

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)

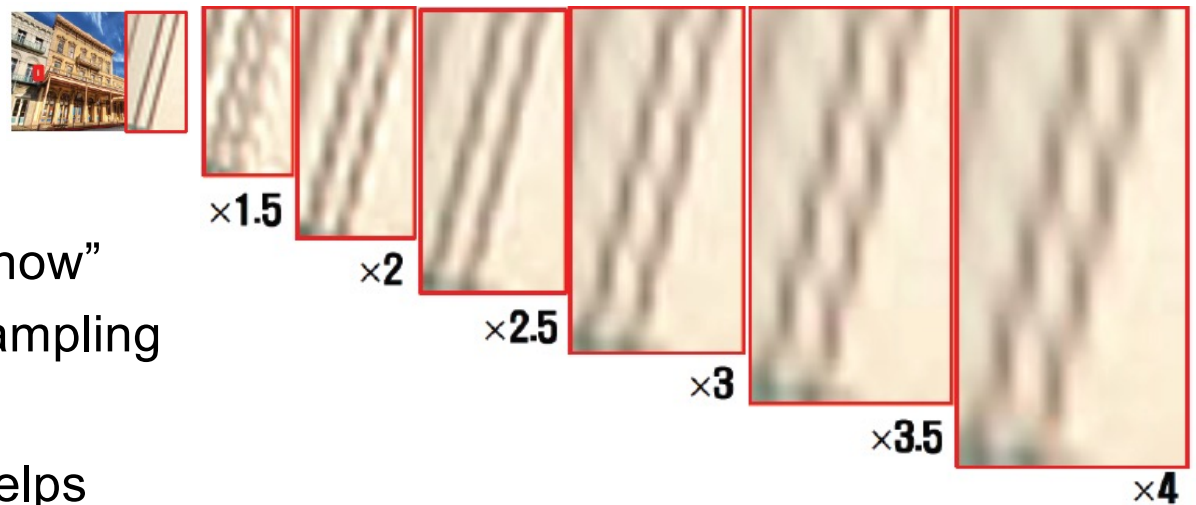
Superresolution

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

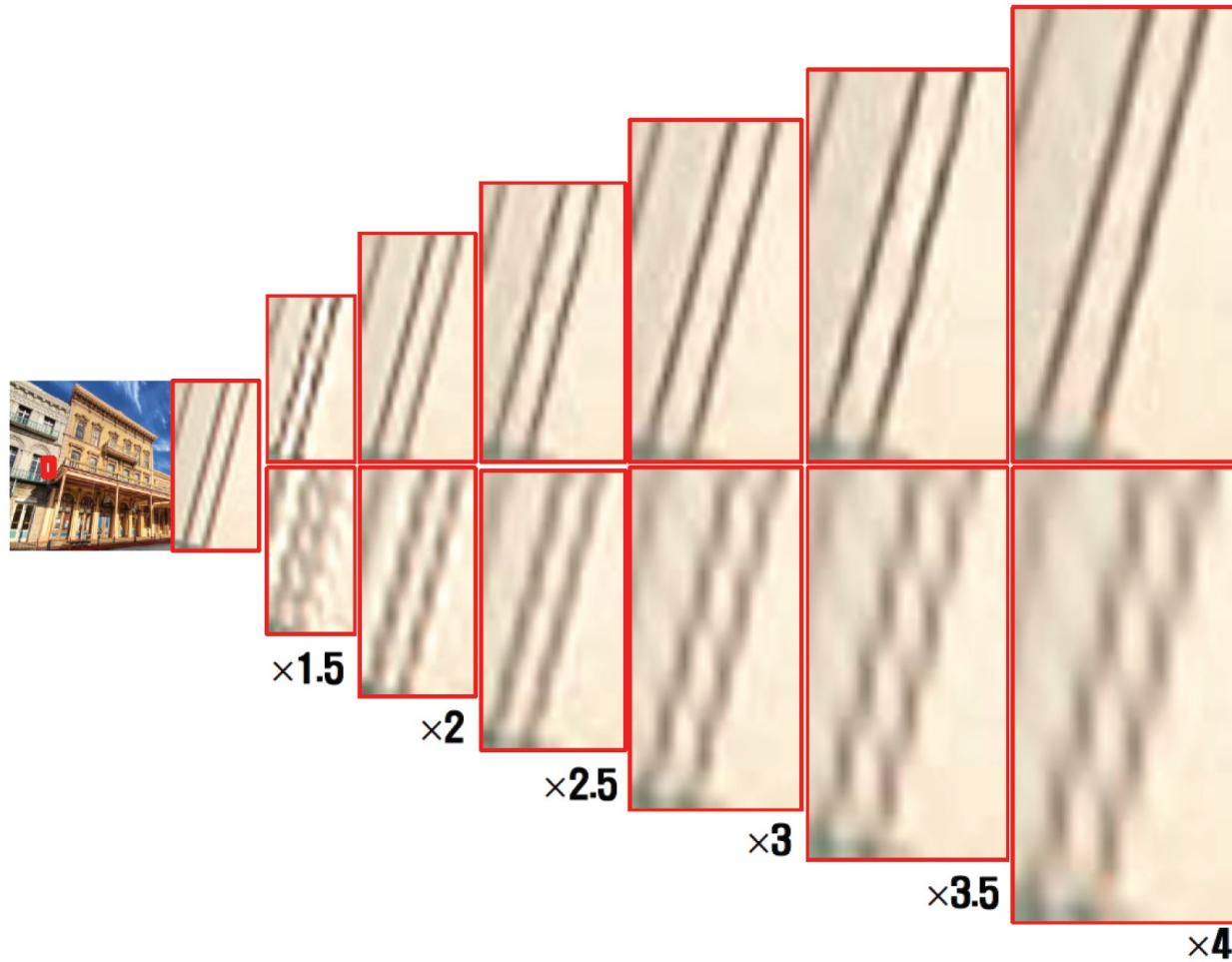
True high-res image-upsampled interpolated low res

$\hat{\mathcal{R}}$

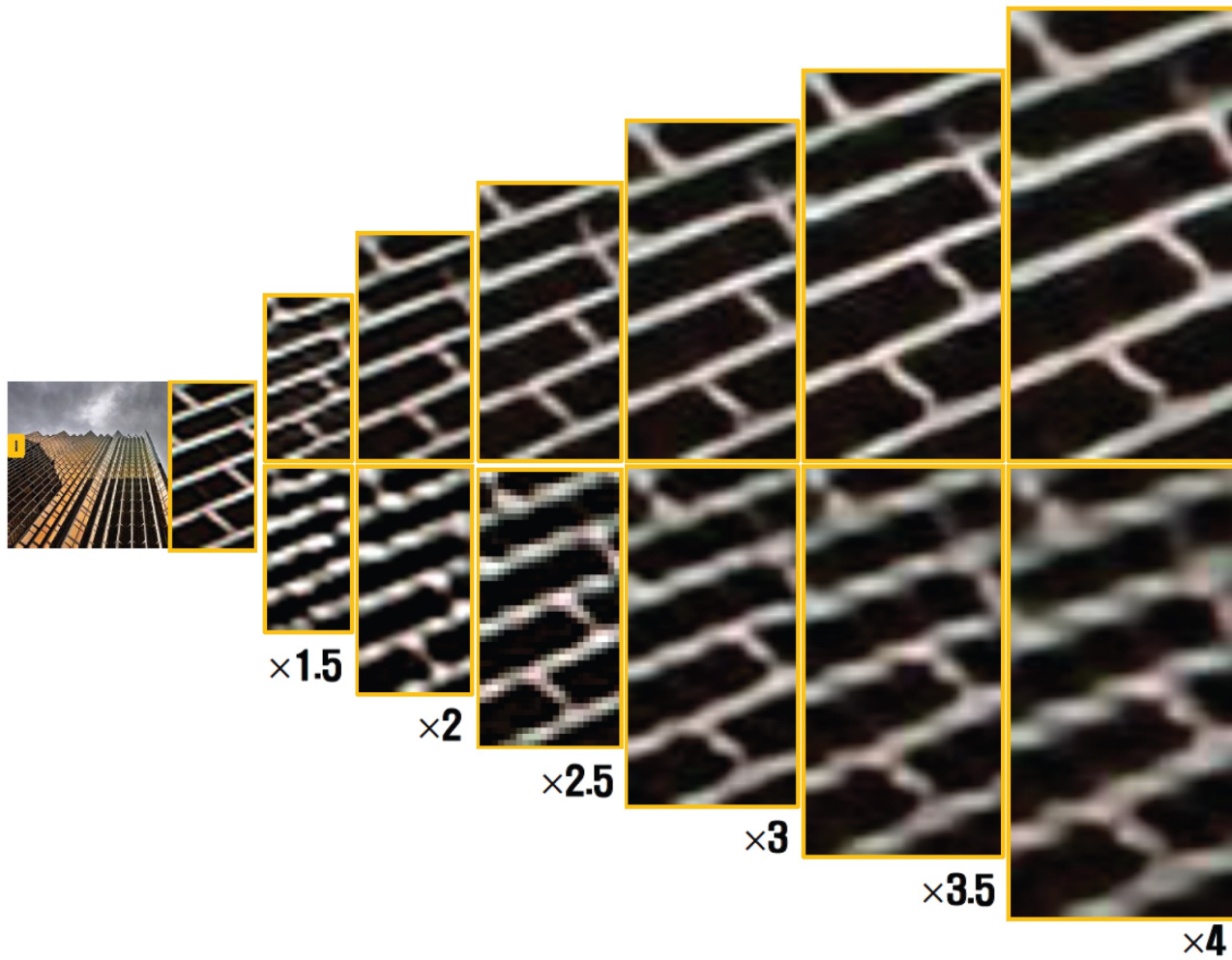
Est true image:

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

Superresolution works



Superresolution works



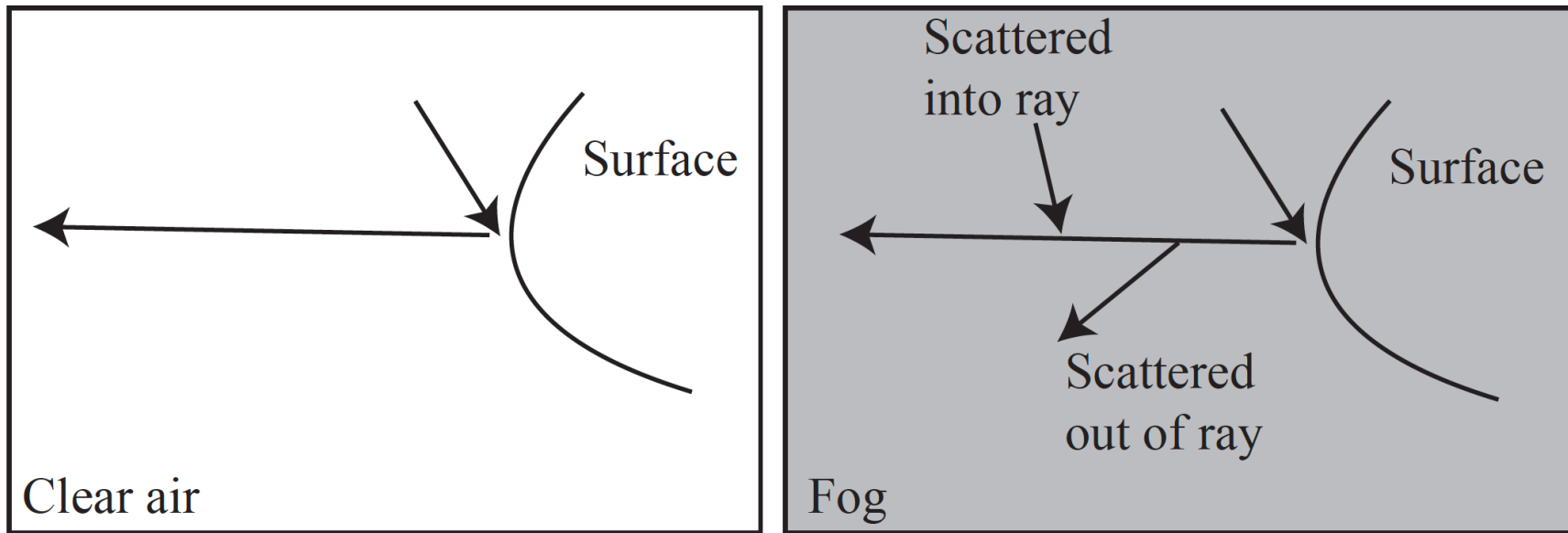
Training and evaluation

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 $4\times$ upsampling, depending on the evaluation dataset.

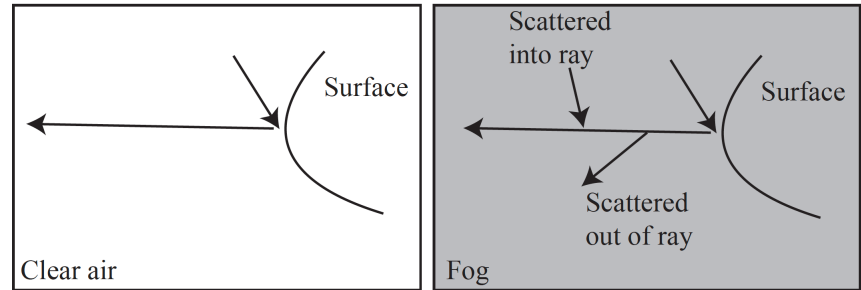
Defoggina



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

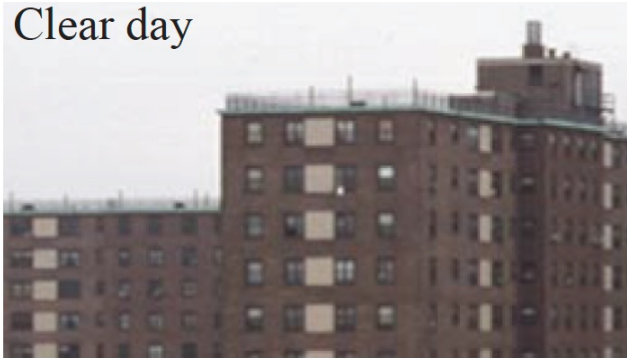


$$p_i(\mathbf{x}) = e^{[-s_i d(\mathbf{x})]} c_i(\mathbf{x}) + (1 - e^{[-s_i d(\mathbf{x})]}) l_i$$

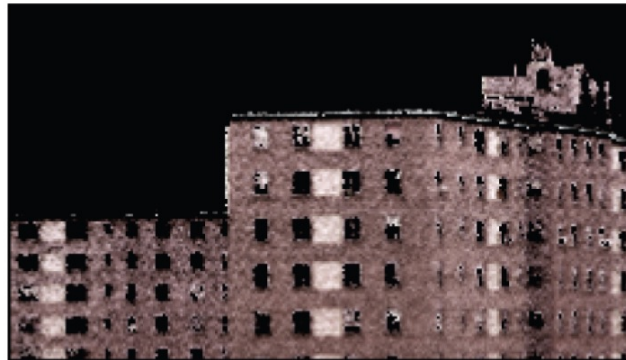
(Doesn't cover blurring, but..)

Amusing fact – you can recover depth from fog

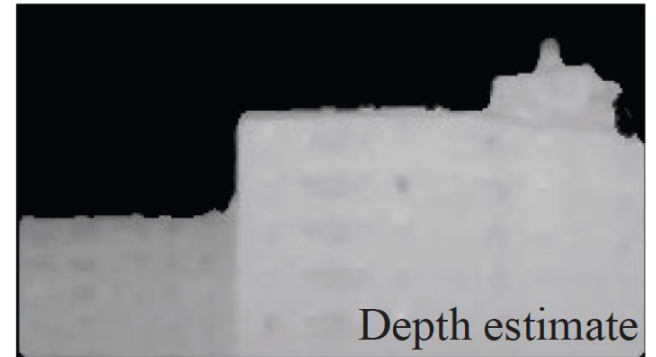
Clear day



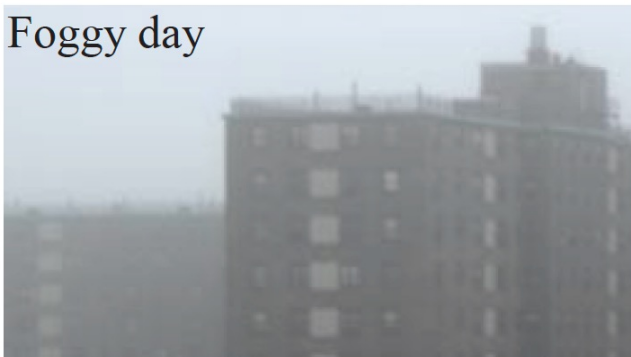
Surface color estimate



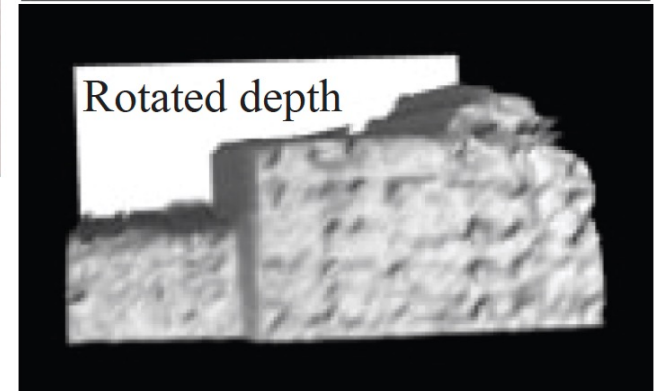
Depth estimate



Foggy day



Rotated depth



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

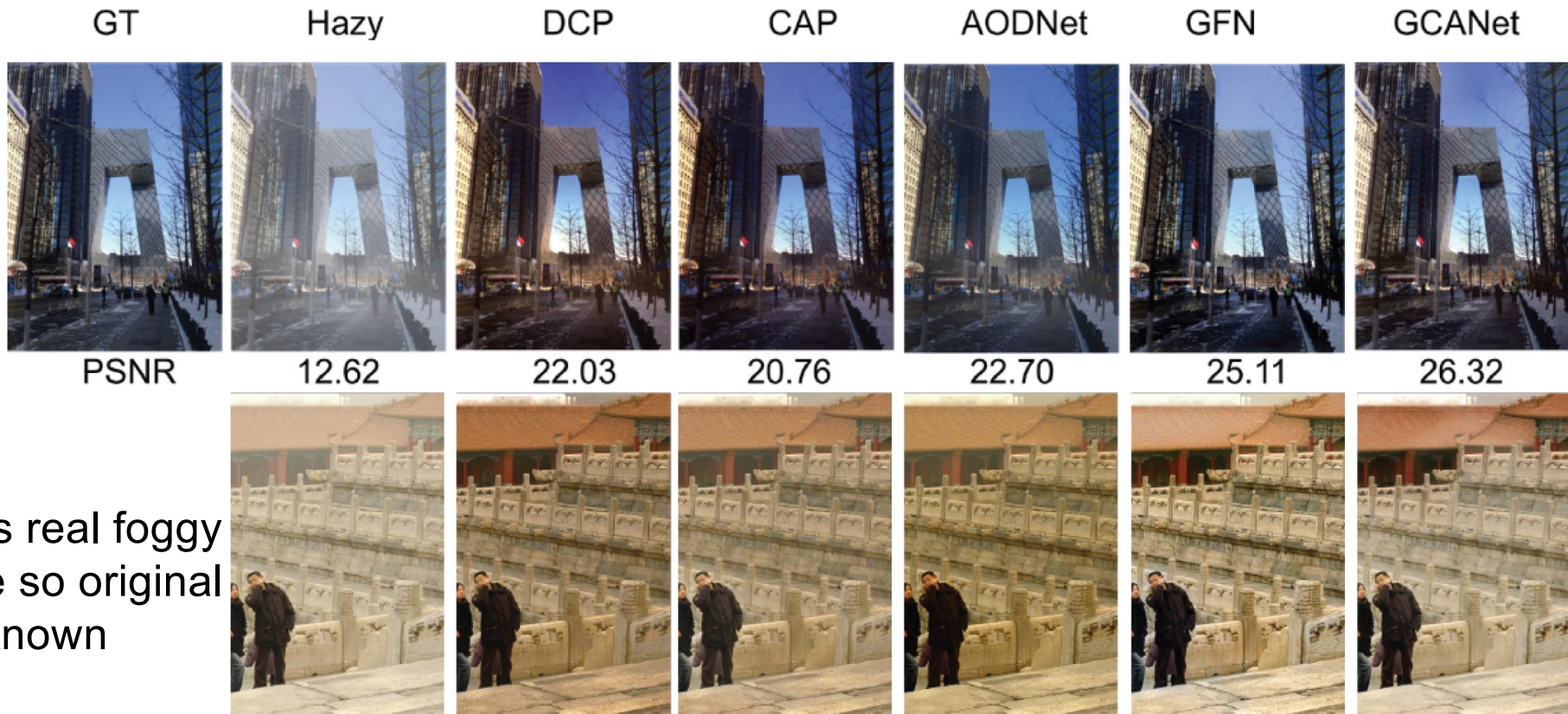
(image no fog, image with sim fog)

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