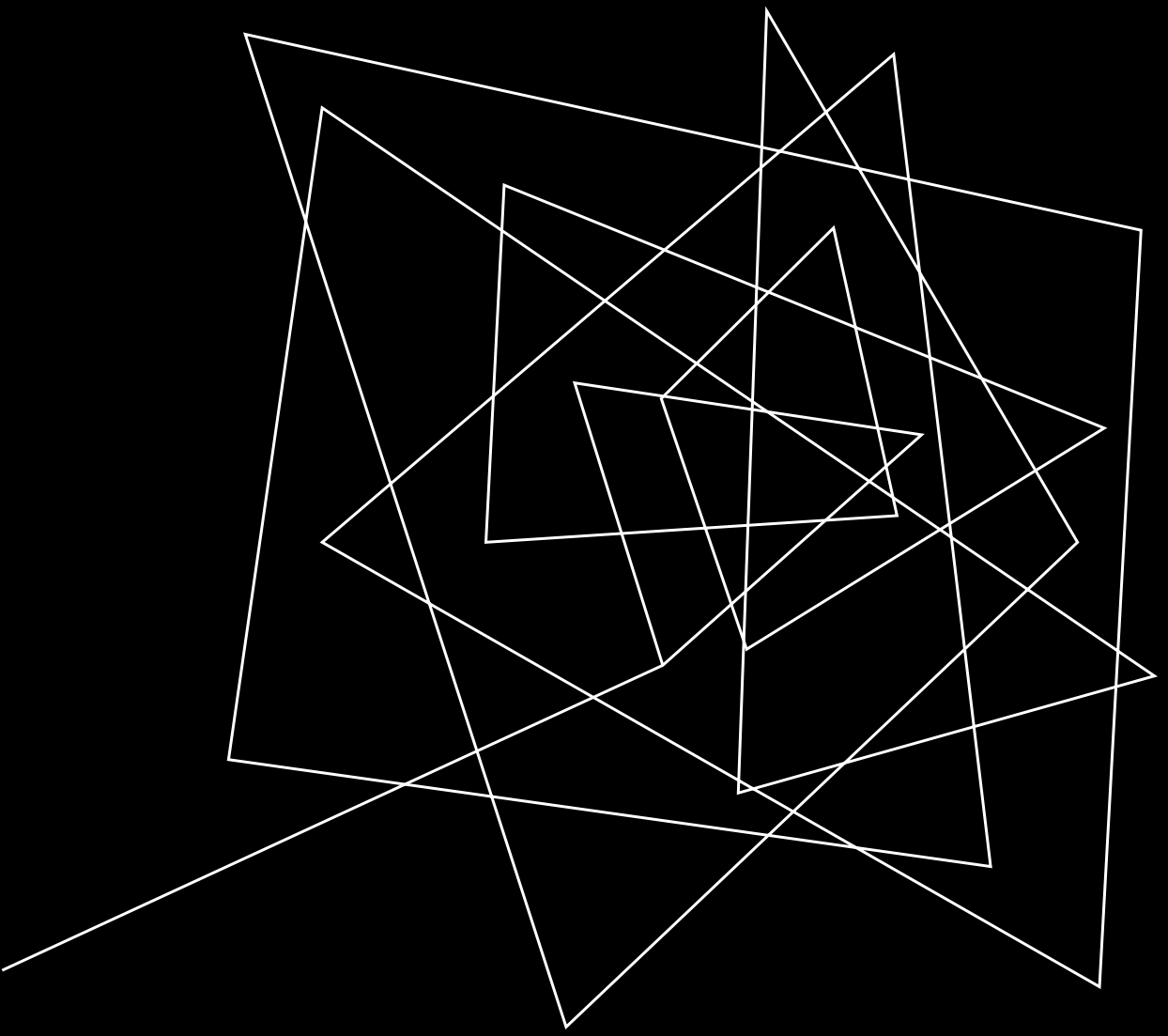
Multi-scale Discriminators


Input
Summer
Winter
Spring
Autumn
Autumn
Spring
Winter
Summer

THE PIX2PIXHD NETWORK TEST UNSEEN TRAIN DATA







THE UNSUPERVISED NETWORKS

UNSUPERVISED MODEL DATASET

For unsupervised models we can use an unpaired dataset

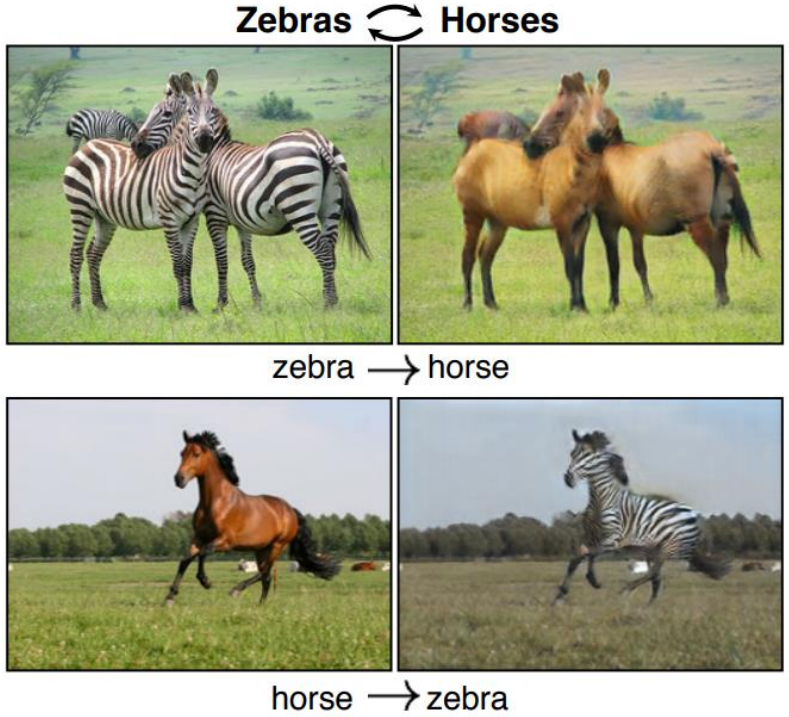
UNSUPERVISED MODEL 1

Unpaired Image-to-Image Translation using Cycle-Consistent Adversarial Networks

CYCLEGAN

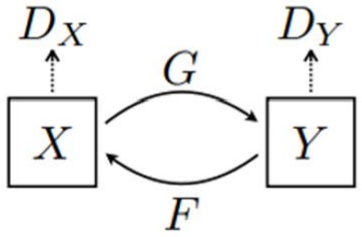
Jun-Yan Zhu, Taesung Park, Phillip Isola, Alexei A. Efros

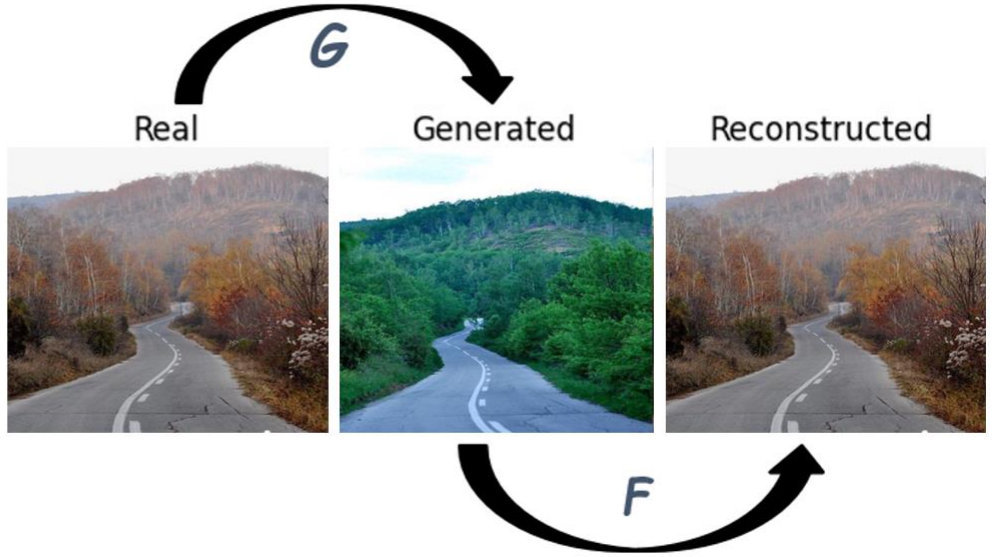
IEEE International Conference on Computer Vision 2017



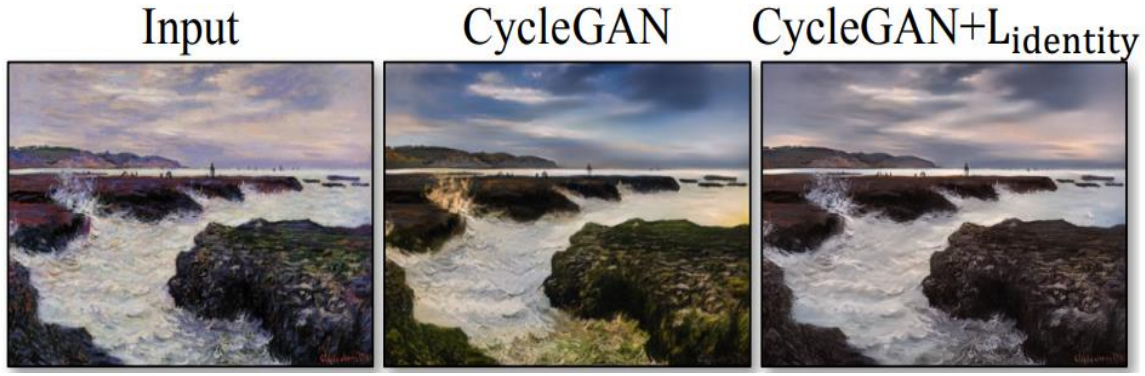
THE CYCLEGAN NETWORK

Cycle Consistency Loss

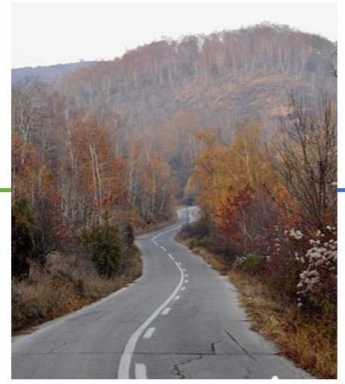




Identity Loss



THE CYCLEGAN NETWORK



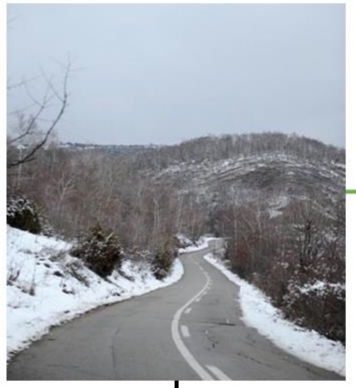
Real

Generator
Autumn → Winter

Discriminator

Least Square Loss

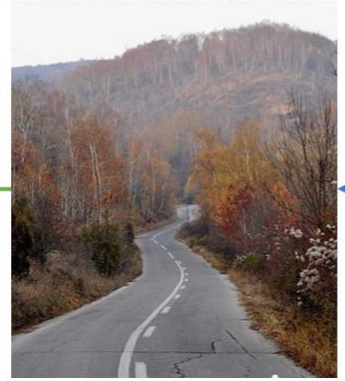
Discriminator



Generated

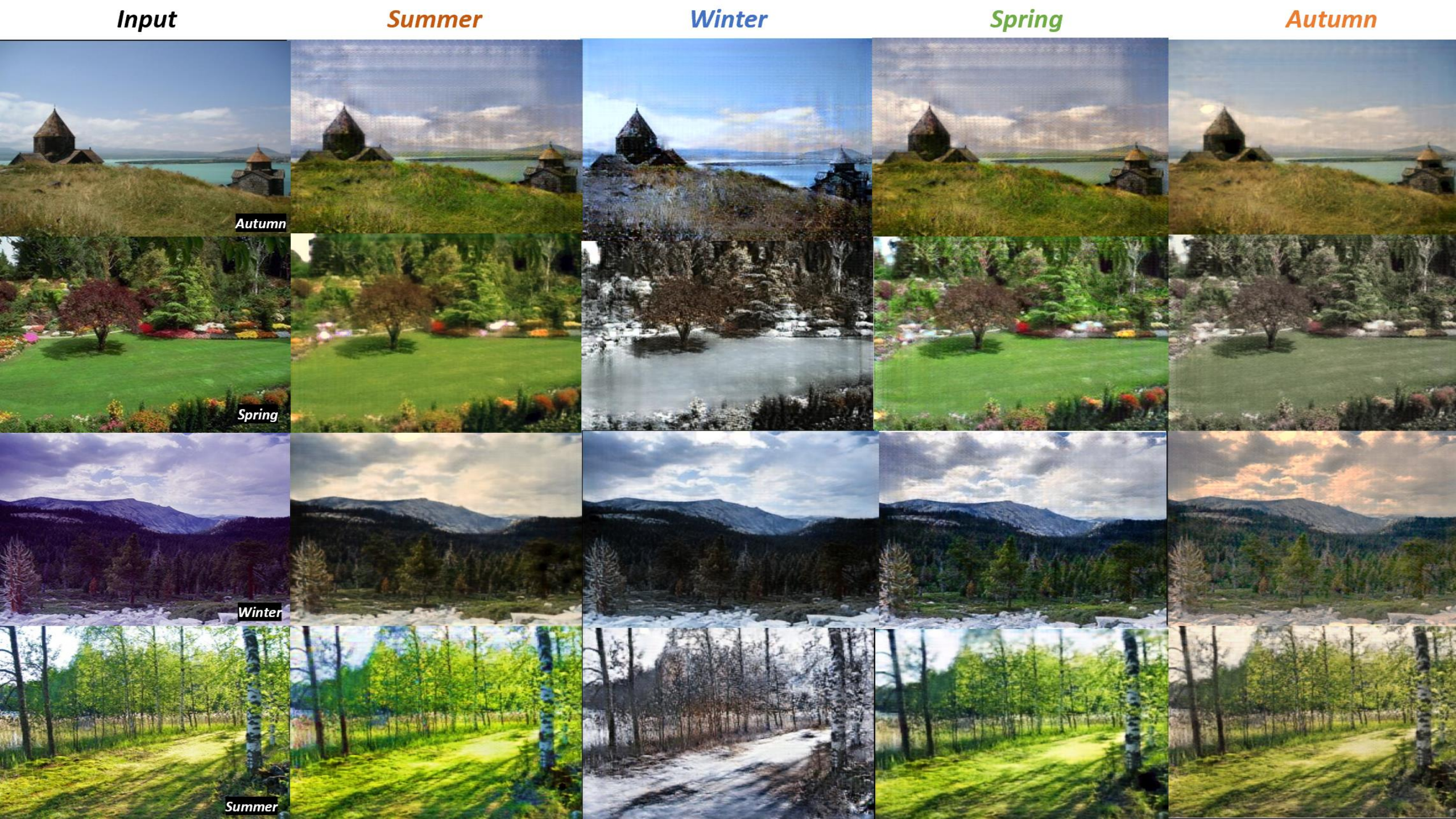
Cycle Consistency Loss

Reconstructed



Generator
Winter ← Autumn

50 Images Buffer


Input
Summer
Winter
Spring
Autumn
Autumn
Spring
Winter
Summer

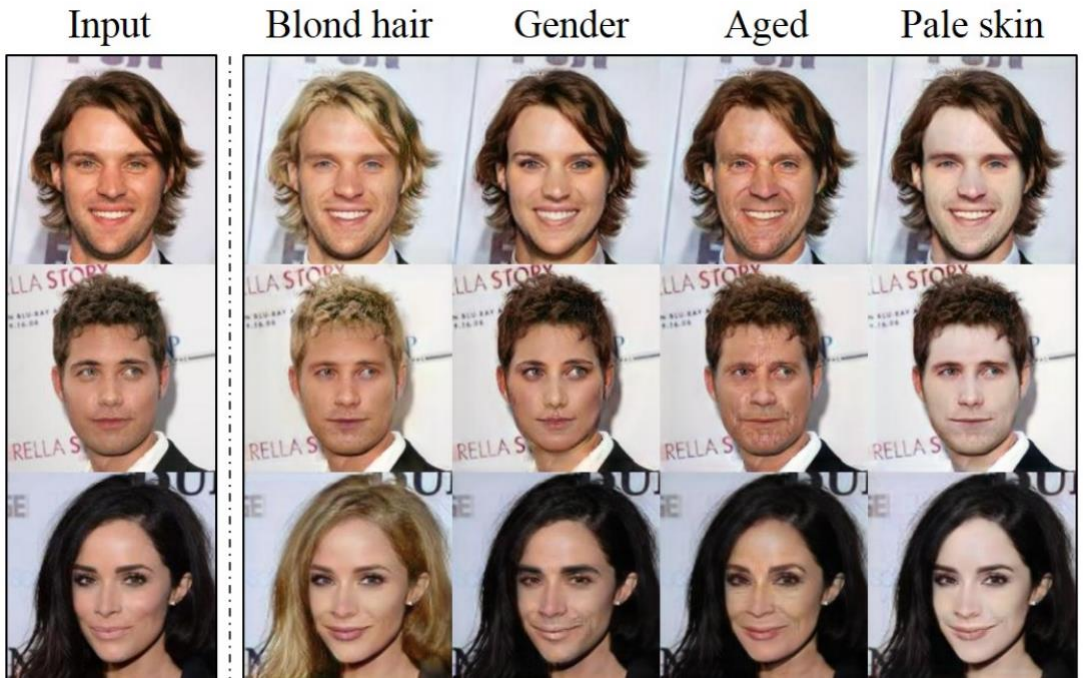
UNSUPERVISED MODEL 2

Unified Generative Adversarial Networks for Multi-Domain Image-to-Image Translation

STARGAN

Yunjey Choi, Minje Choi, Munyoung Kim, Jung-Woo, Sunghun Kim, Jaegul Choo

2018 Conference on Computer Vision and Pattern Recognition (CVPR)



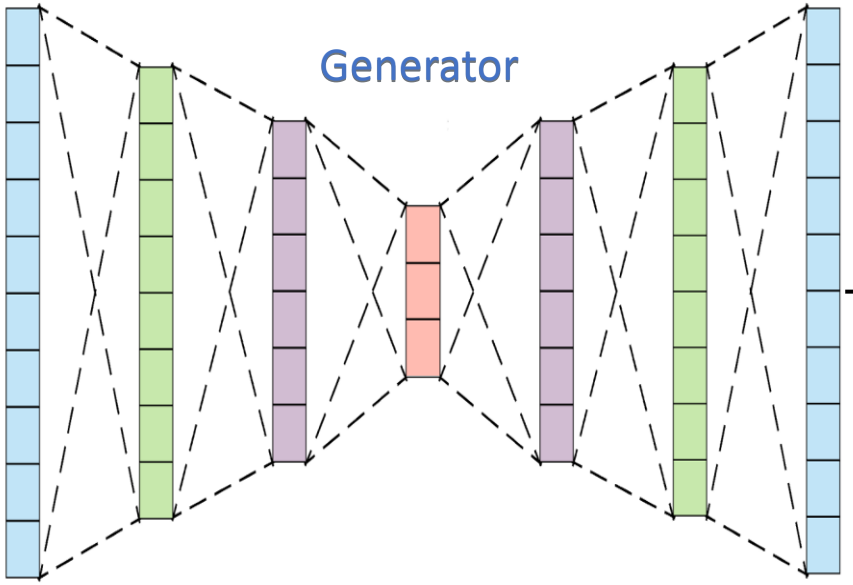
THE STARGAN NETWORK

StarGAN has the same task as the CycleGAN, let us try discuss this example

THE STARGAN NETWORK

(0, 0, 0, 1)

Summer Spring Autumn Winter



Discriminator

0.89

(0.22, 0.17, -0.1, 0.89)

Outputs Classification in order of labels

THE STARGAN NETWORK

Training

How well the generated image looks like a real Image?
How much does it look like the image belong to target domain?

Generator

Discriminator

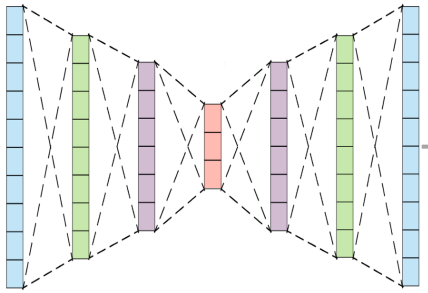
0.90
(0.22, 0.17, -0.1, 0.89)

Uses real/fake output on a generated image

(0, 0, 0, 1)

Summer *Spring* *Autumn* *Winter*

Uses Classifiers Output in Comparison to the target label



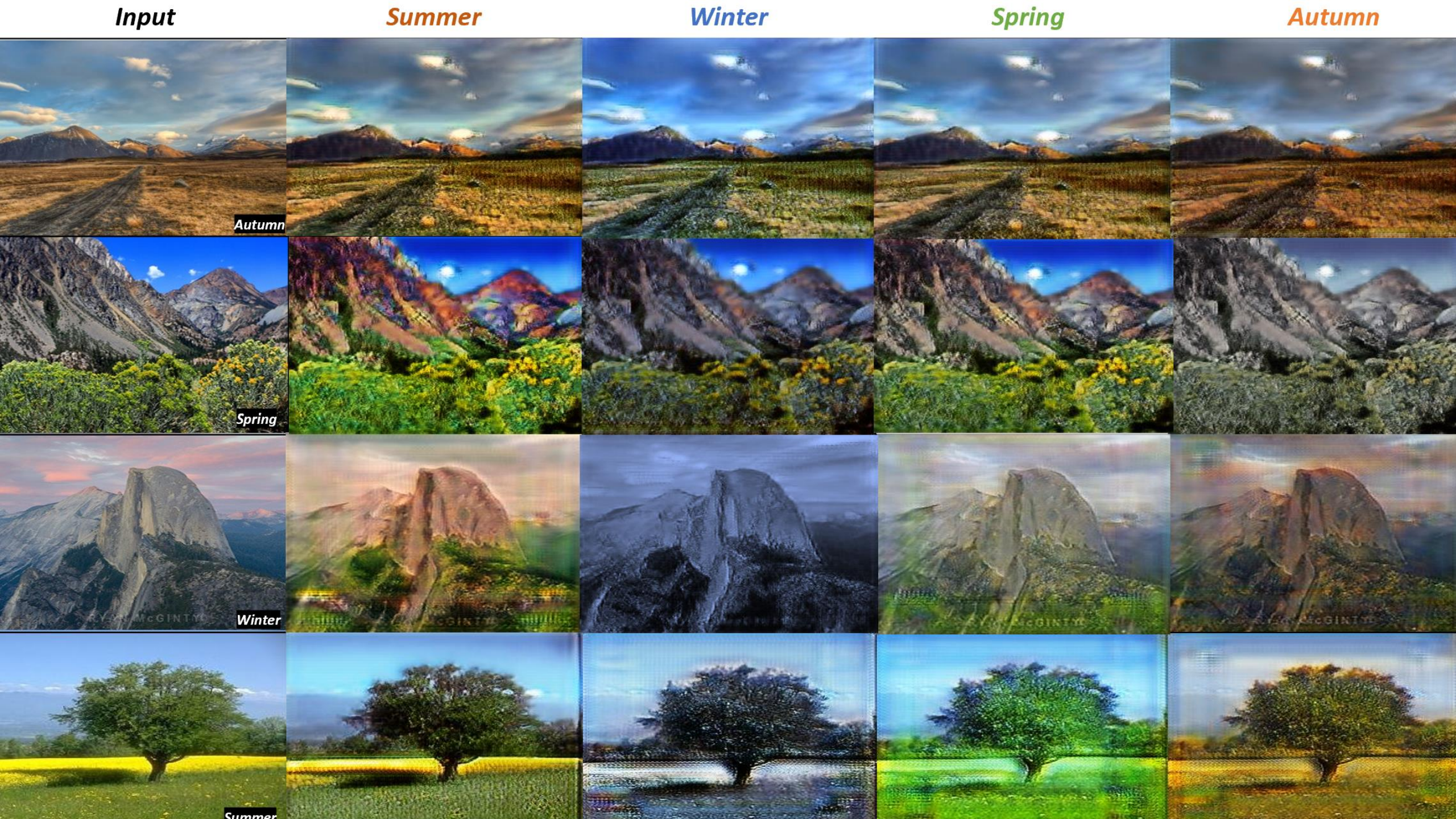
Cycle Consistency Loss

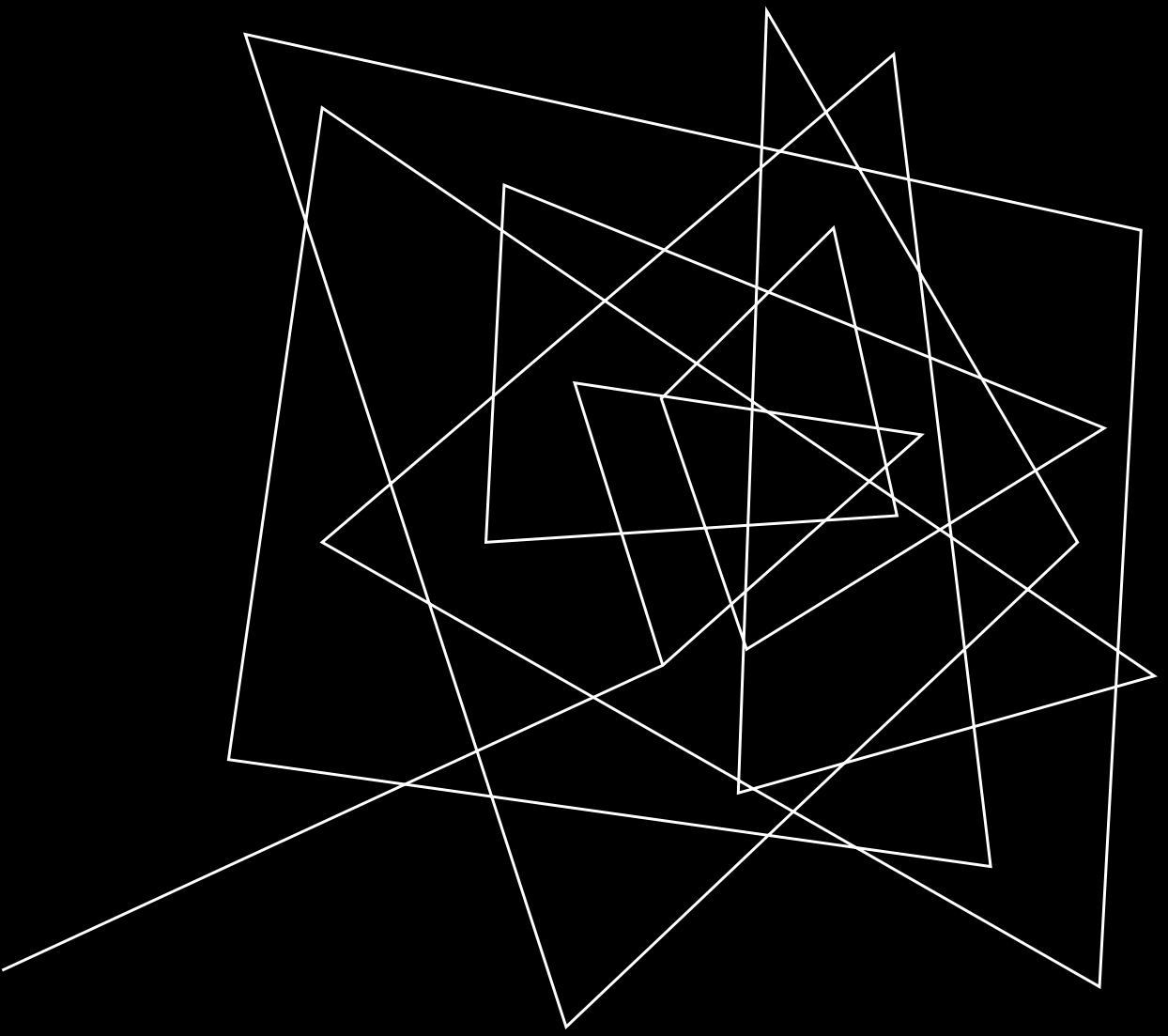
TRAINING STARGAN ON UNPAIRED DATASET

Training On Original Settings

TRAINING STARGAN ON UNPAIRED DATASET

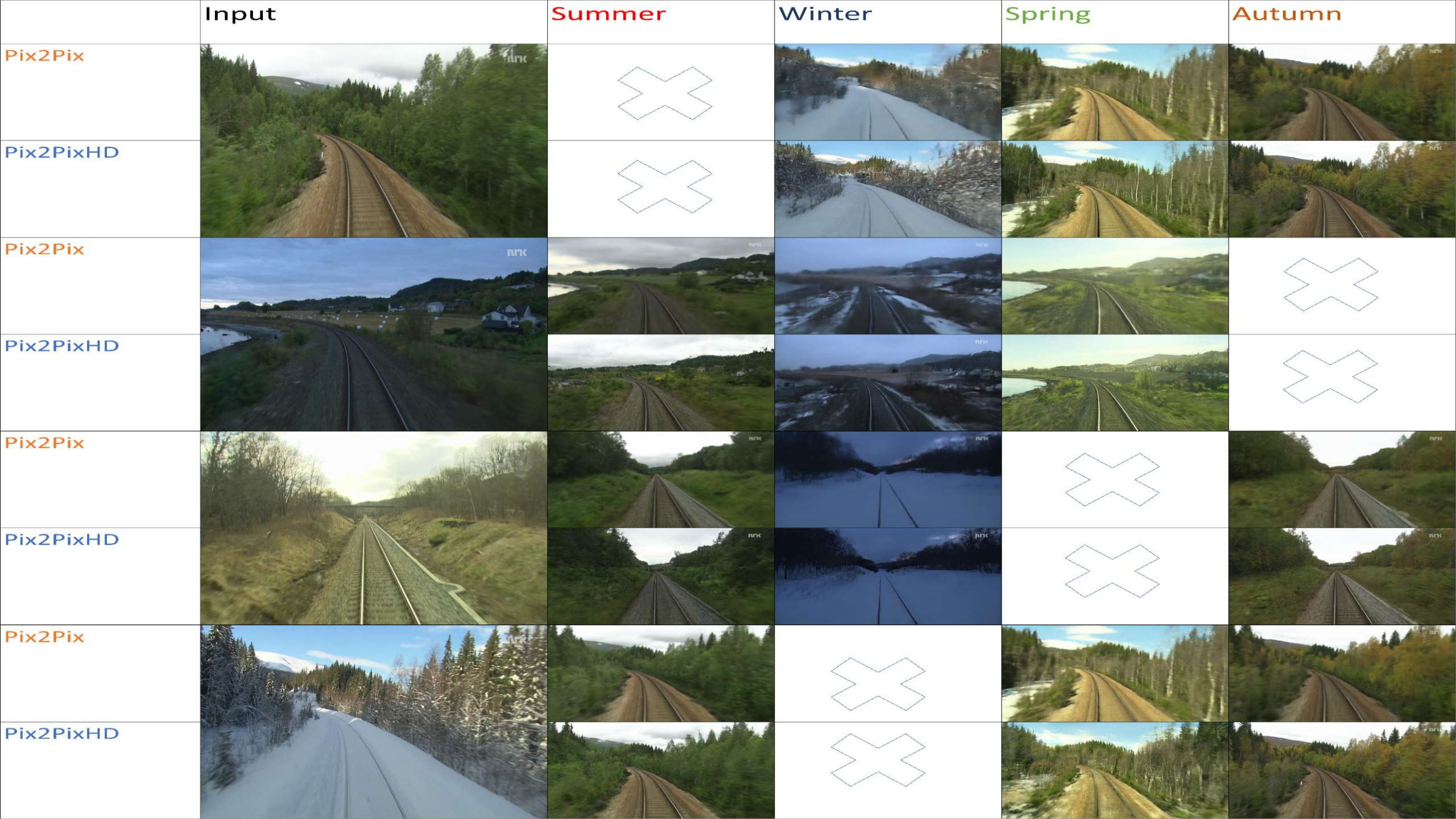
Training With Batch Size 8


Input
Summer
Winter
Spring
Autumn
Autumn
Spring
Winter
Summer

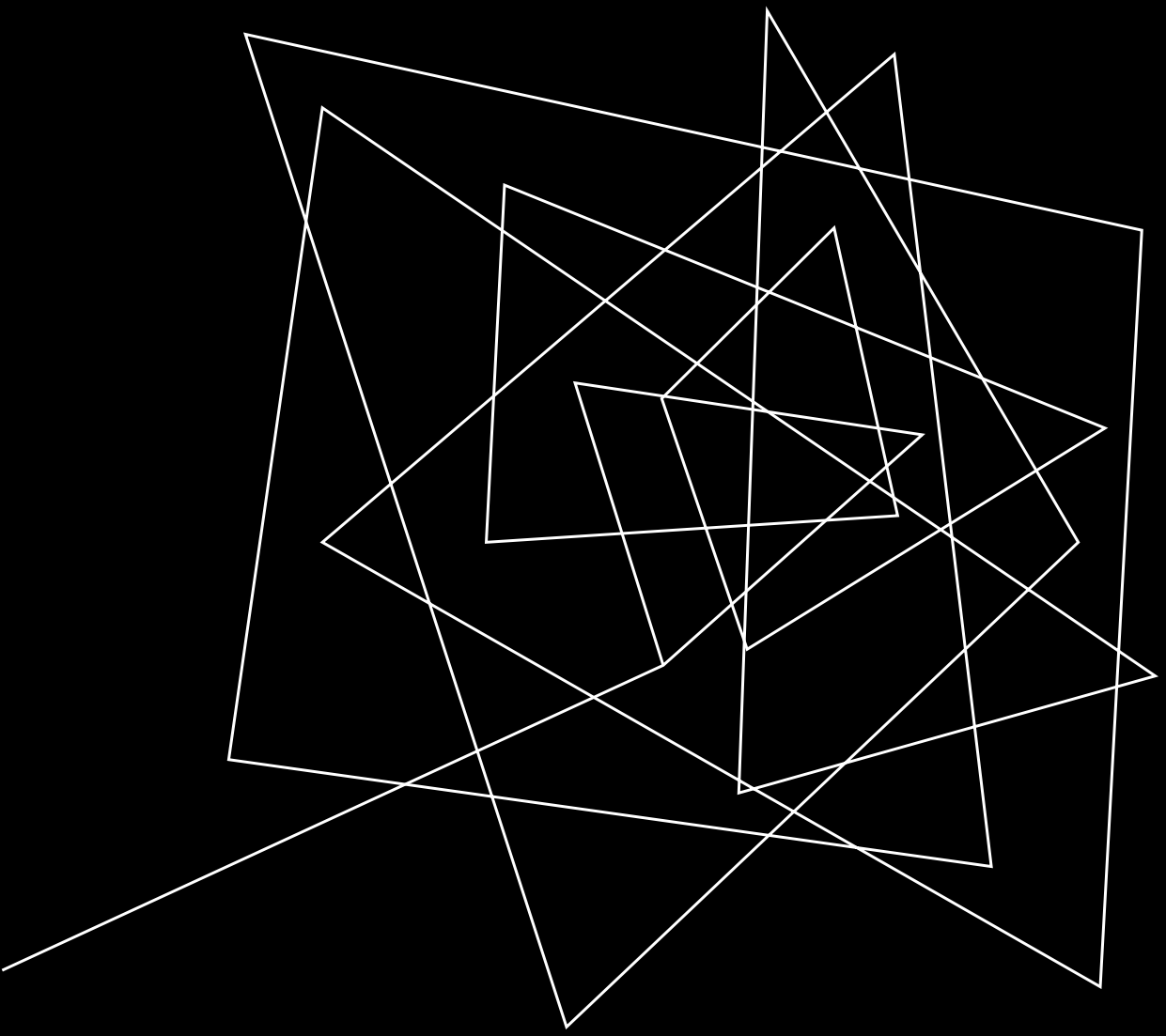


TESTING NETWORKS WITH SAME INPUTS

“We will now test the networks by providing both the networks with the same input image”


Input
Summer
Winter
Spring
Autumn
Pix2Pix
Pix2PixHD
Pix2Pix
Pix2PixHD
Pix2Pix
Pix2PixHD
Pix2Pix
Pix2PixHD


Input
Summer
Winter
Spring
Autumn
CycleGAN
StarGAN
CycleGAN
StarGAN
CycleGAN
StarGAN
CycleGAN
StarGAN



COMPARING THE NETWORKS

“Now we have the generated images from the four networks. We will now see how we setup a Public Survey and the results interpreted from it”

THE SURVEY

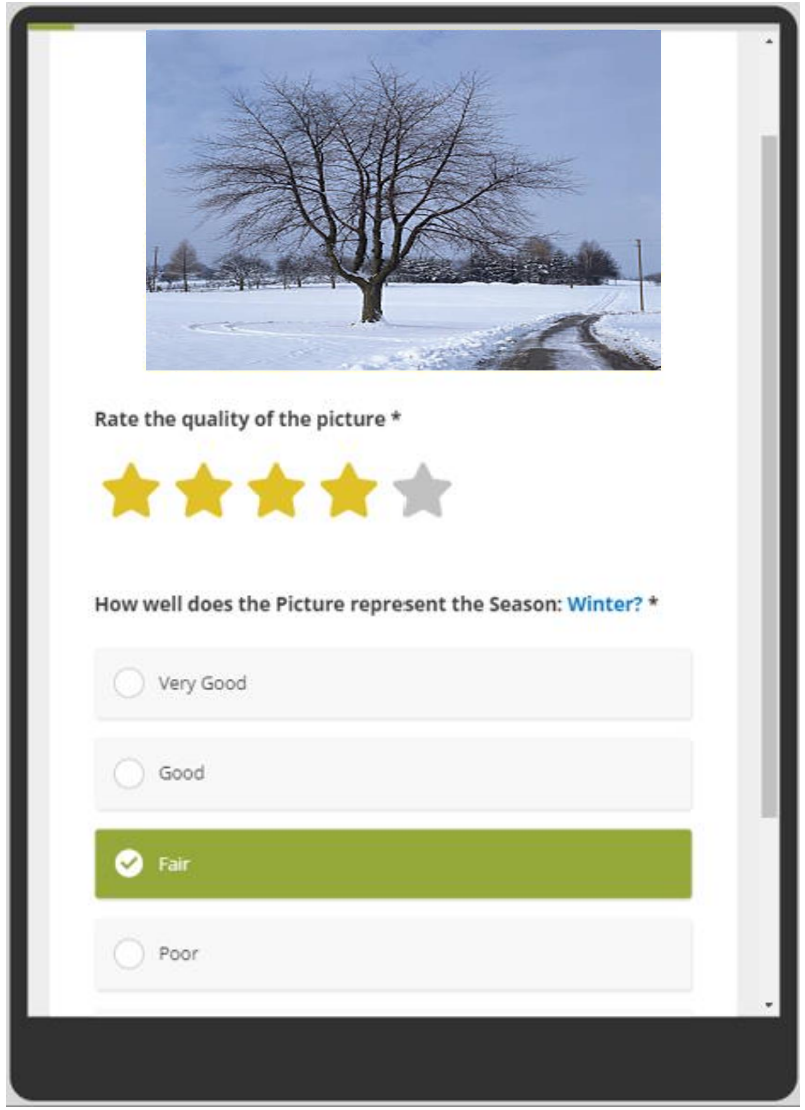
About the Survey:

- The Survey was created using **SurveyHero**
- Total Images: **48**
- **12** Generated Images from each model
- **3** images from each season

Survey Stats:

146	50.2%	71.9%	07:57 min
Responses in Total	Participation Rate	Completion Rate	Avg Completion Time (Trimmed)

Viewed	291
Completed	105
Not Finished	41



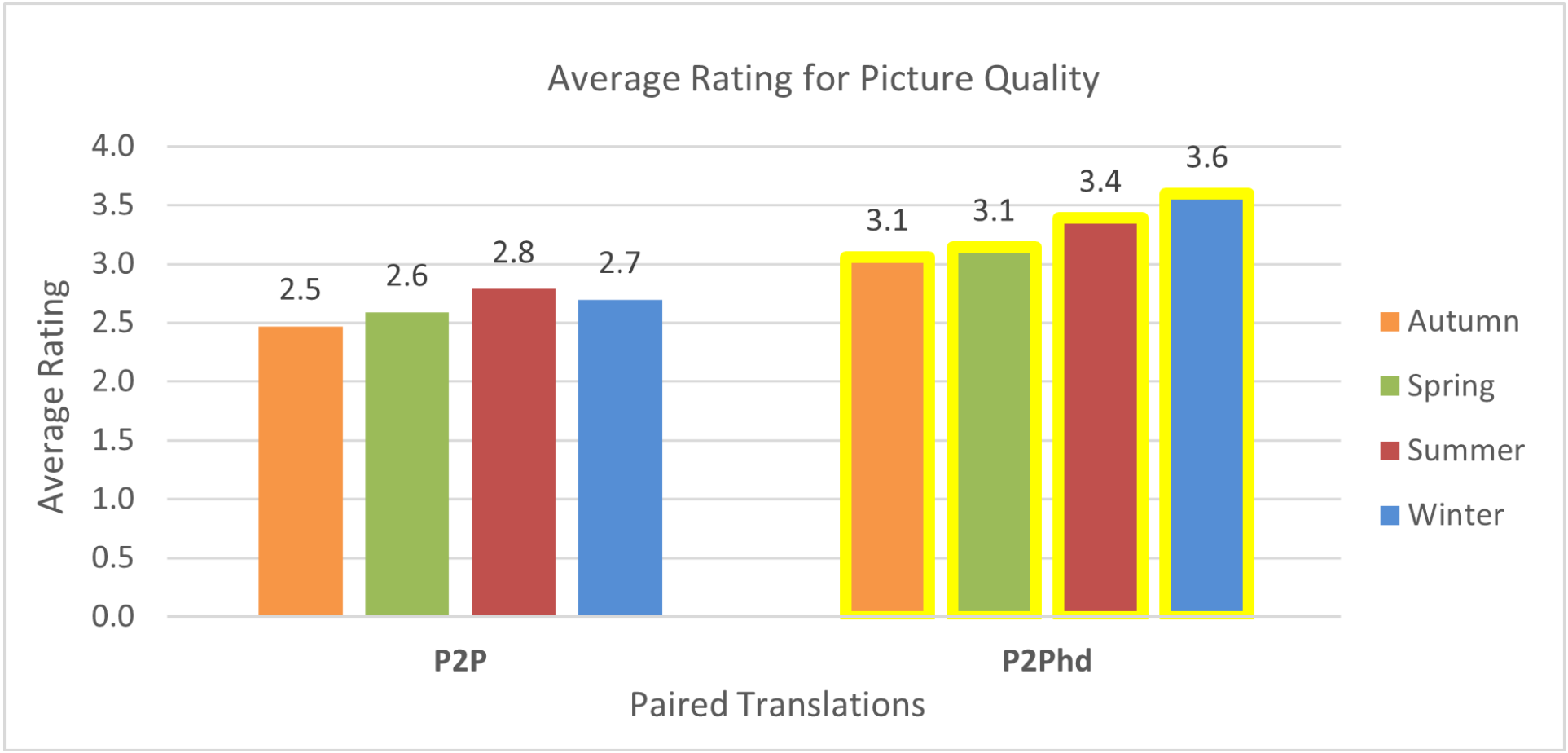
SUPERVISED MODELS SURVEY SCORES

Pix2Pix And Pix2PixHD

INTERPRETING RESULTS FROM THE SURVEY

PAIRED MODELS PIX2PIX and PIX2PIXHD

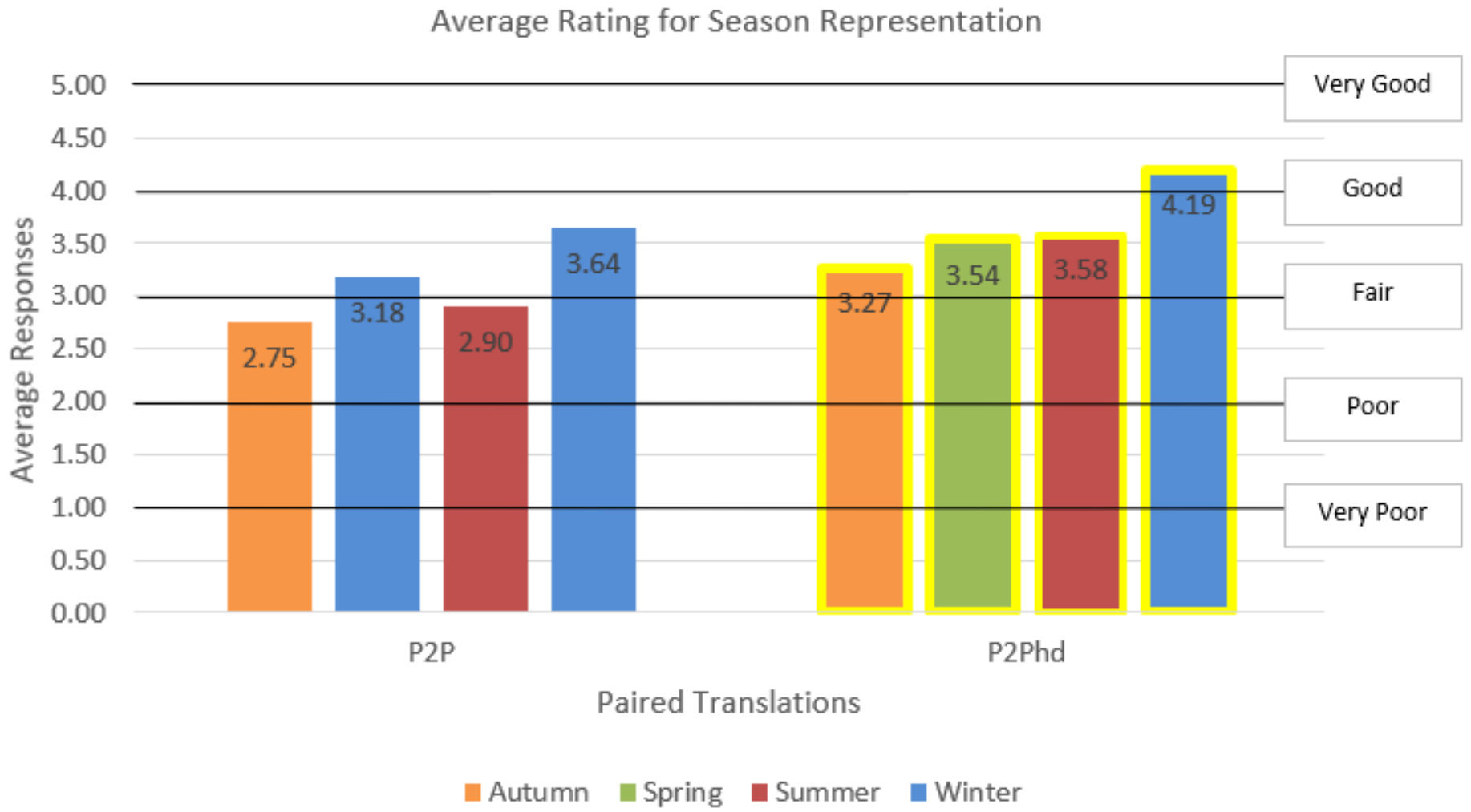
IMAGE QUALITY



INTERPRETING RESULTS FROM THE SURVEY

PAIRED MODELS PIX2PIX and PIX2PIXHD

Desired Seasonal Attribute



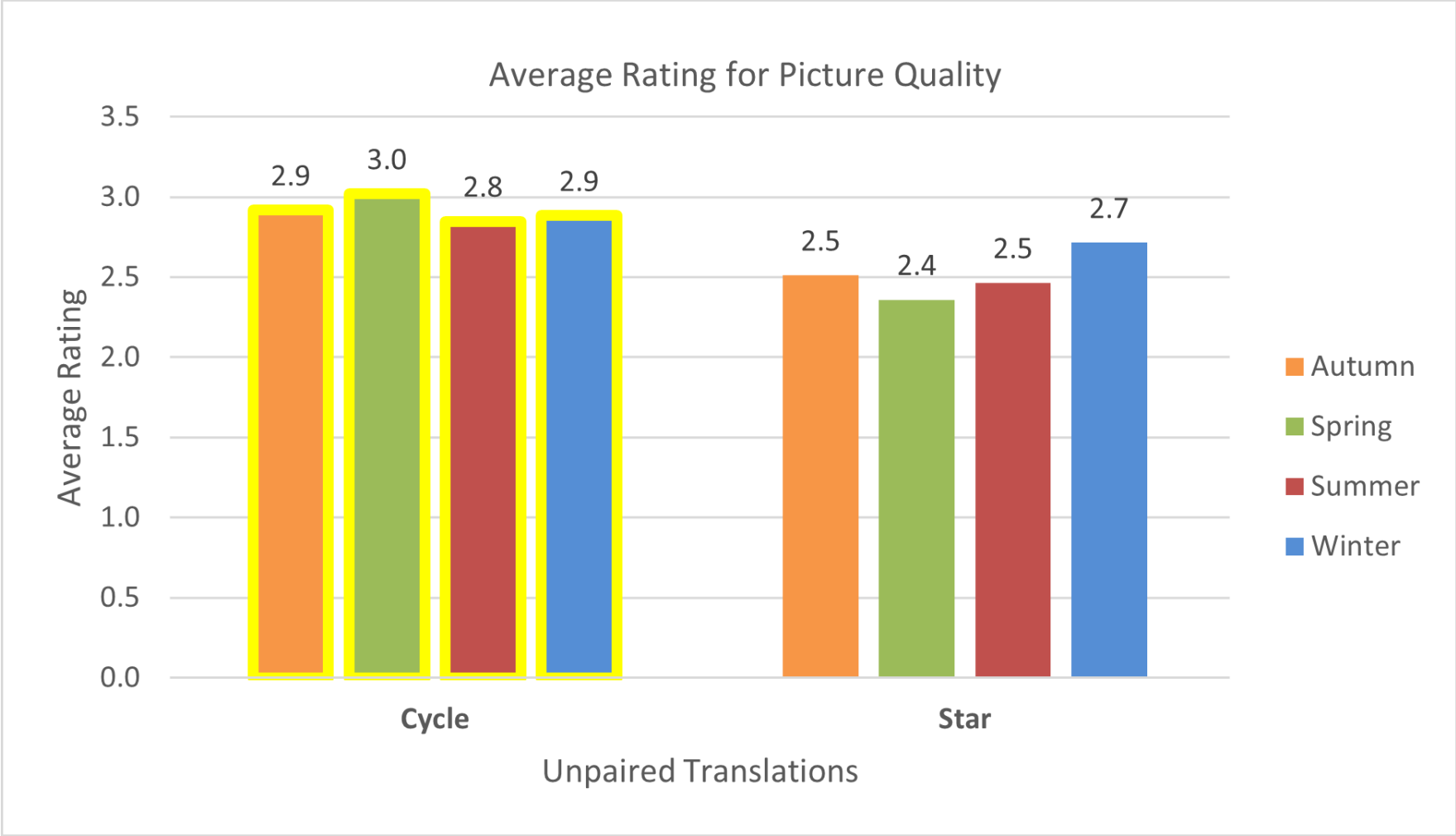
UNSUPERVISED MODELS SURVEY SCORES

CycleGAN and StarGAN

INTERPRETING RESULTS FROM THE SURVEY

UNPAIRED MODELS CycleGAN and StarGAN

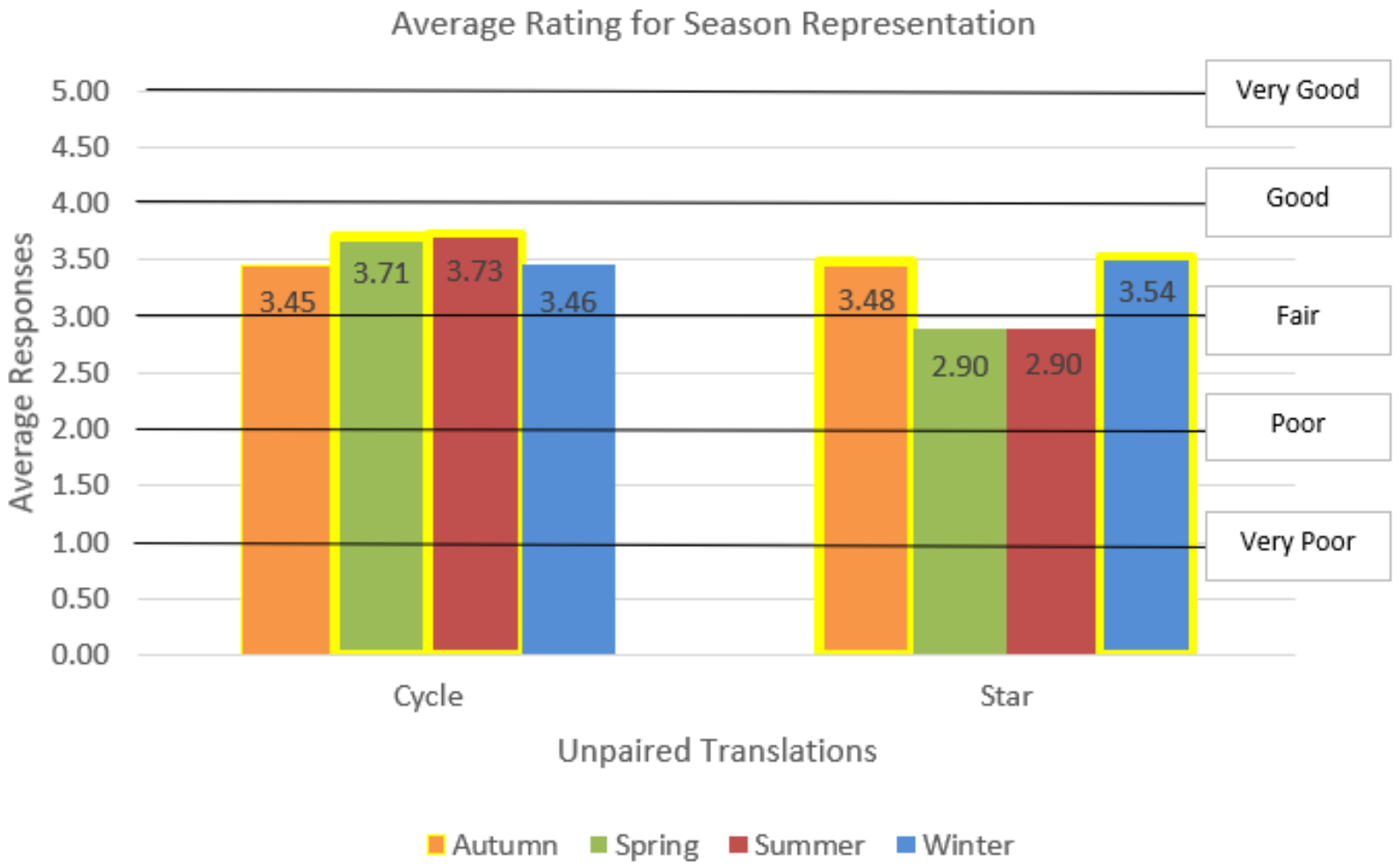
IMAGE QUALITY



INTERPRETING RESULTS FROM THE SURVEY

UNPAIRED MODELS CycleGAN and StarGAN

Desired Seasonal Attribute



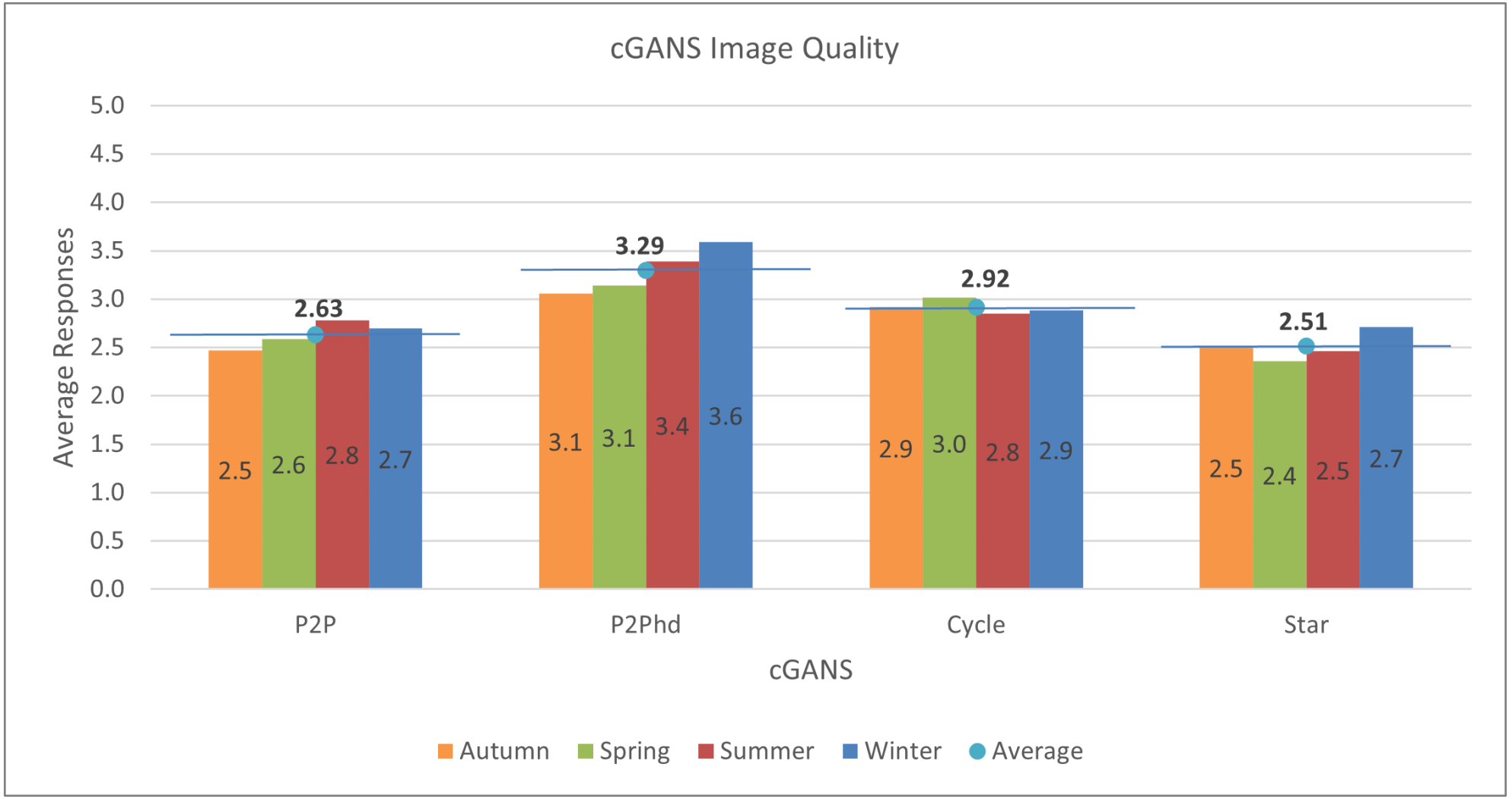
OVERALL SURVEY SCORE

Pix2Pix, Pix2PixHD, CycleGAN and StarGAN

INTERPRETING RESULTS FROM THE SURVEY

All Networks Combined Score

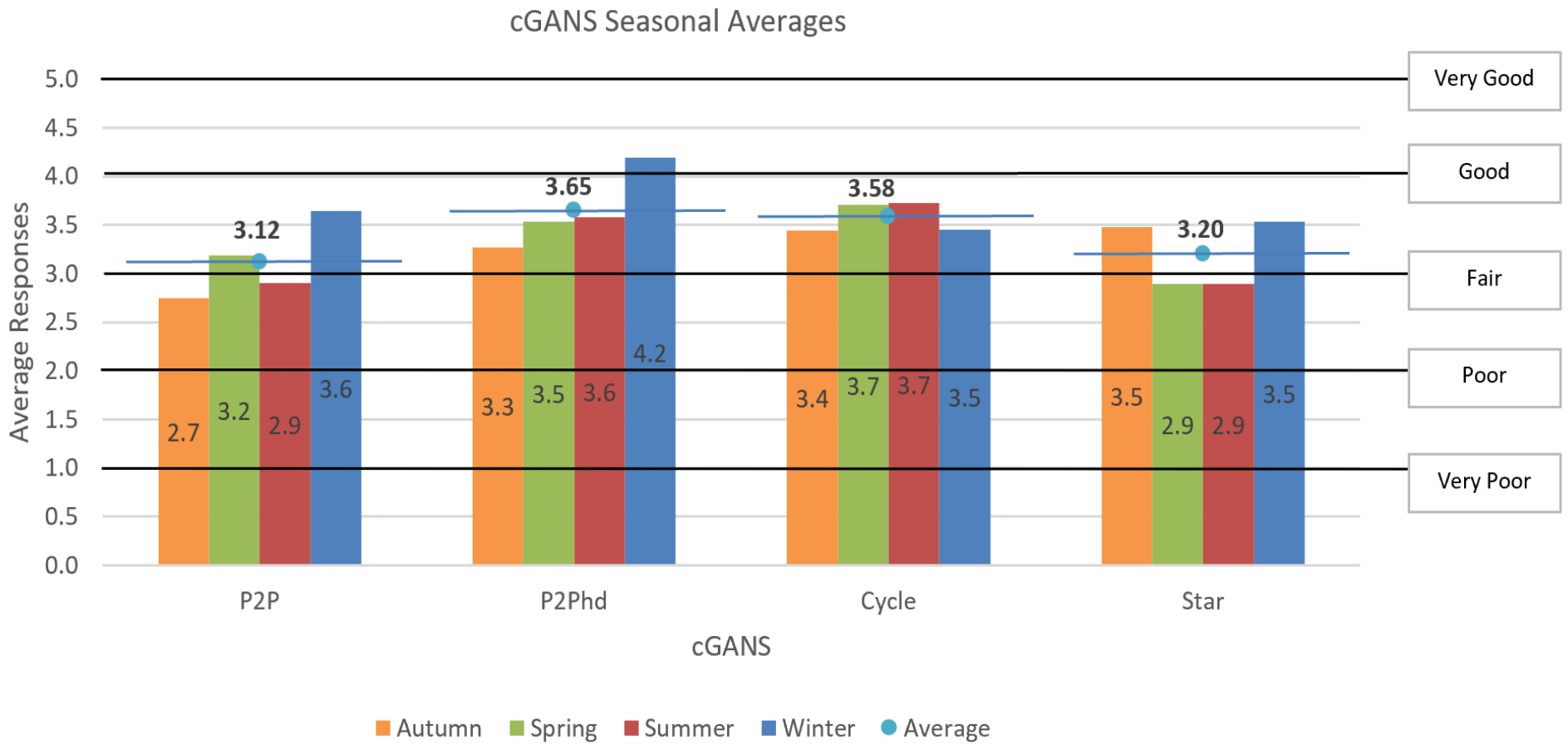
IMAGE QUALITY



INTERPRETING RESULTS FROM THE SURVEY

All Networks Combined Score

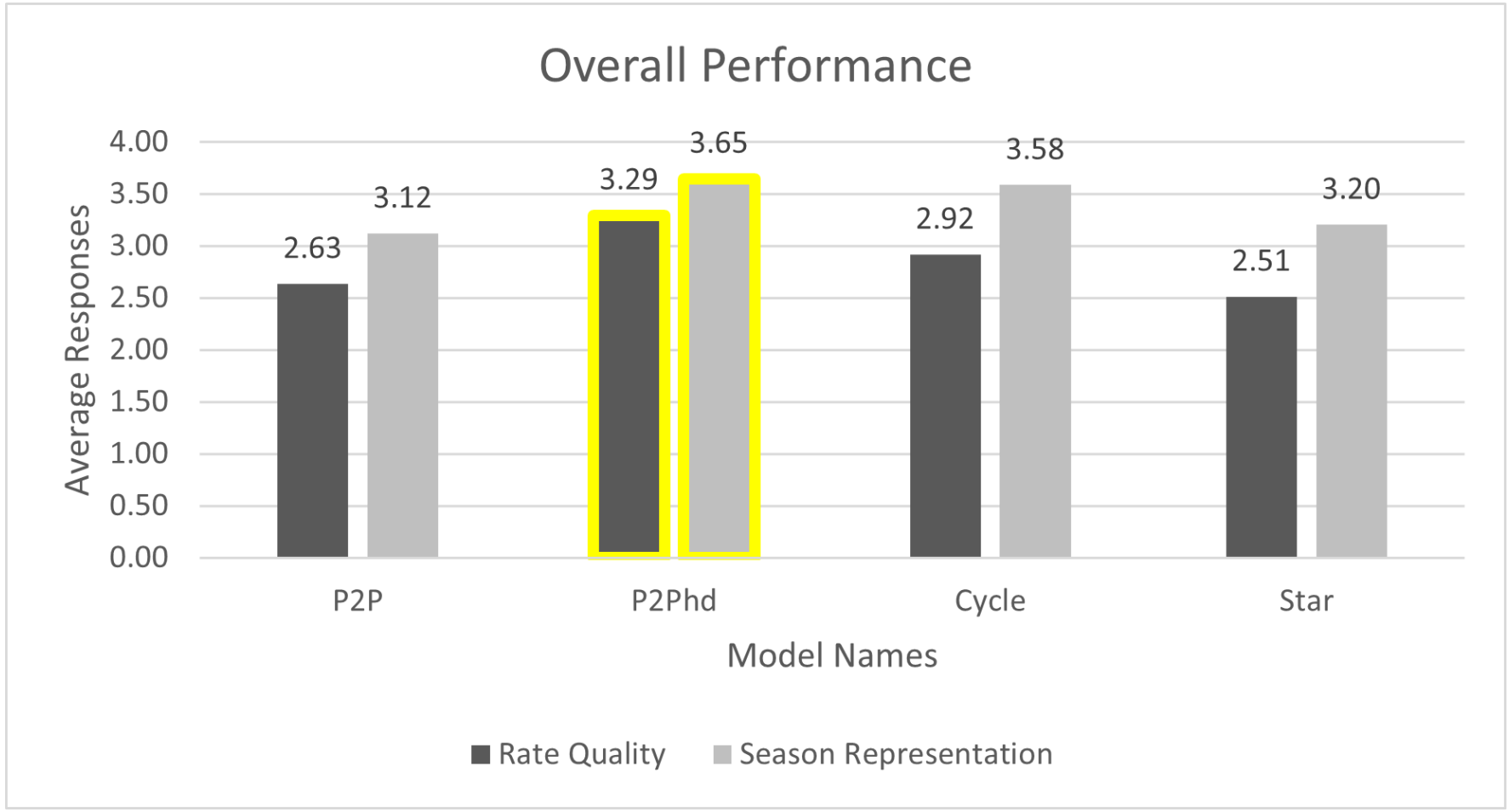
Desired Seasonal Attribute

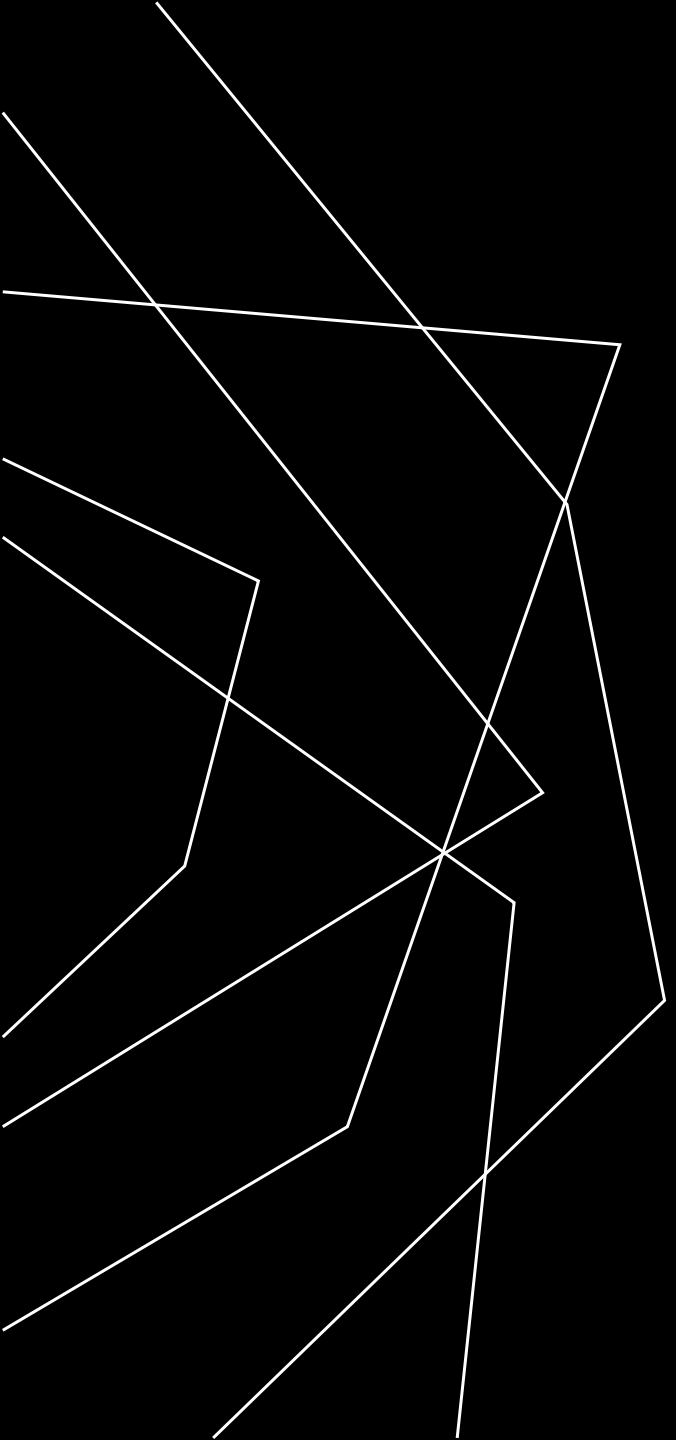


INTERPRETING RESULTS FROM THE SURVEY

Total Average

Image Quality and Desired Seasonal Attribute





THANK YOU