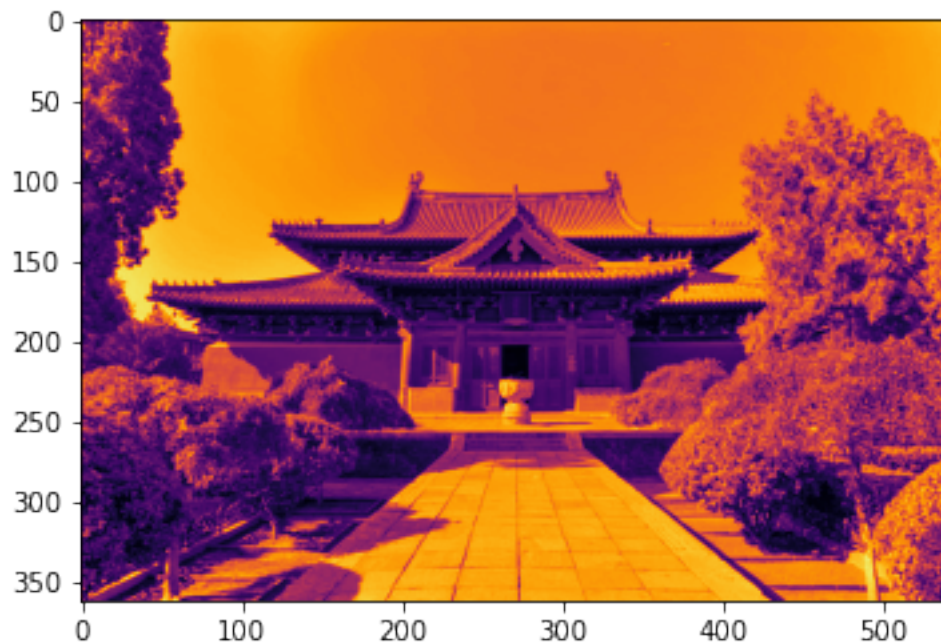


## 1 Boxcar intensity-level entropy

```
1 import numpy as np
2 import numpy.linalg as linalg
3 import matplotlib.pyplot as plt
4 from PIL import Image, ImageFilter, ImageOps
5 from src.utilities import *
6 from src.intensity_entropy import *
7 from src.kernels import *
8 plt.rcParams['image.cmap'] = 'inferno'
```

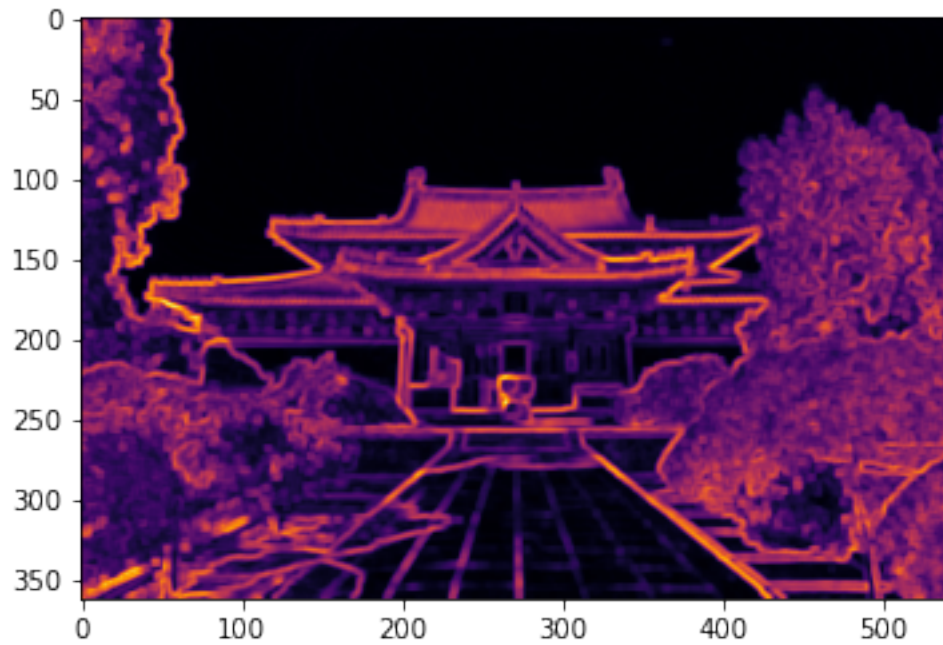
Let's compare the boxcar images for intensity entropy to those for a positive function on an image (the standard deviation) and for different functions of the induced intensity distribution.

```
1 img = ImageOps.grayscale(Image.open('test.jpg'))
2 scale = max(np.shape(img))
3 data = np.array(img)
4 plt.imshow(img);
```



### 1.1 Standard deviation

```
1 plt.imshow(mapbox(2, np.std, np.array(img)));
```

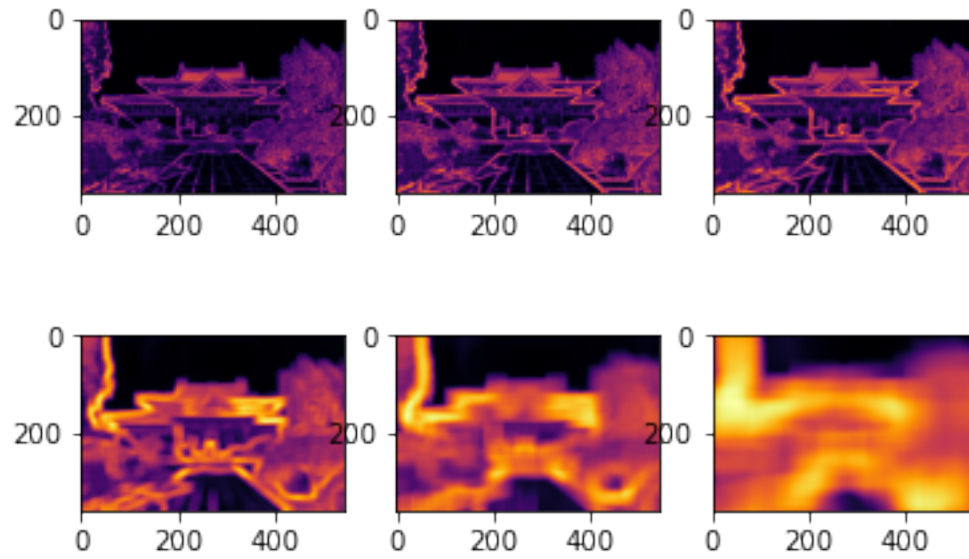


```

1 boxos = list(mapboxes([1,2,3,10,20,50], np.std, np.array(img)))

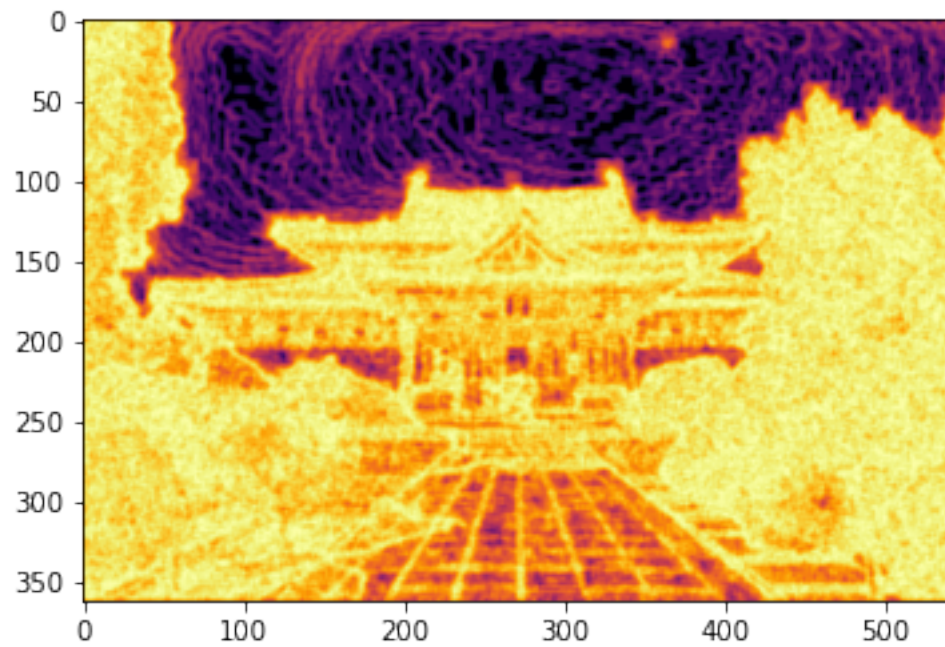
1 _, axarr = plt.subplots(2, np.ceil(len(boxos)/2).astype('int'))
2 for i, subimg in enumerate(boxos[:3]):
3     axarr[0,i].imshow(subimg)
4 for i, subimg in enumerate(boxos[3:]):
5     axarr[1,i].imshow(subimg)
6 plt.show()

```



## 1.2 Intensity entropy

```
plt.imshow(mapbox(2, intensity_entropy, np.array(img)));
```

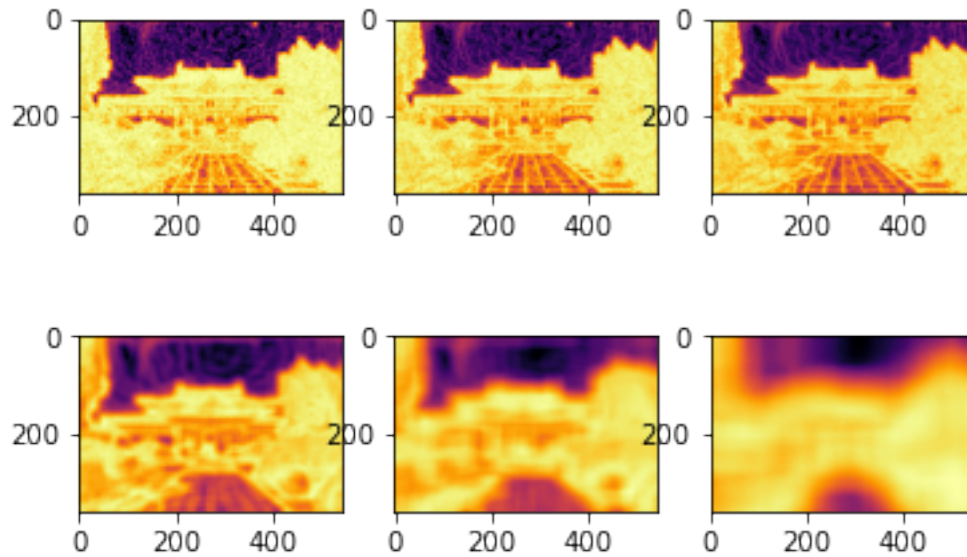


```

1 boxSes = list(mapboxes([1,2,3,10,20,50], intensity_entropy, np.array(img)))

1 _, axarr = plt.subplots(2, np.ceil(len(boxSes)/2).astype('int'))
2 for i, subimg in enumerate(boxSes[:3]):
3     axarr[0,i].imshow(subimg)
4 for i, subimg in enumerate(boxSes[3:]):
5     axarr[1,i].imshow(subimg)
6 plt.show()

```



### 1.3 Replace surprisal with other functions

To what extent do the surprisal-related results depend upon the specific form of the *surprisal*  $x \mapsto -\log(x)$  in the expected value of the intensity distribution? We will replace the expected surprisal with the expected  $f$ , for different functions  $f$  on the empirical probabilities of a pixel taking some intensity.

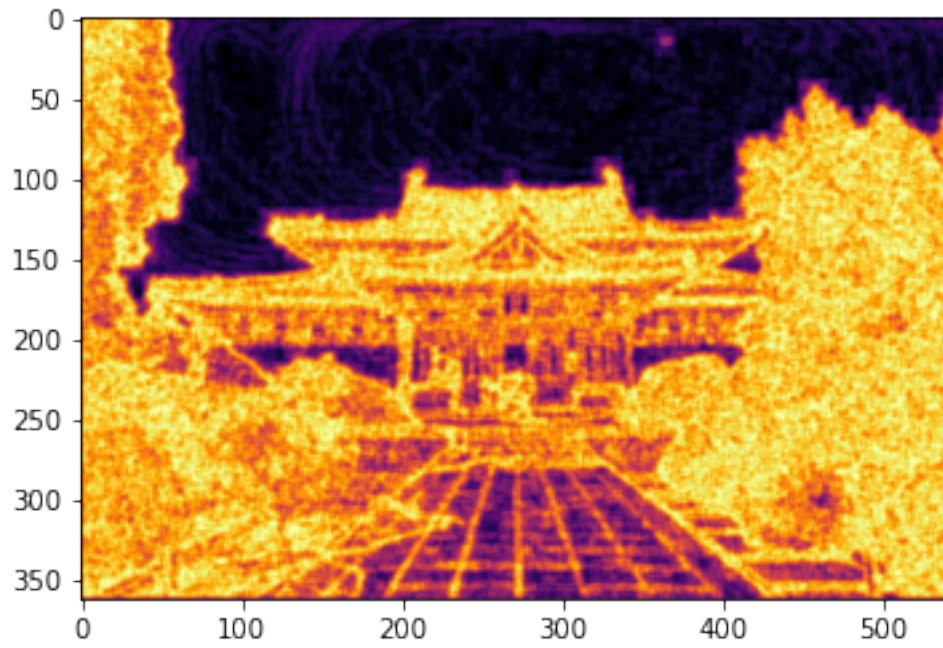
Laurent:  $p \mapsto -1 + 1/p$ .

```

1 plt.imshow(mapbox(2, lambda I: intensity_expected(lambda p: -1 + 1/p if p > 0 else 0, I),
  ↳ np.array(img)));

```





Taylor:  $p \mapsto -(1 + p)$ .

```
plt.imshow(mapbox(2, lambda I: intensity_expected(lambda p: -(1+p), I), np.array(img)));
```

