Other image to image predictions

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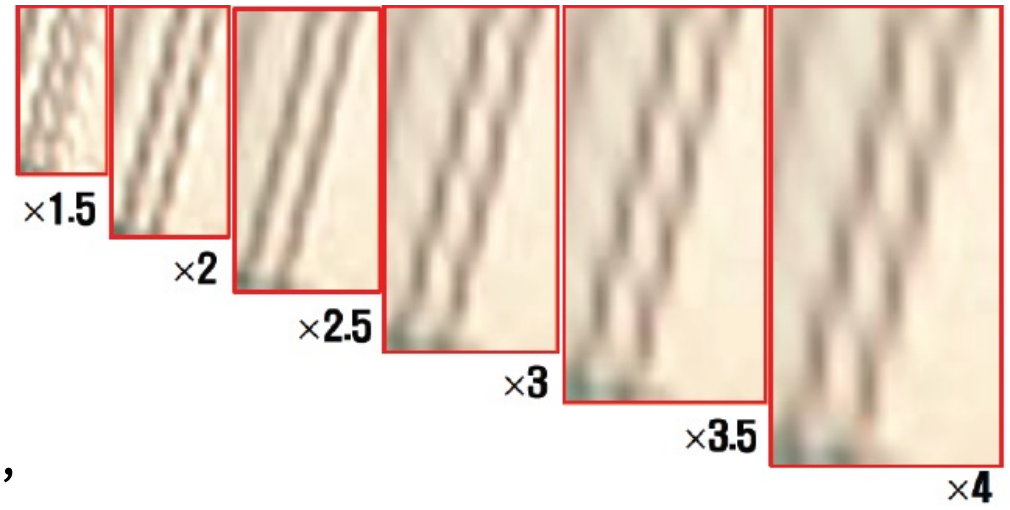
Further image to image mapping

- Generally, it's worth trying anything with
  - image in – image like thing out
- Cases here:
  - Denoising (did this); superresolution; defogging
- Other possibilities:
  - Fix underwater pix; derain; fix color balance; change lighting (?)
- Recipe needs changing for…
  - Edges; semantic segmentation (coming up)

Superresolution

- Take low res image, make high res image:
  - Baseline: upsample and interpolate
- Possibly:
  - Build network for each of 1.5xupsample, 2xupsample, etc.



- Ideally, network ”doesn’t know’
  - by how much you are upsampling
- Fully convolutional u-net helps

This was trained for
2x upsampling

Superresolution

- In:
  - Upsampled, interpolated low resolution image

$$\text{interp}(\mathcal{L})$$

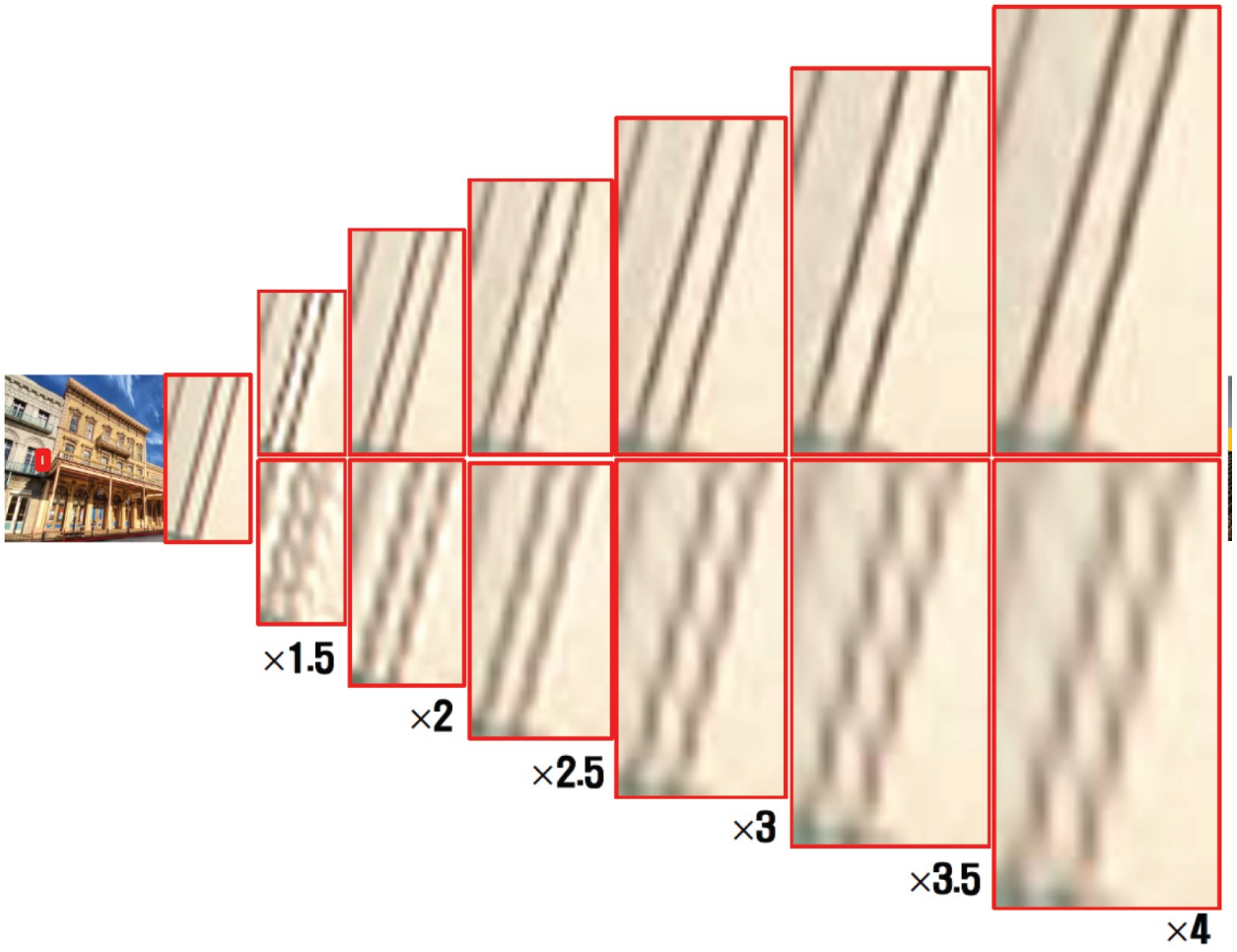
- Out:
  - estimated residual
  - True high-res image-upsampled interpolated low res

$$\hat{\mathcal{R}}$$

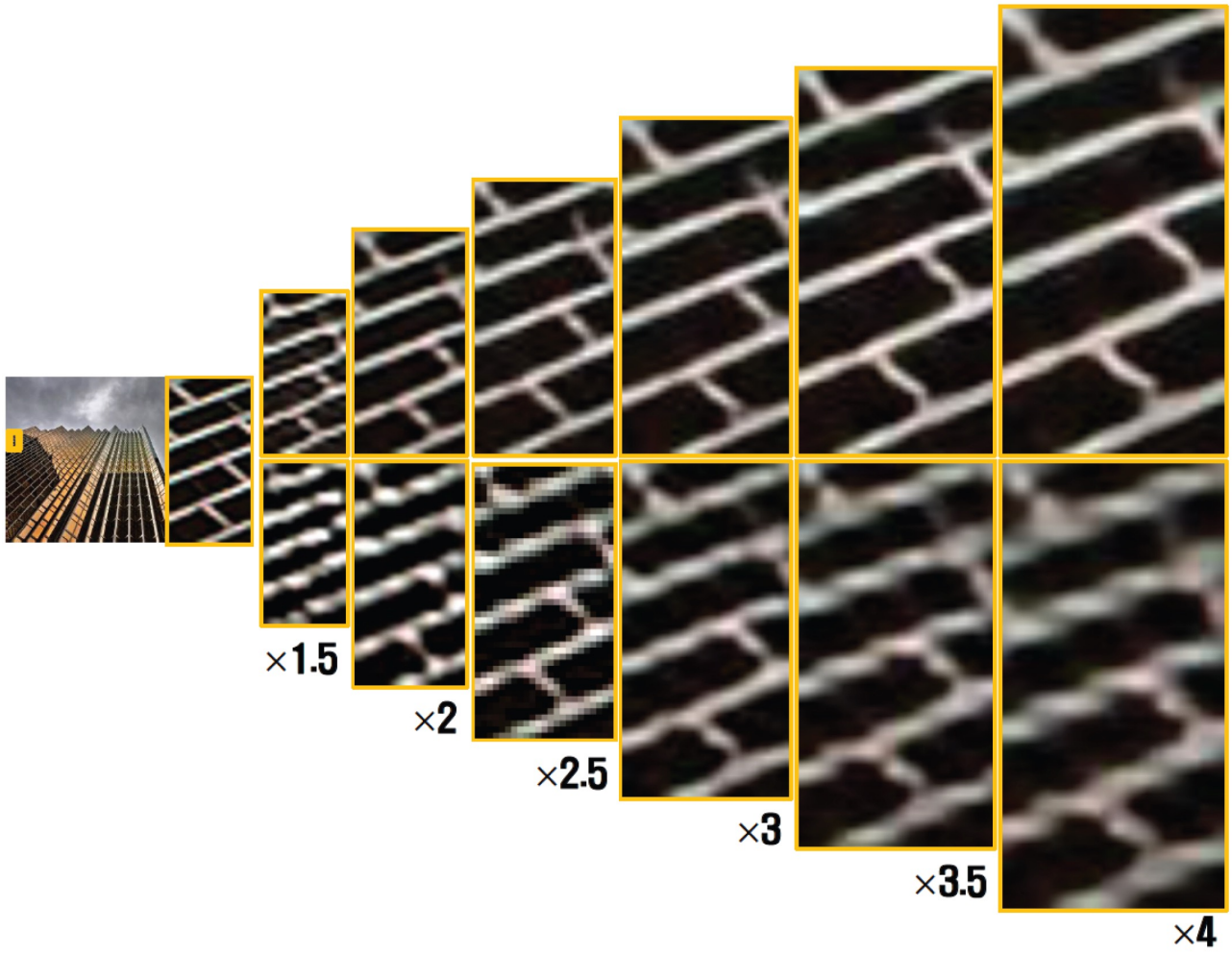
- Est true image:

$$\hat{\mathcal{R}} + \text{interp}(\mathcal{L}).$$

Superresolution works



Superresolution works

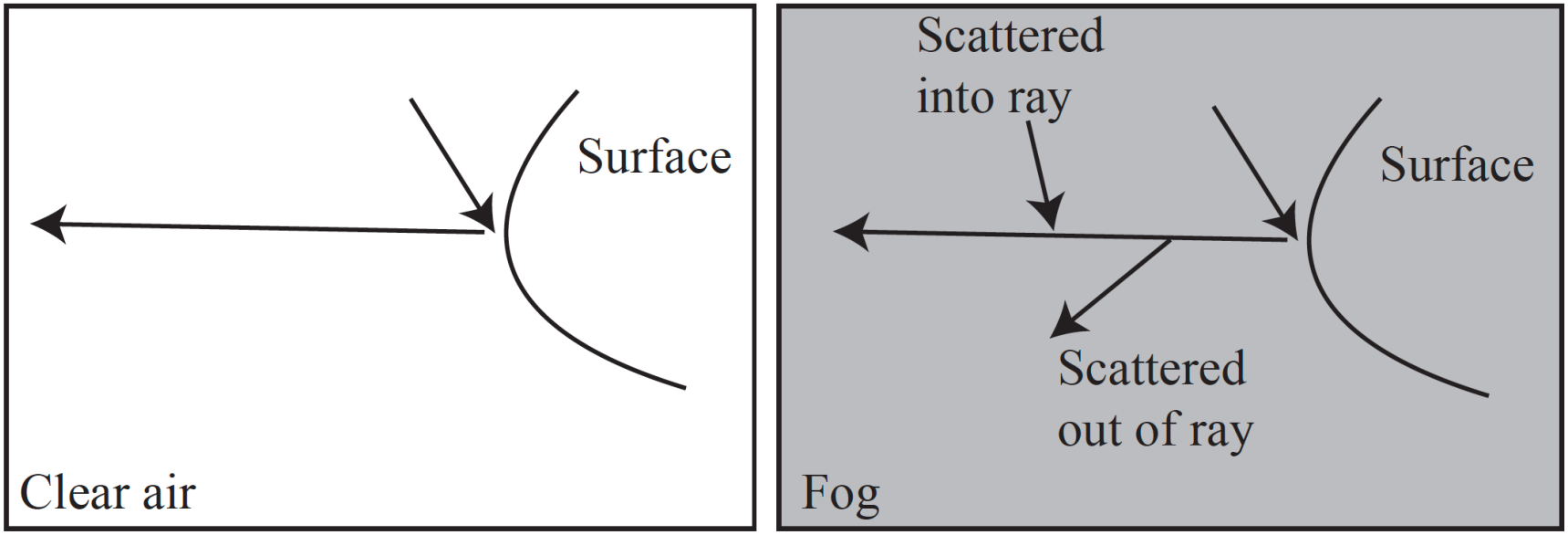


Training and evaluation

- Train on L1/L2 loss
  - perhaps some more stuff, later…

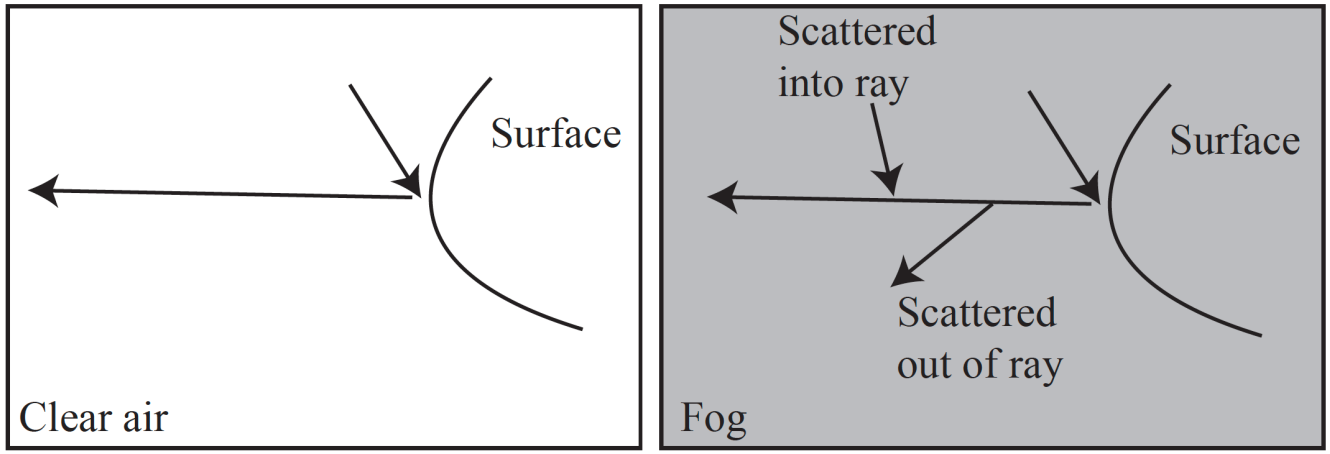
Evaluation is by PSNR on standard datasets. Competitive methods will get PSNRs in the high 20s or early 30s for 4× upsampling, depending on the evaluation dataset.

Defogging



- Fog scatters light out of and into the ray from surface to eye
  - results:
    - distant surfaces experience color shift, depending on depth
    - image is blurred, blurring depends on depth

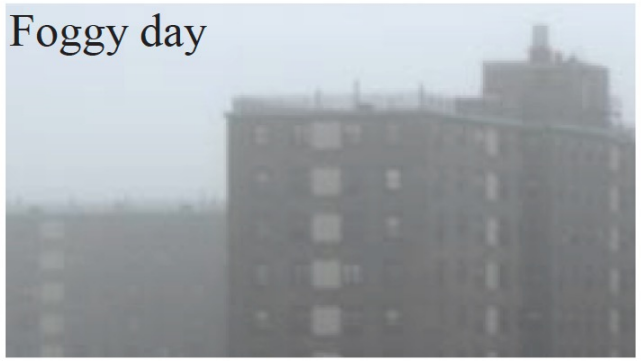
Model of defogging

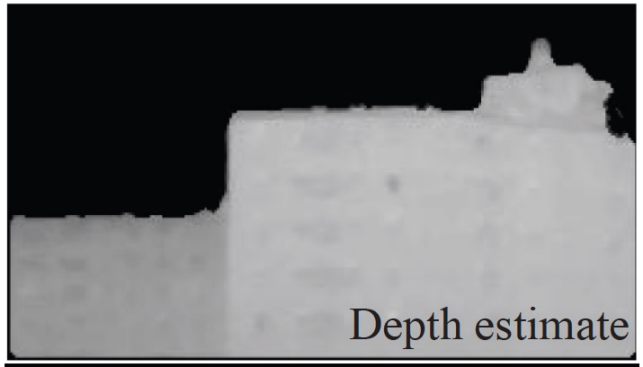


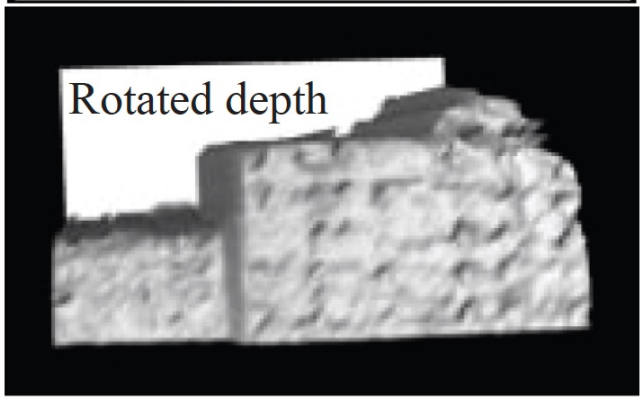
$$p_i(\mathbf{x}) = e^{[-s_i d(\mathbf{x})]} c_i(\mathbf{x}) + (1 - e^{[-s_i d(\mathbf{x})]}) l_i$$

- (Doesn't cover blurring, but..)

Amusing fact – you can recover depth from fog







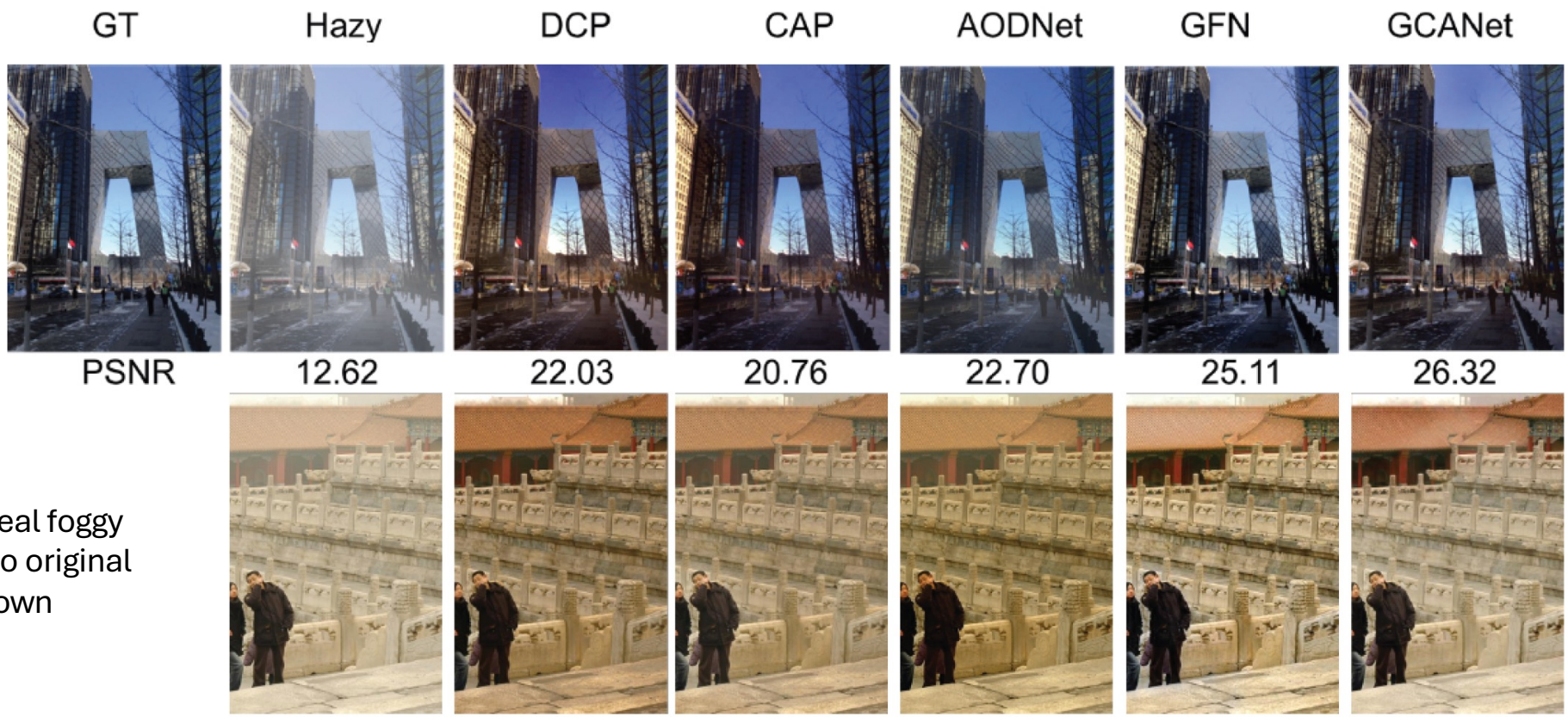
Data is hard!

- (image of real scene with no fog, image of same scene w/fog)
  - is very hard to get.
  - you can get them, but hard to get one and very hard to get many

- Simulation is straightforward
- (image no fog, image with sim fog)
  - is easy to get, and works

- Evaluation
  - usually, PSNR on simulated images, sometimes PSNR on real

Defogging



This is real foggy image so original is unknown

Think about this...

20.7. Section 20.4.2 has: "This model omits a blurring effect, which is easily observed. Distant objects will tend to be somewhat blurred as well, and nearby objects will tend to be sharper." What causes this effect? (a qualitative explanation is enough, and is easy).