

Image Deblurring

Andy Gilbert, Shai Messinger, Anirudh Patel

Introduction

- Image deblurring is a highly relevant problem: **~1.2 trillion photos taken in 2017**, 85% of them on smartphones.
- Neural Networks give the ability to infer complex priors on images.

Problem Statement

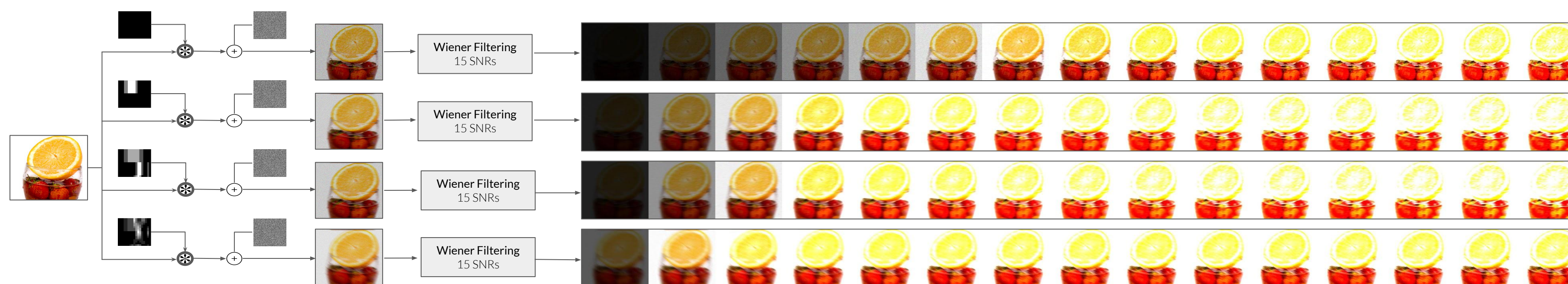
We will deblur by first inputting the images into a sequence of Wiener Filters and then dynamically combining the Wiener filter output using a convolutional neural network.

Dataset

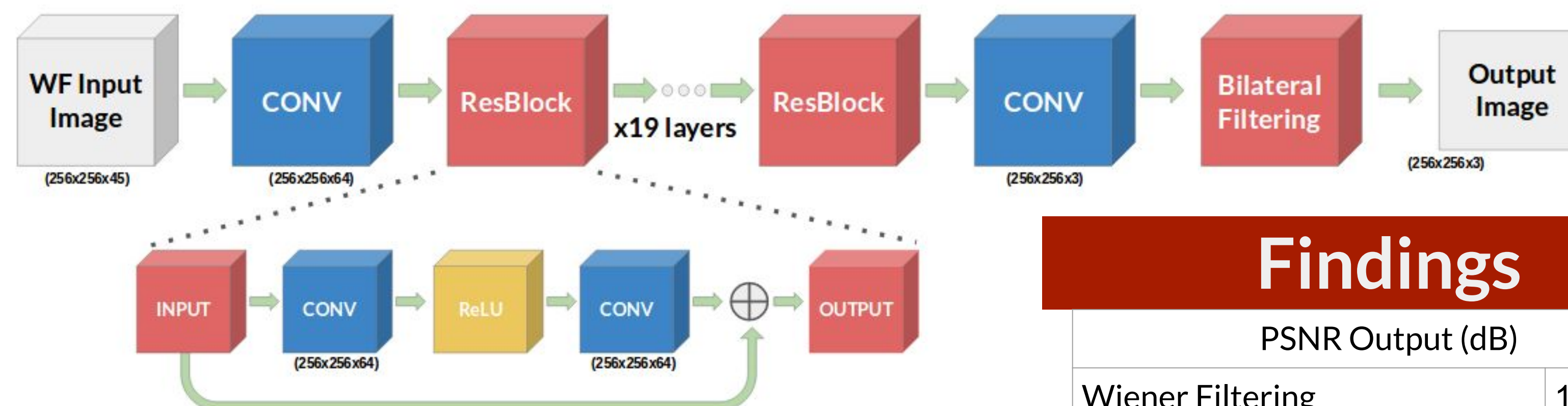
- Used subset of ImageNet dataset (1153 images)
- Created four **blur kernels** per image using Gaussian sampling from a mechanical motion process [1][3].
- Added Gaussian and Poisson noise to each image

Method

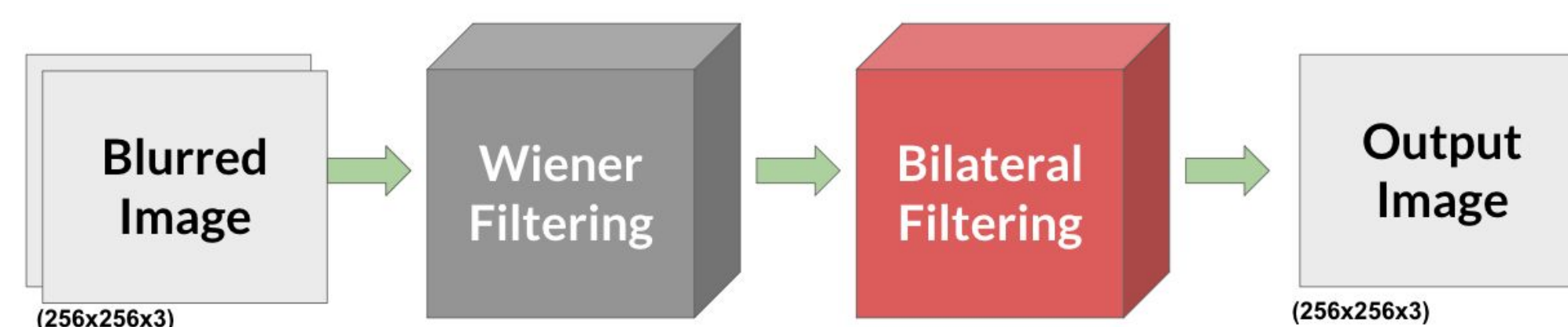
- Inputted images into a Wiener filter with 15 different values of SNR.
- Fed stack of 15 output images into the neural network (see below [2])
- Applied **bilateral filter** to output of NN
- Used **squared norm loss** and **PSNR** for an accuracy measurement
- Compared results to traditional Wiener Filtering.



Our feature creation pipeline



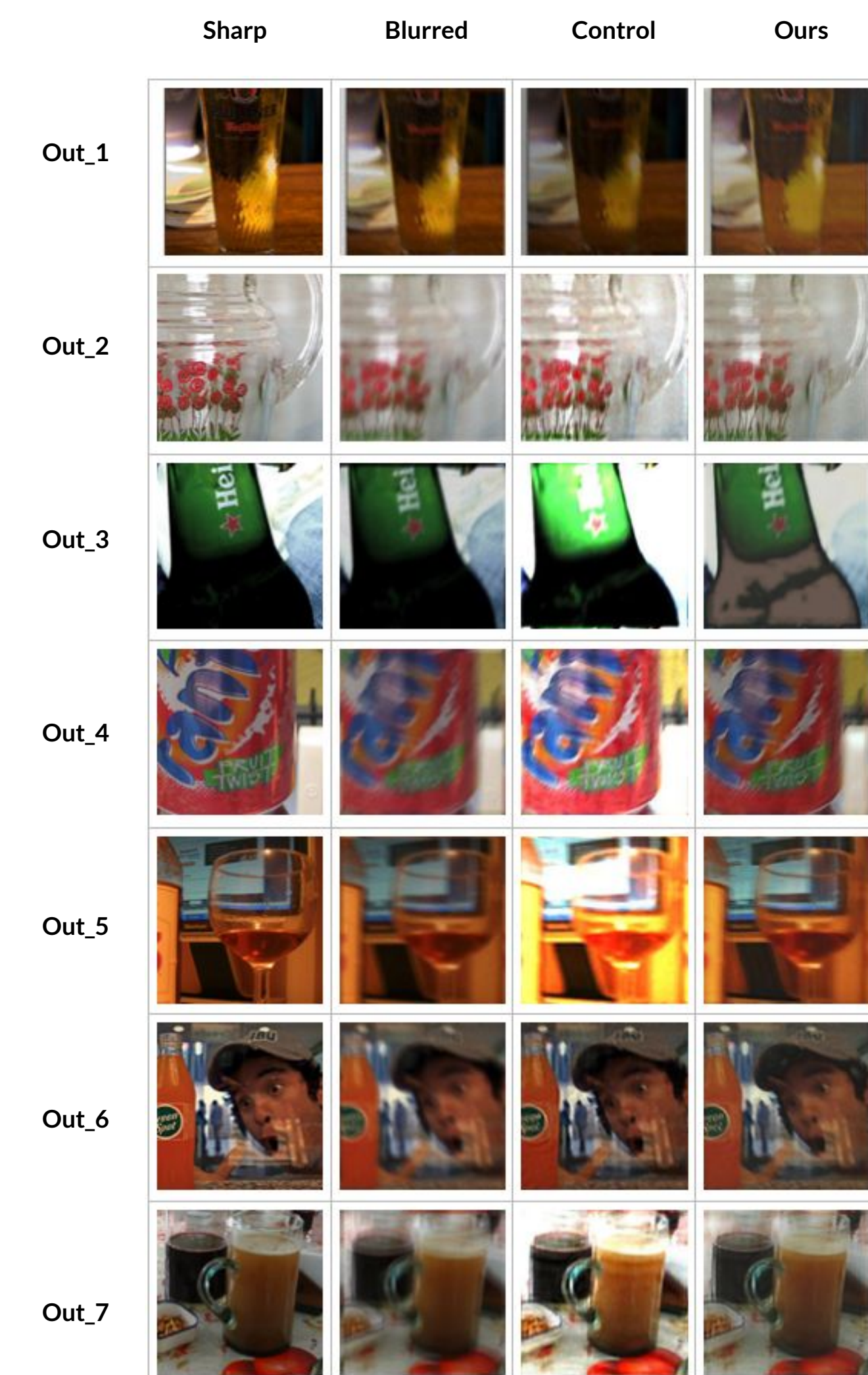
Our NN Architecture



Our baseline for comparison

Findings

PSNR Output (dB)	
Wiener Filtering	16.6
Our network	26.1
Optimal Hyper parameters	
Learning Rate	5 e-4
Filter Size	3
Dropout Rate	.8
Num ResBlocks	19



- Schuler, Christian J., et al. "Learning to deblur." IEEE transactions on pattern analysis and machine intelligence 38.7 (2016): 1439-1451.
- Nah, Seungjun, Tae Hyun Kim, and Kyoung Mu Lee. "Deep multi-scale convolutional neural network for dynamic scene deblurring." arXiv preprint arXiv:1612.02177 3 (2016).
- <http://home.deib.polimi.it/boracchi/Projects/PSFGeneration.html>