Simple image blur by convolution with a Gaussian kernel

Blur an an image (./elephant.png) using a Gaussian kernel.

[(./formula)](./formula)

Convolution is easy to perform with FFT: convolving two signals boils down to multiplying their FFTs (and performing an inverse FFT).

c² ~/ pip install fftpack matplotlib

In [1]:

```
import numpy as np
from scipy import fftpack
import matplotlib.pyplot as plt
```

Original Image Input

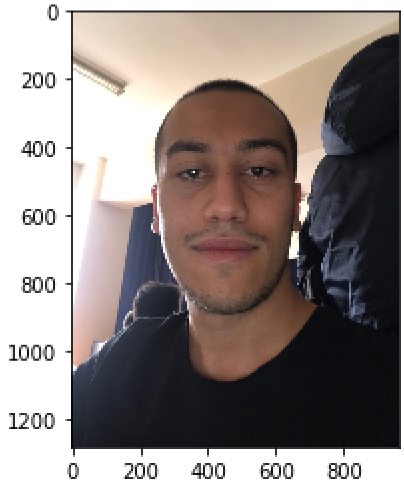
In [2]:

```
# read local image
img = plt.imread('/Users/cagataycali/Desktop/simple-image-convolution-fft/in.pn
g')

# Generate plot
plt.figure()

# Draw image on plot
plt.imshow(img)

# Show plot
plt.savefig('1.png')
```



Prepare an Gaussian convolution kernel

In [3]:

```
# First a 1-D  Gaussian
t = np.linspace(-10, 10, 30)
bump = np.exp(-0.1*t**2)
bump /= np.trapz(bump) # normalize the integral to 1
```

In [4]:

```
# make a 2-D kernel out of it
kernel = bump[:, np.newaxis] * bump[np.newaxis, :]
```

Implement convolution via FFT

In [5]:

```
# Padded fourier transform, with the same shape as the image
# We use :func:`scipy.signal.fftpack.fft2` to have a 2D FFT
kernel_ft = fftpack.fft2(kernel, shape=img.shape[:2], axes=(0, 1))
```

In [6]:

```
# convolve
img_ft = fftpack.fft2(img, axes=(0, 1))
```

In [7]:

```
# the 'newaxis' is to match to color direction
img2_ft = kernel_ft[:, :, np.newaxis] * img_ft
img2 = fftpack.ifft2(img2_ft, axes=(0, 1)).real
```

In [8]:

```
# clip values to range
img2 = np.clip(img2, 0, 1)
```

In [9]:

```
# plot output
plt.figure()
plt.imshow(img2)
plt.savefig('2.png')
```