

Image Domain Conversion

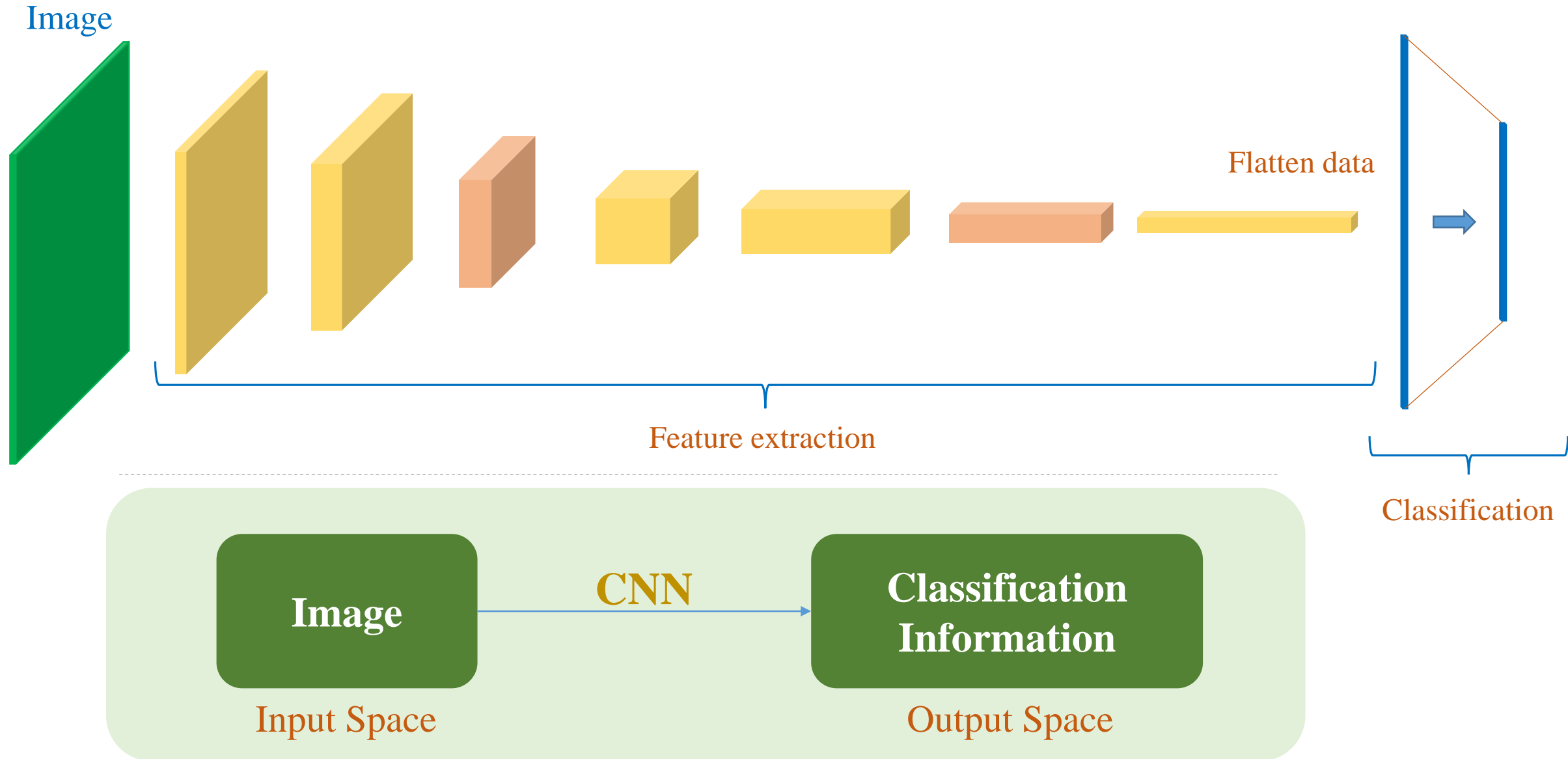
(Draft version)

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Ph.D. in Computer Science

Outline

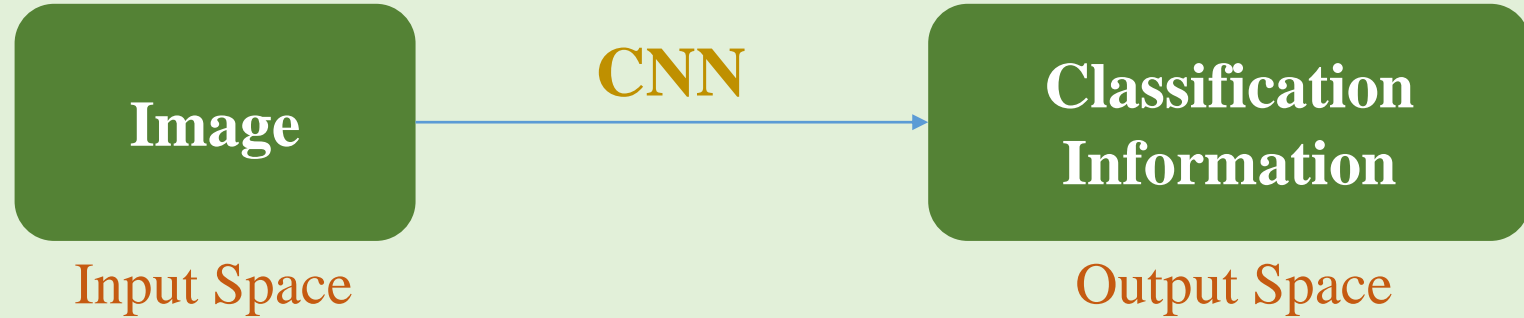
- **Introduction to Numpy**
- **Numpy Array Indexing**
- **Numpy Array Operations**
- **Broadcasting**
- **Data Processing**

Motivation

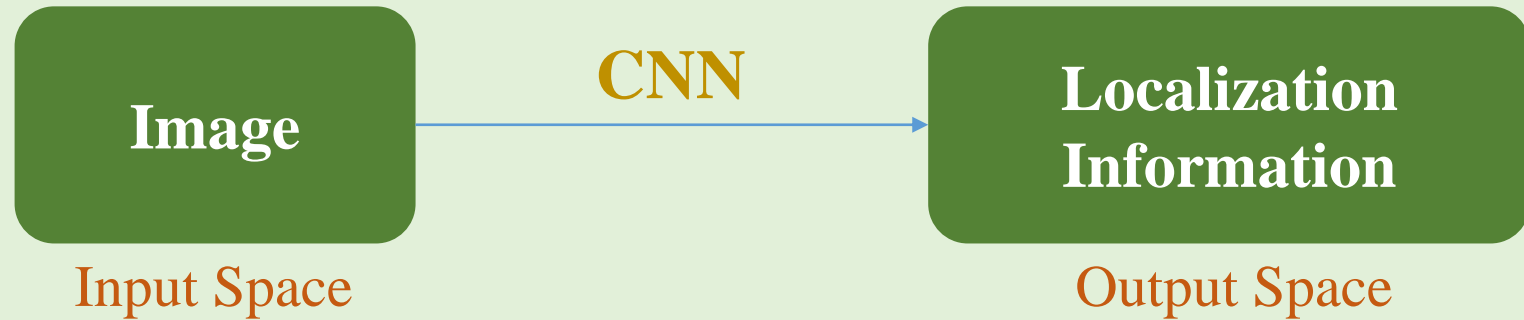


Motivation

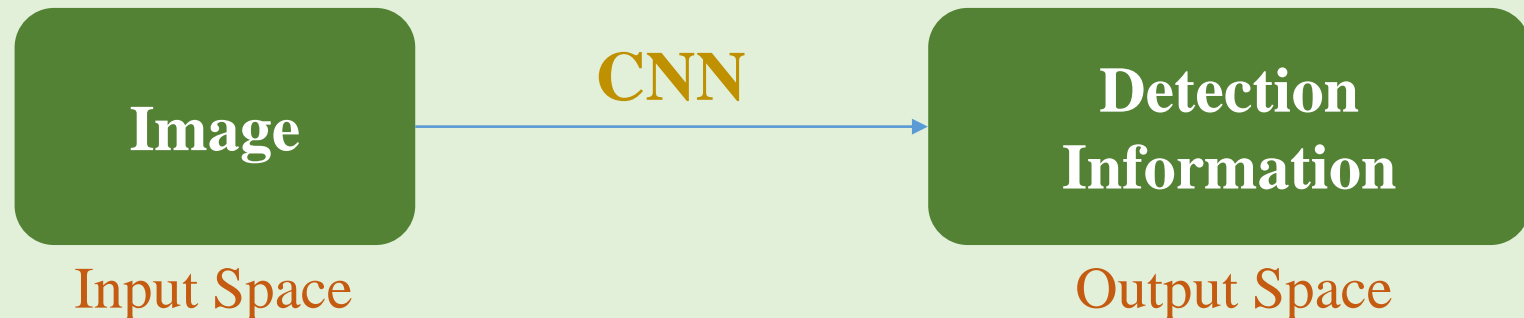
**Image
Classification**



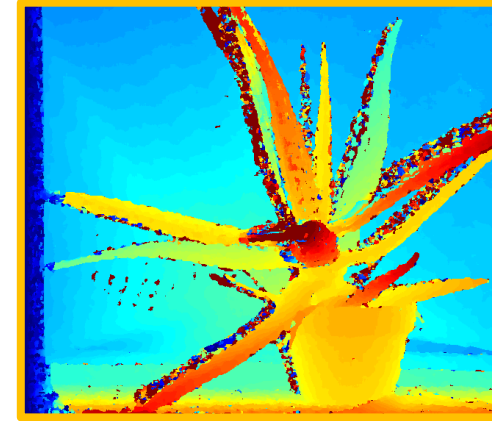
**Image
Localization**



**Image
Detection**



Motivation



Image

Input Space

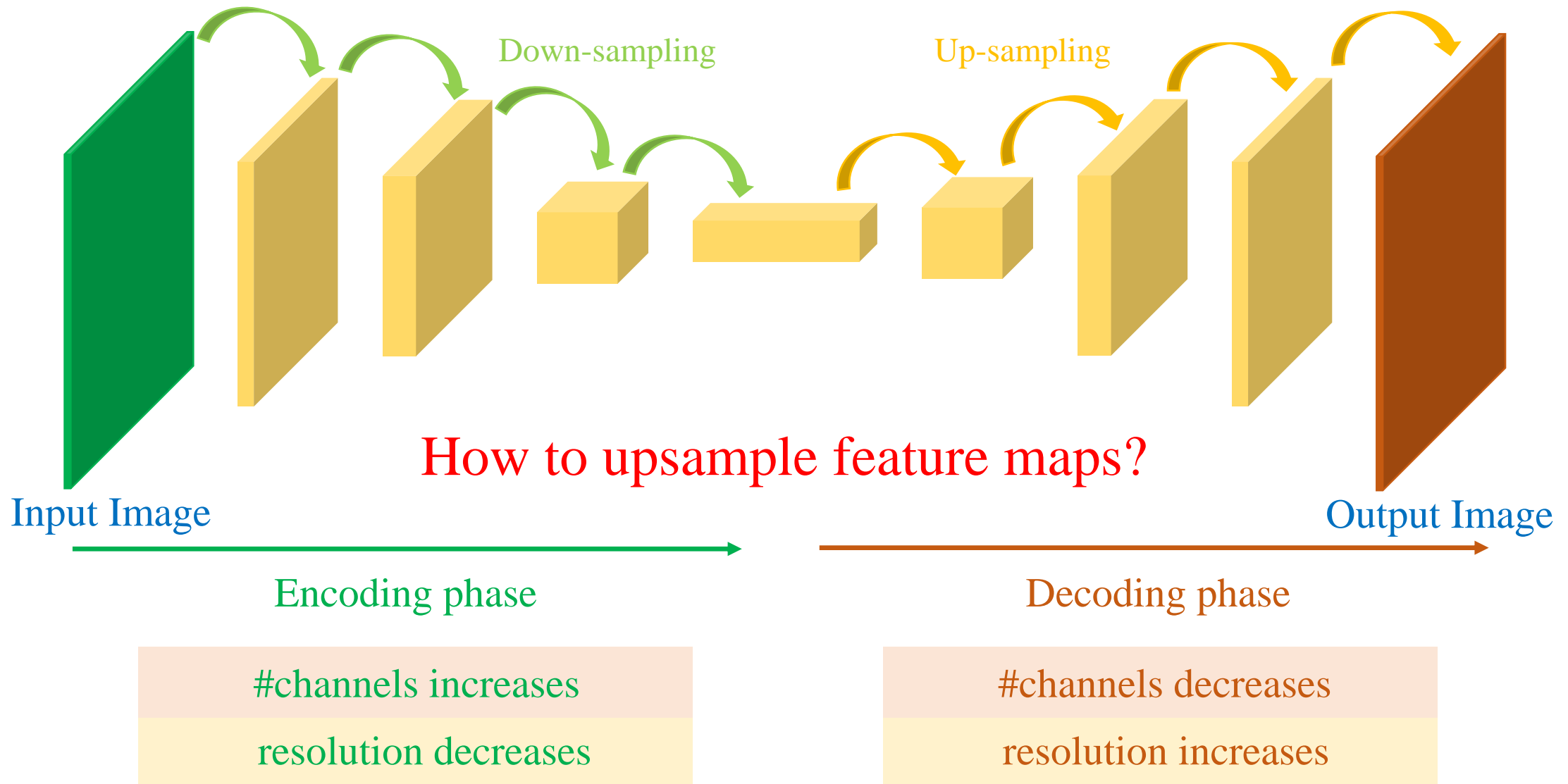
How?

Image

Output Space



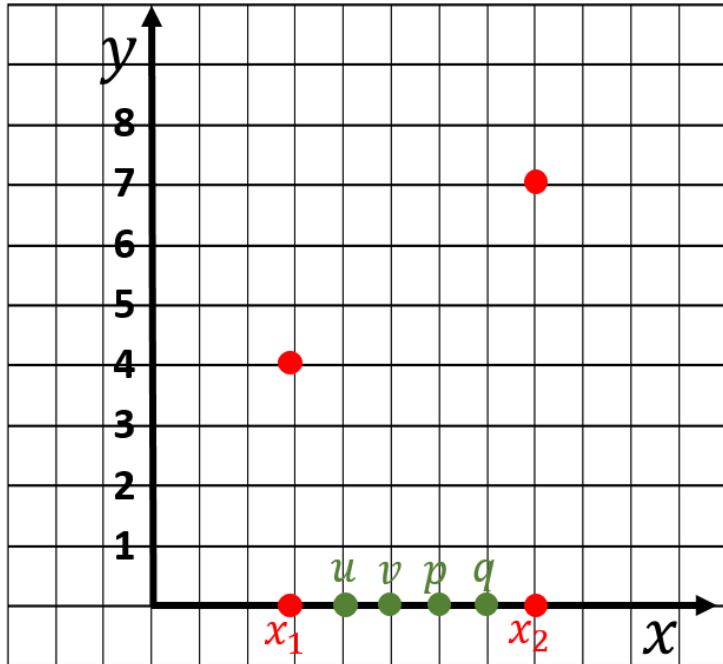
Motivation



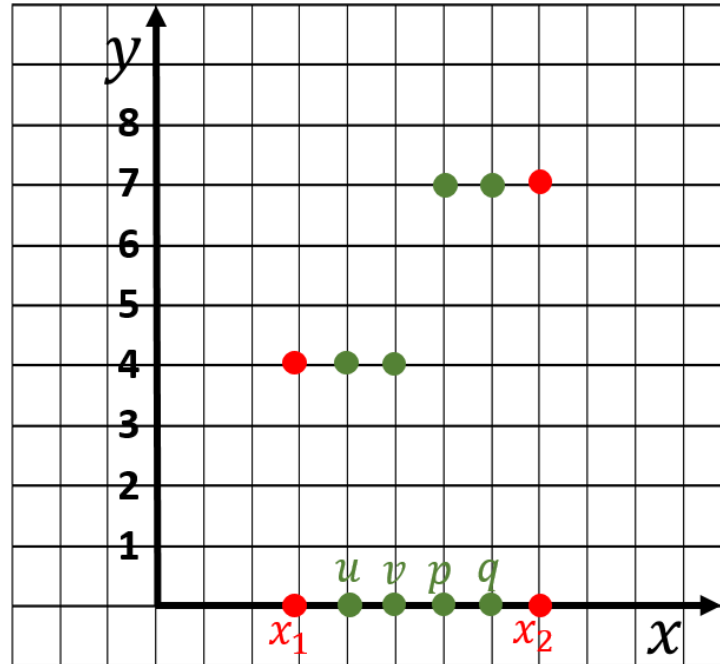
How to Upsample Feature Maps

❖ Solution 1: Image upsampling

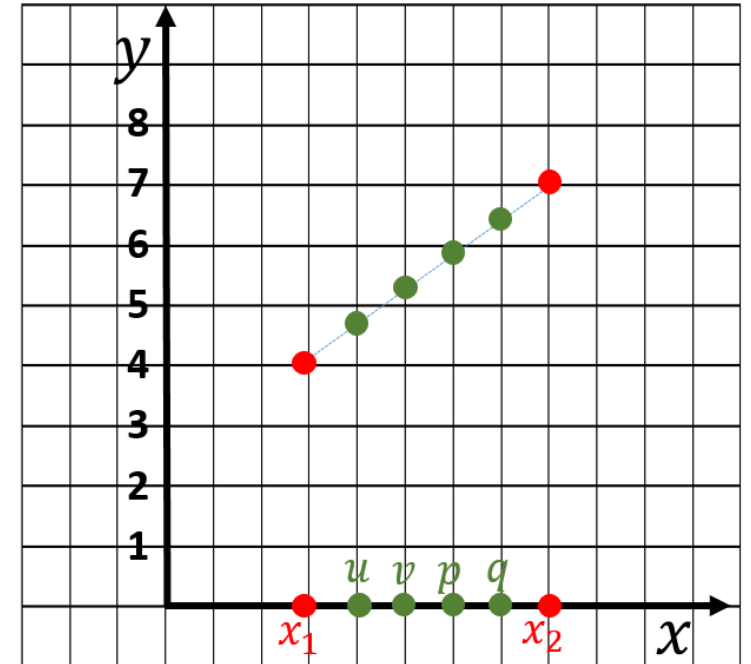
❖ Data interpolation



Tìm giá trị cho các vị trí u , v , p và q



Nearest neighbor: Tính khoảng cách đến x_1 và x_2 , và lấy giá trị của x gần hơn



Nội suy theo hàm tuyến tính

How to Upsample Feature Maps

❖ Solution 1: Feature upsampling

❖ Data interpolation



Ảnh gốc



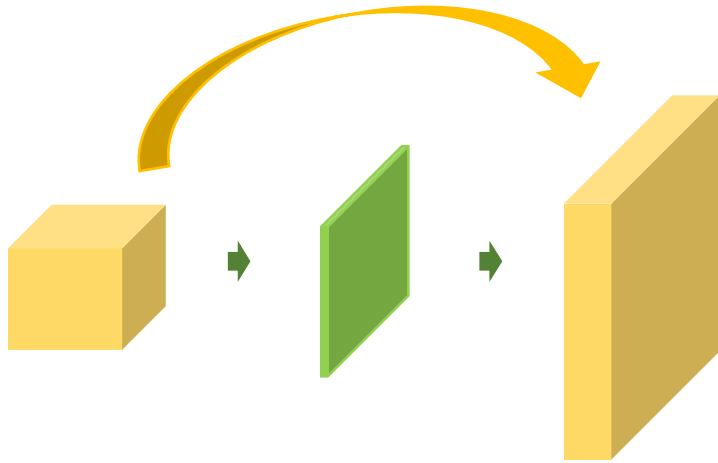
Ảnh phóng to dùng nearest neighbor



Ảnh phóng to dùng hàm tuyến tính

How to Upsample Feature Maps

Naïve approach: Only use 'image upsampling'



Output feature maps are lack of details

```
model = tf.keras.Sequential()
model.add(tf.keras.layers.UpSampling2D(interpolation='bilinear'))
model.add(tf.keras.layers.Conv2D(num_filters,
                                kernel_size,
                                padding='same',
                                kernel_initializer=initializer))
```

Use 'image upsampling'+Conv



Reduce the weakness
from upsampling

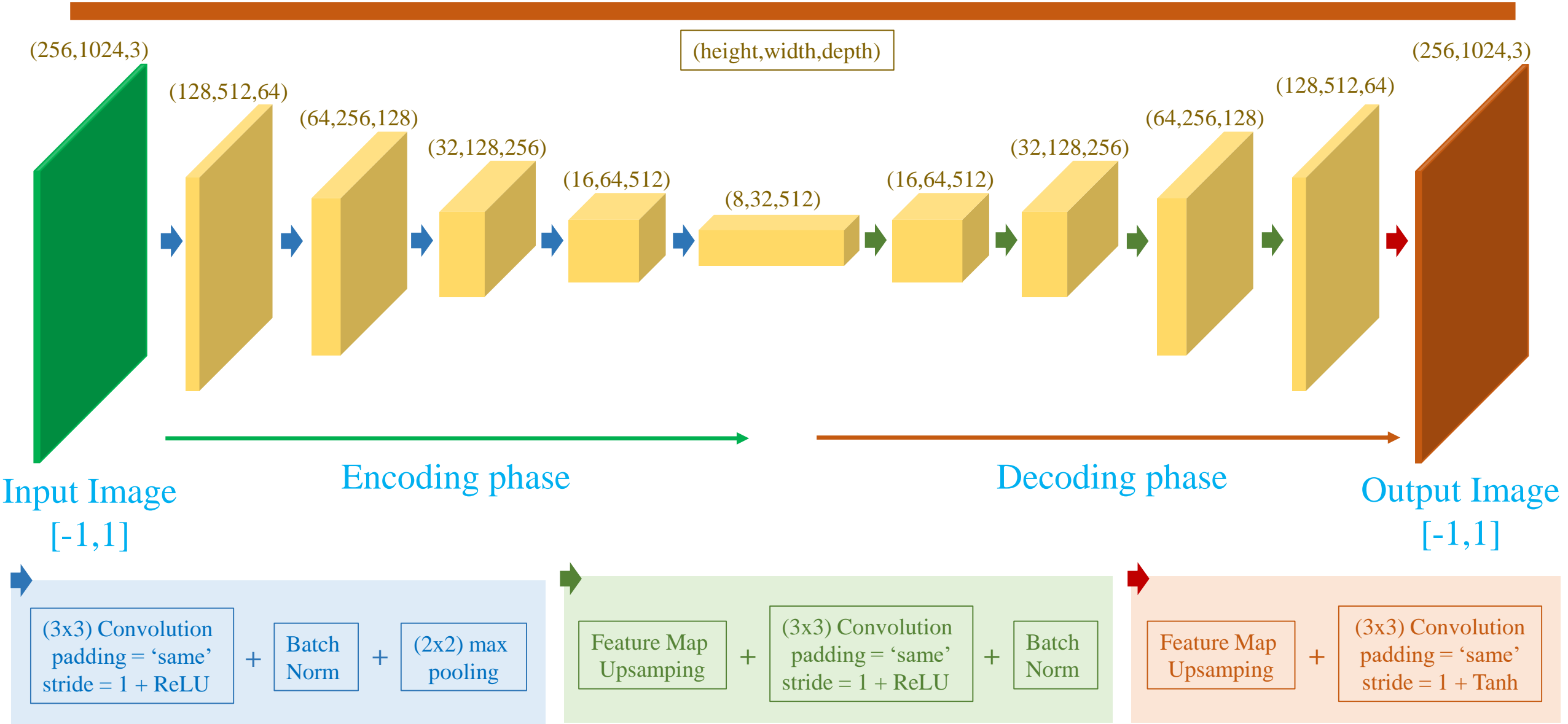


upsampling

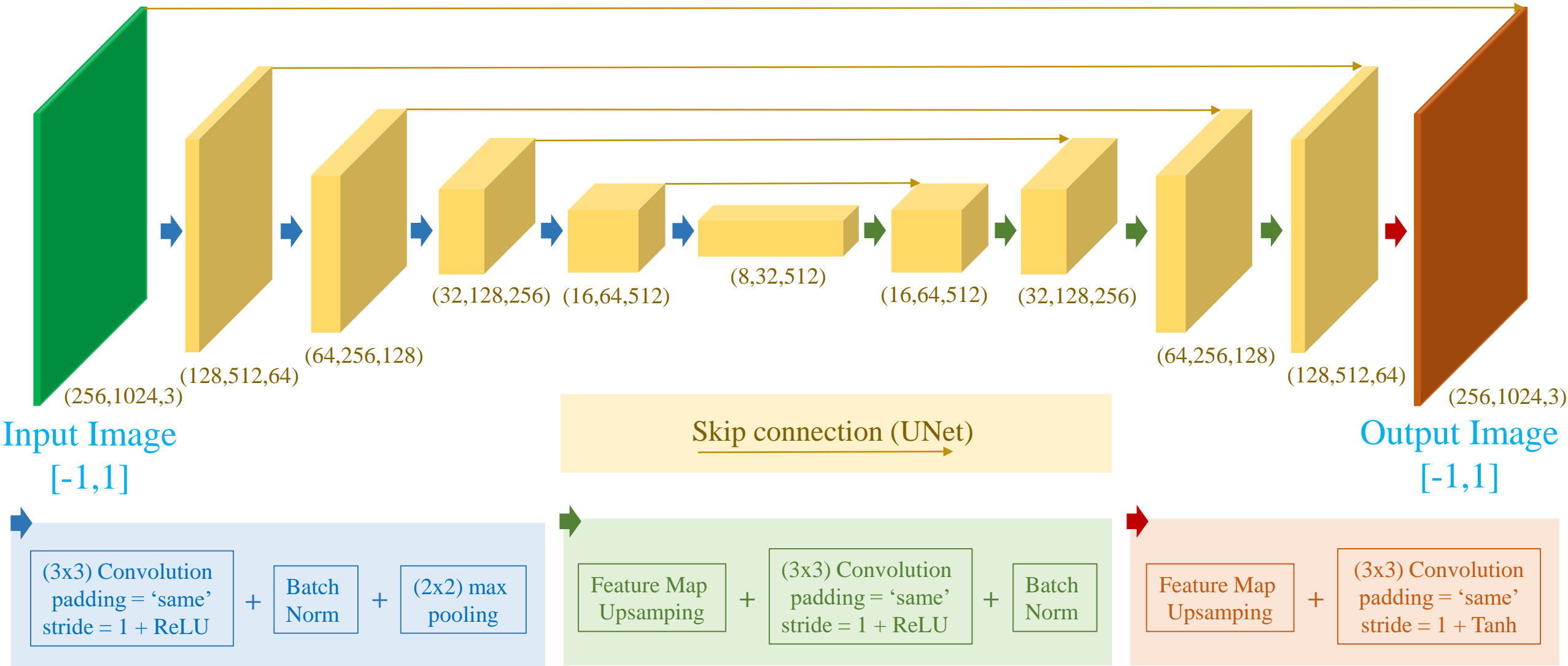


conv
padding='same'
stride=1

How to Upsample Feature Maps

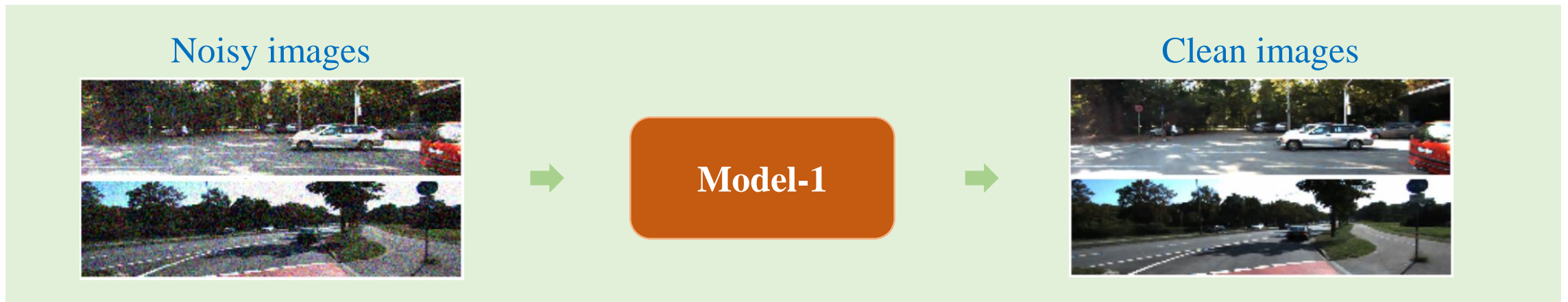
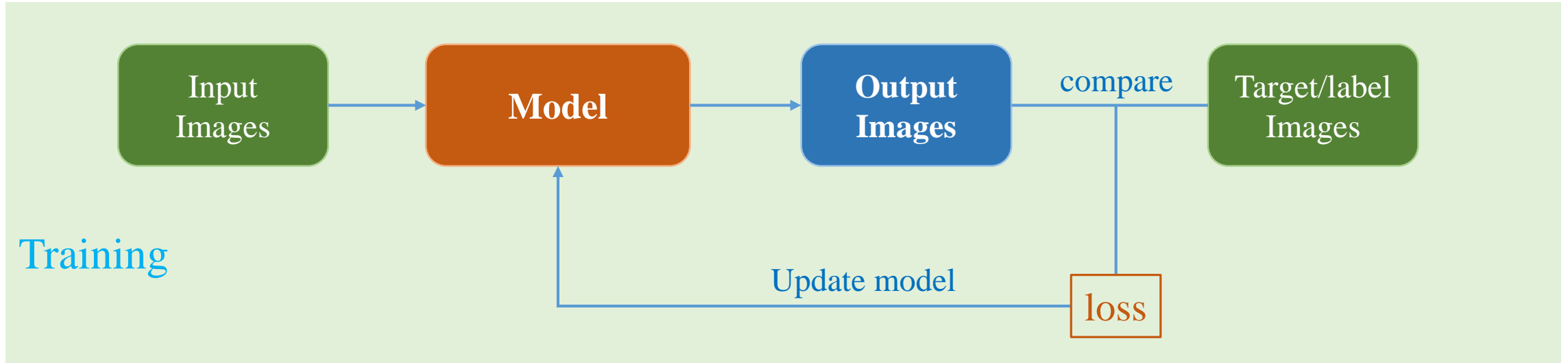


How to Upsample Feature Maps



How to Upsample Feature Maps

❖ Solution 1: Feature upsampling



How to Upsample Feature Maps

Grayscale images

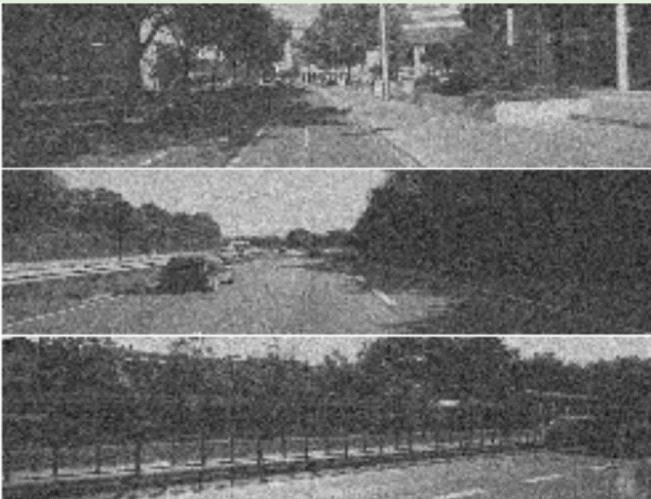


Model-1



Color images

Noisy and
grayscale images



Model-1

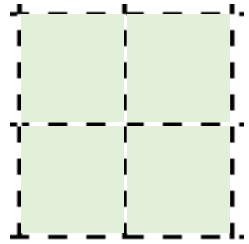


Clean and color images

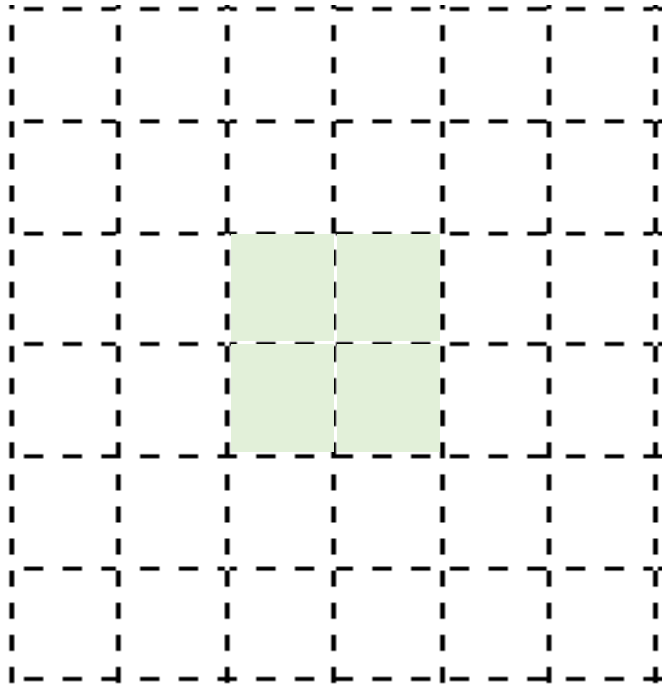
How to Upsample Feature Maps

❖ Solution 2: Convolution Transpose (Use convolution to upsample feature maps)

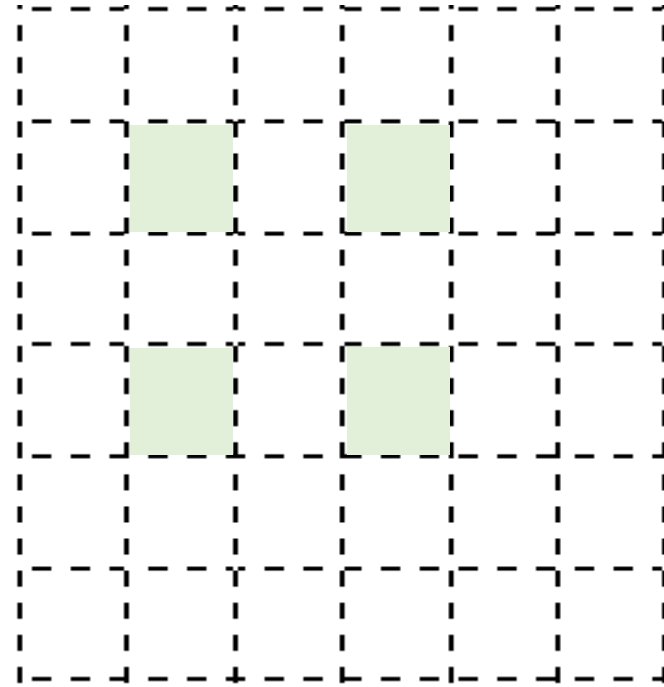
Increase Data
from 2x2 to 4x4



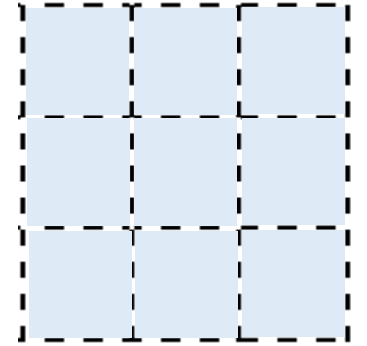
Data



Data + padding=2 (D_1)

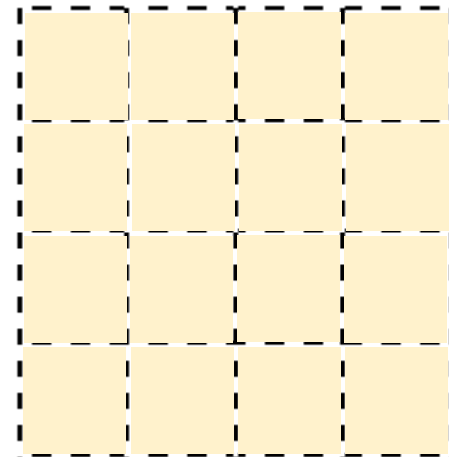


Data + stride=2 + padding=(1,1,2,2) (D_2)



Kernel K

Output



In Keras

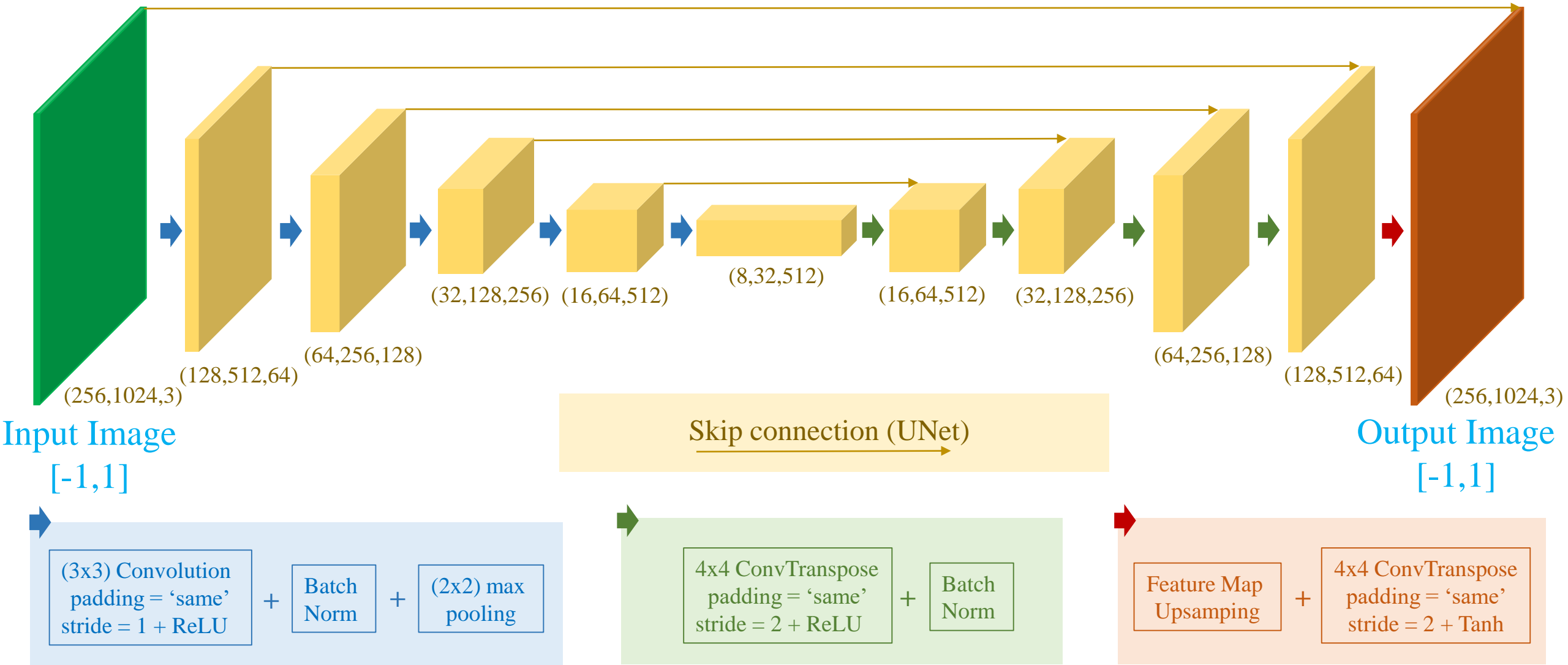
```
kernel_size = 4  
Conv2DTranspose(num_filters, kernel_size,  
                 strides=2, padding='same')
```

Convolution(D_1 with K)

Convolution(D_2 with K)



How to Upsample Feature Maps



How to Upsample Feature Maps

Noisy images



Model-2



Clean images



Grayscale images



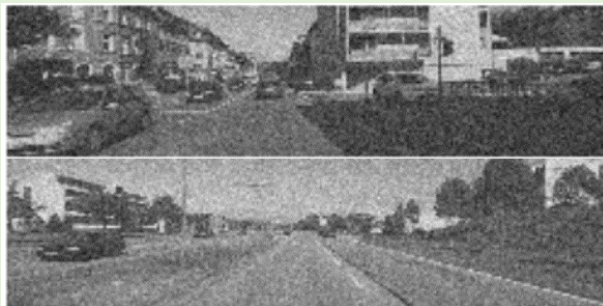
Model-2



Color images



Noisy and grayscale images



Model-2



Clean and color images



Advanced Tensorflow



Reading

Convolution transpose

<https://arxiv.org/pdf/1603.07285v1.pdf>

Summary

