Aligning face images

By Philipp Wagner | April 10, 2012

Some people have asked me how I've aligned the face images in my articles. Giving people my ImageMagick hack is embarrassing for me, so I've decided to rewrite it into a Python script. You don't need to copy and paste it, as the script comes with the source folder of my Guide on Face Recognition: crop_face.py.

The code is really easy to use. To scale, rotate and crop the face image you just need to call `CropFace(image, eye_left, eye_right, offset_pct, dest_sz)`, where:

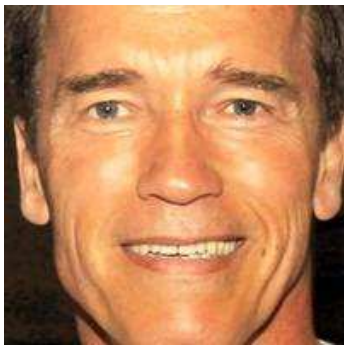
- `eye_left` is the position of the left eye
- `eye_right` is the position of the right eye
- `offset_pct` is the percent of the image you want to keep next to the eyes (horizontal, vertical direction)
- `dest_sz` is the size of the output image

If you are using the same `offset_pct` and `dest_sz` for your images, they are all aligned at the eyes.

example

Imagine we are given this photo of Arnold Schwarzenegger, which is under a Public Domain license. The `(x,y)`-position of the eyes are approximately `(252,364)` for the left and `(420,366)` for the right eye. Now you only need to define the horizontal offset, vertical offset and the size your scaled, rotated & cropped face should have. Here are some examples:

Configuration	Cropped, Scaled, Rotated Face
0.1 (10%), 0.1 (10%), (200,200)	

Configuration	Cropped, Scaled, Rotated Face
0.2 (20%), 0.2 (20%), (200,200)	
0.3 (30%), 0.3 (30%), (200,200)	
0.2 (20%), 0.2 (20%), (70,70)	

crop_face.py

```
#!/usr/bin/env python
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```

```
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# POSSIBILITY OF SUCH DAMAGE.

import sys, math, Image

def Distance(p1,p2):
  dx = p2[0] - p1[0]
  dy = p2[1] - p1[1]
  return math.sqrt(dx*dx+dy*dy)

def ScaleRotateTranslate(image, angle, center = None, new_center = None, scale = None, resample=Image
  if (scale is None) and (center is None):
    return image.rotate(angle=angle, resample=resample)
  nx,ny = x,y = center
  sx=sy=1.0
  if new_center:
    (nx,ny) = new_center
  if scale:
    (sx,sy) = (scale, scale)
  cosine = math.cos(angle)
  sine = math.sin(angle)
  a = cosine/sx
  b = sine/sx
  c = x-nx*a-ny*b
  d = -sine/sy
  e = cosine/sy
  f = y-nx*d-ny*e
  return image.transform(image.size, Image.AFFINE, (a,b,c,d,e,f), resample=resample)

def CropFace(image, eye_left=(0,0), eye_right=(0,0), offset_pct=(0.2,0.2), dest_sz = (70,70)):
  # calculate offsets in original image
  offset_h = math.floor(float(offset_pct[0])*dest_sz[0])
  offset_v = math.floor(float(offset_pct[1])*dest_sz[1])
  # get the direction
  eye_direction = (eye_right[0] - eye_left[0], eye_right[1] - eye_left[1])
  # calc rotation angle in radians
  rotation = -math.atan2(float(eye_direction[1]),float(eye_direction[0]))
  # distance between them
  dist = Distance(eye_left, eye_right)
  # calculate the reference eye-width
  reference = dest_sz[0] - 2.0*offset_h
  # scale factor
  scale = float(dist)/float(reference)
  # rotate original around the left eye
  image = ScaleRotateTranslate(image, center=eye_left, angle=rotation)
  # crop the rotated image
  crop_xy = (eye_left[0] - scale*offset_h, eye_left[1] - scale*offset_v)
  crop_size = (dest_sz[0]*scale, dest_sz[1]*scale)
  image = image.crop((int(crop_xy[0]), int(crop_xy[1]), int(crop_xy[0]+crop_size[0]), int(crop_xy[1]+
  # resize it
  image = image.resize(dest_sz, Image.ANTIALIAS)
  return image

if __name__ == "__main__":
  image =  Image.open("arnie.jpg")
  CropFace(image, eye_left=(252,364), eye_right=(420,366), offset_pct=(0.1,0.1), dest_sz=(200,200)).s
```

```
CropFace(image, eye_left=(252,364), eye_right=(420,366), offset_pct=(0.2,0.2), dest_sz=(200,200)).s
CropFace(image, eye_left=(252,364), eye_right=(420,366), offset_pct=(0.3,0.3), dest_sz=(200,200)).s
CropFace(image, eye_left=(252,364), eye_right=(420,366), offset_pct=(0.2,0.2)).save("arnie_20_20_70
```