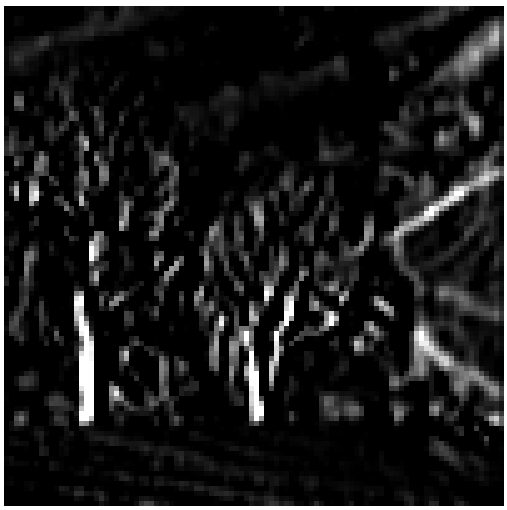
卷积 / MaxPooling的直观理解

竖直的卷积核可以找到竖直的结构

In[15]:=
```
img1 = ImageConvolve[ , {{-1, 0, 1}, {-2, 0, 2}, {-1, 0, 1}}]
```

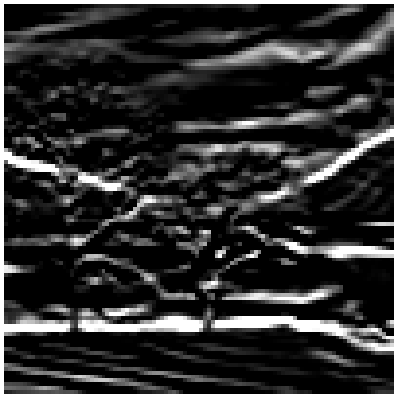
Out[15]=



横向的卷积核可以找到水平的结构

In[17]:=
```
img2 = ImageConvolve[ , {{-1, 0, 1}, {-2, 0, 2}, {-1, 0, 1}}^T]
```

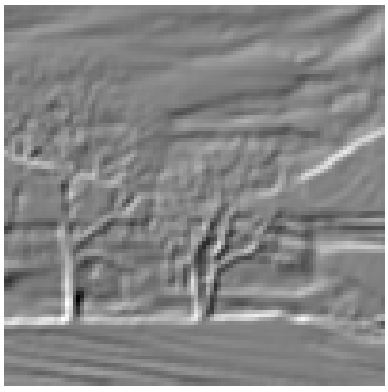
Out[17]=



将两个方向的信息组合在一起

In[18]:=
```
img3 = ImageAdd[img1, img2] // ImageAdjust
```

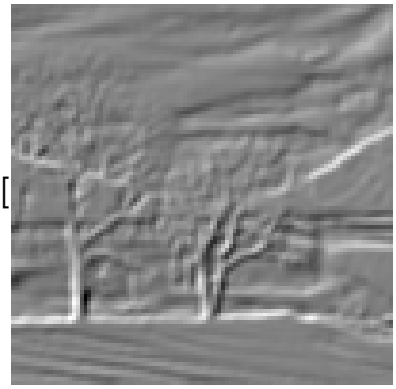
Out[18]=



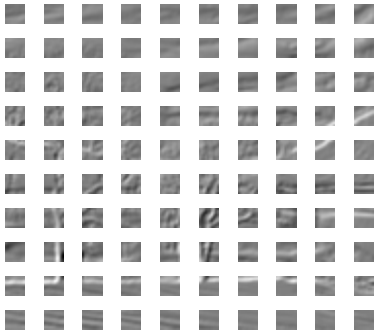
MaxPooling

首先将图片拆分为10x10的小方块

In[36]:=
```
imgs = ImagePartition[ , {10, 10}] // Grid
```



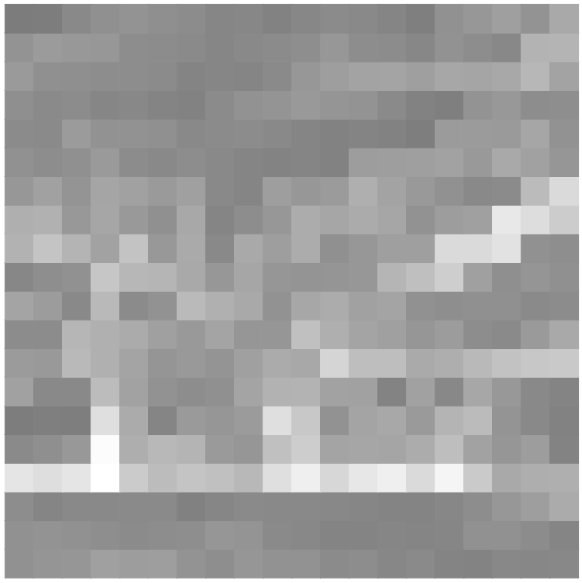
Out[36]=



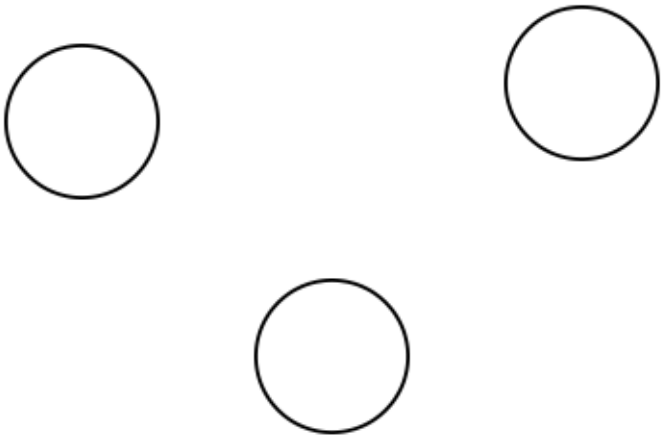
再用方块中最大的值代表这一方块，得到一个缩小的图形

In[35]:=
```
Image[Max[Flatten[ImageData[#]]] & /@ # & /@ imgs]
```

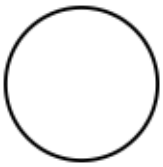
Out[35]=



使用卷积寻找图中的圆圈：



卷积核:

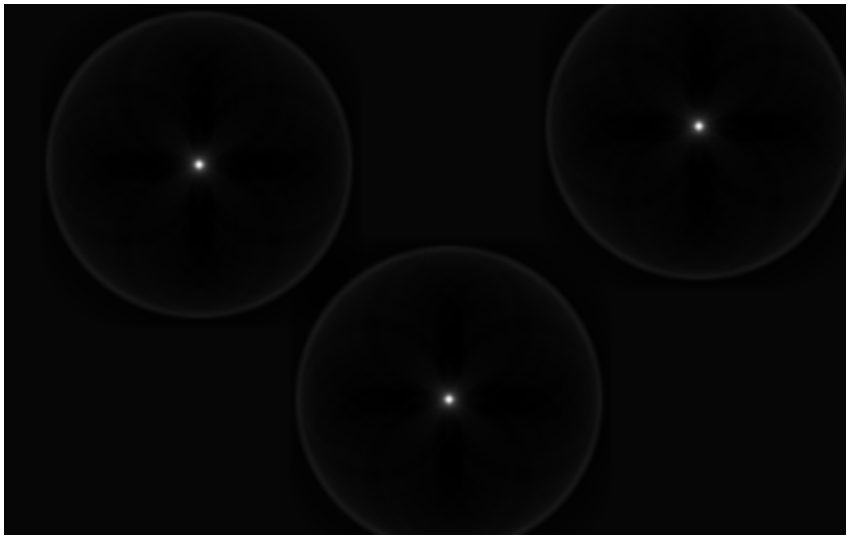
In[186]:= core =  ;

```
core = ImageData@ColorConvert[core, "Grayscale"];
```

进行卷积:

In[189]:=
```
img5 =
 ImageConvolve[ImageSubtract[ , 0.988], core - 0.942] // ImageAdjust
```

Out[189]=

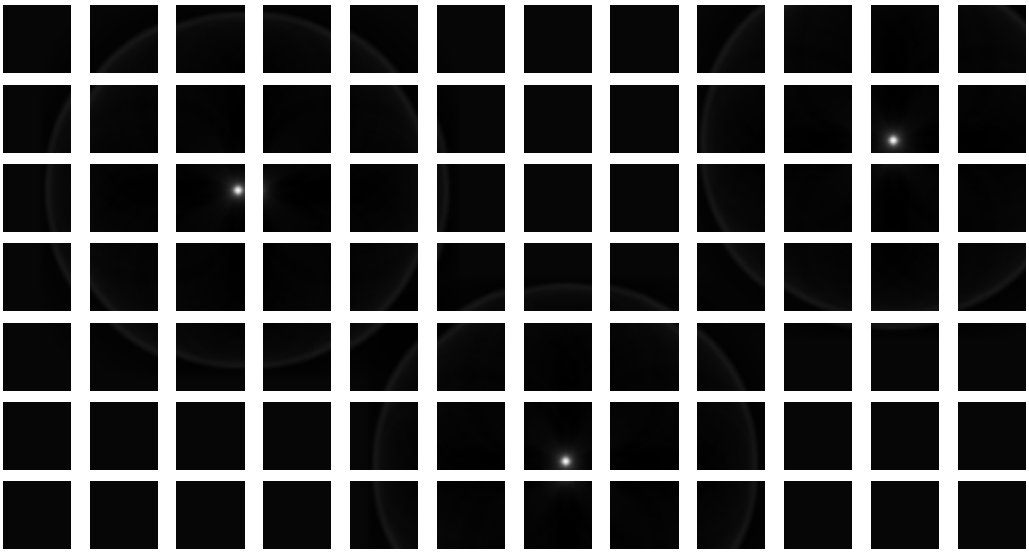


MaxPooling

先将图像拆分为方格

In[193]:=
```
(imgs = ImagePartition[img5, {35, 35}]) // Grid
```

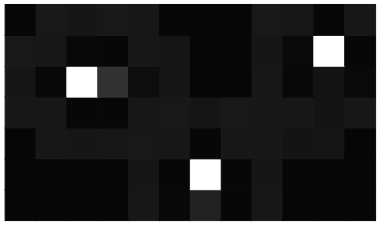
Out[193]=



然后提取其中最大的值：

In[195]:=
```
imgAfterPooling = Image[Max[Flatten[ImageData[#]]] & /@ # & /@ imgs]
```

Out[195]=



将图像拉平：

In[198]:=
```
l = Flatten[ImageData[imgAfterPooling]]
```

Out[198]=
```
{0.0263307, 0.0947724, 0.0896073, 0.0941797, 0.0935628, 0.0263307, 0.0263307,
 0.0263307, 0.0940246, 0.0908309, 0.0289735, 0.0923369, 0.0940246, 0.0935675,
 0.0330057, 0.0287039, 0.092849, 0.0841416, 0.0263307, 0.0263307, 0.0883505,
 0.0390547, 1., 0.0289504, 0.0875218, 0.034599, 1., 0.199015, 0.0514218,
 0.0833606, 0.0263307, 0.0263307, 0.0935795, 0.0348749, 0.0762309, 0.0365897,
 0.0935795, 0.0932113, 0.0286615, 0.0278614, 0.092458, 0.0947723, 0.0850353,
 0.0941797, 0.0932113, 0.0934347, 0.0799232, 0.0928331, 0.0263307,
 0.0934347, 0.0885952, 0.092833, 0.0940246, 0.092614, 0.030735, 0.092297,
 0.092849, 0.0800288, 0.0822998, 0.0263307, 0.0263307, 0.0263307, 0.0263307,
 0.0263307, 0.0889687, 0.0295959, 1., 0.0303754, 0.0876425, 0.0263307,
 0.0263307, 0.0263307, 0.0263307, 0.0263307, 0.0263307, 0.0263307, 0.0935795,
 0.0322923, 0.135576, 0.0276302, 0.092458, 0.0263307, 0.0263307, 0.0263307}
```

根据数据计数（大于0.9的元素个数）：

In[210]:=
```
Count[l, x_ /; x > 0.9]
```

Out[210]=
```
3
```