图像处理 hw8

Sunday, October 4, 2020 10:19

P1

Y代表亮度分量，Cb代表蓝色色度分量

Cr代表红色色度分量。

RGB:

R代表红色色度分量，G代表绿色色度分量，B代表蓝色色度分量

CYM:

C代表青色色度分量，Y代表黄色色度分量，M代表品红色度分量

HSV:

H代表色调，S代表饱和度，V代表强度/亮度

P2

$$\vec{u} = \frac{\partial R}{\partial x}\vec{r} + \frac{\partial G}{\partial x}\vec{g} + \frac{\partial B}{\partial x}\vec{b}$$

$$\vec{v} = \frac{\partial R}{\partial y}\vec{r} + \frac{\partial G}{\partial y}\vec{g} + \frac{\partial B}{\partial y}\vec{b}$$

$$g_{xx} = \vec{u}\cdot\vec{u} \quad g_{yy} = \vec{v}\cdot\vec{v} \quad g_{xy} = \vec{u}\vec{v}$$

$$\frac{\partial f}{\partial \theta} = \vec{u}\cos\theta + \vec{v}\sin\theta$$

$$H(\theta) = \|\vec{u}\cos\theta + \vec{v}\sin\theta\|_{l_2}^2 = (\vec{u}\cos\theta + \vec{v}\sin\theta)^2$$

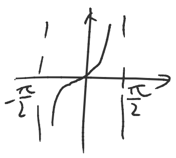
使H取极值的θ满足 $\frac{\partial H}{\partial \theta} = 0$

$$\Rightarrow \quad 2(\vec{u}\cos\theta + \vec{v}\sin\theta)(-\vec{u}\sin\theta + \vec{v}\cos\theta) = 0$$

$$-\vec{u}^2\sin\theta\cos\theta + \vec{v}^2\sin\theta\cos\theta - \vec{u}\vec{v}\sin^2\theta + \vec{u}\vec{v}\cos^2\theta = 0$$

$$\frac{1}{2}(\vec{v}^2 - \vec{u}^2)\sin 2\theta + \vec{u}\vec{v}\cos 2\theta = 0$$

$$\therefore \quad \frac{\sin 2\theta}{\cos 2\theta} = \frac{2\vec{u}\vec{v}}{\vec{u}^2 - \vec{v}^2}$$



$T = \pi$

$$\tan 2\theta = \frac{2\vec{u}\vec{v}}{\vec{u}^2 - \vec{v}^2} = \tan(2\theta + k\pi),\ k \in \mathbb{Z}.$$

$$\theta = \frac{1}{2}\tan^{-1}\frac{2\vec{u}\vec{v}}{\vec{u}^2 - \vec{v}^2} + k\frac{\pi}{2}$$

$$= \frac{1}{2}\tan^{-1}\frac{2g_{xy}}{g_{xx} - g_{yy}} + k\frac{\pi}{2},\ k \in \mathbb{Z}$$

$$\therefore \quad H(\theta) = (\vec{u}c\theta + \vec{v}s\theta)^2$$

$$= \frac{1}{2}(2\vec{u}^2c^2\theta + 2\vec{v}^2s^2\theta + 4\vec{u}\vec{v}\cos\theta)$$

$$= \frac{1}{2}(\vec{u}^2c^2\theta + \vec{v}^2s^2\theta + \vec{u}^2s^2\theta + \vec{v}^2c^2\theta + (-\vec{u}^2s^2\theta - \vec{v}^2c^2\theta + \vec{u}^2c^2\theta + \vec{v}^2s^2\theta) + 2\vec{u}\vec{v}s2\theta)$$

$$= \frac{1}{2}\left(\vec{u}^2 c^2\theta + \vec{v}^2 s^2\theta + \vec{u}^2 s^2\theta + \vec{v}^2 c^2\theta + (-\vec{u}^2 s^2\theta - \vec{v}^2 c^2\theta + \vec{u}^2 c^2\theta + \vec{v}^2 s^2\theta) + 2\vec{u}\vec{v}\, s2\theta \right)$$

$$= \frac{1}{2}\left((\vec{u}^2+\vec{v}^2)(c^2\theta + s^2\theta) + (\vec{u}^2-\vec{v}^2)(c^2\theta - s^2\theta) + 2\vec{u}\vec{v}\, s2\theta \right)$$

$$= \frac{1}{2}\left((\vec{u}^2+\vec{v}^2) + (\vec{u}^2-\vec{v}^2)\, c2\theta + 2\vec{u}\vec{v}\, s2\theta \right)$$

$$= \frac{1}{2}\left((g_{xx} + g_{yy}) + (g_{xx} - g_{yy})\, c2\theta + 2 g_{xy}\, s2\theta \right)$$

$$\therefore F_\theta(x,y) = \sqrt{H(\theta)} = \left[\frac{1}{2}\left(g_{xx} + g_{yy} + (g_{xx} - g_{yy})\, c2\theta + 2 g_{xy}\, s2\theta \right) \right]^{\frac{1}{2}}$$

P3：取得人物面部皮肤之后作为样本，计算图像与该样本之间的欧氏距离和马氏距离，筛选出距离小于一定值的部分，则可以得人物的皮肤部分提取出来，其效果如下所示。