Opening

April 28, 2019

```python
In [ ]: import numpy as np
        import cv2
        def pad(img,shp):
                p=np.zeros((shp[0]+1,shp[1]+1))
                p[1:,1:]=np.copy(img)
                p[0,1:]=img[0]
                p[1:,0]=img[:,0]
                p[0,0]=img[0,0]
                p[-1,0]=img[-1,0]
                return p

        def comp_erosion(sample,metric):
                for i in range(2):
                        for j in range(2):
                                if sample[i,j]!=metric[i,j]:
                                        return False
                return True

        def comp_dilation(sample,metric):
                for i in range(2):
                        for j in range(2):
                                if sample[i,j]==metric[i,j]:
                                        return True
                return False

        def slice(img):
                temp=np.array(img)
                print(temp.shape)
                int_slice=np.zeros((temp.shape[0],temp.shape[1],8))
                for x in range(8):
                        int_slice[:,:,x]=temp%(2)
                        temp=(temp/2).astype(int)
                return int_slice

        def stitch(int_slice,shp):
                out=np.zeros(shp)
                for x in range(8):
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                out=out+int_slice[:,:,x]*(2**x)
        return out


    img=cv2.imread('morph1.jpg',0)
    shp=img.shape
    temp=pad(img,shp)
    int_slice=slice(temp)
    struct_el=np.array([[1,1],[1,1]])
    int_slice_new=np.zeros((shp[0],shp[1],8))
    for x in range(8):
            for i in range(shp[0]):
                    for j in range(shp[1]):
                            if comp_erosion(int_slice[i:i+2,j:j+2,x],struct_el):
                                    int_slice_new[i,j,x]=1


    int_slice=np.array(int_slice_new)
    int_slice_new=np.zeros((shp[0],shp[1],8))
    for x in range(8):
            test=pad(int_slice[:,:,x],shp)
            for i in range(shp[0]):
                    for j in range(shp[1]):
                            if comp_dilation(test[i:i+2,j:j+2],struct_el):
                                    int_slice_new[i,j,x]=1


    out=stitch(int_slice_new,shp)
    out=np.array(out, dtype = np.uint8)
    print(img)
    print(out)
    cv2.imshow('image', img)
    cv2.imshow('opened', out)
    cv2.waitKey(0)
    cv2.destroyAllWindows()

(451, 451)
[[0 0 0 ... 0 0 0]
 [0 0 0 ... 0 0 0]
 [0 0 0 ... 4 0 0]
 ...
 [2 0 2 ... 1 0 0]
 [0 0 0 ... 0 0 0]
 [0 0 0 ... 0 0 0]]
[[0 0 0 ... 0 0 0]
 [0 0 0 ... 0 0 0]
 [0 0 0 ... 0 0 0]
 ...
 [0 0 0 ... 0 0 0]
 [0 0 0 ... 0 0 0]
```

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 [0 0 0 ... 0 0 0]]
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In [ ]: