Adding bloom and corona effects to image

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Basic steps

load image into python (preferable opencv imread)
transform image into Lab color scale :

```
Lab_img =cv2.cvtColor(img, cv2.COLOR_BGR2RGB)
```

Select intensity channel of transformed image :

```
L = Lab_img[:,:,0]
```

Select n brightest pixels with largest L value
Apply mask/filter/kernel as described in article to selected pixel
Cut of values of L larger than maximum range $L \rightarrow Min(L, 255)$

Mask construction

masks are essentially matrices We will use matrix-coordinate system indexed from middle of matrix The values of matrix are given by point spread function:

$$P(r,\phi) = \begin{cases} 1-\epsilon, & \text{if } r = 0 \\ \epsilon f(r,\phi), & \text{otherwise} \end{cases} \tag{1}$$

For bloom filter $f(r,\phi) = f_b(r,\phi)$:

$$f_b(r,\phi) = \frac{\epsilon}{(1+(\frac{r}{R})^2)^\beta} \tag{2}$$

Indexing

The relation between usual indices (i, j) in range $(0, 2n+1)$ and middle indexed indices (k, l) in range $(-n, n)$ is $k = i - n$, $l = i - n$

$$\begin{bmatrix} (0,0) & (0,1) & \cdots & (0,2n) \\ (1,0) & (1,1) & \cdots & (1,2n) \\ \vdots & \vdots & \ddots & \vdots \\ (2n,0) & (2n,1) & \cdots & (2n,2n) \end{bmatrix} \rightarrow \begin{bmatrix} (-n,-n) & (-n,n+1) & \cdots & (-n,n) \\ (-n+1,-n) & (-n+1,-n+1) & \cdots & (-n+1,n) \\ \vdots & \vdots & \ddots & \vdots \\ (n,-n) & (n,-n+1) & \cdots & (n,n) \end{bmatrix} \tag{3}$$

the new (k, l) indices can be transformed into polar indices as

$$r = \sqrt{k^2 + l^2} \tag{4}$$

$$\phi = \tan^{-1}(k/l) \tag{5}$$

(I encourage you to use np.arctan2(x,y))

Mask application

Main loop runs over brightest pixels at positions $x, y \in B$. Another loop runs around neighborhood of brightest pixels. New intensities can be calculated

$$I_{new}(x_{offset}, y_{offset}) += \sum_{\{x,y\} \in B} I_{x,y} * K(x - x_{new}, y - y_{new}) \quad (6)$$

Where initially $I_new = I$.

Thank you!