Professor_Bear_Image_Analysis_Convolution

March 14, 2017

1 Professor Bear :: Image Analysis :: Convolution

1.1 Professor Bear github

Code for Professor Bear YouTube videos at https://github.com/nikbearbrown

1.2 Download Anaconda 4 for Python 2.7

Download Anaconda 4 for Python 2.7 version https://www.continuum.io/downloads

Anaconda 4.3.0 includes an easy installation of Python (2.7.13, 3.4.5, 3.5.2, and/or 3.6.0) and updates of over 100 pre-built and tested scientific and analytic Python packages. These packages include NumPy, Pandas, SciPy, Matplotlib, and Jupyter. Over 620 more packages are available. https://docs.continuum.io/anaconda/pkg-docs

1.3 iPython

Go to the directory that has your iPython notebook
At the command line type
jupyter notebook notebookname
ipython notebook notebookname will also work
For example,
jupyter notebook Professor_Bear_Image_Analysis_Loading_Histograms.ipynb

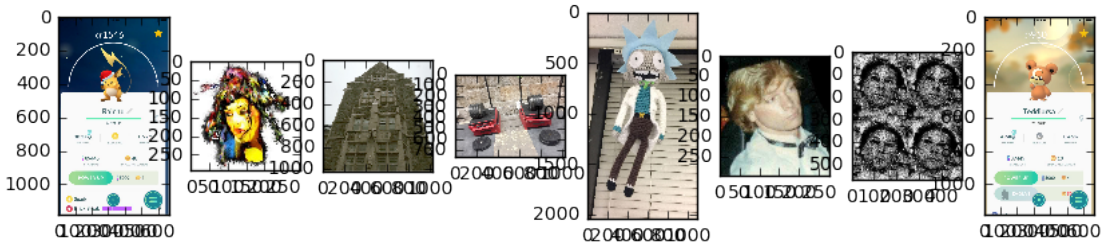
```
In [1]: # Bring in python image analysis libraries
        %matplotlib inline
        import random
        import matplotlib.pyplot as plt
        import matplotlib.image as mpimg
        import numpy as np
        from skimage import color
        import skimage.filters as filters
        from skimage.transform import hough_circle
        from skimage.feature import peak_local_max
        from skimage import feature
        from skimage import morphology
        from skimage.draw import circle_perimeter
        from skimage import img_as_float, img_as_ubyte
        from skimage import segmentation as seg
```

```
from skimage.morphology import watershed
from scipy import ndimage as nd
from scipy.ndimage import convolve
from skimage import feature
import glob # for bulk file import

# Set defaults
plt.rcParams['image.cmap'] = 'gray' # Display grayscale images
plt.rcParams['image.interpolation'] = 'none' # Use nearest-neighbour
plt.rcParams['figure.figsize'] = 10, 10

# Import test images
imgpaths = glob.glob("./img/*.jpg") + glob.glob("./img/*.png")
# imgpaths = glob.glob("images/*.jpg") + glob.glob("images/*.png")  Windows
# Windows has different relative paths than Mac/Unix
imgset = [mpimg.imread(x) for x in imgpaths]

# Display thumbnails of the images to ensure loading
plt.figure()
for i,img in enumerate(imgset):
    plt.subplot(1, len(imgset), i+1)
    plt.imshow(img, cmap = 'gray')
```



1.4 Convolution

As Wikipedia says (https://en.wikipedia.org/wiki/Convolution) a convolution is a mathematical operation on two functions (f and g); it produces a third function, that is typically viewed as a modified version of one of the original functions, giving the integral of the pointwise multiplication of the two functions as a function of the amount that one of the original functions is translated.

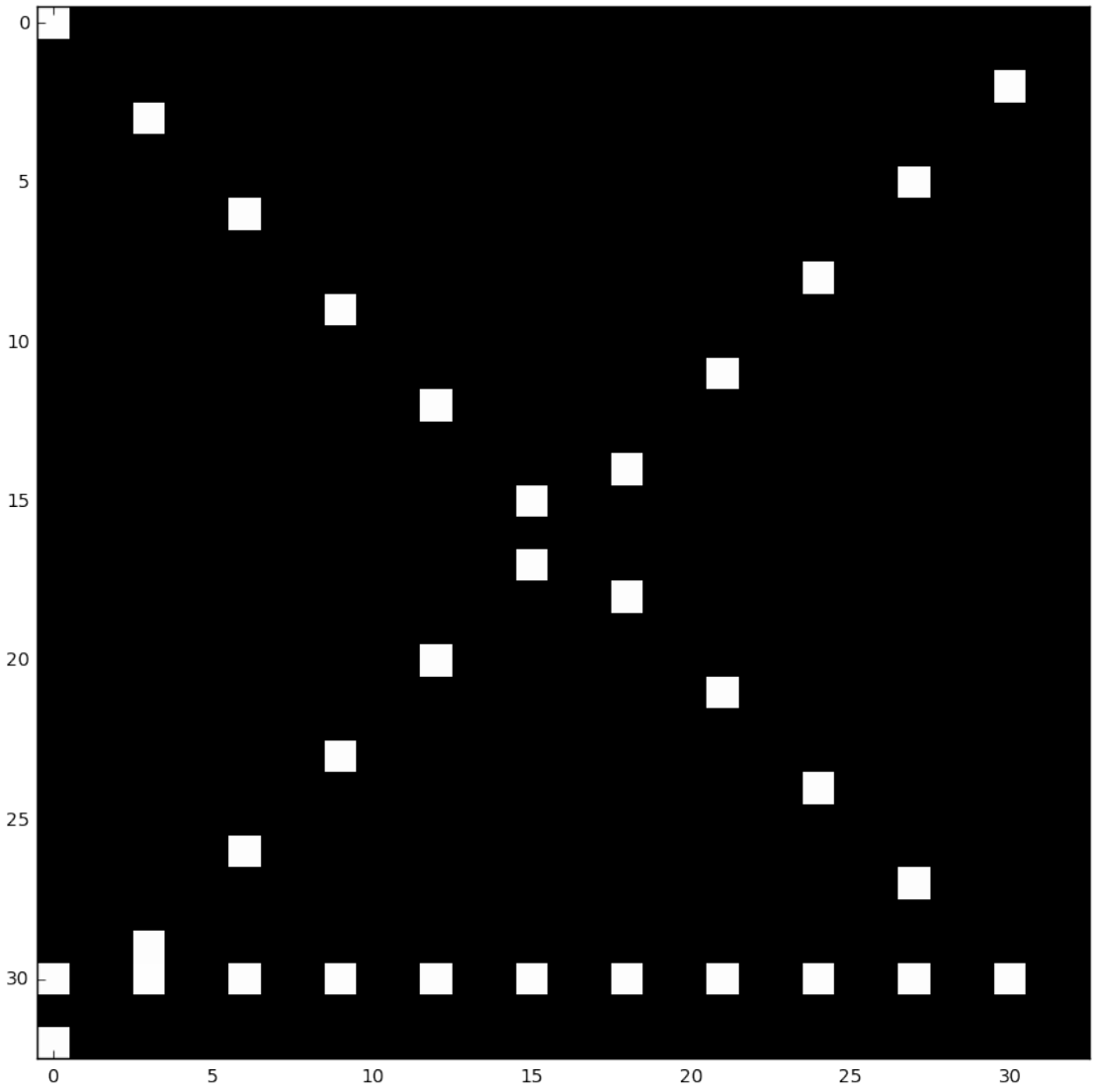
1.5 Create some arbitrary kernels

```
In [2]: def generate_kernel_a(size):
            kernel = np.zeros((size,size))
            for x in range(size):
                if x%3==0:
```

```
            kernel[x][x] = 1.0
            kernel[size-3][x] = 1.0
            kernel[size-1-x][x] = 1.0
        kernel = kernel / float(sum(sum(kernel)))
        return kernel

    kernel_a = generate_kernel_a(33)
    plt.imshow(kernel_a)
```

Out[2]: <matplotlib.image.AxesImage at 0x11920fa90>

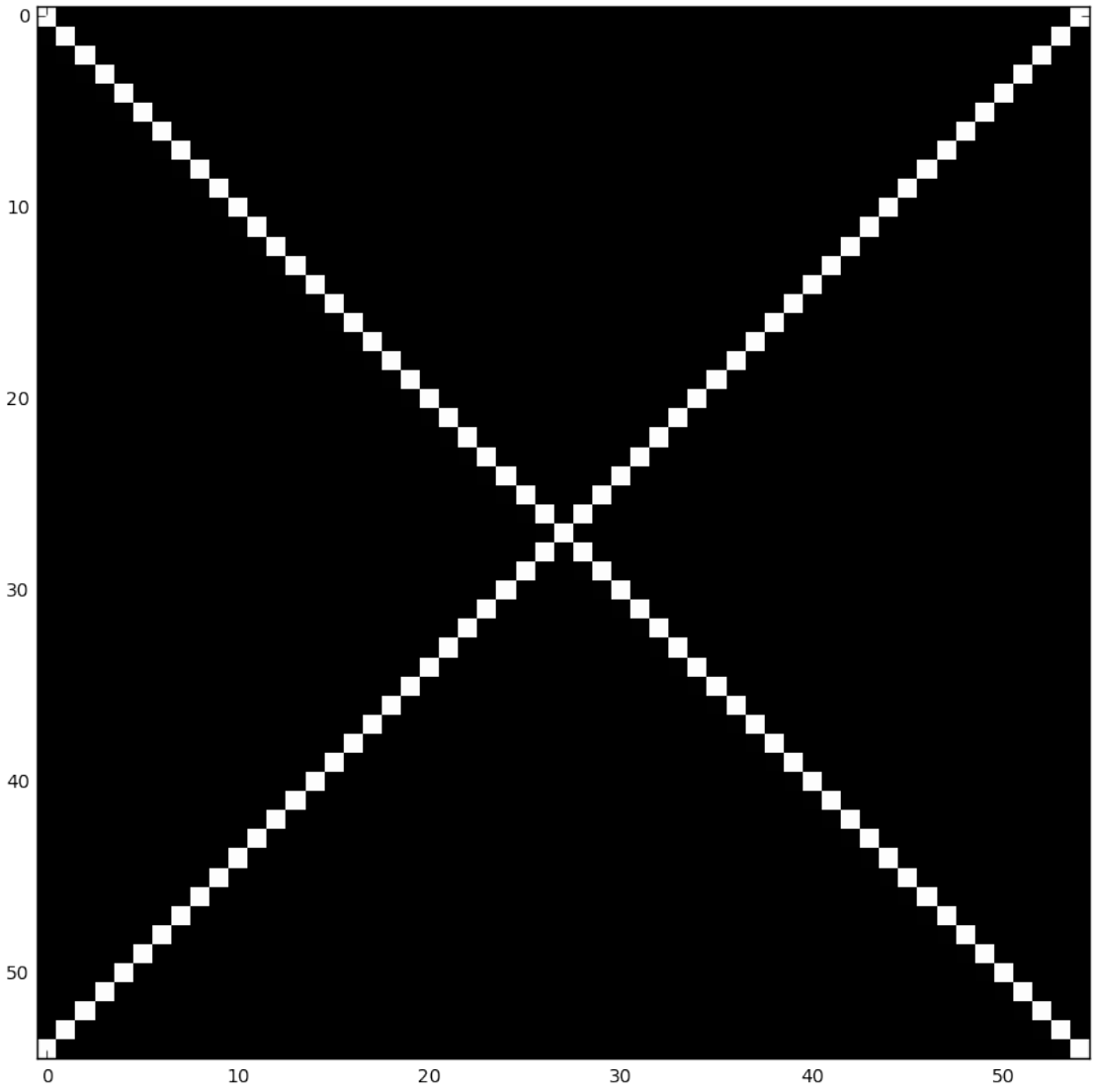


In [3]:
```
def generate_kernel_b(size):
    kernel = np.zeros((size,size))
```

```
            for x in range(size):
                kernel[x][x] = 1.0
                kernel[size-1-x][x] = 1.0
            kernel = kernel / float(sum(sum(kernel)))
            return kernel

        kernel_b = generate_kernel_b(55)
        plt.imshow(kernel_b)
```

Out[3]: <matplotlib.image.AxesImage at 0x119253690>

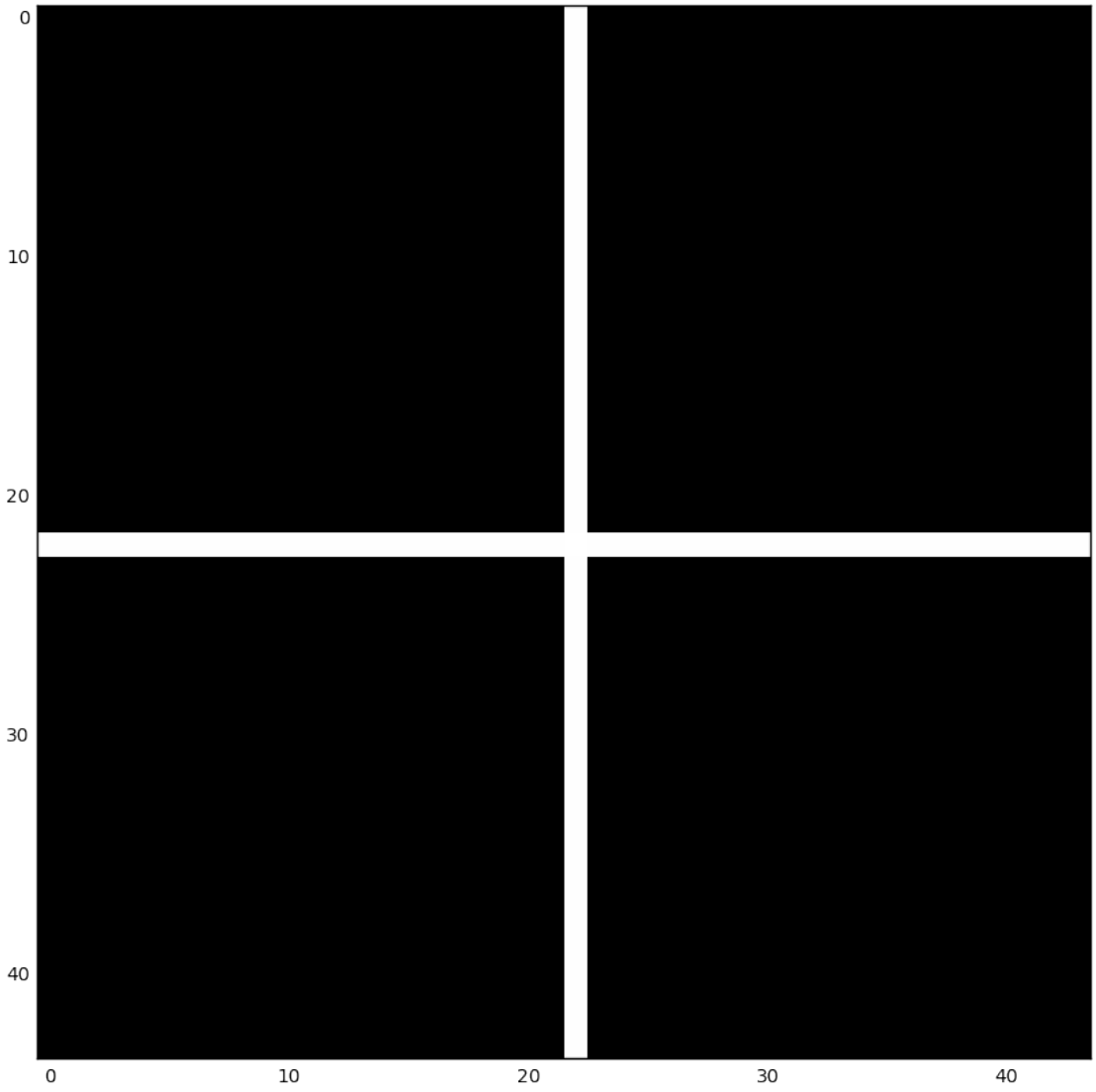



```
In [4]: def generate_kernel_c(size):
            kernel = np.zeros((size,size))
```

```
            for x in range(size):
                kernel[size/2][x] = 1.0
                kernel[x][size/2] = 1.0
            kernel = kernel / float(sum(sum(kernel)))
            return kernel

        kernel_c = generate_kernel_c(44)
        plt.imshow(kernel_c)
```

Out[4]: <matplotlib.image.AxesImage at 0x11947fb90>

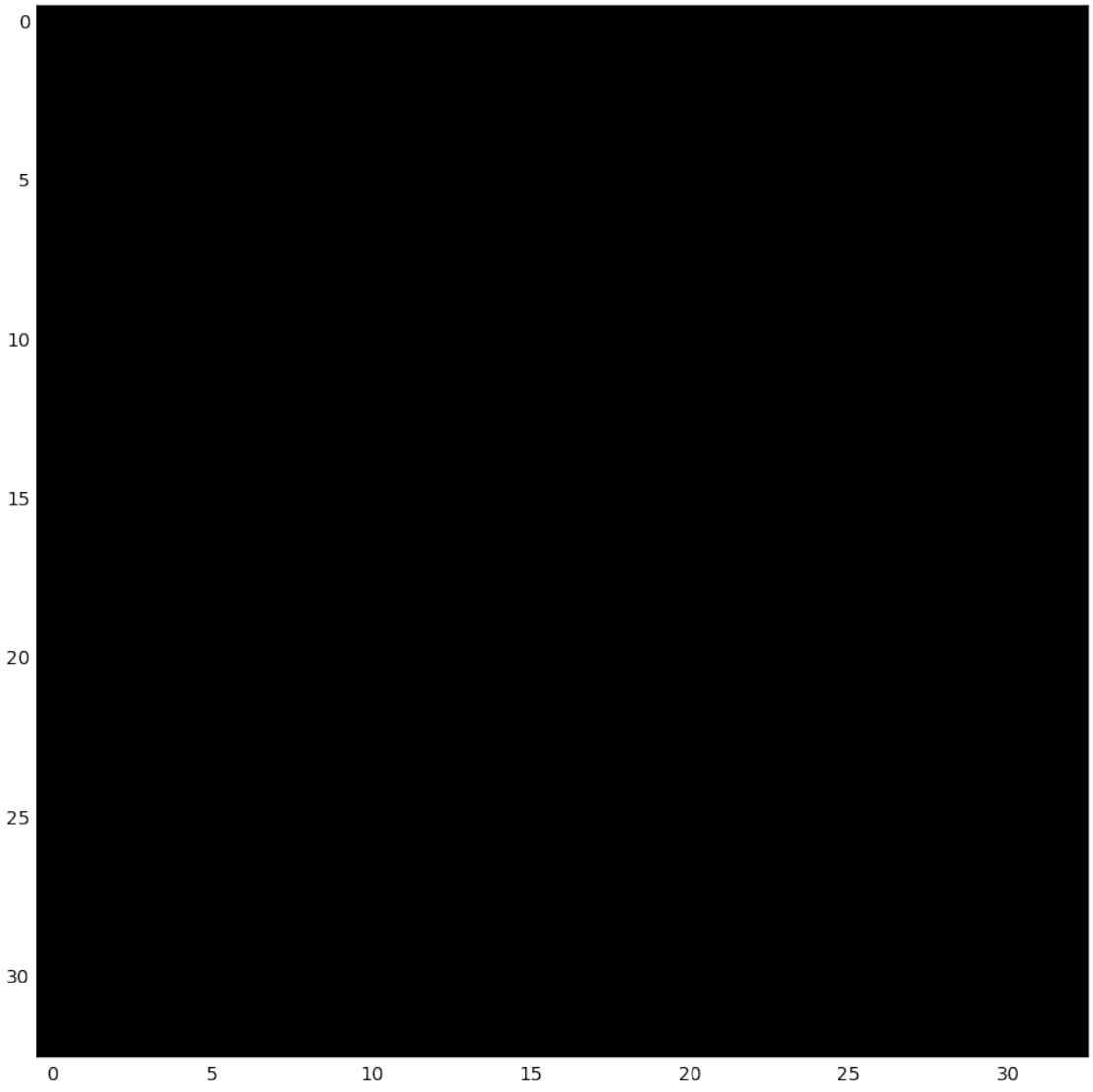



```
In [5]: def generate_kernel_d(size):
            kernel = np.zeros((size,size))
```

```
        return kernel

    kernel_d = generate_kernel_d(33)
    plt.imshow(kernel_d)
```

Out[5]: <matplotlib.image.AxesImage at 0x11963f050>

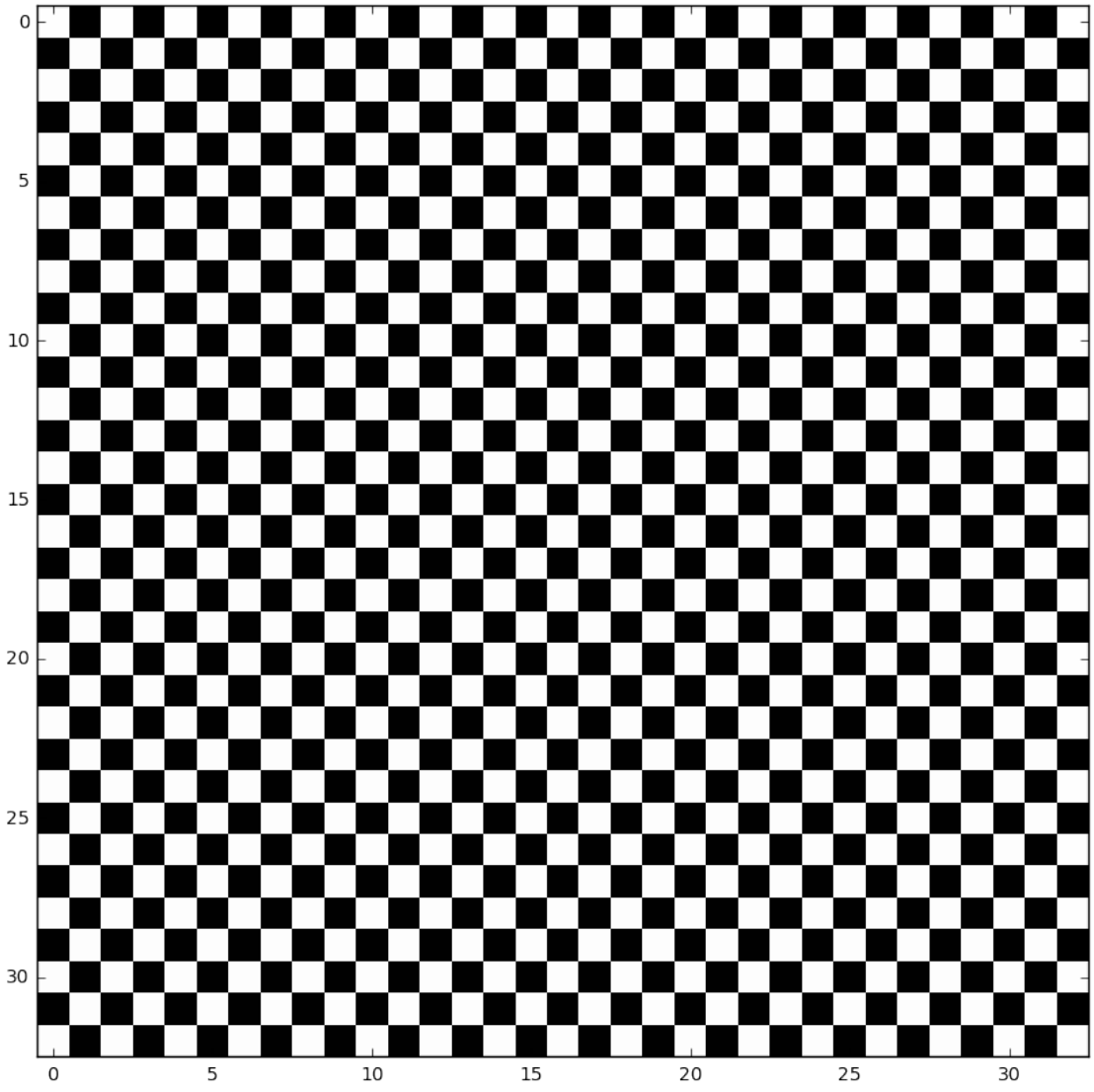



```
In [6]: def generate_kernel_e(size):
            kernel = np.zeros((size,size))
            for x in range(size):
                for y in range(size):
                  if (x+y)%2==0:
                    kernel[x][y] = 1.0
```

```
            kernel = kernel / float(sum(sum(kernel)))
            return kernel

        kernel_e = generate_kernel_e(33)
        plt.imshow(kernel_e)
```

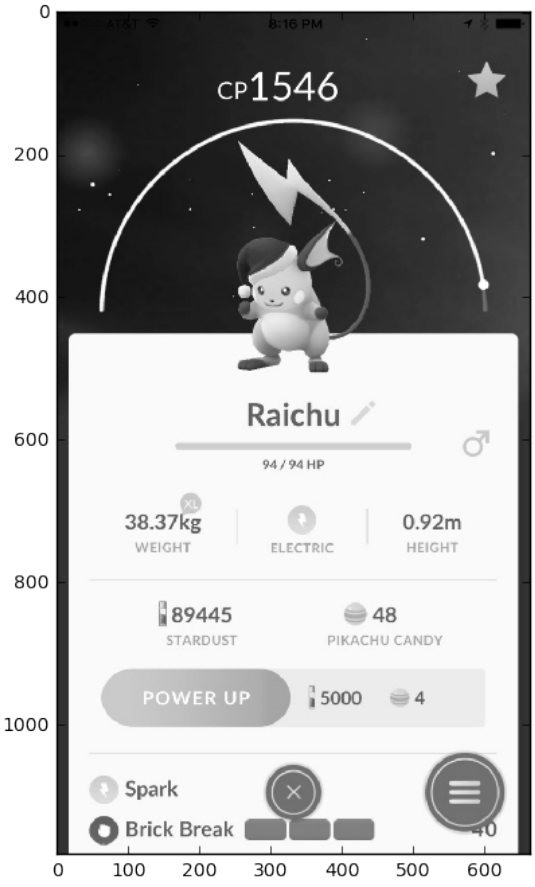
Out[6]: <matplotlib.image.AxesImage at 0x11aa2c5d0>

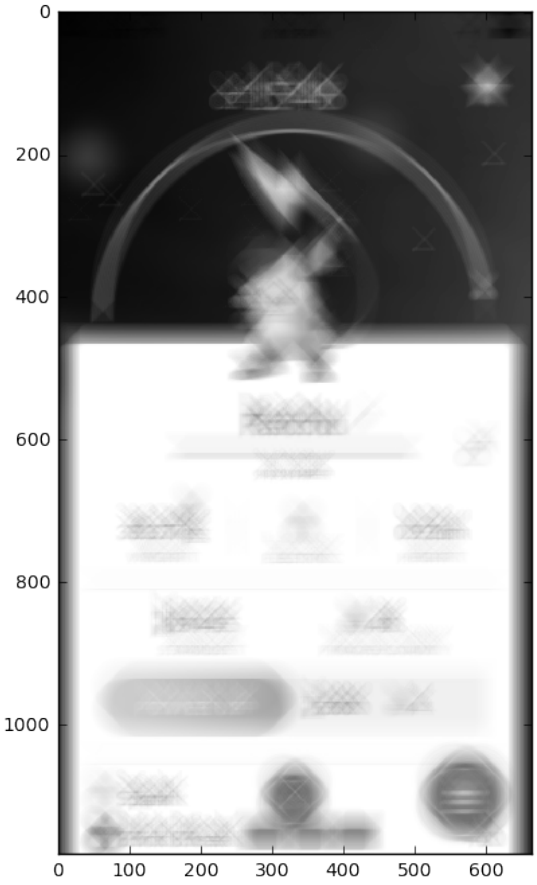


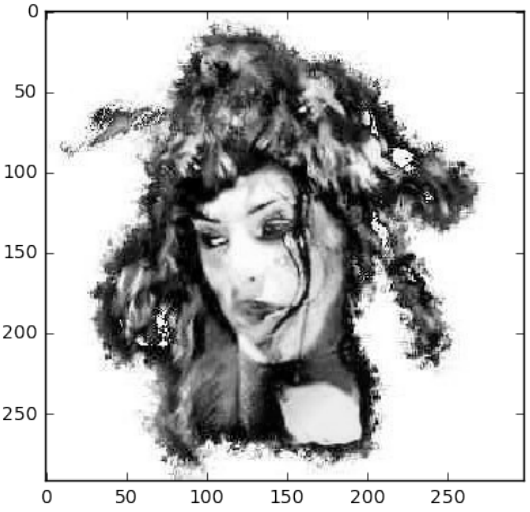
In [7]: *## Convolution - convolution is a mathematical operation on two functions*

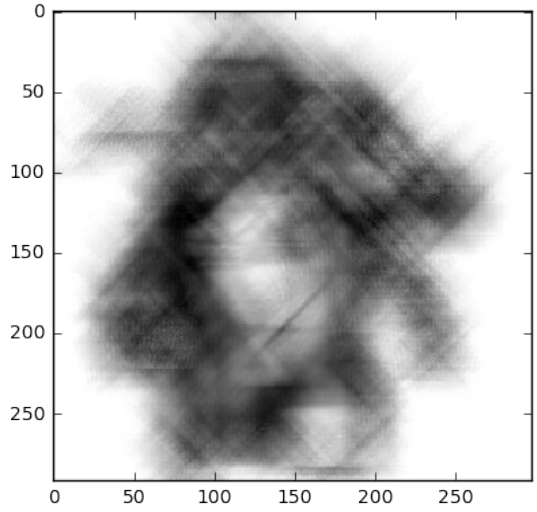
```
In [8]: for i,img in enumerate(imgset):
            imgbw = color.rgb2grey(img)
            plt.figure()
            plt.subplot(1, 2, 1)
```

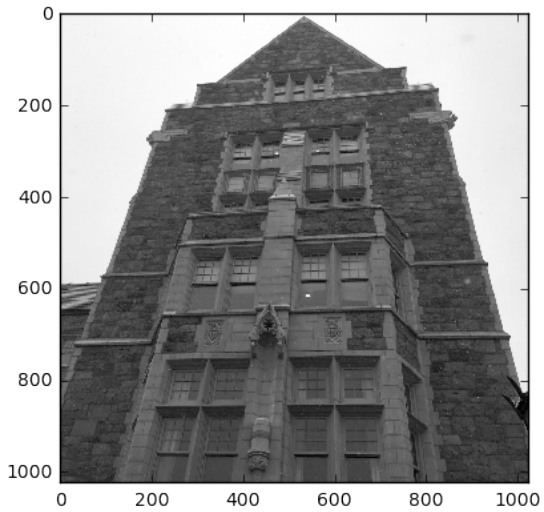
```
plt.imshow(imgbw)
plt.subplot(1, 2, 2)
plt.imshow(convolve(imgbw, kernel_a))
```







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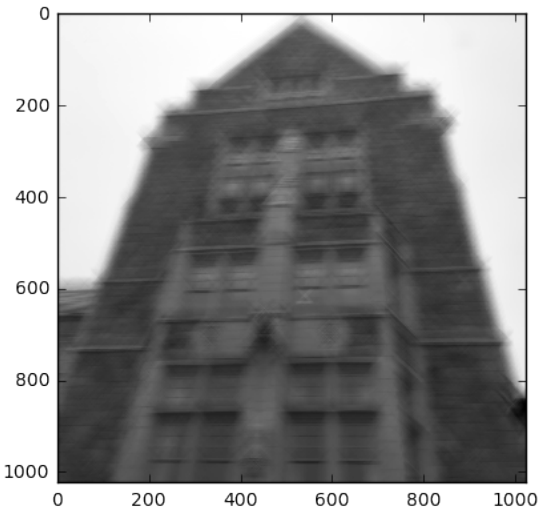
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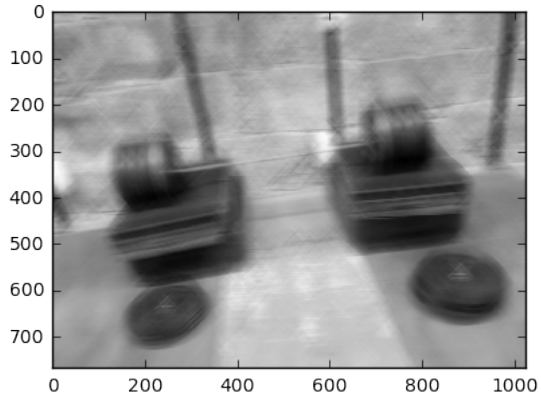
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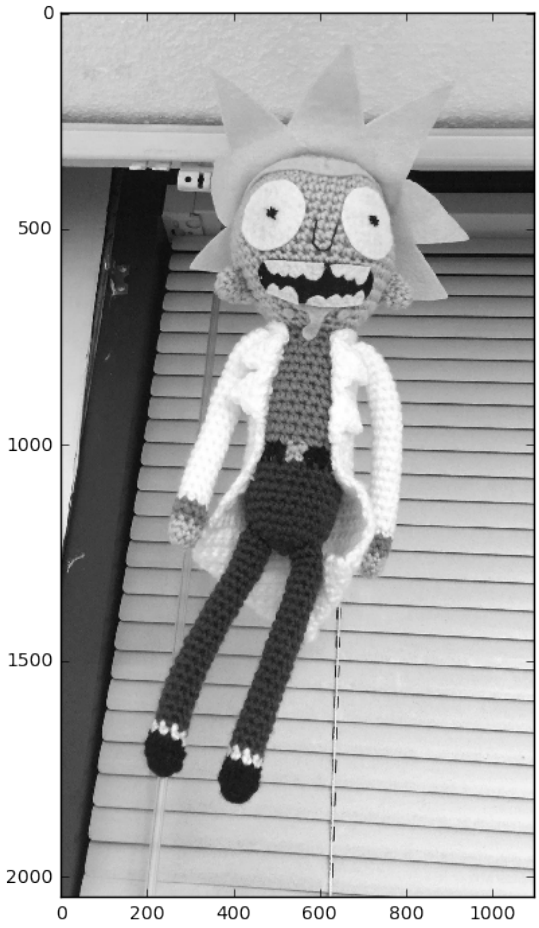
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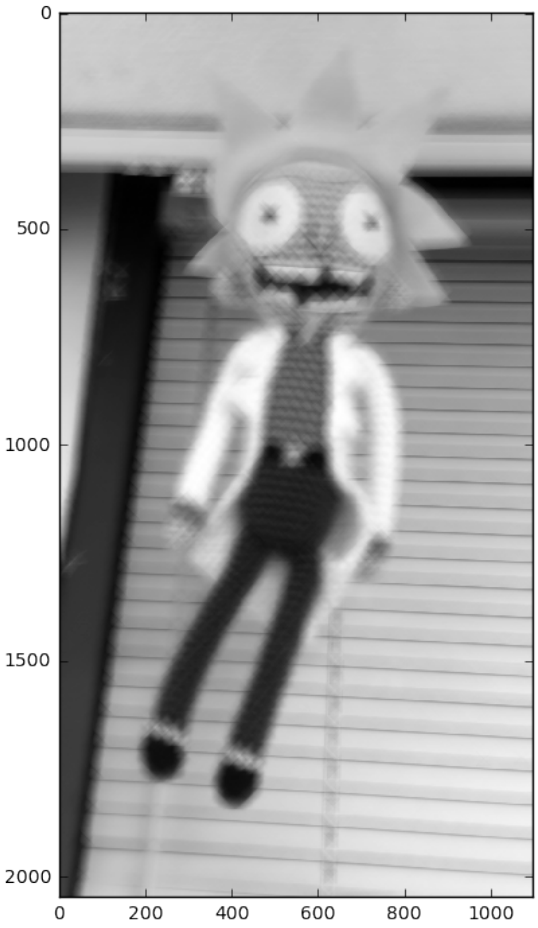
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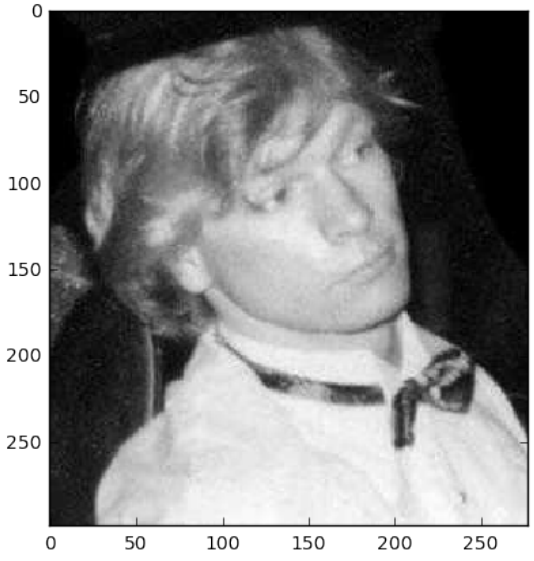
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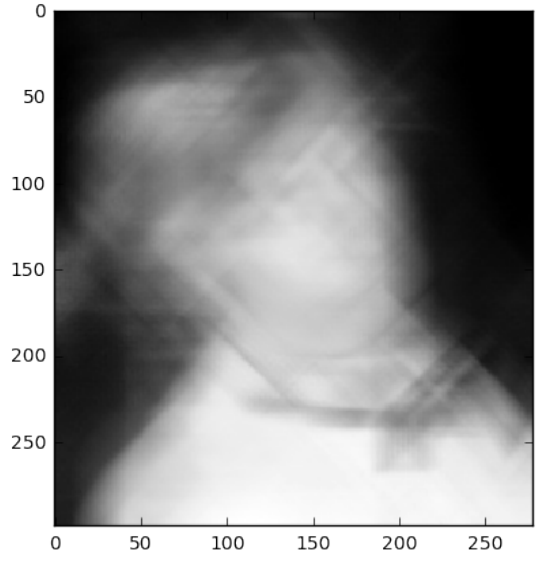
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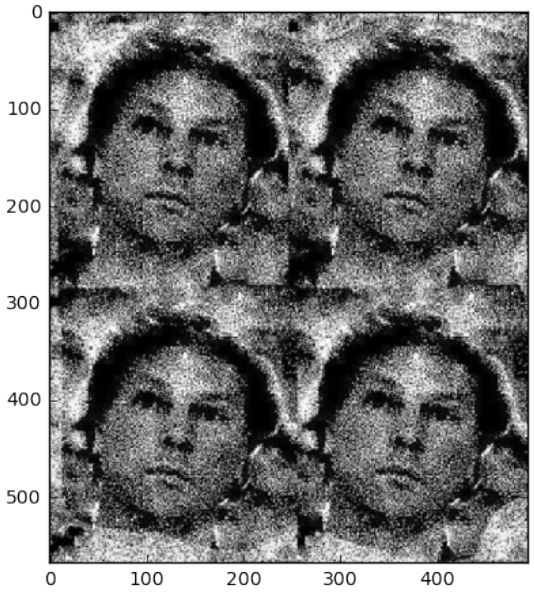

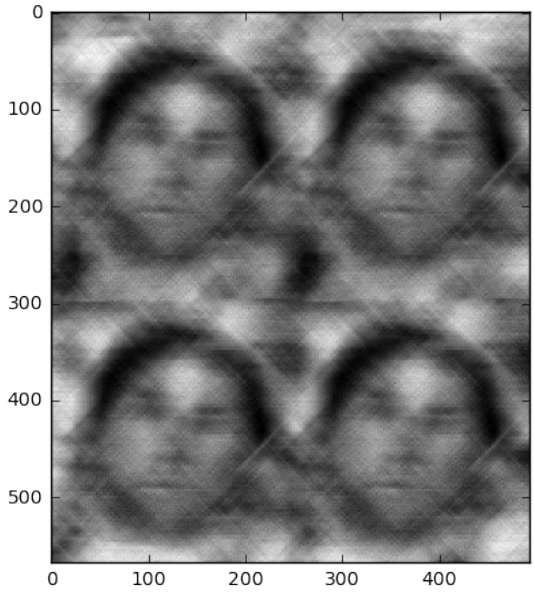

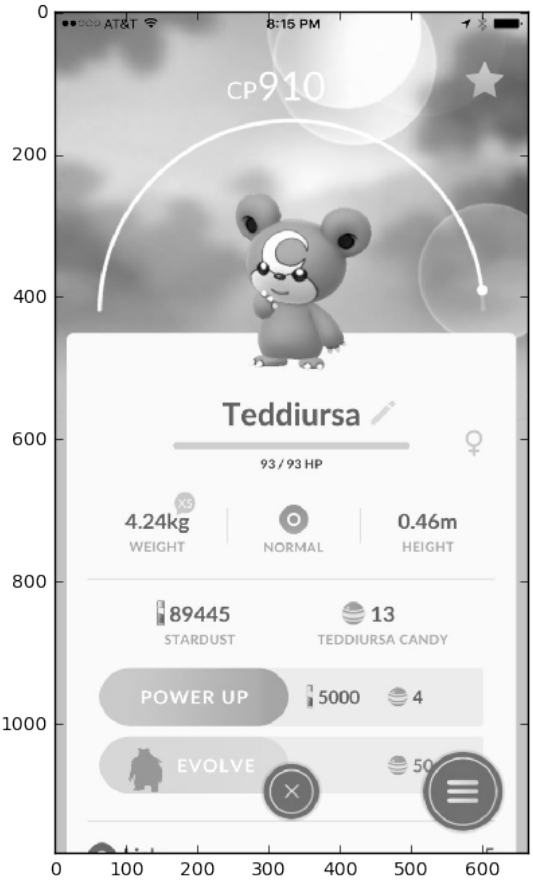
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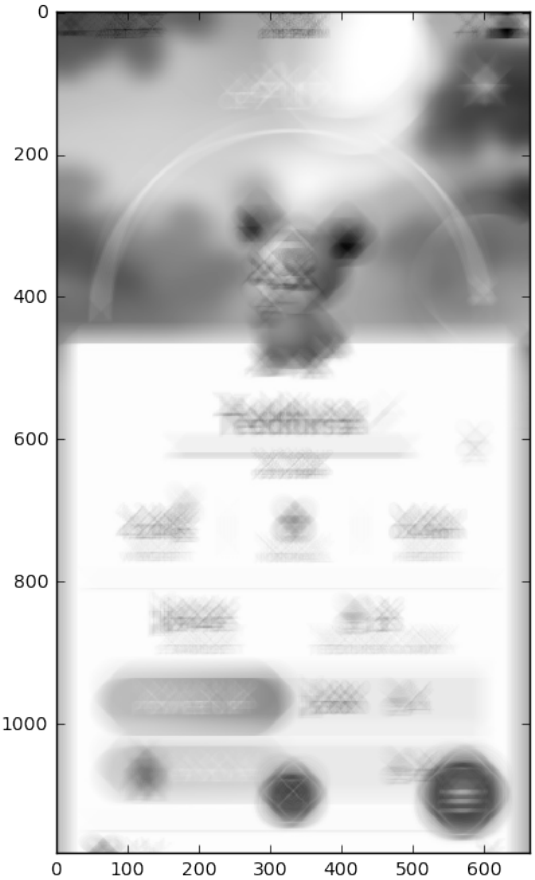
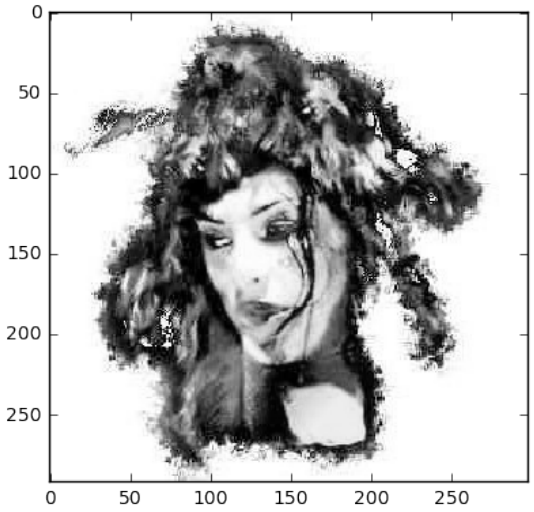
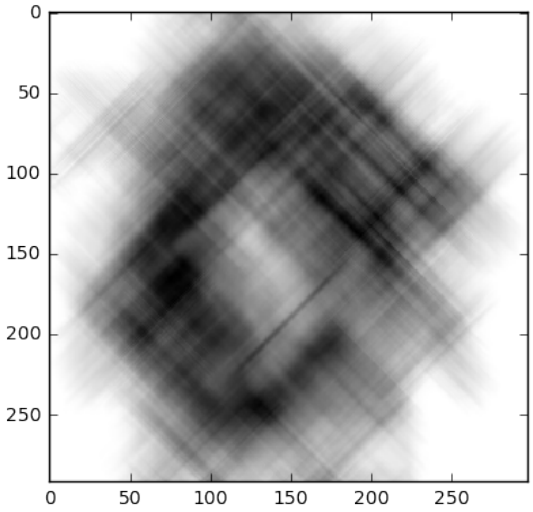
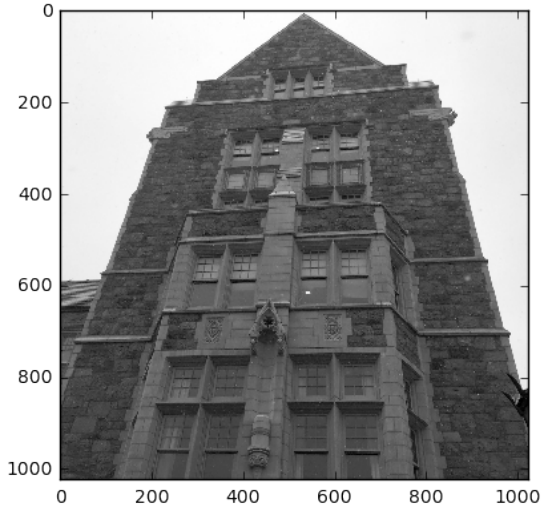
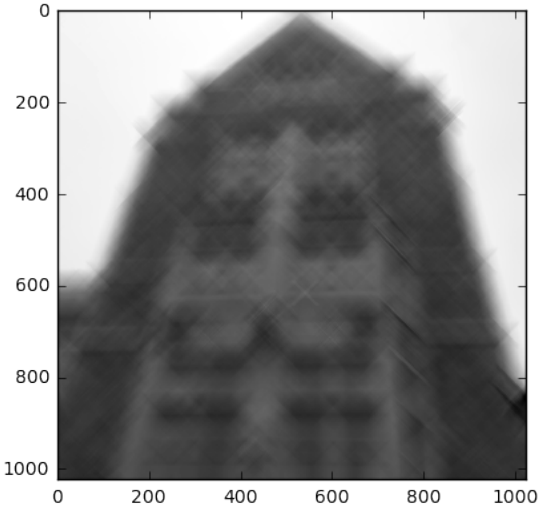
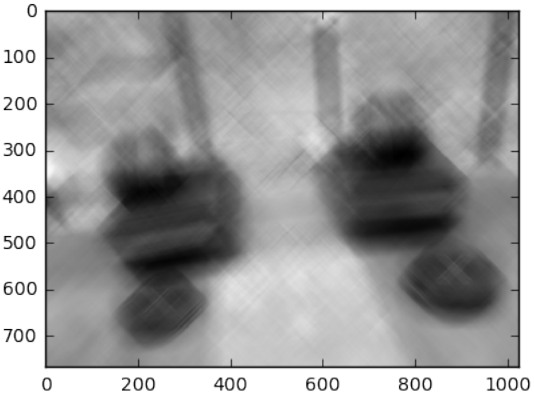
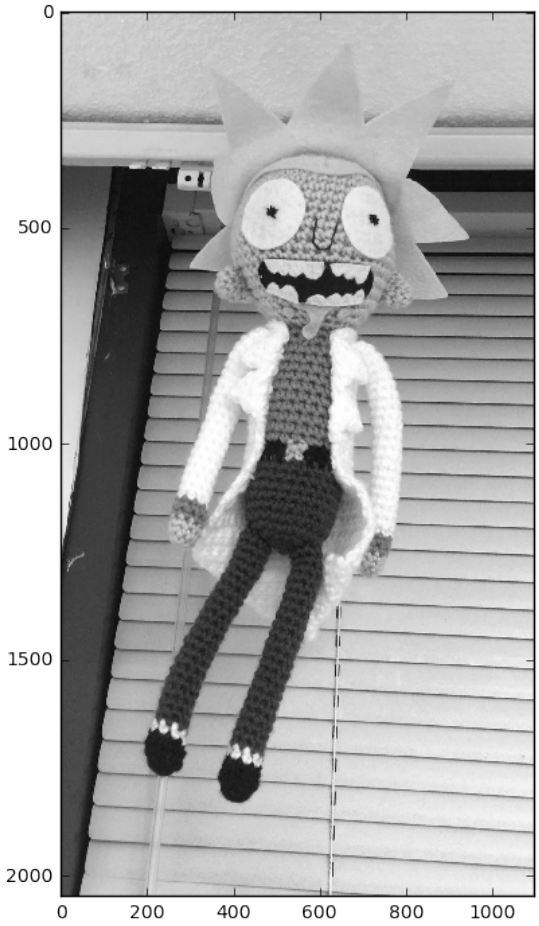


```
In [9]: for i,img in enumerate(imgset):
            imgbw = color.rgb2grey(img)
            plt.figure()
            plt.subplot(1, 2, 1)
            plt.imshow(imgbw)
            plt.subplot(1, 2, 2)
            plt.imshow(convolve(imgbw, kernel_b))
```

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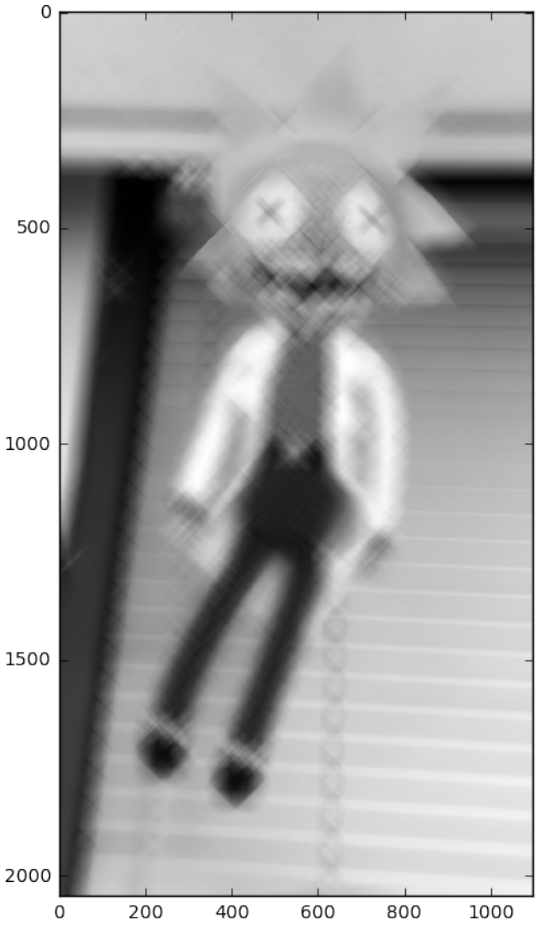
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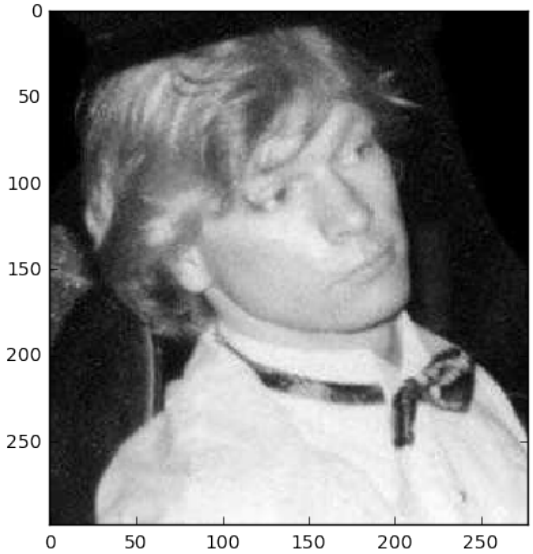
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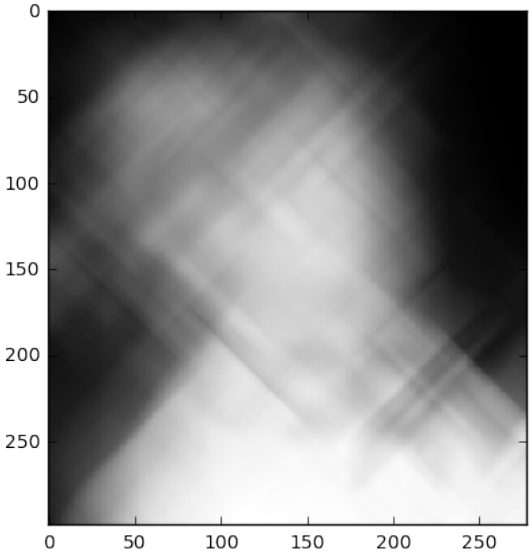
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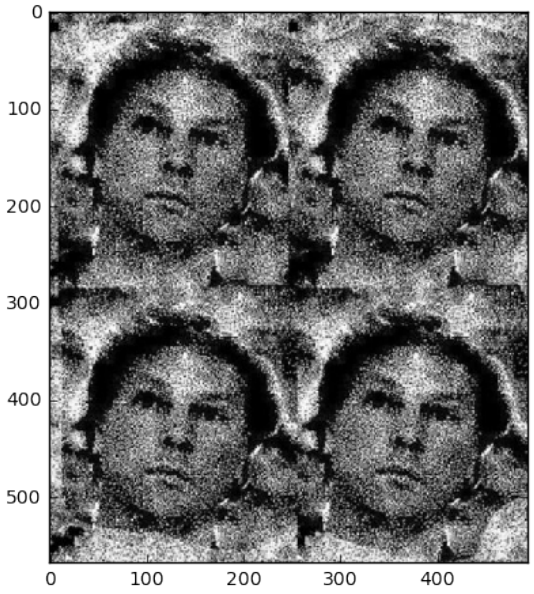

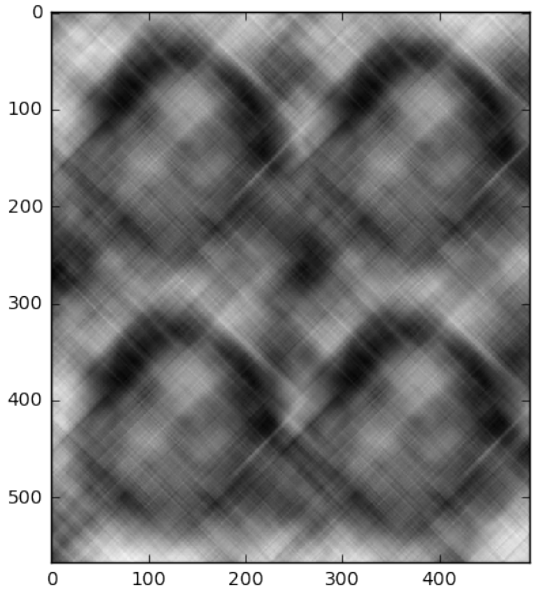

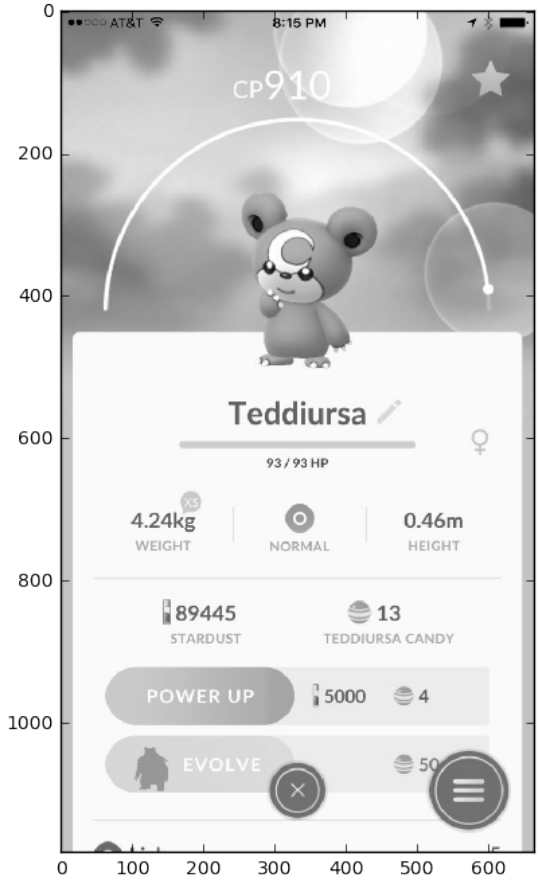
AT&T
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4.24kg
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0.46m
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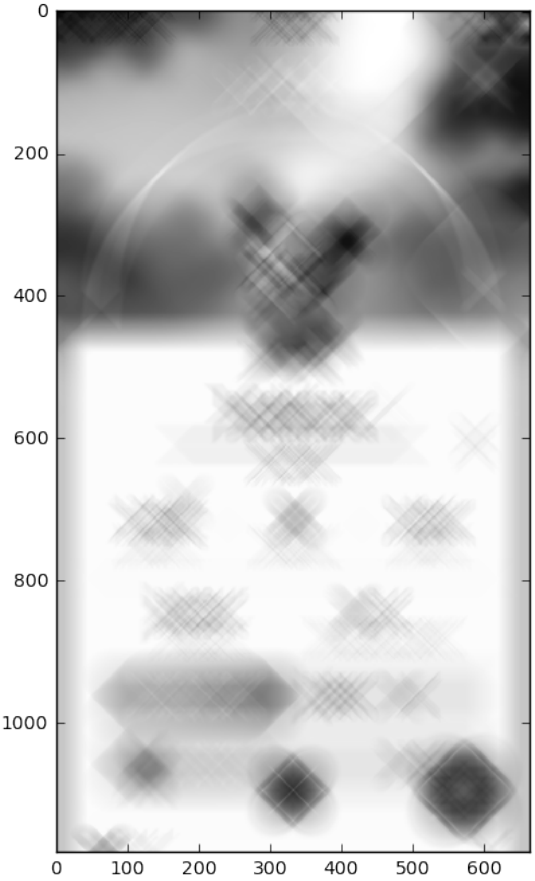
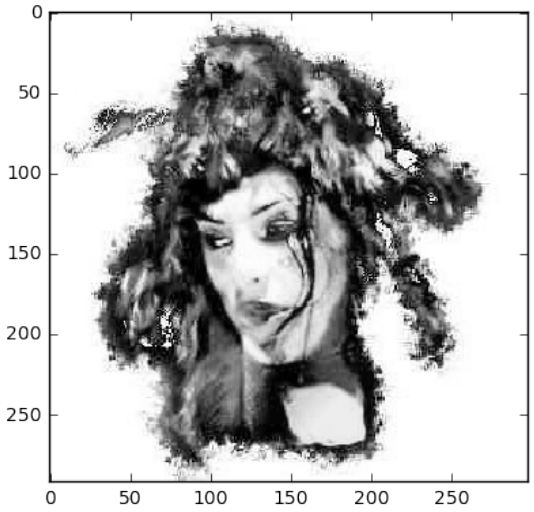
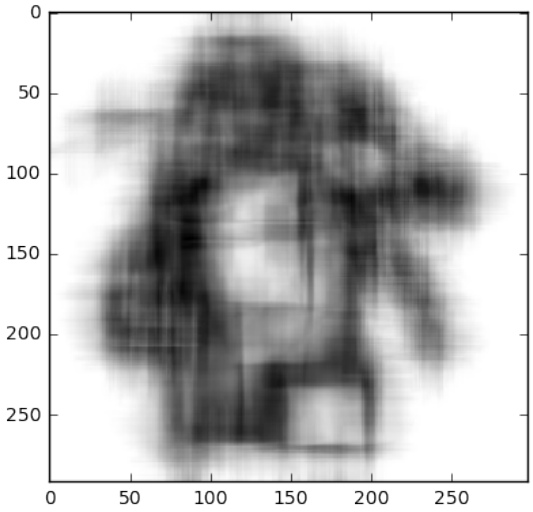
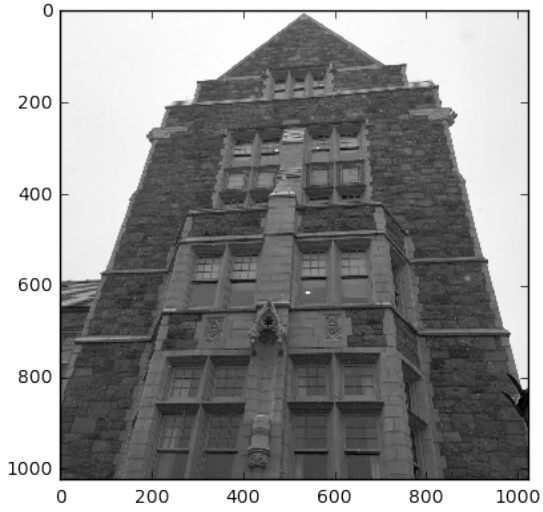
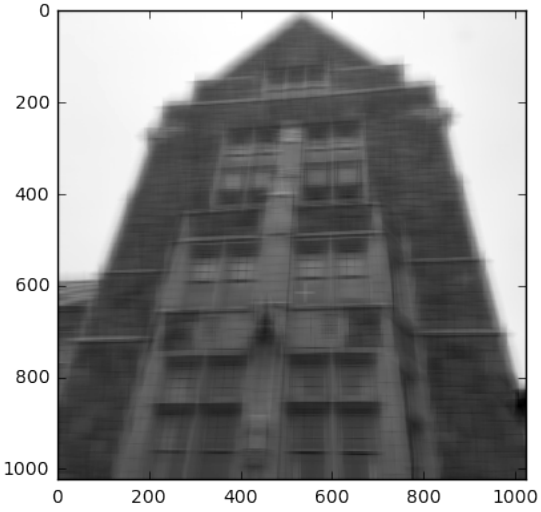
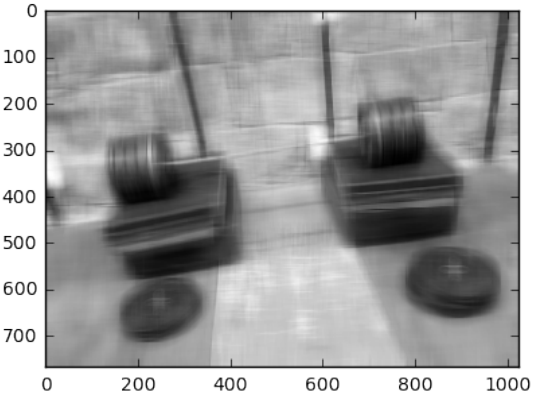
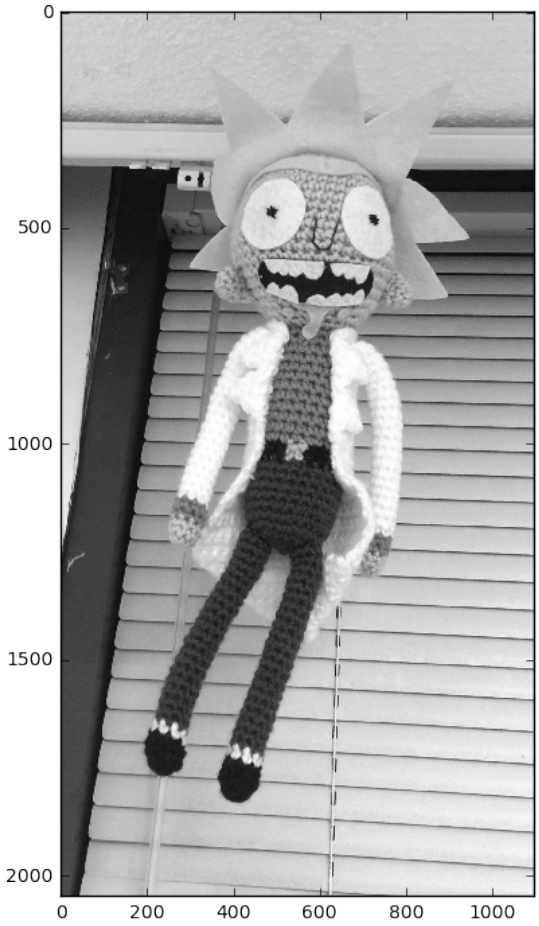


```
In [10]: for i,img in enumerate(imgset):
             imgbw = color.rgb2grey(img)
             plt.figure()
             plt.subplot(1, 2, 1)
             plt.imshow(imgbw)
             plt.subplot(1, 2, 2)
             plt.imshow(convolve(imgbw, kernel_c))
```

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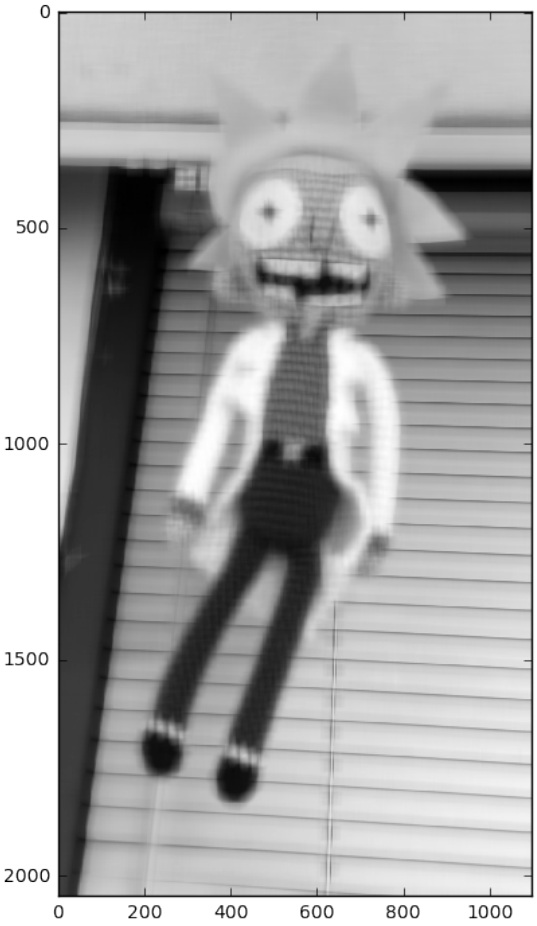
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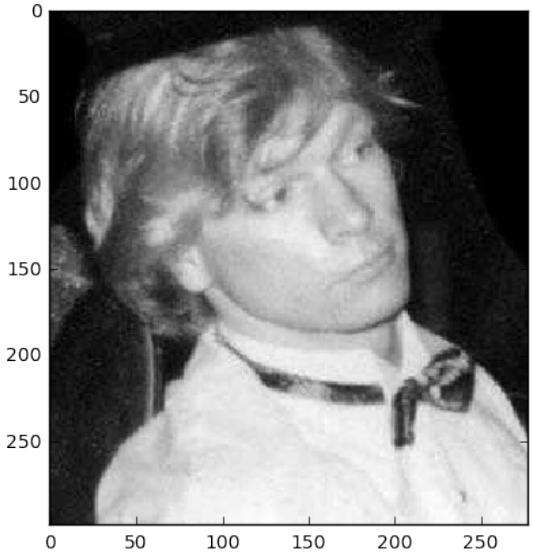
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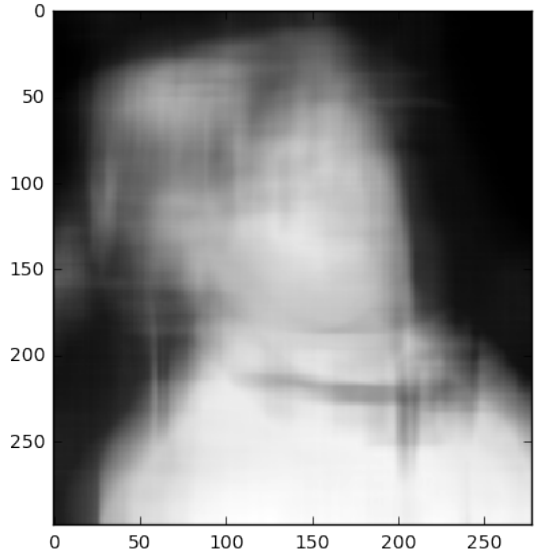
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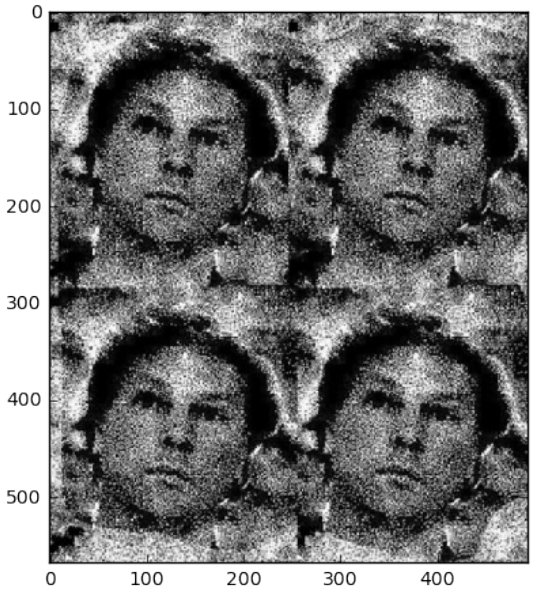

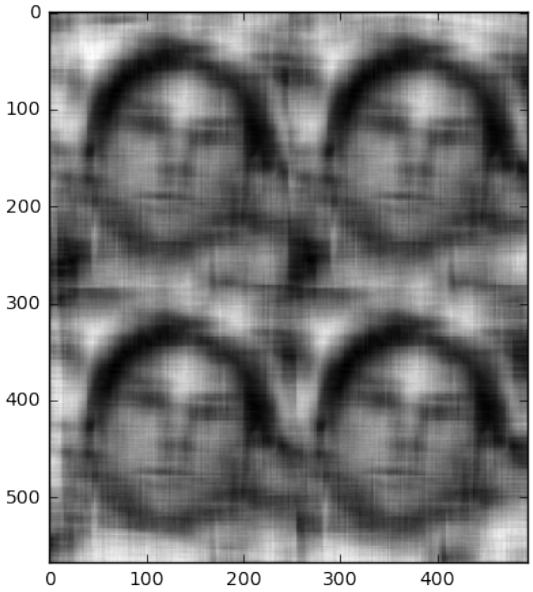

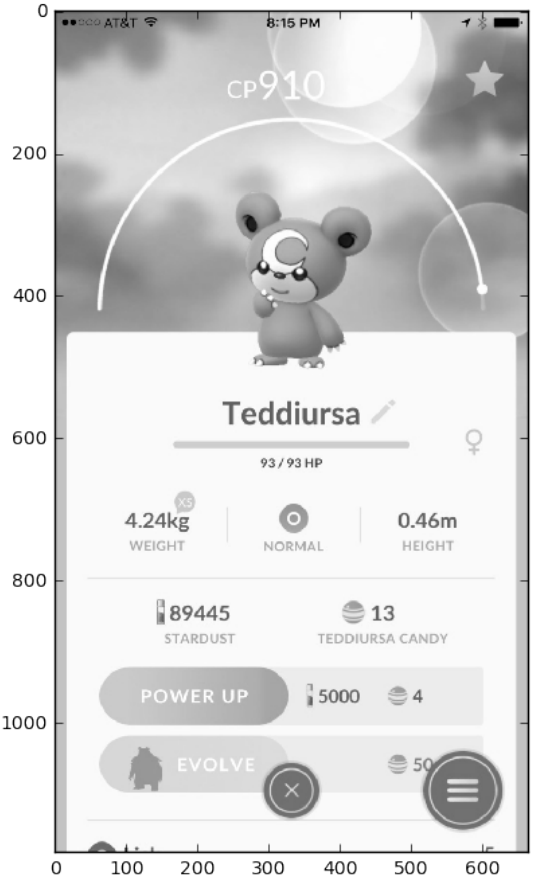
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Teddiursa
93 / 93 HP
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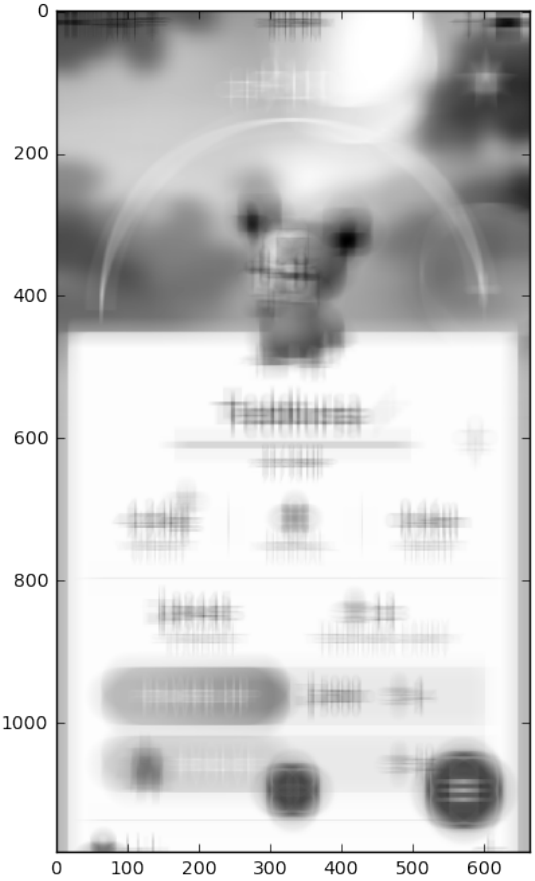

```
In [11]: for i,img in enumerate(imgset):
             imgbw = color.rgb2grey(img)
             plt.figure()
             plt.subplot(1, 2, 1)
             plt.imshow(imgbw)
             plt.subplot(1, 2, 2)
             plt.imshow(convolve(imgbw, kernel_d))
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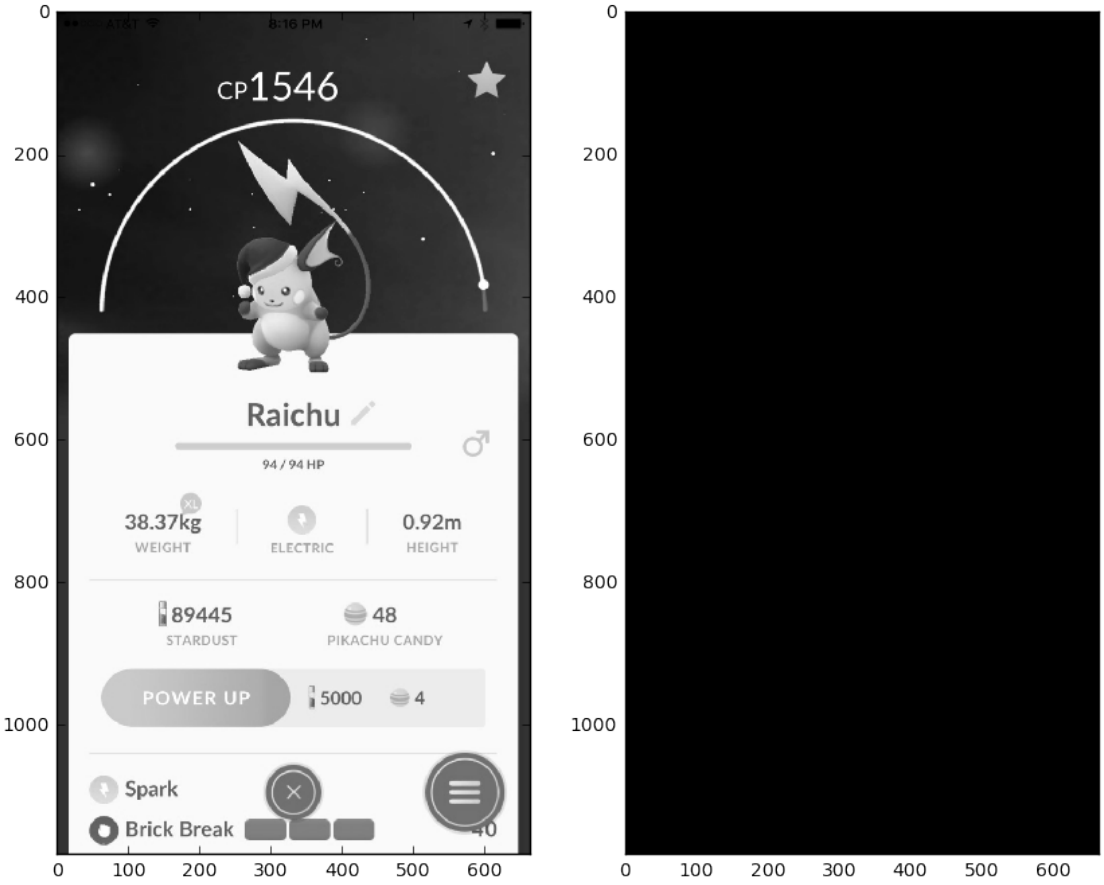

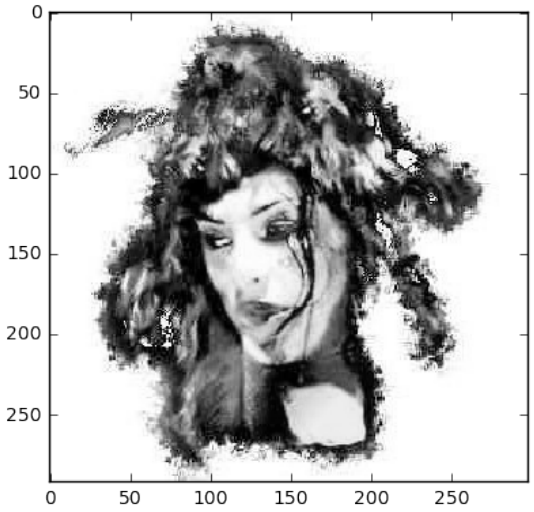
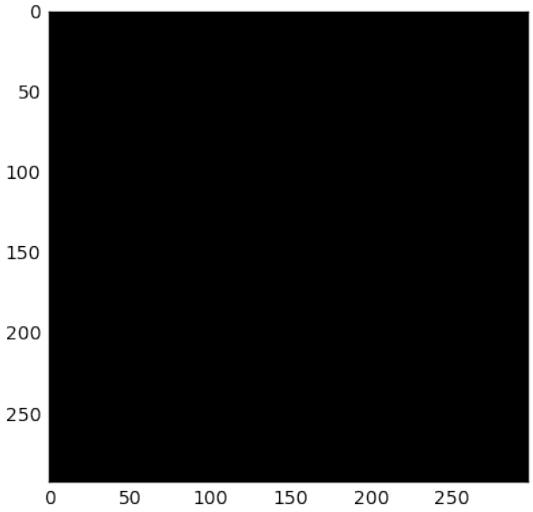
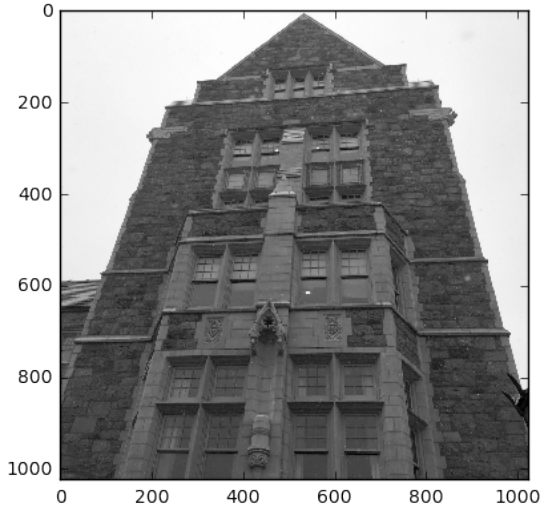
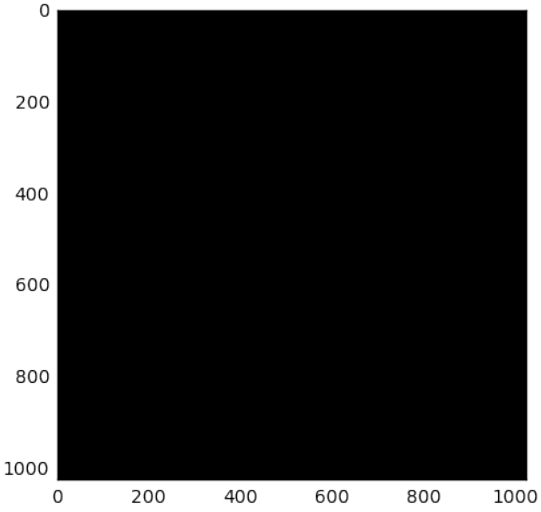

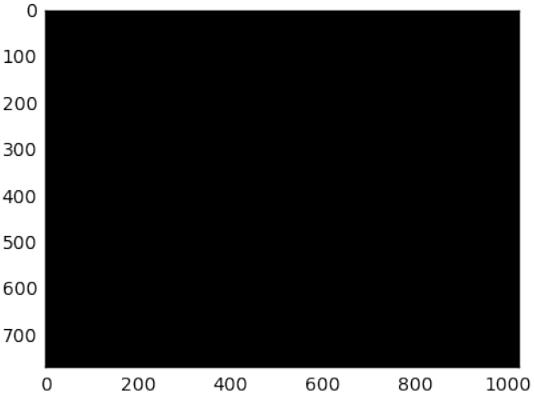

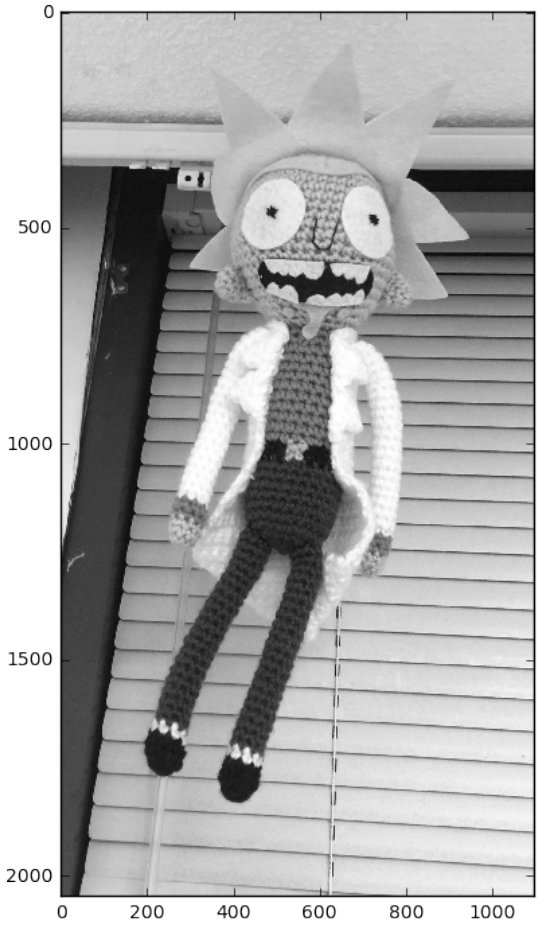
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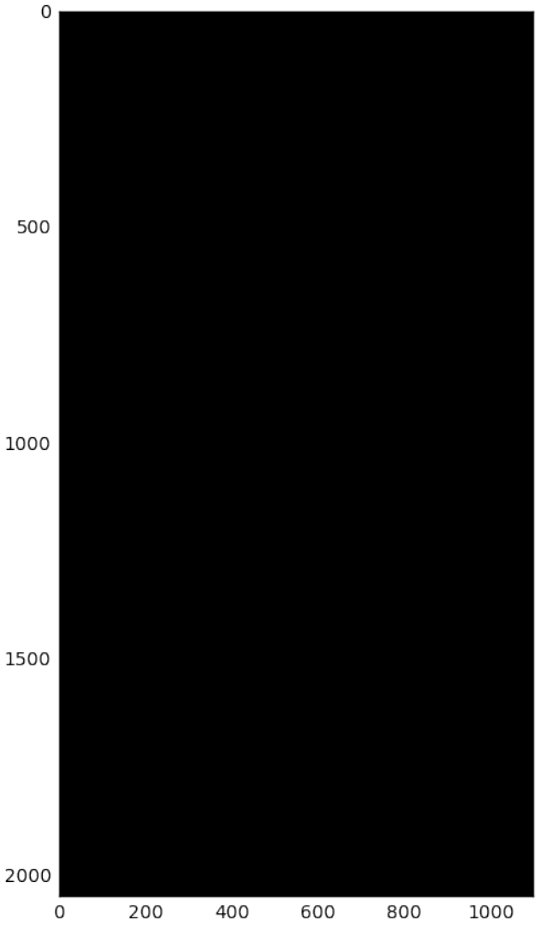
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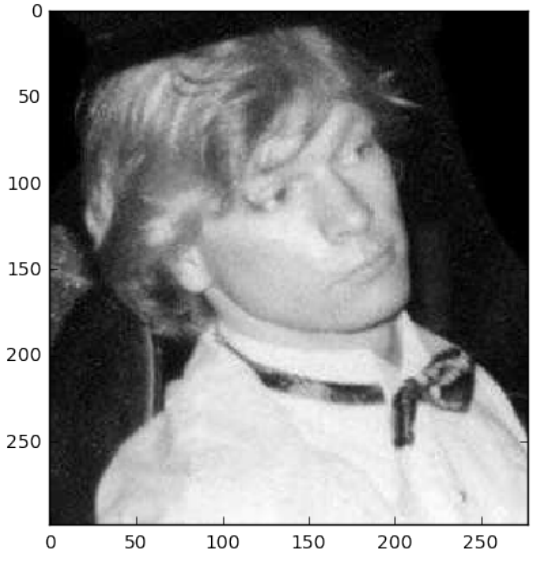
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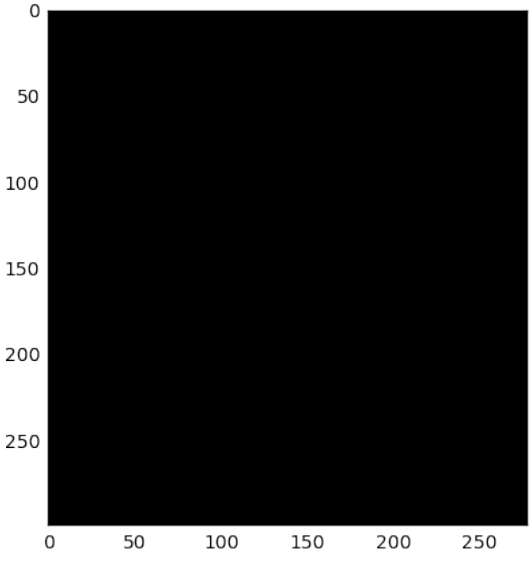
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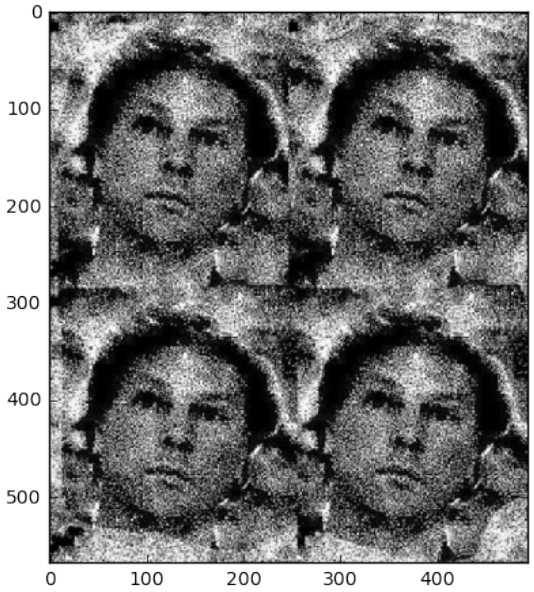

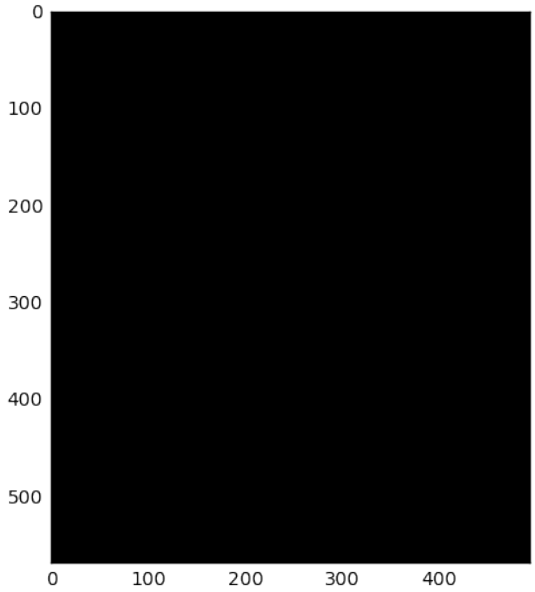

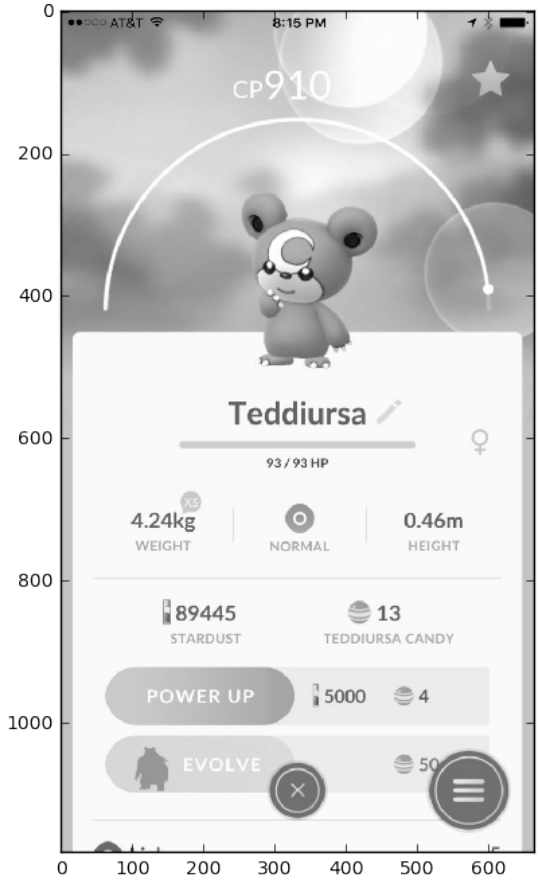
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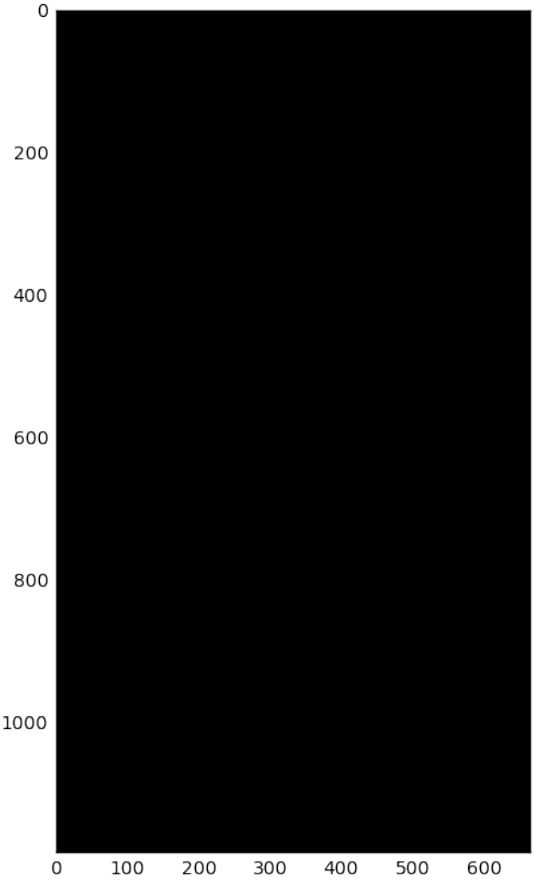

```
In [12]: for i,img in enumerate(imgset):
             imgbw = color.rgb2grey(img)
             plt.figure()
             plt.subplot(1, 2, 1)
             plt.imshow(imgbw)
             plt.subplot(1, 2, 2)
             plt.imshow(convolve(imgbw, kernel_e))
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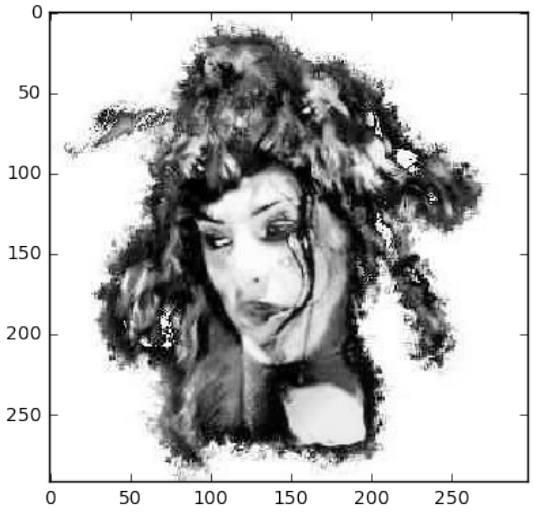
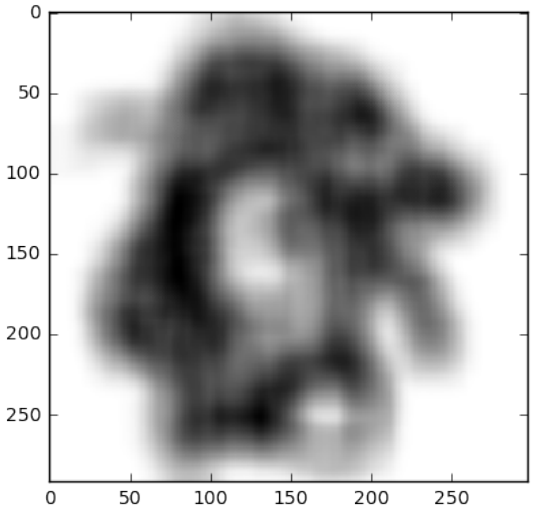
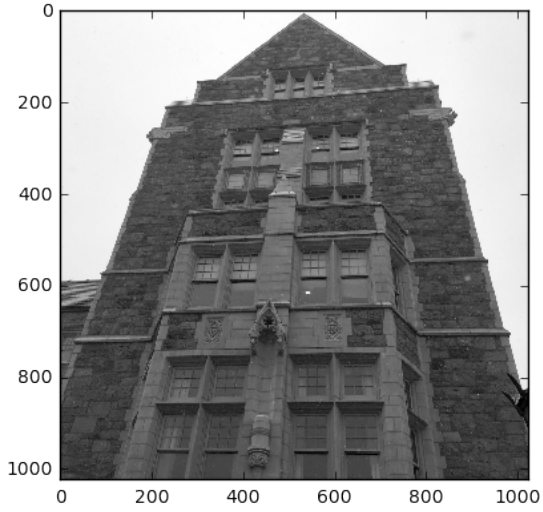
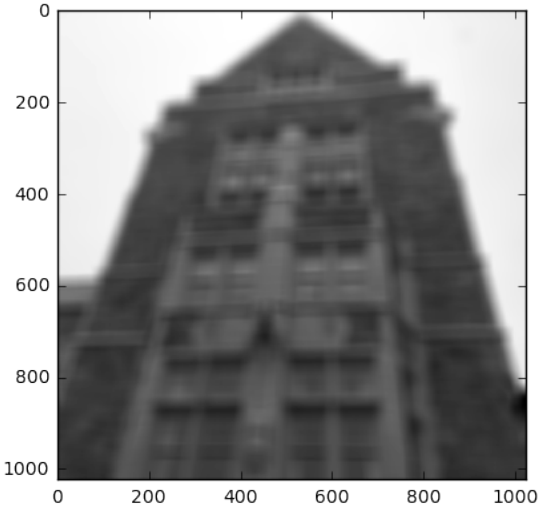

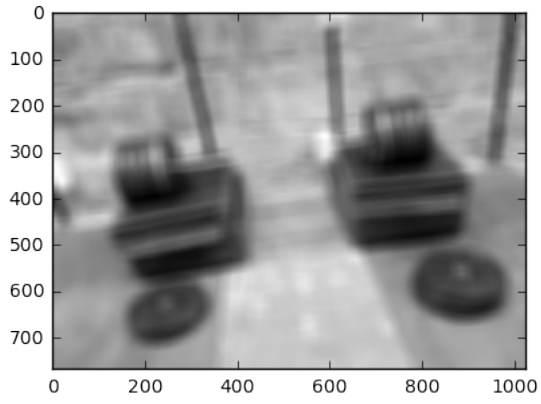

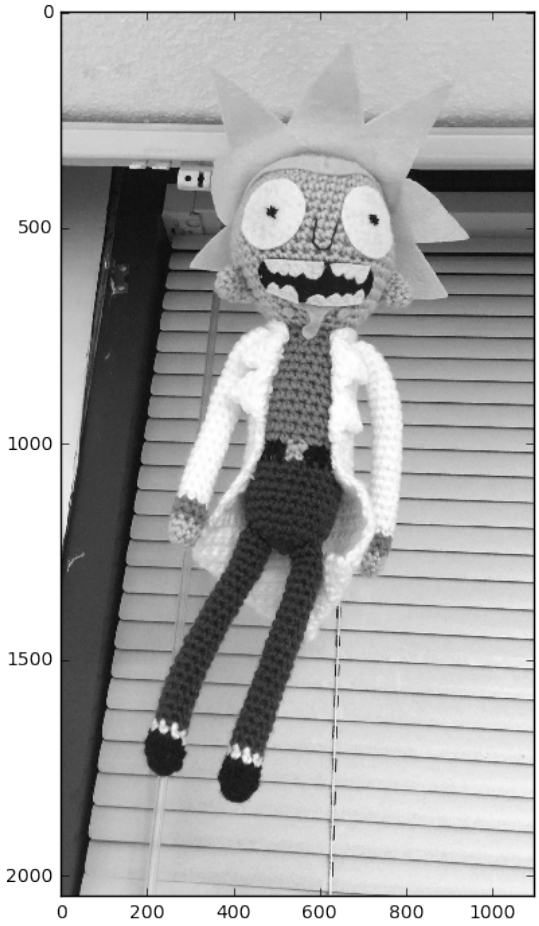
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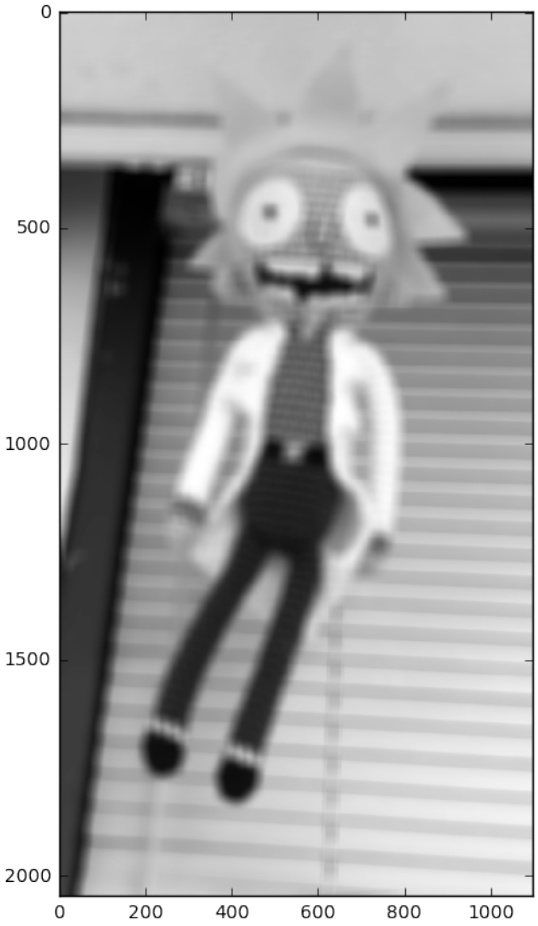
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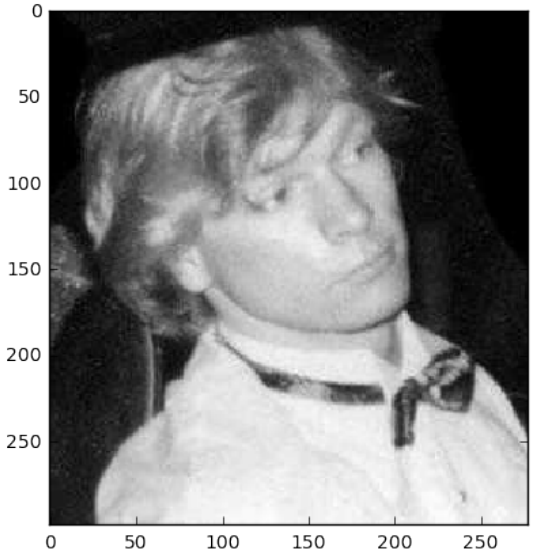
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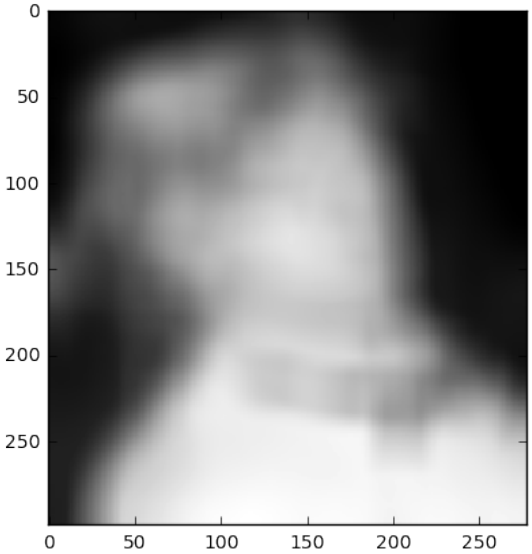
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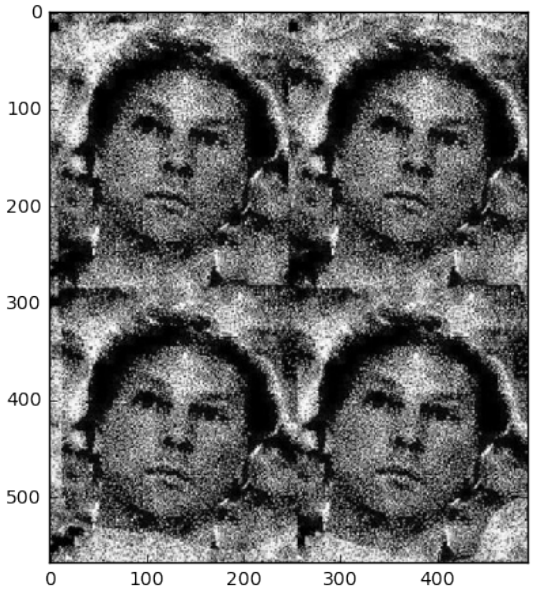

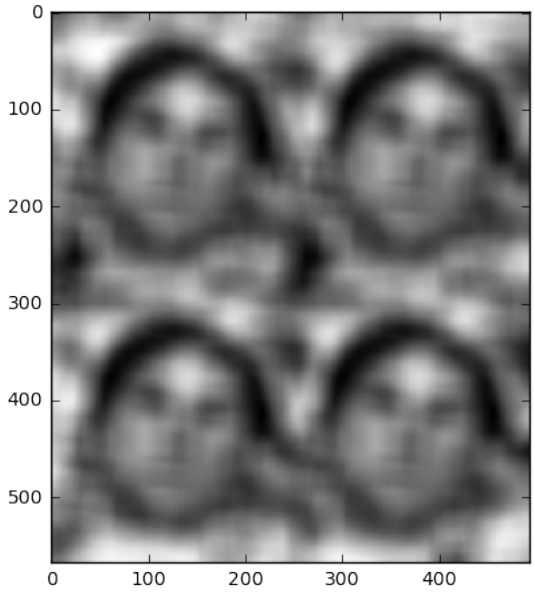

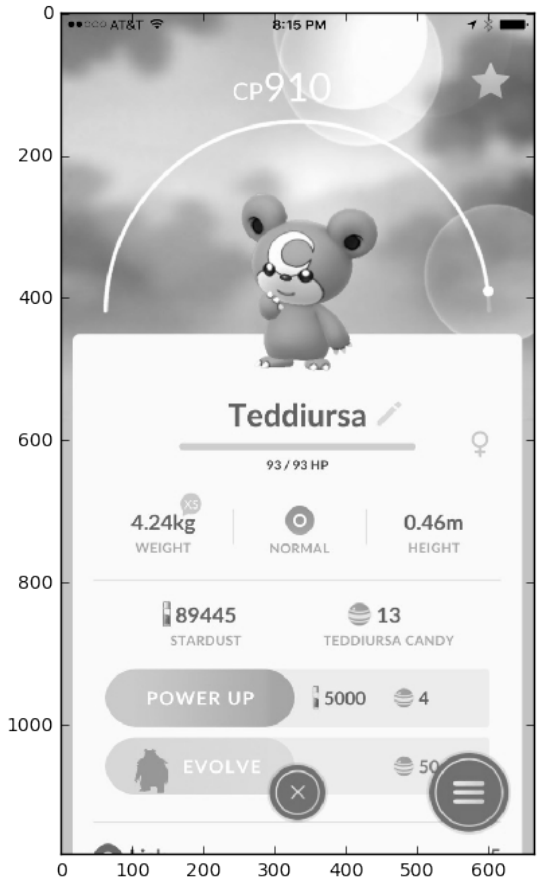
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8:15 PM
CP910
Teddiursa
93 / 93 HP
4.24kg
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NORMAL
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HEIGHT
89445
STARDUST
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TEDDIURSA CANDY
POWER UP
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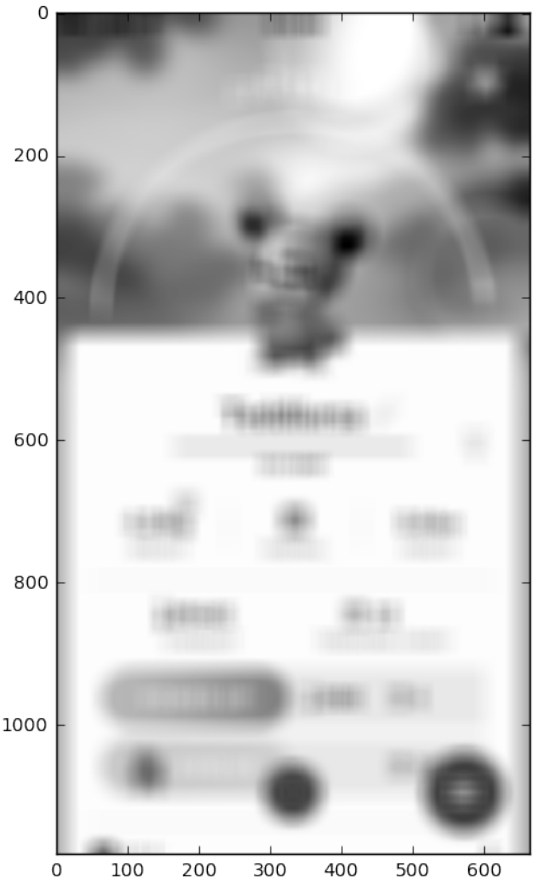

2 Python Tutorials

Python 101 Beginning Python http://www.rexx.com/~dkuhlman/python_101/python_101.html
The Official Python Tutorial - [http://www.python.org/doc/current/tut/tut.html](http://www.python.org/
The Python Quick Reference -http://rgruet.free.fr/PQR2.3.html
YouTube Python Tutorials
Google Python Class - http://www.youtube.com/watch?v=tKTZoB2Vjuk
Python Fundamentals Training – Classes http://www.youtube.com/watch?v=rKzZEtxIX14
Python 2.7 Tutorial Derek Banas - http://www.youtube.com/watch?v=UQi-L-_chcc
Python Programming Tutorial thenewboston - http://www.youtube.com/watch?v=4Mf0h3HphEA

3 Evaluation

Install Anaconda 4 for Python 2.7 and get this notebook to run with a set of your images.