

**Imperial College**  
London



# Huawei Image Denoising Challenge 2018

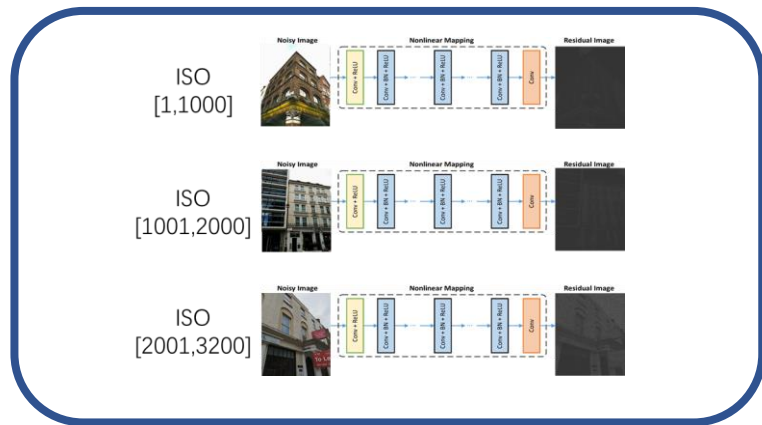
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**Imperial College London**

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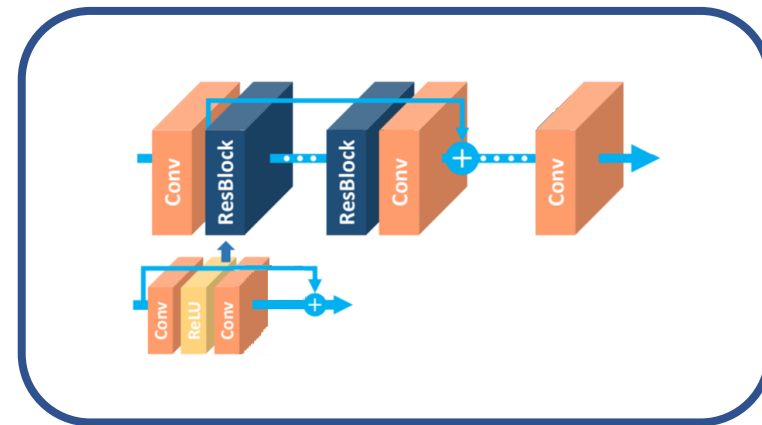
# Outline



## 1) Dataset Split



## 3) Self-Ensemble

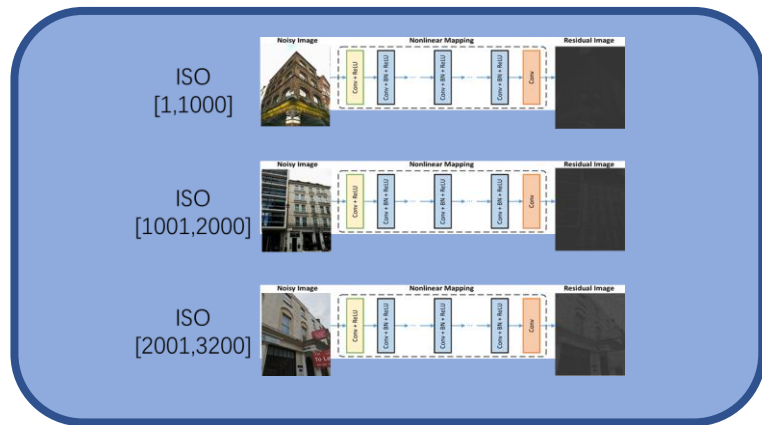


## 2) Backbone Improvement



## 4) Results

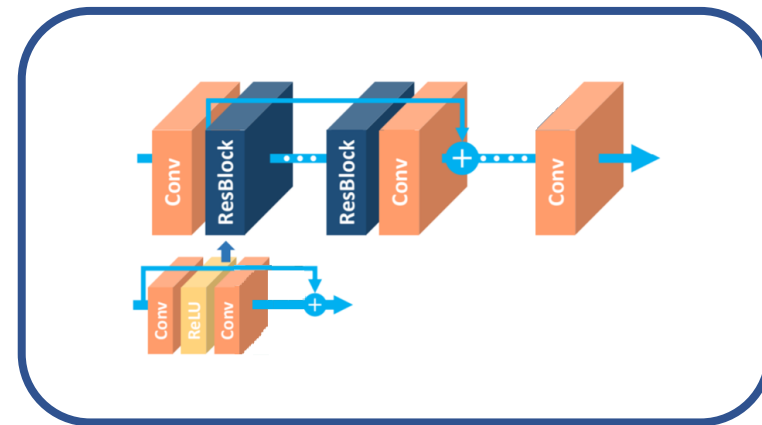
# Outline



## 1) Dataset Split



## 3) Self-Ensemble

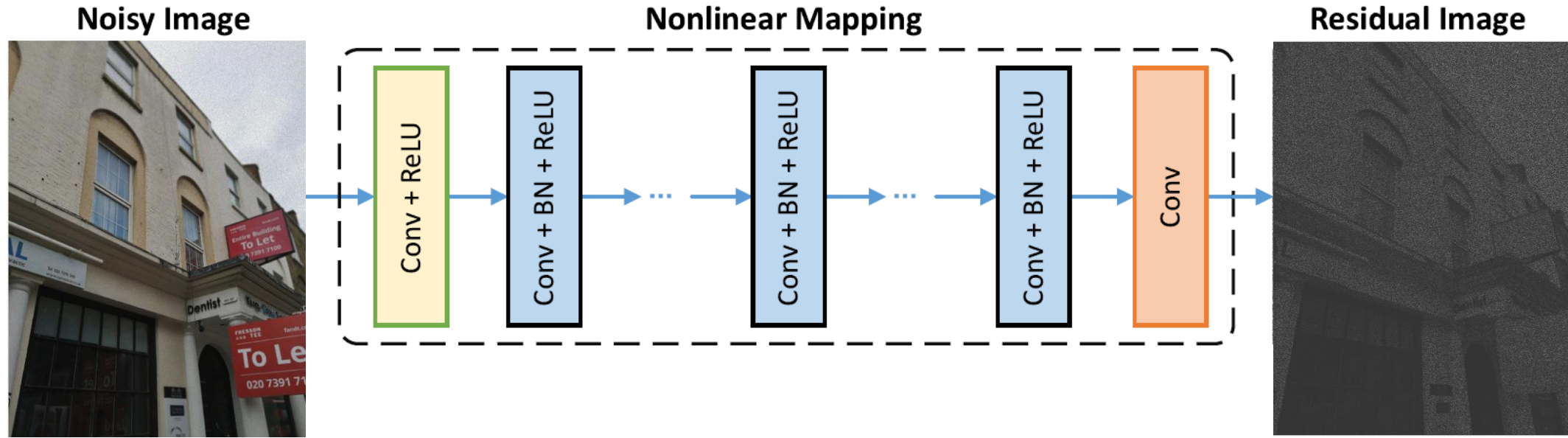


## 2) Backbone Improvement



## 4) Results

# DnCNN Baseline

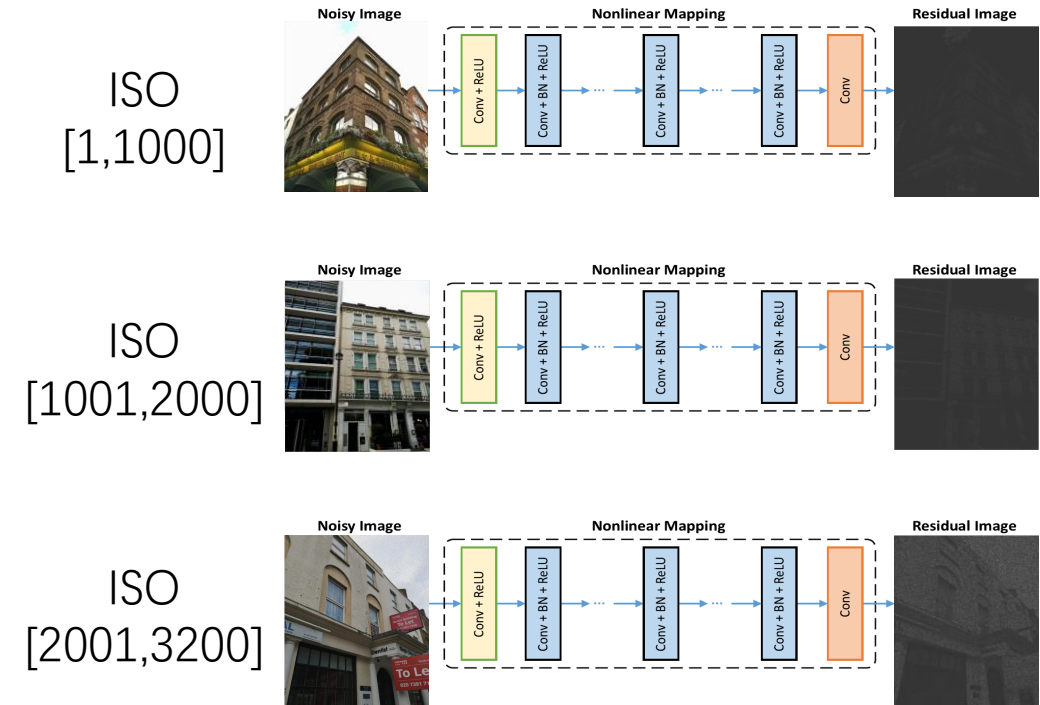


- **Learn** the distribution of **noise**
- Training using patches with the size of 64\*64 pixels
- L2 loss

	PSNR
DnCNN [1] Baseline	40.82

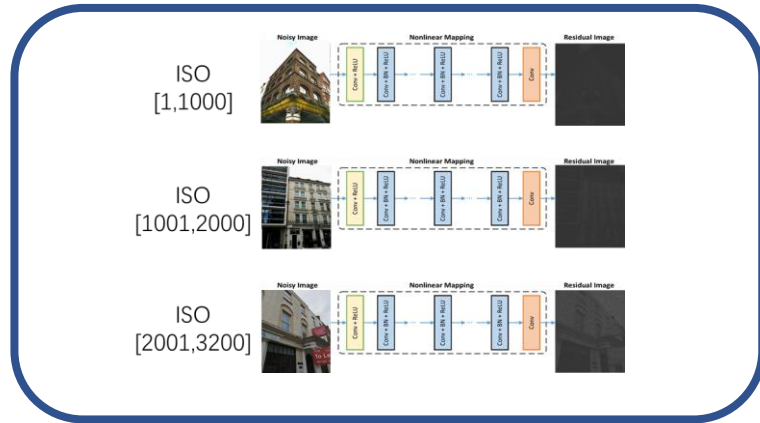
# Split dataset based on ISO

- **Split dataset** (both training and test) into three groups based on **ISO**
- Train different models for different images



	PSNR	Improvement
DnCNN	40.82	-
DnCNN + 3 split	42.40	+1.58

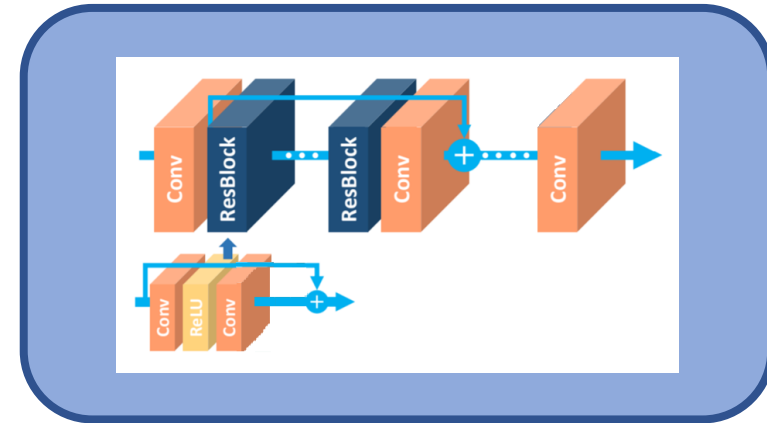
# Outline



## 1) Dataset Split



## 3) Self-Ensemble



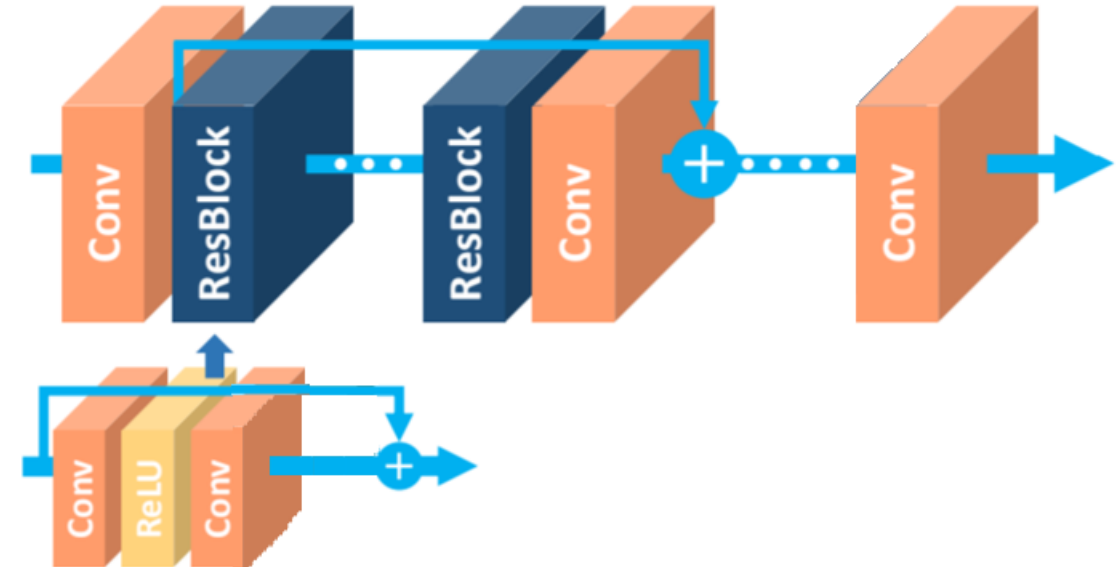
## 2) Backbone Improvement



## 4) Results

# Backbone Improvement

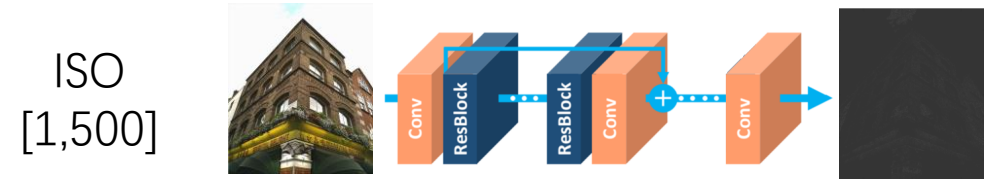
- An advanced model in image super-resolution (EDSR [2])
- **Deeper** architectures (20 Resblocks)
- Enhanced **residual** blocks



	PSNR	Improvement
DnCNN + 3 split	42.40	-
EDSR + 3 split	43.44	+1.04

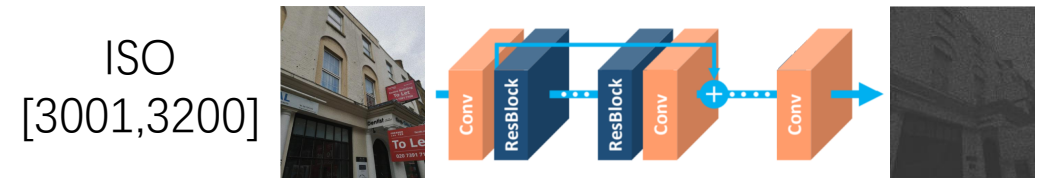
# More training and more Splits

- Training for a longer time
- **More Splits** at the ISO intervals of 500



Totally divided  
into 7 splits

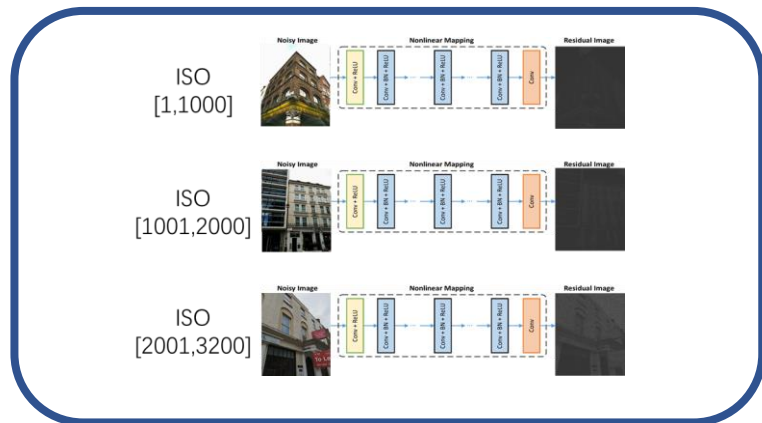
⋮



	PSNR	Improvement
EDSR + 3 split	43.44	-
EDSR + 7 split	45.80	+2.38



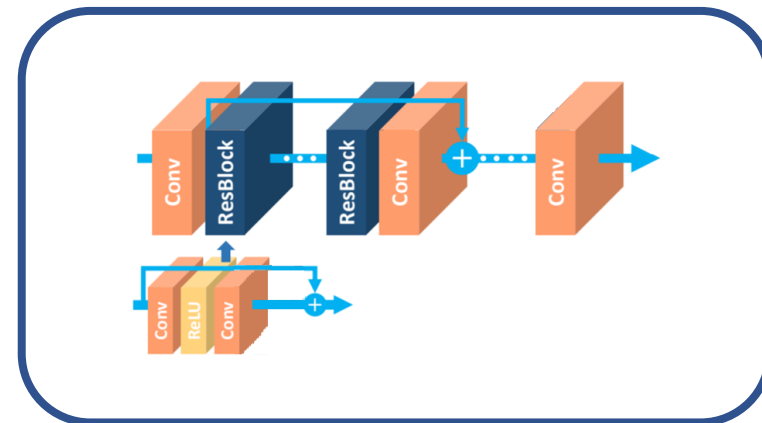
# Outline



## 1) Dataset Split



## 3) Self-Ensemble



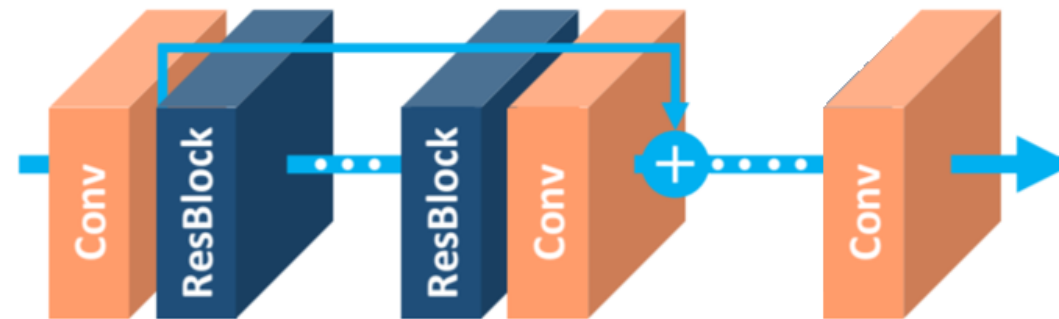
## 2) Backbone Improvement



## 4) Results

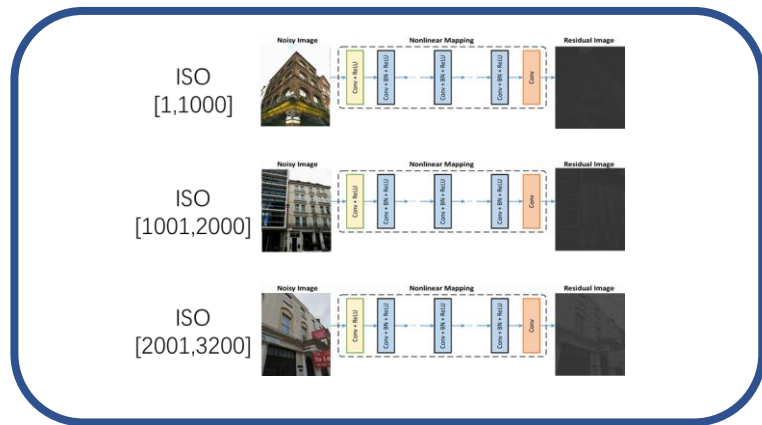
# Self-ensemble

- During the test time, **flip** and **rotate** the image and generate **8** augmentations
- Average the output
- We also notice that **continuing training** using **L1** loss get improvements (++) , however the leaderboard was closed



	PSNR	Improvement
EDSR + 7 split	45.80	-
EDSR + 7 split +self-ensemble	45.94	+0.14
EDSR + 7 split +self-ensemble++	45.94+	+

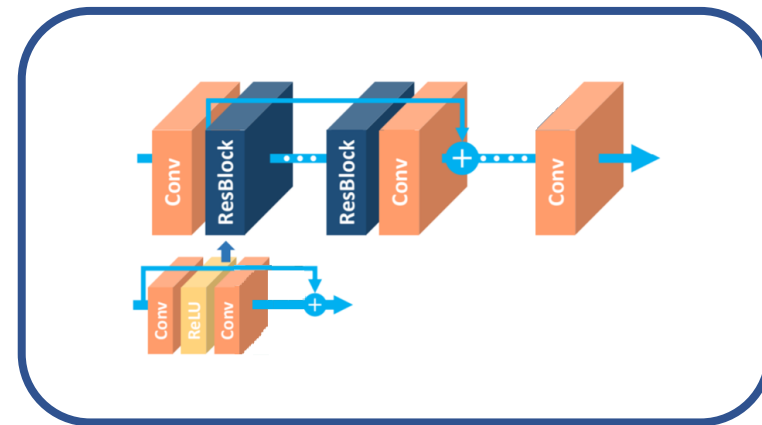
# Outline



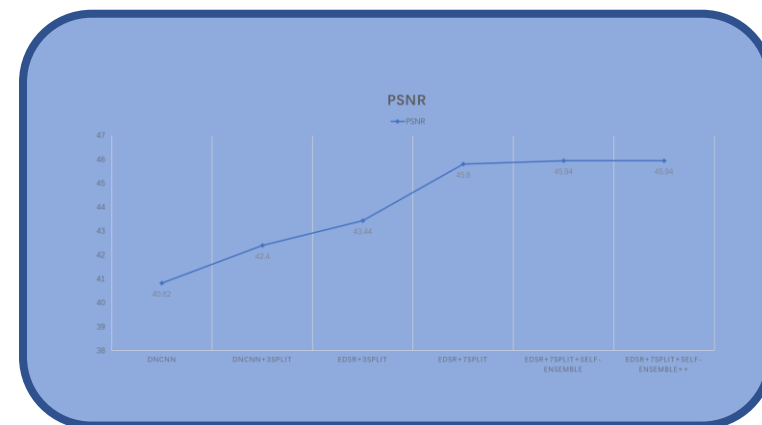
## 1) Dataset Split



## 3) Self-Ensemble



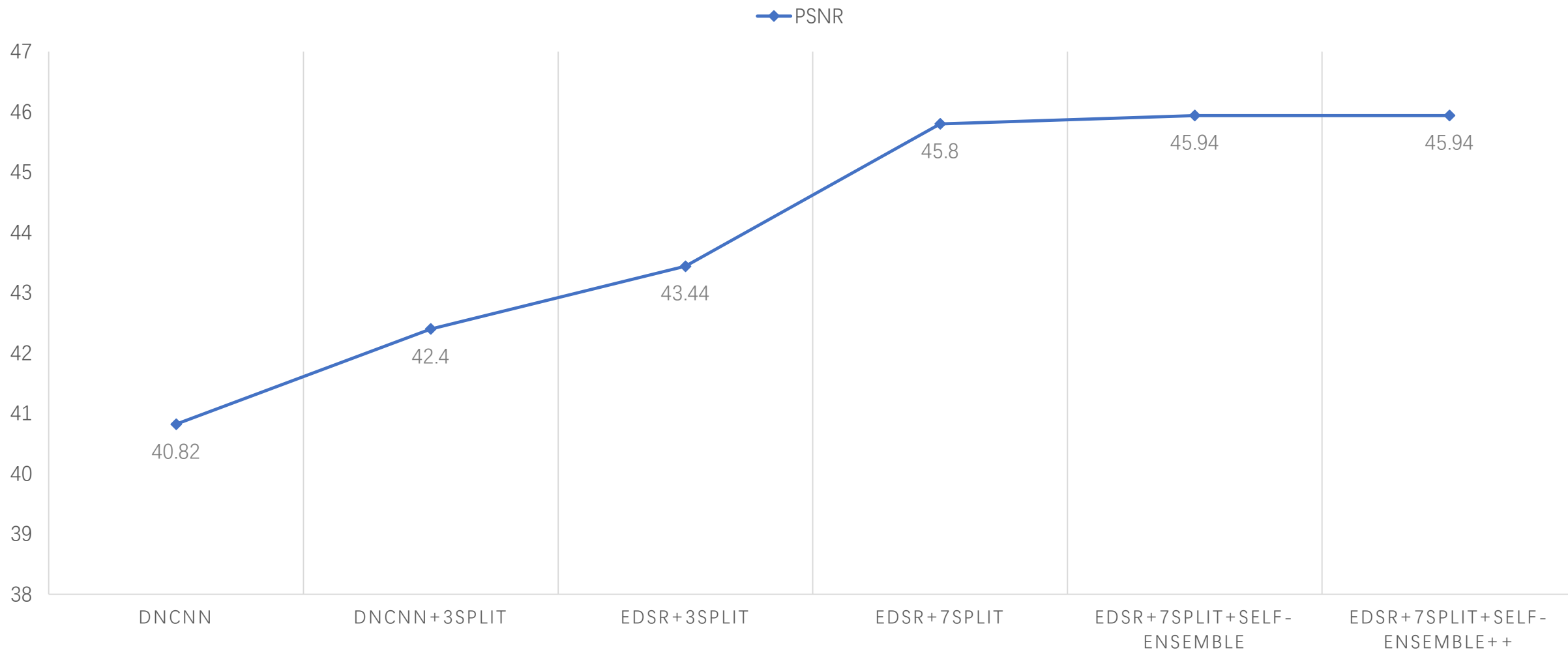
## 2) Backbone Improvement



## 4) Results

# Results

## DENOISE CHALLENGE



# Results



Noisy Image



Denoised Results



# Results

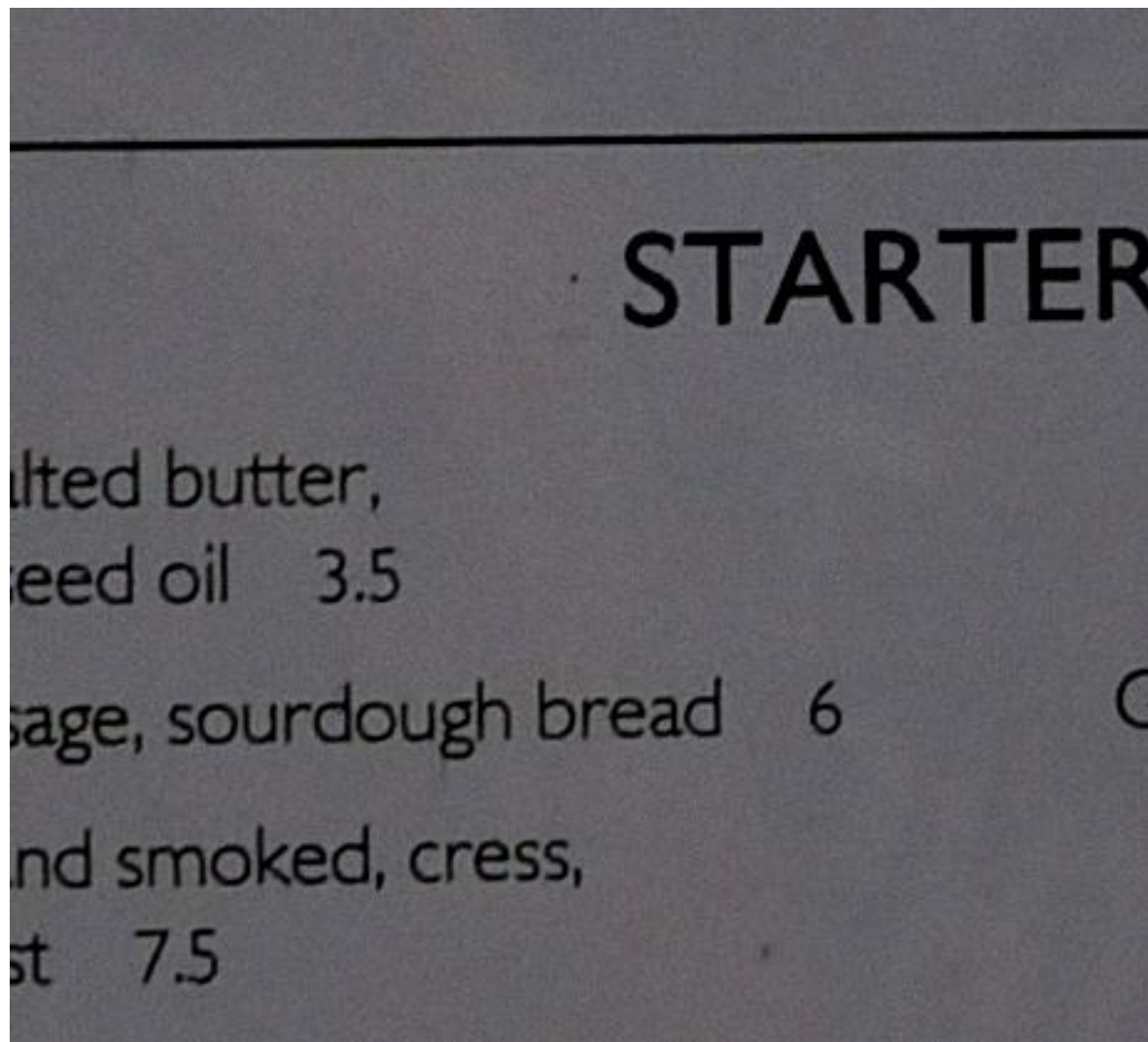


Noisy Image

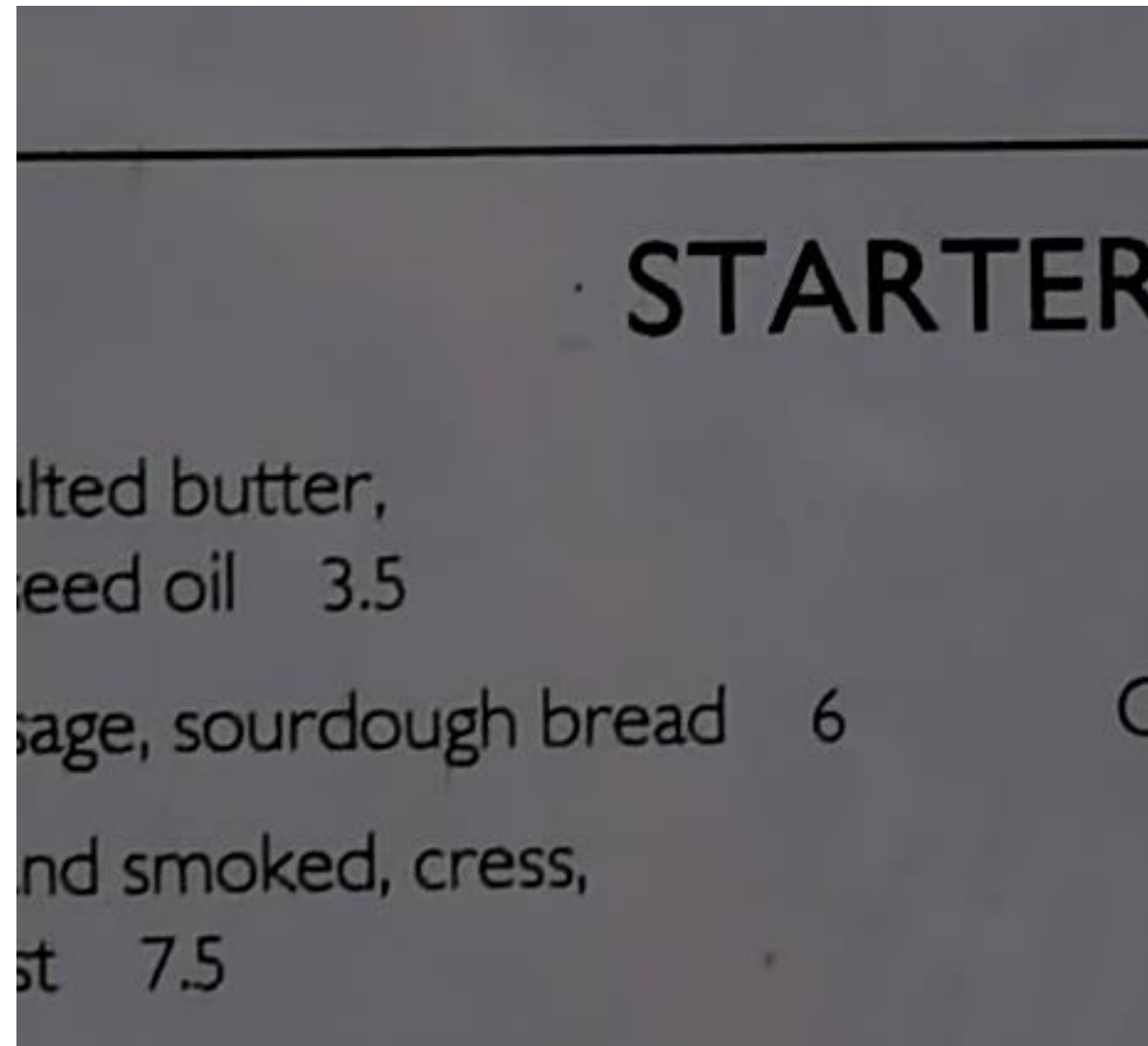


Denoised Results

# Results



Noisy Image



Denoised Results

# Summary

1. Dataset split
2. Backbone Improvement
3. Self-ensemble

## Other improvements:

1. Suitable size of training patch
2. The combination of loss functions



# Thanks

- Thank Huawei to host the challenge and provide such a great opportunity to practice AI skills

