Color transfer between images
Μεταφορά χρώματος μεταξύ εικόνων

Ένα ερώτημα

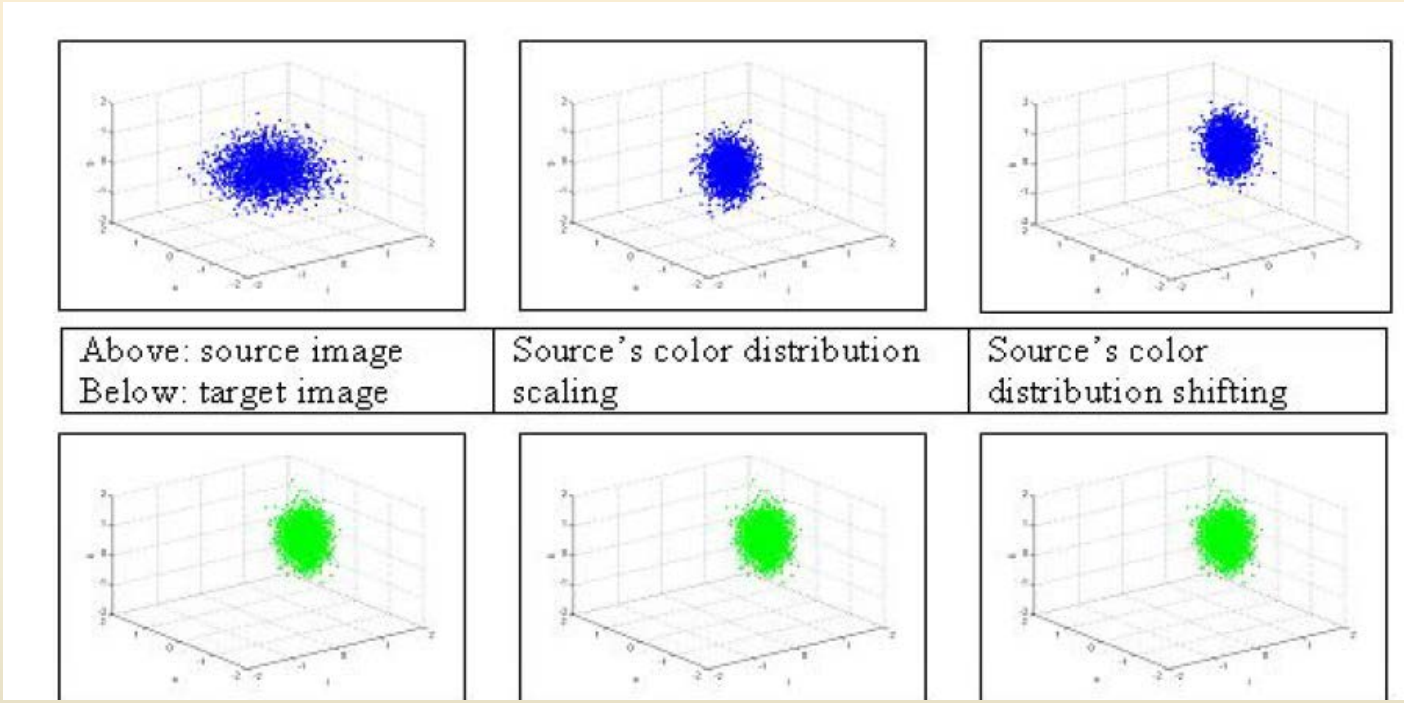
source

target

Τελική εικόνα

Linear color transfer: scale and shift

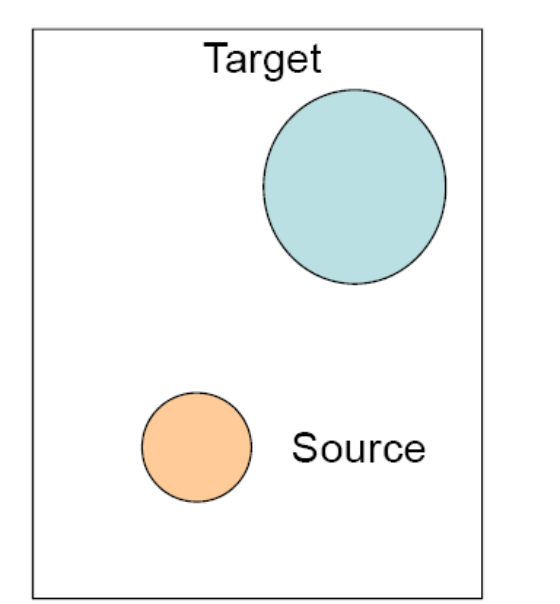
Scale and shift of the color distributions using *mean* and *std*.



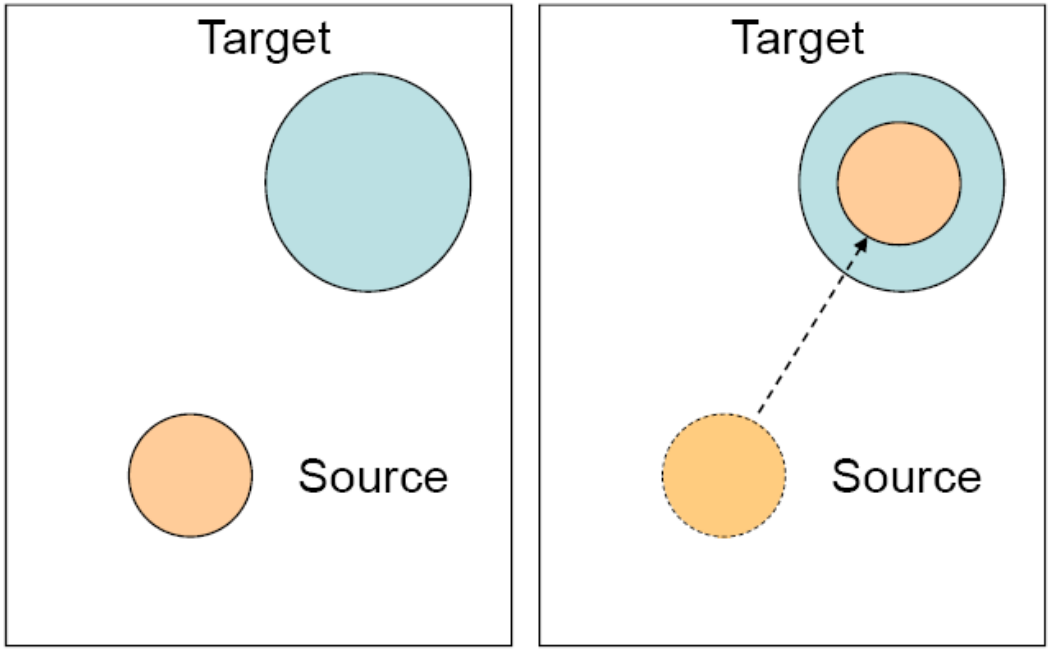
Above: source image Below: target image	Source's color distribution scaling	Source's color distribution shifting

$$C' = \frac{\sigma_t}{\sigma_s}(C_s - \mu_s) + \mu_t$$

Linear transform

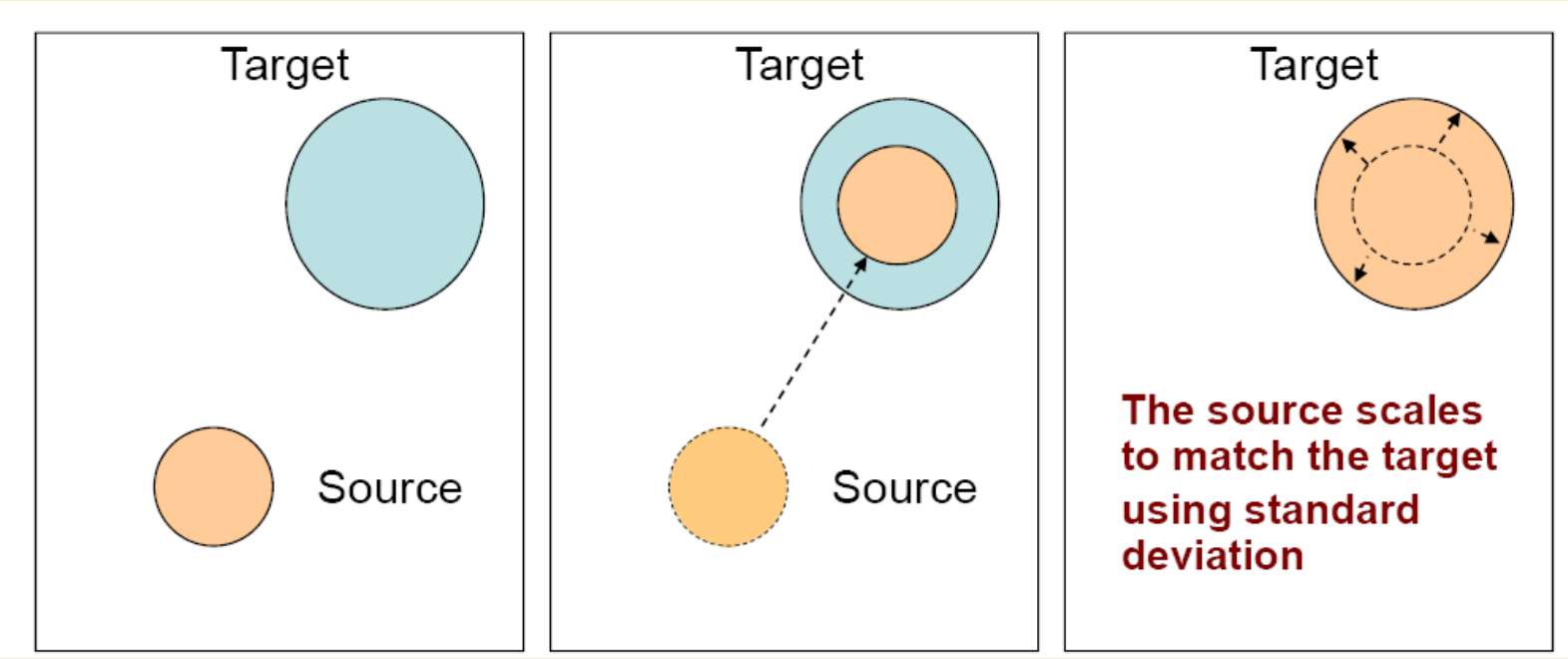


Simplified illustration of linear color transfer in 2D



The source shifts to the target using means

Simplified illustration of linear color transfer in 2D



Simplified illustration of linear color transfer in 2D

Color Transfer Implementation

$$C' = \frac{\sigma_t}{\sigma_s}(C_s - \mu_s) + \mu_t$$

Where C' = new color

C_s = old color

σ_t = SD of target image

σ_s = SD of source image

μ_t = mean of target image

μ_s = mean of source image

Simple Implementation

- Color transfer in RGB color space : Perform color transfer directly without any transformatio to other color models by using equation shown in slide no. 10

1. Read image into 3-dim. array (by using *loadimage(…)*)
2. For each layer of R, G, B perform the following:

For each pixel p(i,j), compute a new value as :

$$C' = \frac{\sigma_t}{\sigma_s}(C_s - \mu_s) + \mu_t$$

Color transfer in other Color spac Models

- Before transferring of colors, image may be transformed to other color models for better quality of transferring
- Color model of $l\alpha\beta$ is suggested by *Reinhard et al., 2001*

RGB to $l\alpha\beta$ Transformation

1. RGB to *LMS*

$$\begin{pmatrix} L \\ M \\ S \end{pmatrix} = \begin{pmatrix} 0.3811 & 0.5783 & 0.0402 \\ 0.1967 & 0.7244 & 0.0782 \\ 0.0241 & 0.1288 & 0.8444 \end{pmatrix} \begin{pmatrix} R \\ G \\ B \end{pmatrix}$$

2. Linear to logarithmic space

$$L = \log(L)$$
$$M = \log(M)$$
$$S = \log(S)$$

3. LMS to $l\alpha\beta$

$$\begin{pmatrix} l \\ \alpha \\ \beta \end{pmatrix} = \begin{pmatrix} 1/\mathrm{sqrt}(3) & 0 & 0 \\ 0 & 1/\mathrm{sqrt}(6) & 0 \\ 0 & 0 & 1/\mathrm{sqrt}(2) \end{pmatrix} \begin{pmatrix} 1 & 1 & 1 \\ 1 & 1 & -2 \\ 1 & -1 & 0 \end{pmatrix} \begin{pmatrix} L \\ M \\ S \end{pmatrix}$$

- Perform color transfer in $l\alpha\beta$ color model as described previously
- After finishing color transfer, transform color model back to RGB for displaying

$I\alpha\beta$ to RGB Transformation

1. $I\alpha\beta$ to LMS

$$\begin{pmatrix} L \\ M \\ S \end{pmatrix} = \begin{pmatrix} 1 & 1 & 1 \\ 1 & 1 & -1 \\ 1 & -2 & 0 \end{pmatrix} \begin{pmatrix} \text{sqrt}(3)/3 & 0 & 0 \\ 0 & \text{sqrt}(6)/6 & 0 \\ 0 & 0 & \text{sqrt}(2)/2 \end{pmatrix} \begin{pmatrix} I \\ \alpha \\ \beta \end{pmatrix}$$

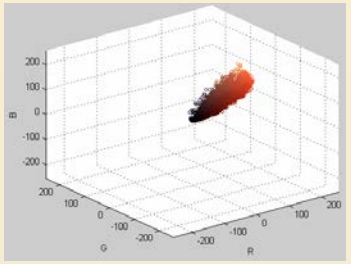
2. Logarithmic to linear space

$$L = 10^{L}$$
$$M = 10^{M}$$
$$S = 10^{S}$$

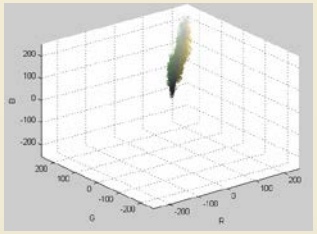
3. *LMS* to RGB

$$\begin{pmatrix} R \\ G \\ B \end{pmatrix} = \begin{pmatrix} 4.4679 & -3.5873 & 0.1193 \\ -1.2186 & 2.3809 & -0.1624 \\ 0.0497 & -0.2439 & 1.2045 \end{pmatrix} \begin{pmatrix} L \\ M \\ S \end{pmatrix}$$

RGB~lab



RGB



lab