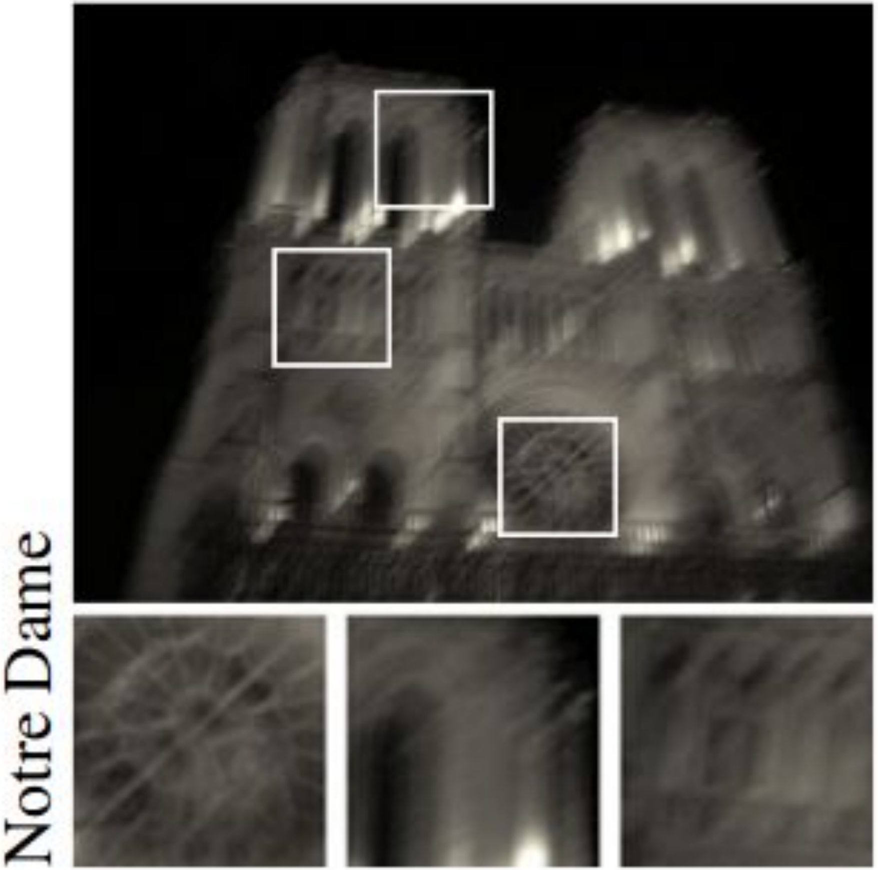
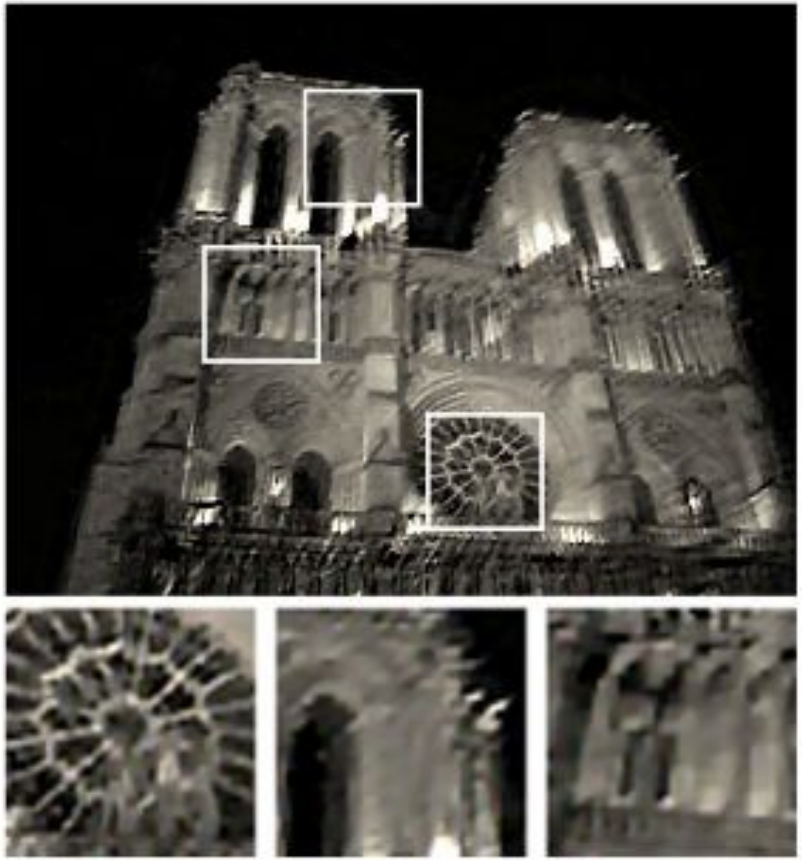
DL Methods for Motion Deblurring

Objective of Motion Deblurring

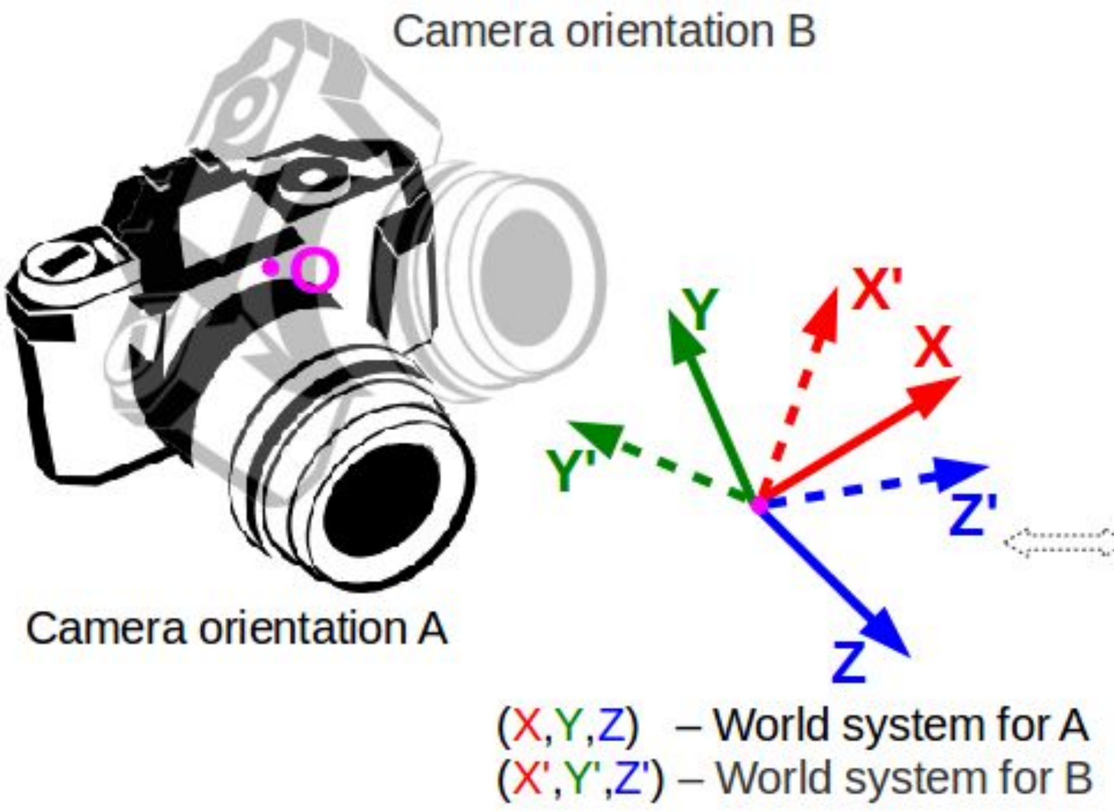


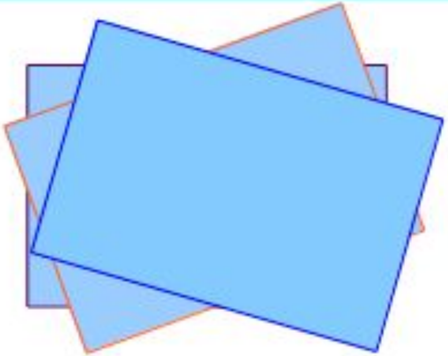
Blurred Image



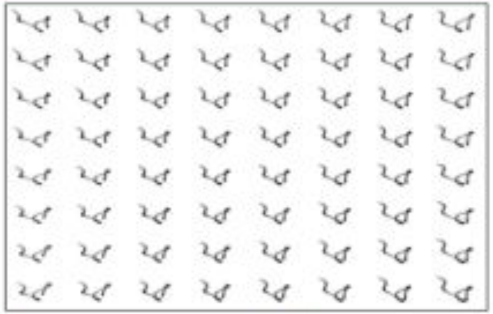
Clean Image

Motion blur Model



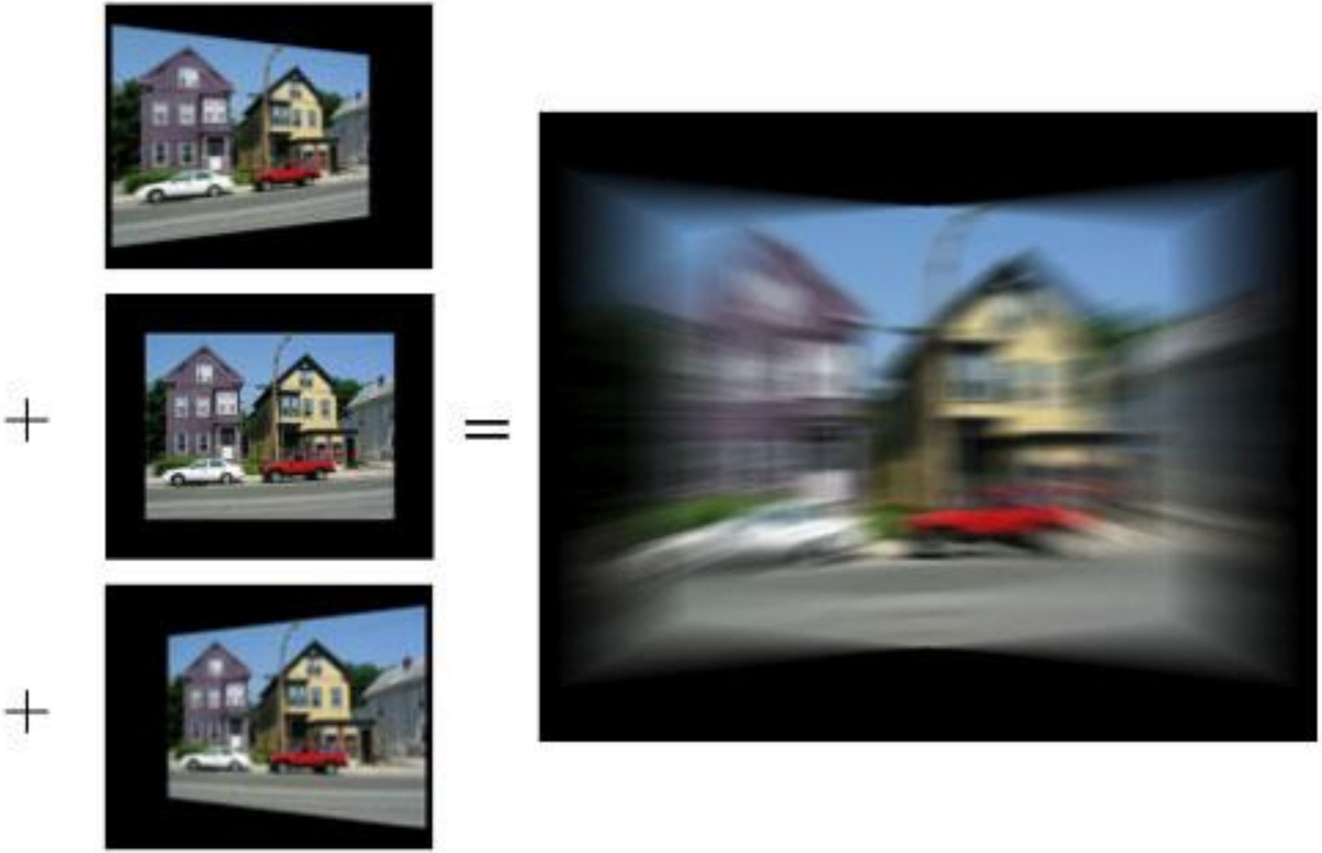


(a) World-projections captured by LF-sensor position

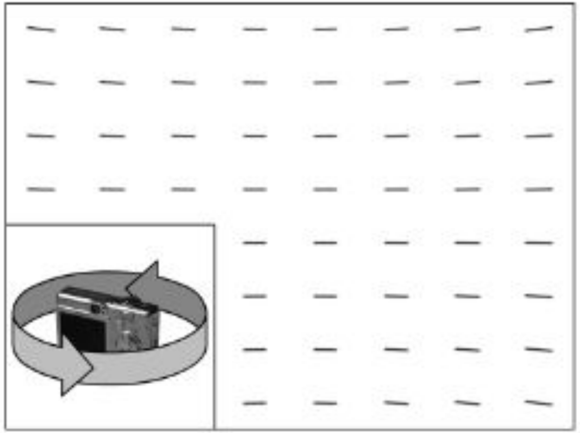


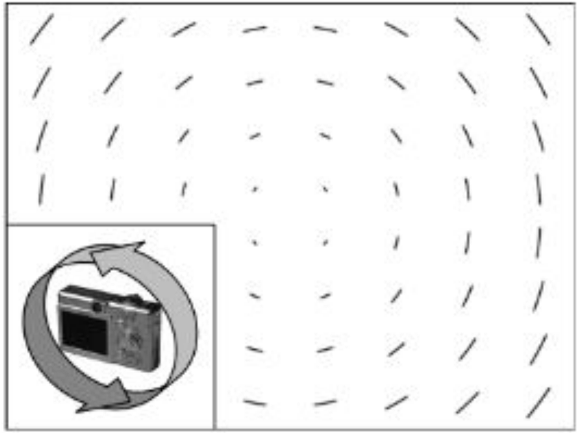
(b) Point-spread function in the latent image

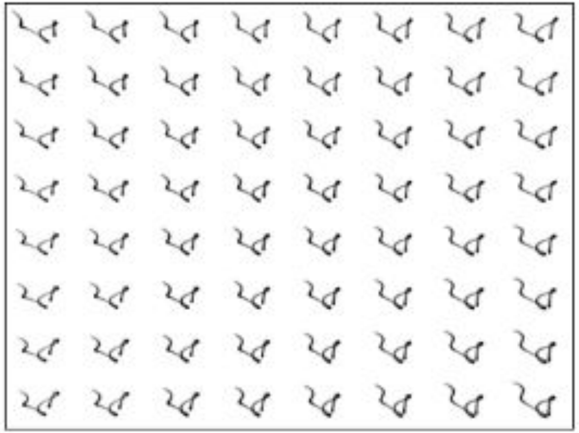
Interpretation 1: As a Sum of Warped Images



Interpretation 2: As Space-variant Convolution

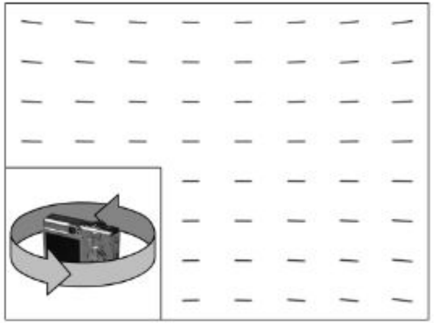

Y-axis rotation of the camera


Z-axis rotation of the camera

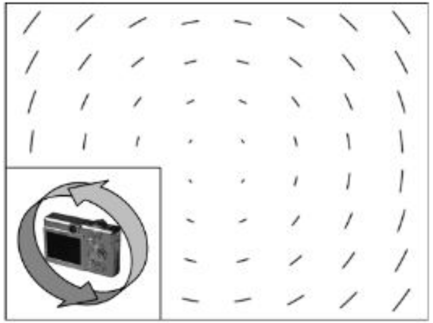

Arbitrary sequence of rotations

Formation of Point Spread Function (PSF)

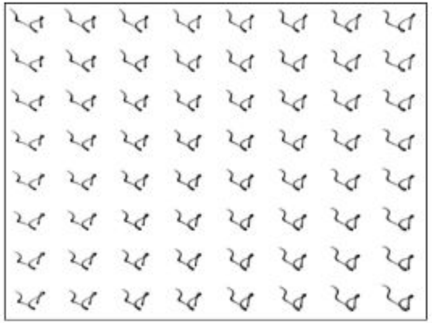
Interpretation 2: As Space-variant Convolution



Y-axis rotation of the camera



Z-axis rotation of the camera



Arbitrary sequence of rotations

Clean Image

$*$

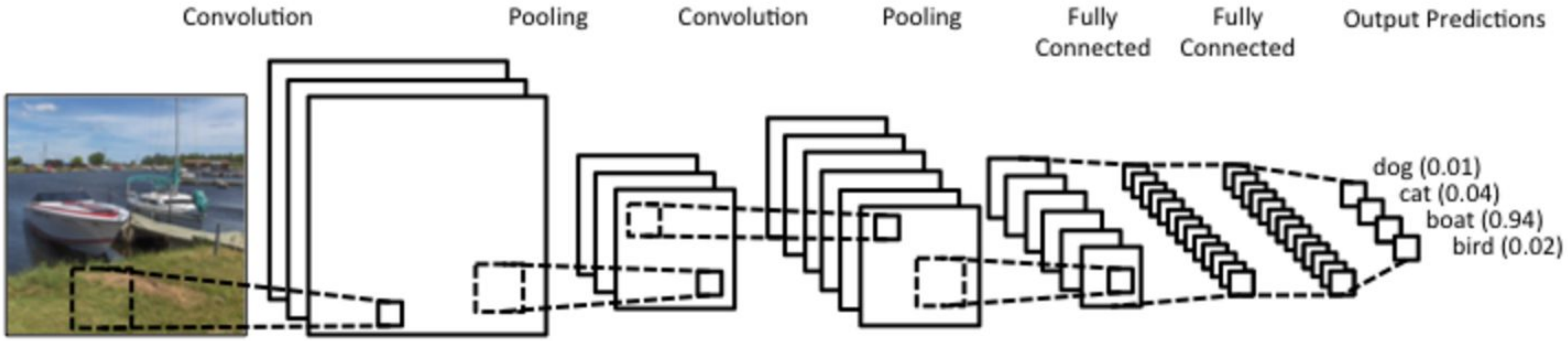
PSF

$=$

Blurred Image

Approach 1

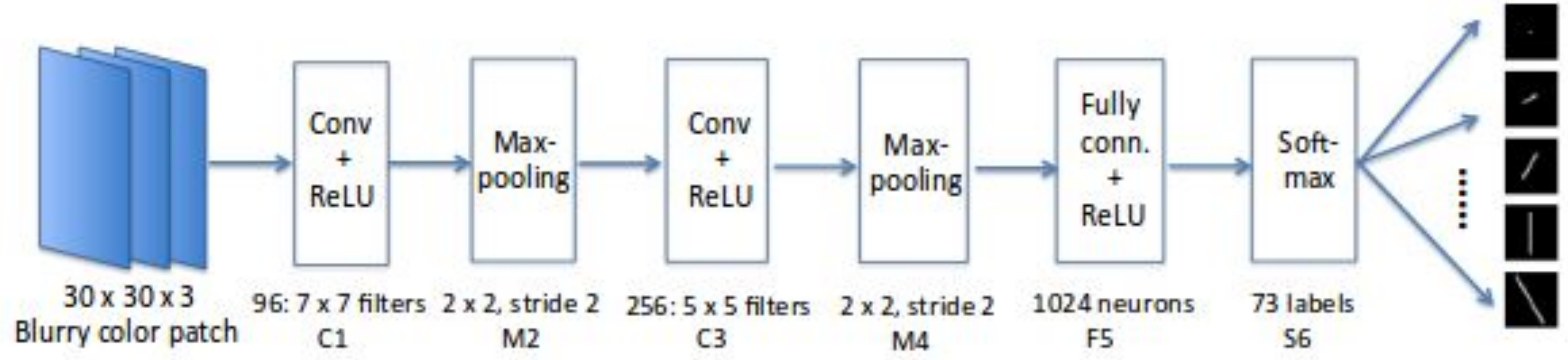
Kernel classification using CNN.



<u>Central Idea</u> : Harnesses classification capabilities of CNN

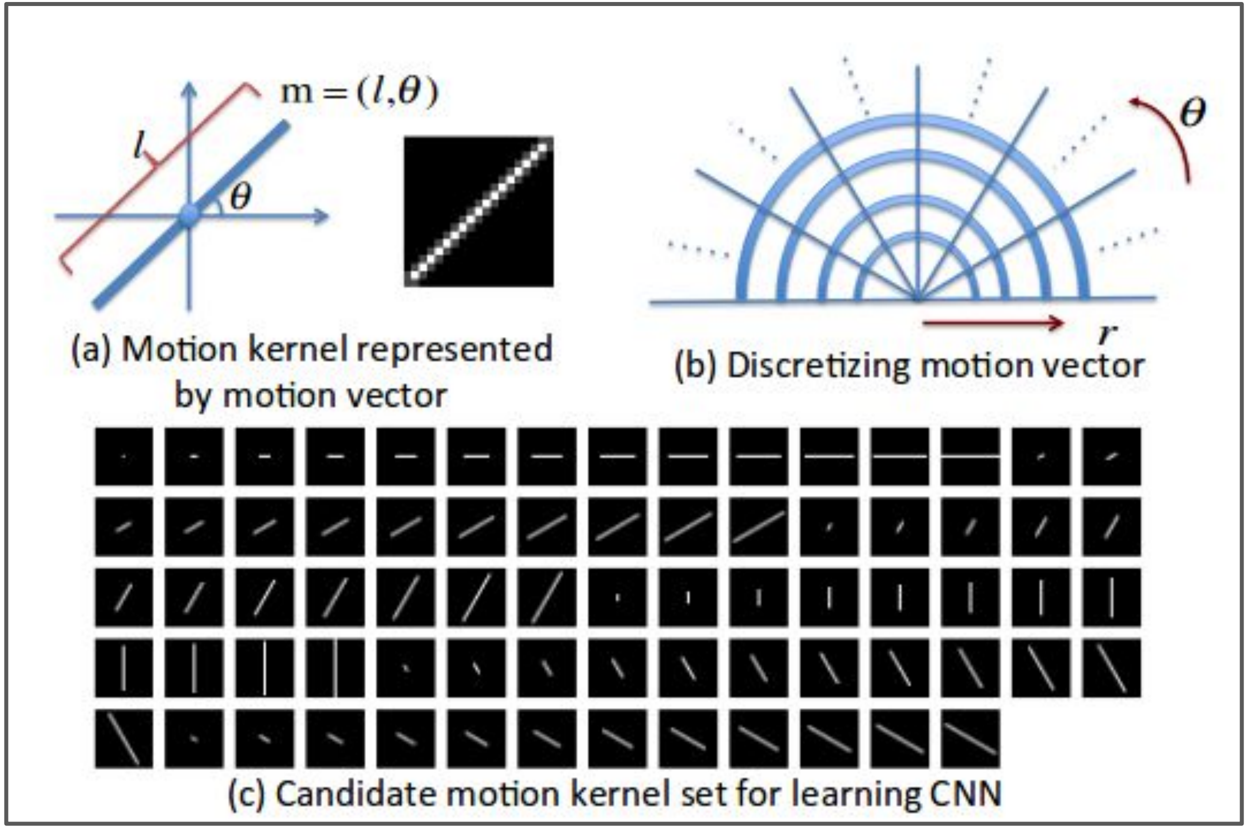
Deep learning for Non-uniform Motion Blur Removal.
Jian Sun, Cao, Xu, Jean Ponce. CVPR 2015.

Kernel classification using CNN.

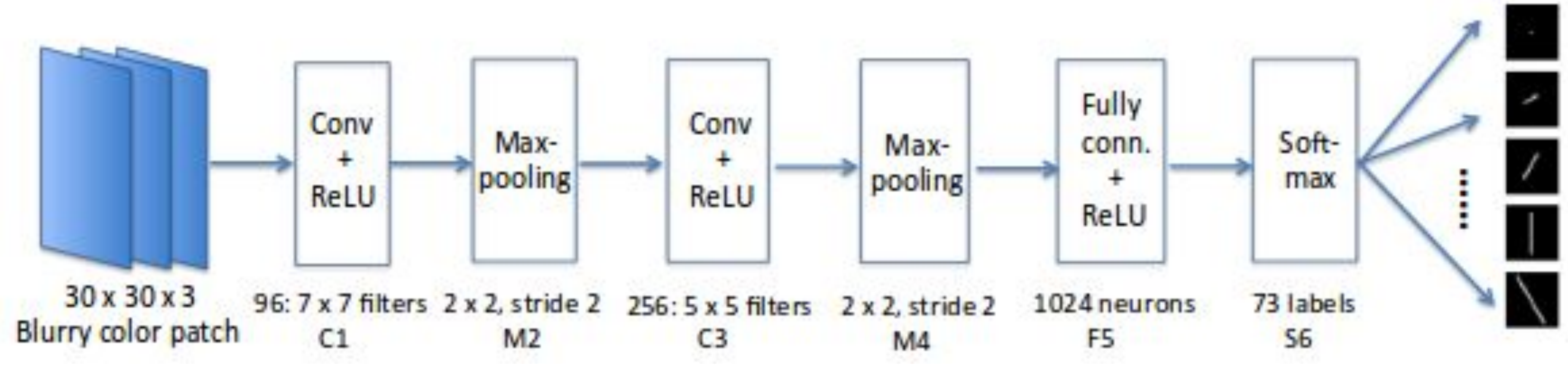


<u>Central Idea</u> : Harnesses classification capabilities of CNN

Kernel classification using CNN.



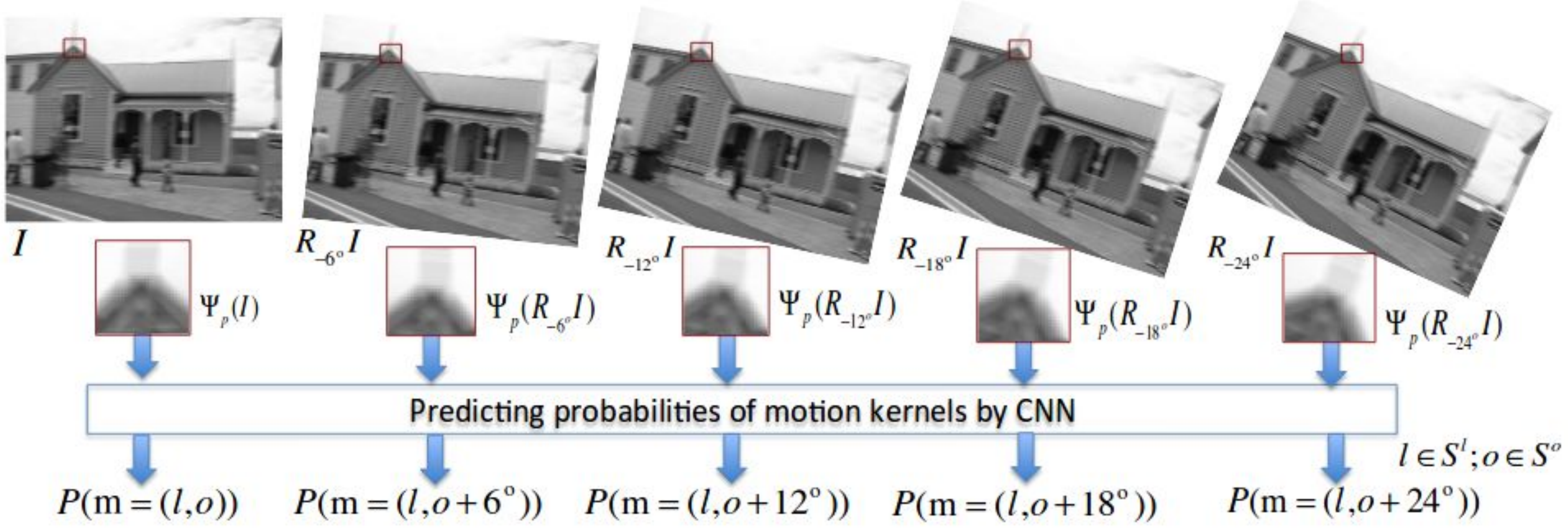
Kernel classification using CNN.



Problem 1: Only 36 classes of Kernels (too small).

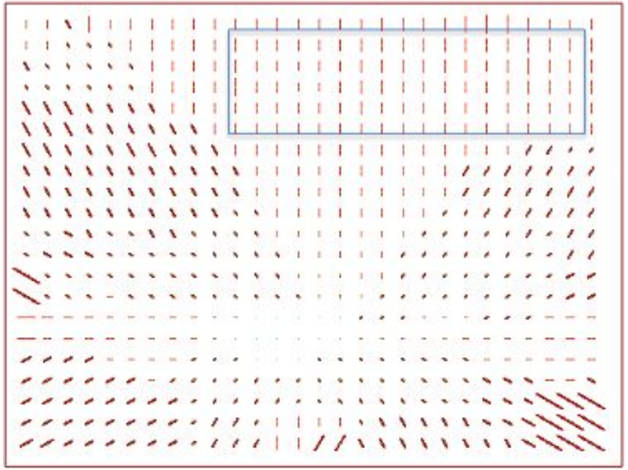
Kernel classification using CNN.

Solution: Only 36 classes of Kernels (too small).

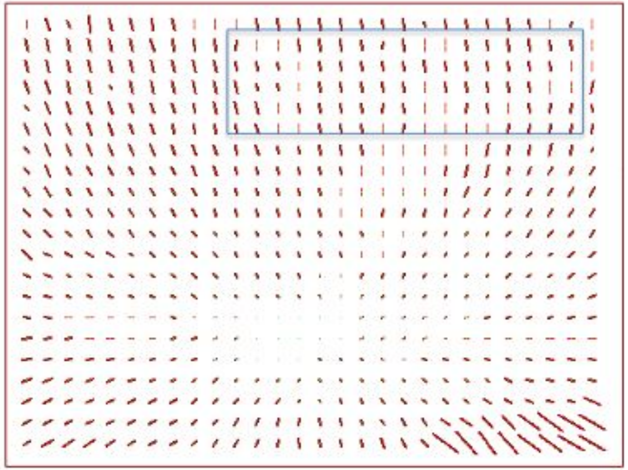


Kernel classification using CNN.

Analysis of Kernel Extension:



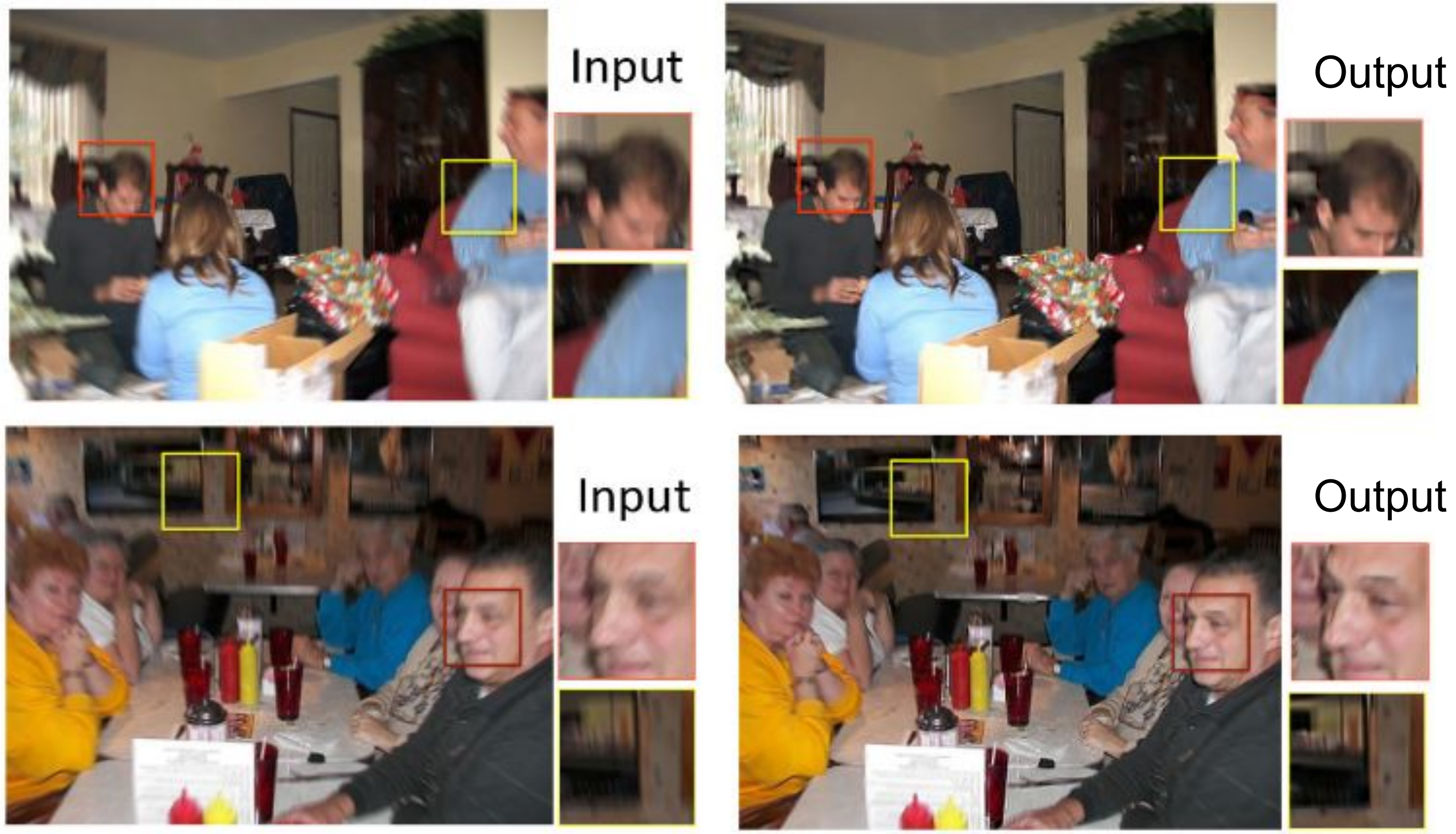
Approximation with **36** Kernels



Approximation with **361** Kernels

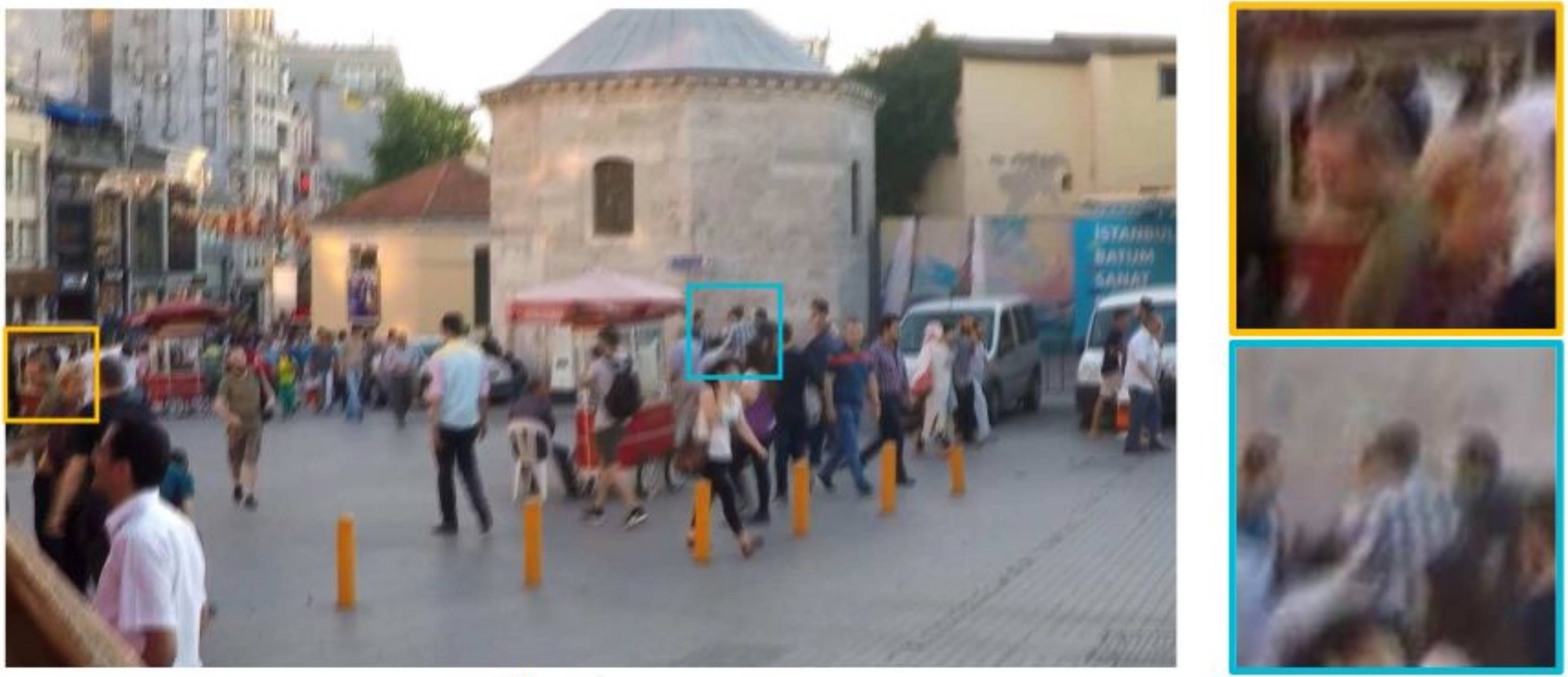
Kernel classification using CNN.

Results:



Approach 2

End-to-end training using CNN with Multi-scale Loss

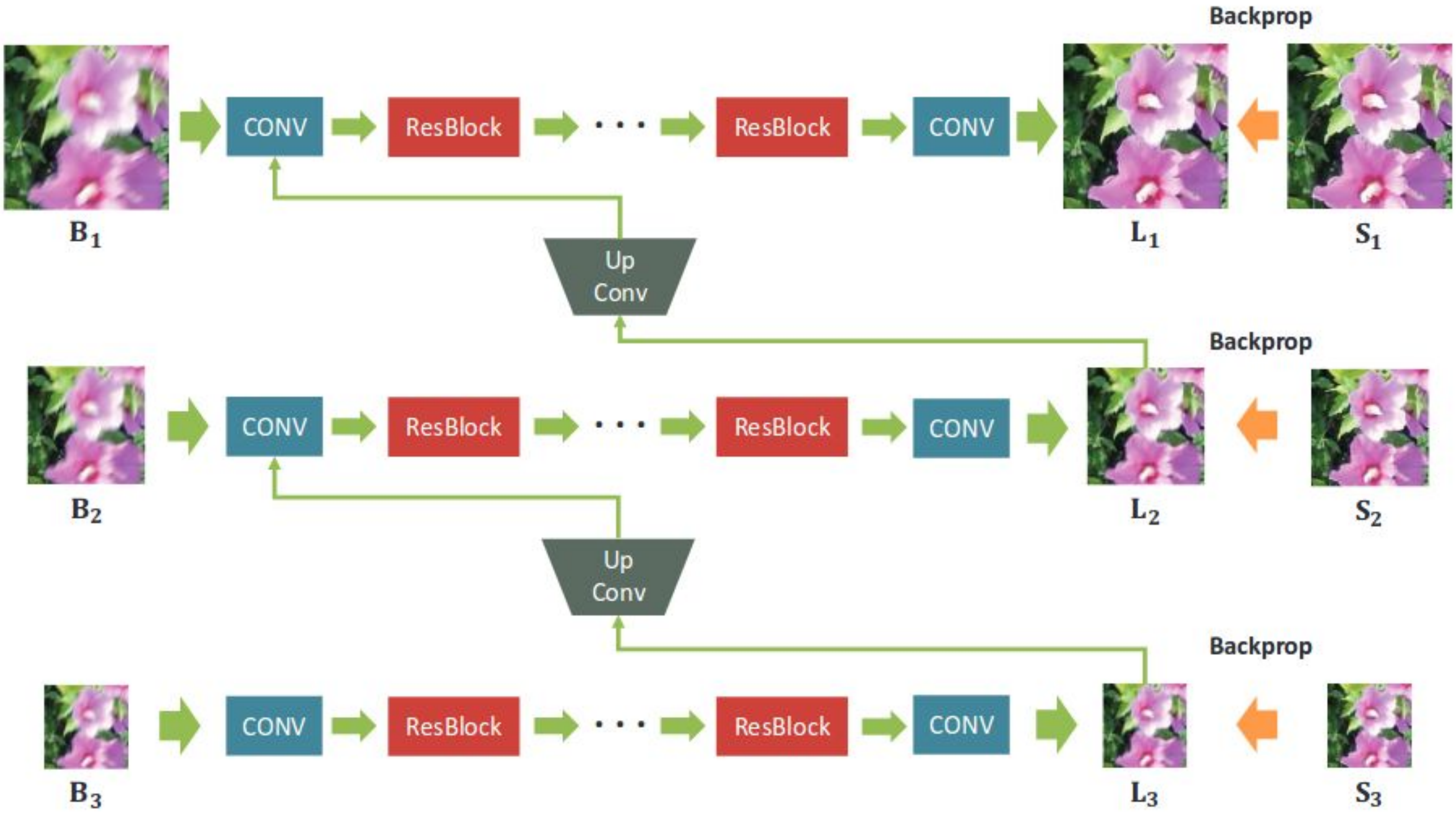


Blurry image

Deep Multi-scale Convolutional Neural Network for Dynamic Scene Deblurring
Seungjun Nah, Tae Hyun Kim, and Kyoung Mu Lee, CVPR 2017

End-to-end training using CNN with Multi-scale Loss

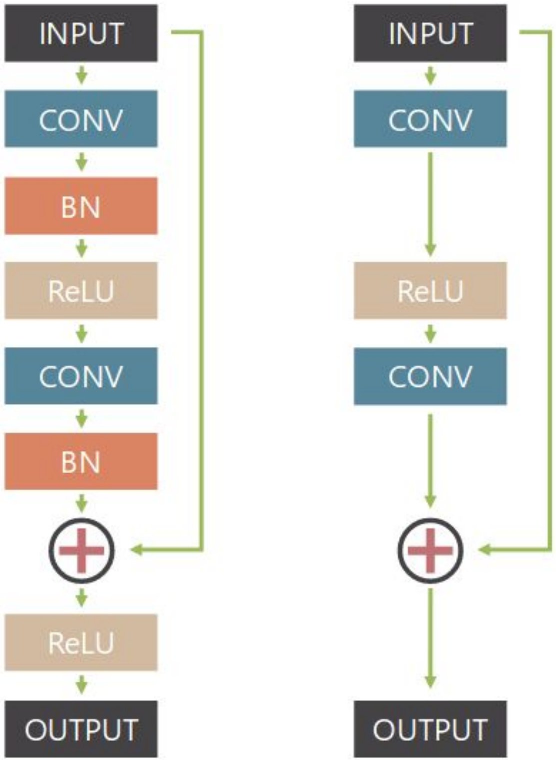
Deep Multi-scale Convolutional Neural Network for Dynamic Scene Deblurring
Seungjun Nah, Tae Hyun Kim, and Kyoung Mu Lee, CVPR 2017



Backprop
CONV
ResBlock
· · ·
ResBlock
CONV
B1
L1
S1
Up Conv
Backprop
CONV
ResBlock
· · ·
ResBlock
CONV
B2
L2
S2
Up Conv
Backprop
CONV
ResBlock
· · ·
ResBlock
CONV
B3
L3
S3

End-to-end training using CNN with Multi-scale Loss

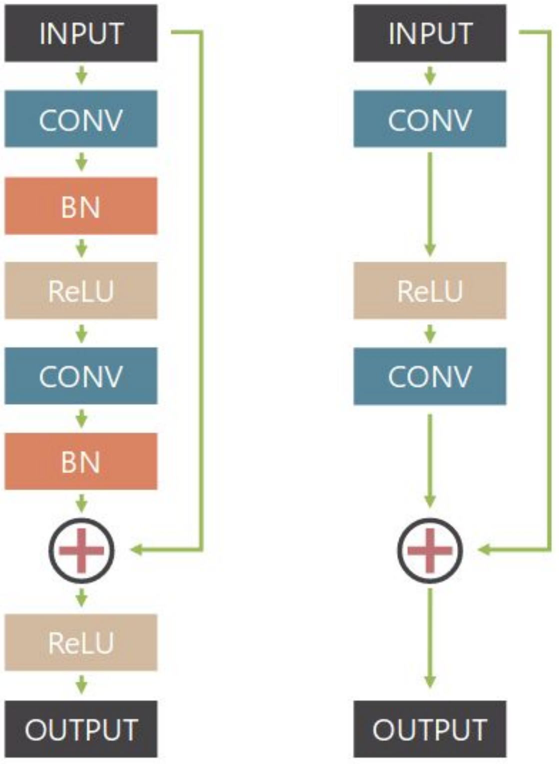
More Details



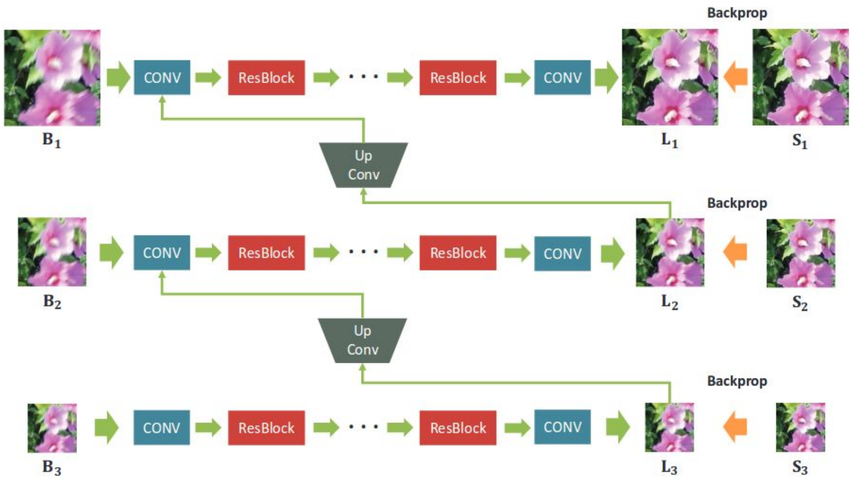
Resblock Modified Resblock

End-to-end training using CNN with Multi-scale Loss

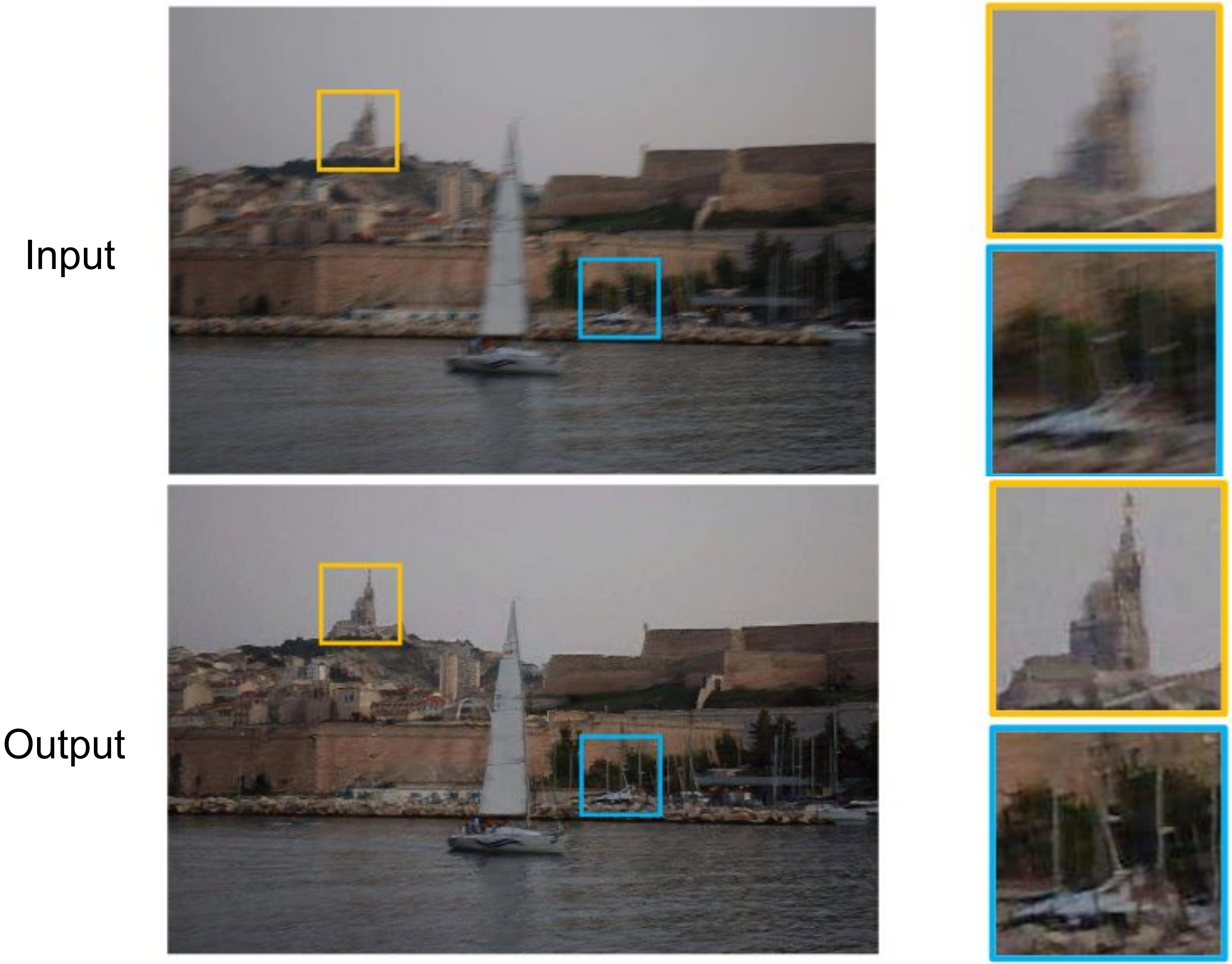
More Details



Resblock Modified Resblock



1. Coarsest level operates on 64X64 image patches
2. MSE Loss in all scales
3. Training data obtained using GoPro cameras.


Input
Output