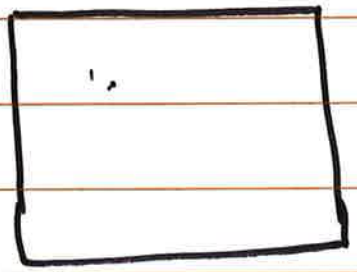
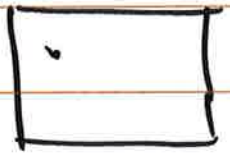
Assignment

→ No library scaling function



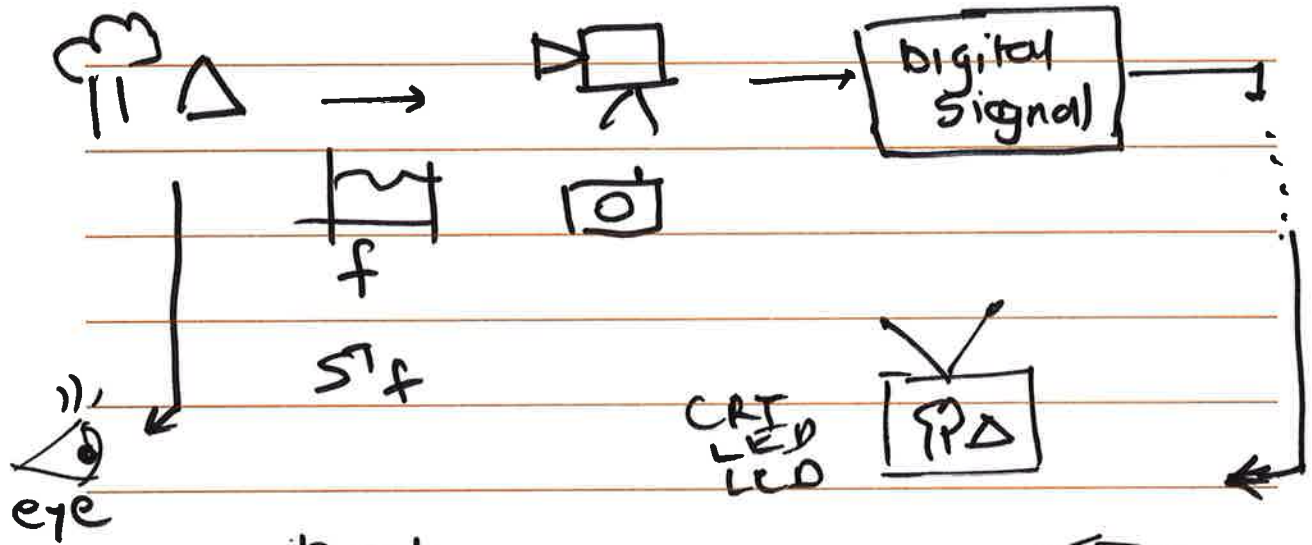
I

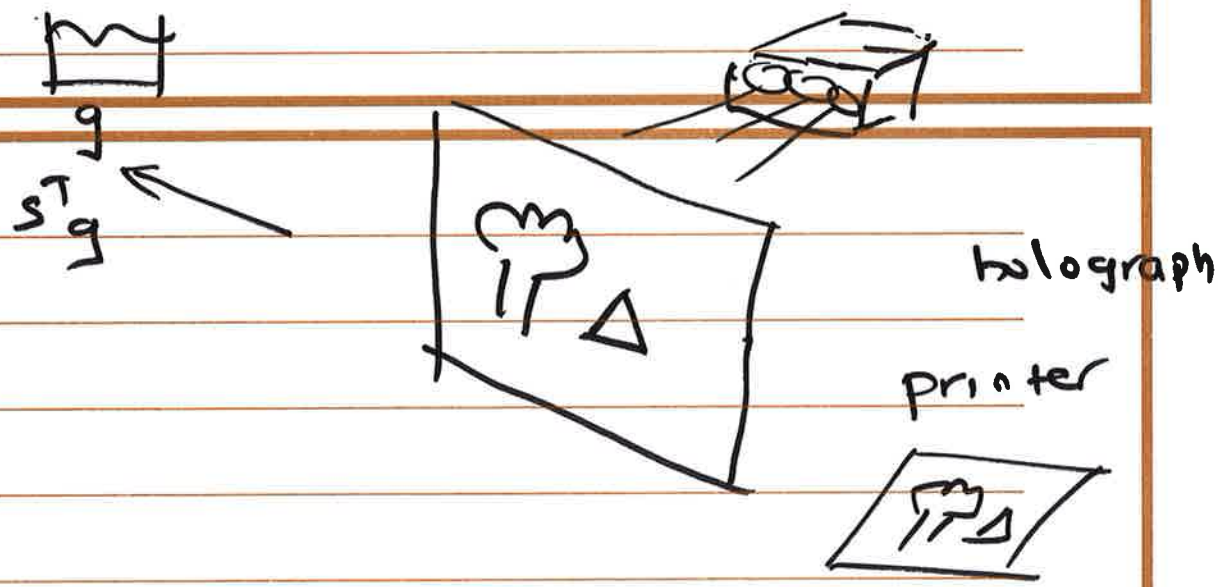


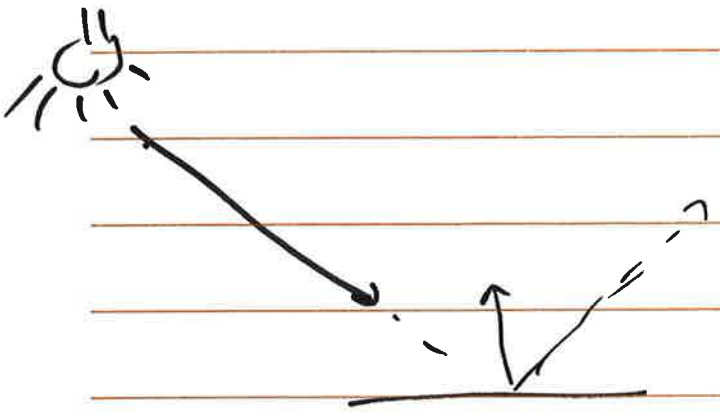
O

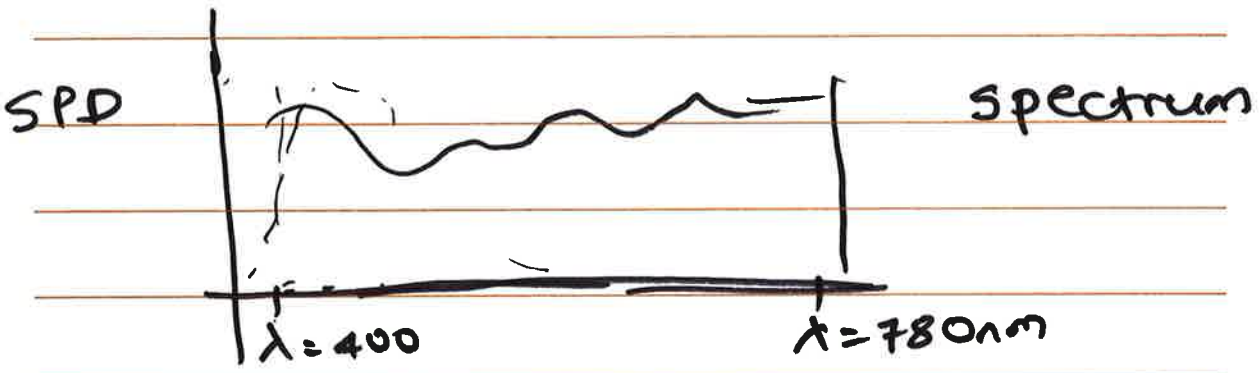
please implement your own scaling function

Color Theory



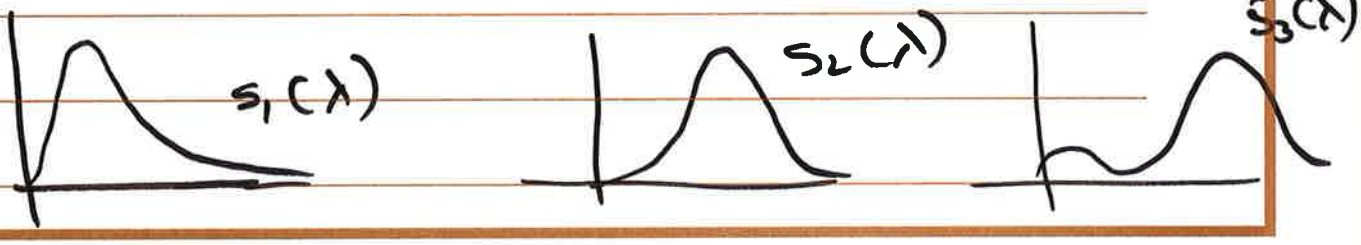






c_1 c_2 c_3 cones

s_1 s_2 s_3



$$c_1 = \int_{\lambda=400}^{780} s_1(\lambda) f(\lambda)\, d\lambda$$

$$c_2 = \int_{\lambda} s_2(\lambda) f(\lambda)\, d\lambda$$

$$c_3 = \int_{\lambda} s_3(\lambda) f(\lambda)\, d\lambda$$

$$f = \begin{bmatrix} f(\lambda_1) \\ f(\lambda_2) \\ \vdots \\ f(\lambda_n) \end{bmatrix} \qquad S = \begin{bmatrix} s_1(\lambda_1) & s_2(\lambda_1) & s_3(\lambda_1) \\ s_1(\lambda_2) & s_2(\lambda_2) & s_3(\lambda_2) \\ \vdots & \vdots & \vdots \\ s_1(\lambda_n) & s_2(\lambda_n) & s_3(\lambda_n) \end{bmatrix} \quad \begin{matrix} s_1 & s_2 & s_3 \end{matrix}$$

$$S^T f = \begin{bmatrix} s_1(\lambda_1) & s_1(\lambda_2) & \cdots & s_1(\lambda_n) \\ s_2(\lambda_1) & s_2(\lambda_2) & \cdots & s_2(\lambda_n) \\ s_3(\lambda_1) & s_3(\lambda_2) & \cdots & s_3(\lambda_n) \end{bmatrix} \begin{bmatrix} f(\lambda_1) \\ f(\lambda_2) \\ \vdots \\ f(\lambda_n) \end{bmatrix}$$

$$= \begin{bmatrix} \sum_{i=1}^{n} s_1(\lambda_i) f(\lambda_i) \\ \sum s_2(\lambda_i) f(\lambda_i) \\ \sum s_3(\lambda_i) f(\lambda_i) \end{bmatrix}$$

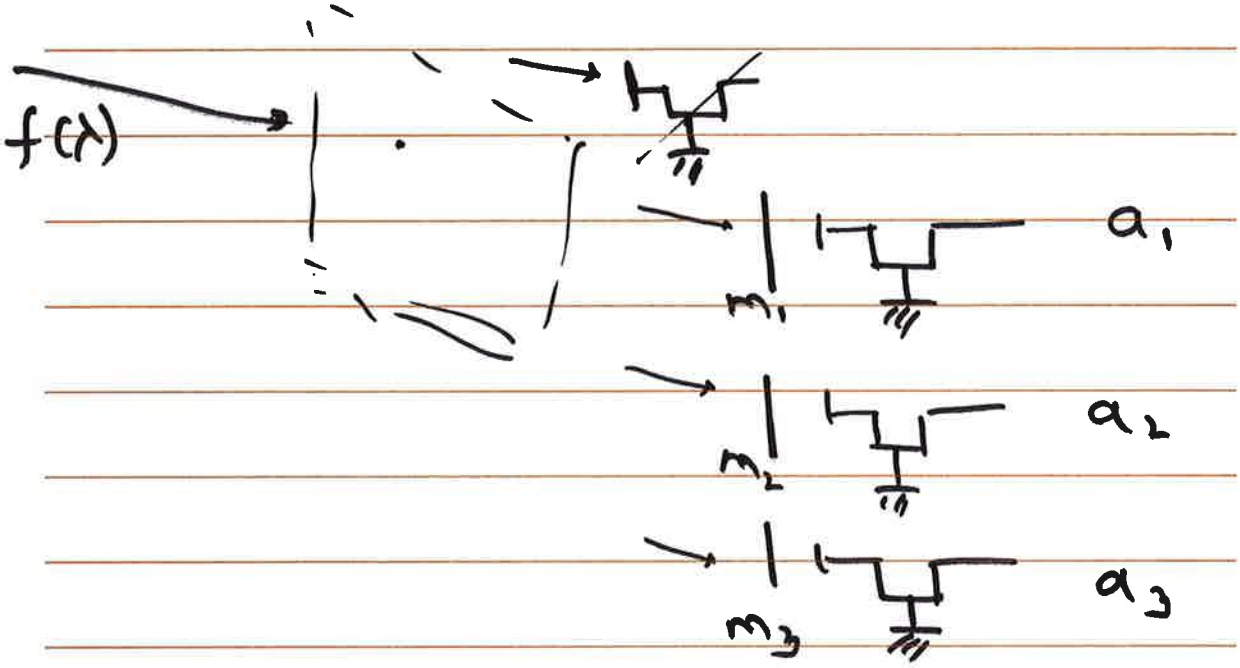
$$= \begin{bmatrix} c_1 \\ c_2 \\ c_3 \end{bmatrix}$$

$$c_i = s_i(\lambda_1) f(\lambda_1) + s_i(\lambda_2) f(\lambda_2) \cdots$$

$$f = [10 \; 20]^T \qquad s_i = [4 \; 0]$$

$$= [2 \; 1]$$

camera



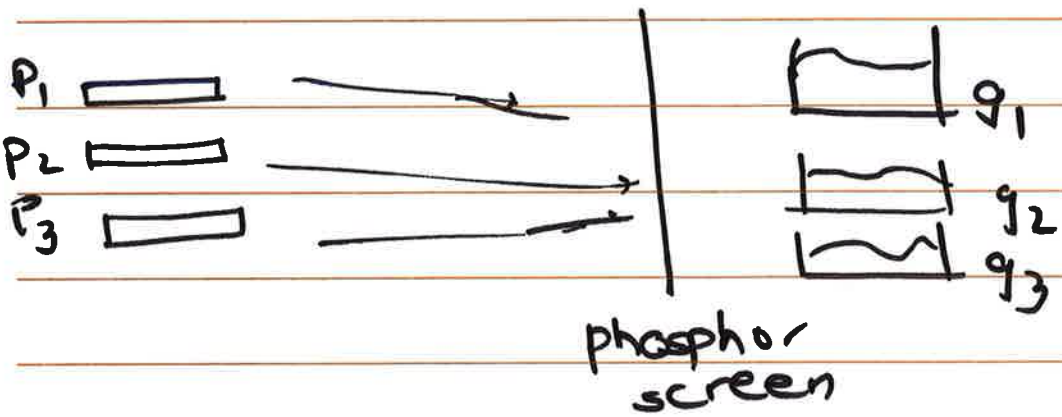
$$a_1 = \int m_1(\lambda) f(\lambda)\, d\lambda$$

$$M^T f = \begin{bmatrix} m_1(\lambda_1) & m_1(\lambda_2) & \cdots & m_1(\lambda_n) \\ m_2(\lambda_1) & m_2(\lambda_2) & \cdots & m_2(\lambda_n) \\ m_3(\lambda_1) & m_3(\lambda_2) & \cdots & m_3(\lambda_n) \end{bmatrix} \begin{bmatrix} f(\lambda_1) \\ f(\lambda_2) \\ \vdots \\ f(\lambda_n) \end{bmatrix}$$

$$= \begin{bmatrix} \sum m_1(\lambda) f(\lambda) \\ \sum m_2(\lambda) f(\lambda) \\ \sum m_3(\lambda) f(\lambda) \end{bmatrix}$$

$$= \begin{bmatrix} a_1 \\ a_2 \\ a_3 \end{bmatrix}$$

display



$p_1 v_1$

$p_2 v_2$

$p_3 v_3$

$$q = q_1 + q_2 + q_3$$
$$= p_1 v_1 + p_2 v_2 + p_3 v_3$$

put $v_i = a_i$

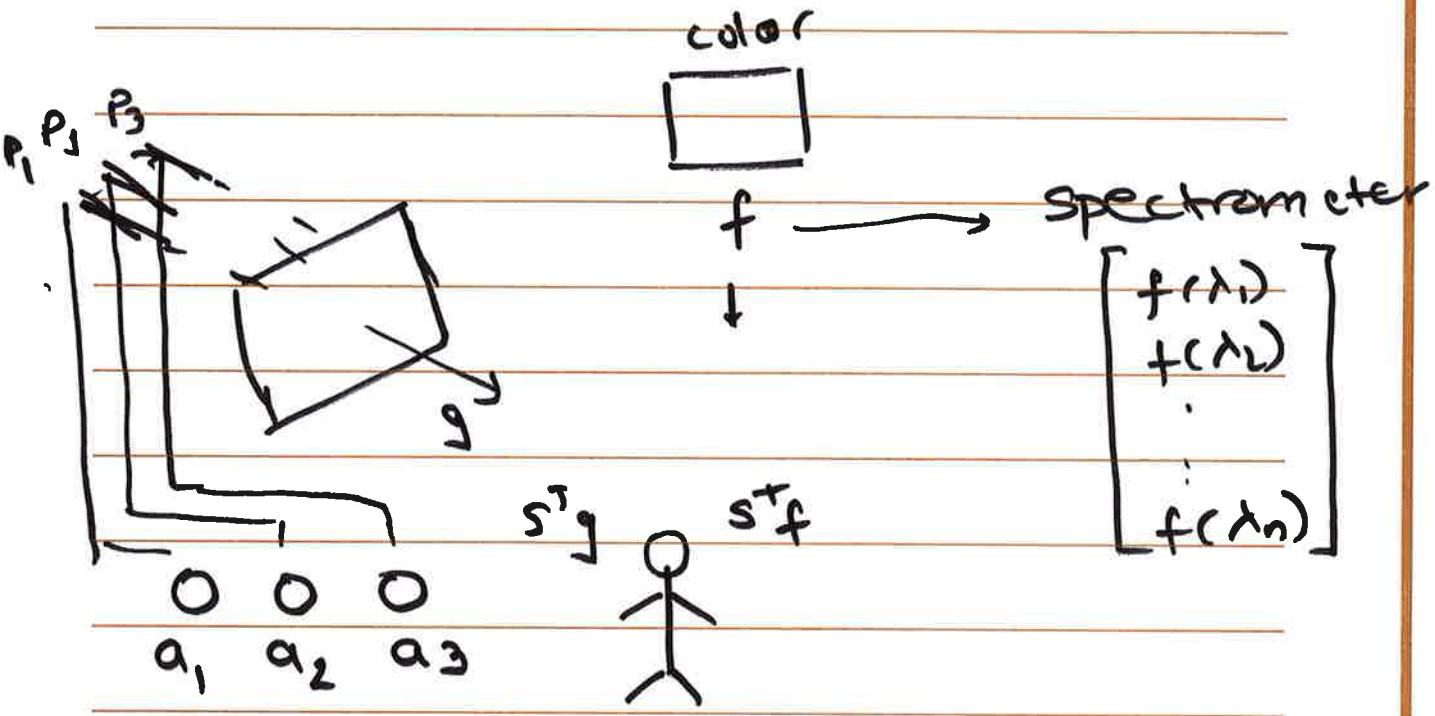
$$q = p_1 a_1 + p_2 a_2 + p_3 a_3$$
$$= Pa$$

$$s^T f = s^T q = s^T P a$$

$$s^T f = s^T P a$$

$$a = \left[s^T P \right]^{-1} s^T f$$

CMF



$$\begin{bmatrix} a_1 \\ a_2 \\ a_3 \end{bmatrix} = \begin{bmatrix} m_1(\lambda_1) & m_1(\lambda_2) & \cdots & m_1(\lambda_n) \\ m_2(\lambda_1) & m_2(\lambda_2) & \cdots & m_2(\lambda_n) \\ m_3(\lambda_1) & m_3(\lambda_2) & \cdots & m_3(\lambda_n) \end{bmatrix} \begin{bmatrix} f(\lambda_1) \\ f(\lambda_2) \\ \vdots \\ f(\lambda_n) \end{bmatrix}$$

3D space: XYZ RGB

xy chromaticity space

$$x = \frac{X}{X+Y+Z}$$

$$y = \frac{Y}{X+Y+Z}$$

$$z = 1 - x - y$$