# <u>Semi-Supervised Outdoor Image Generation</u> <u>Conditioned on Weather Signals</u>

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# Background & Goal



- Unintuitive data to understand
- Spatio-temporal dense

- Intuitive data to understand
- Spatio-temporal sparse

**Goal** : Generating images which can tell weather situations at arbitrary time and locations.



# **Problems & Solution**



Image translation needs a lot of pair outdoor images (input) and weather signals (condition) as training data.

→Collection source : SNS Posted outdoor images





Comment : Today is very Clear! Post time : YYYY/MM/DD Post place : lat, lon



Comment : It's going to rain... Post time : YYYY/MM/DD Post place : lat, lon



It is hard to synchronize outdoor images with weather signals due to the mismatch between the posted/captured time of images.



## **Proposed Method**



### STEP 3) Training of conditional outdoor image generator

![](_page_4_Figure_1.jpeg)

### Data collection result

#### Semi-supervised approach : A few of high-confidence pairs and a lot of outdoor images

#### Flicker & OpenWeatherMap

764,566 pairs

Check semantic consistency by comparing condition predicted from outdoor image and weather signals.

From the remaining data, remove outliers of weather signals and duplicate images.

![](_page_5_Picture_6.jpeg)

• High-confidence pairs (171,489 pairs)

train : val : test =  $2 : 2 : 1 \rightarrow$  For training *R*, train(**68,595** pairs)

• Low-confidence outdoor images (201,059 images)  $\rightarrow$  Augmented : For training T of semi-supervised approach

### Experiment①Evaluations of semi-supervised training

**Comparison with supervised approach:** Require high-confidence pairs of image and weather condition

→ Existing dataset

Image2Wether[1]: Outdoor images labeled weather condition by human (i2w)

#### **5 weather classes**

sunny	70,501
cloudy	45,662
rain	1,252
snow	1,369
foggy	357

![](_page_6_Picture_6.jpeg)

Divide to train : val : test = **59,319 : 59,321 : 500**  $\rightarrow$  For training *R*, *T* of supervised approach

test : 100 images for each class

train, val : Half of remaining for each class

### Experiment①Evaluations of semi-supervised training

![](_page_7_Figure_1.jpeg)

Increasing training data more than 3 times by semi-supervised approach resulted in the generator performance improved.

# Experiment②Evaluations of image generation conditioned <u>on weather signals</u>

![](_page_8_Figure_1.jpeg)

• Even if the weather class of  $\hat{O}$  is same, it is possible to express differences such as cloudcover.

 $\rightarrow$  We realize conditional transform on weather signal.

# Conclusion

- We proposed the conditional semi-supervised outdoor image generator.
- We confirmed the validity of semi-supervised approach.
- We realized the diverse image transformation by using the weather signal as input condition.