
Subject: Add new color Standard conversions RGB <-> Cie XYZ <-> Cie L*a*b*

Posted by [tojocky](#) on Tue, 03 May 2011 13:53:34 GMT

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Hello All (especialy Mirek),

According by addresses:

- http://en.wikipedia.org/wiki/Lab_color_space#cite_note-12
- <http://www.easyrgb.com/index.php?X=MATH&H=01#text1>
- and others source-code projects

I propose to add the following functions in Core/Color.h/cpp:

```
void RGBtoXYZ(double r, double g, double b, double& x, double& y, double& z){
```

```
    r /= 255;
```

```
    g /= 255;
```

```
    b /= 255;
```

```
    double delta = 0.04045;//?
```

```
    if (r > delta)
```

```
        r = pow(((r + 0.055) / 1.055), 2.4);
```

```
    else r /= 12.92;
```

```
    if (g > delta)
```

```
        g = pow(((g + 0.055) / 1.055), 2.4);
```

```
    else g /= 12.92;
```

```
    if (b > delta)
```

```
        b = pow(((b + 0.055) / 1.055), 2.4);
```

```
    else b /= 12.92;
```

```
    x = r * 41.24 + g * 35.76 + b * 18.05;
```

```
    y = r * 21.26 + g * 71.52 + b * 7.22;
```

```
    z = r * 1.93 + g * 11.92 + b * 95.05;
```

```
}
```

```
void XYZtoRGB(double x, double y, double z, int &r, int &g, int &b){
```

```
    double dr,dg,db;
```

```
    dr = 0.032406 * x - 0.015372 * y - 0.0049865 * z;
```

```
    dg = -0.0096891 * x + 0.018758 * y + 0.00041514 * z;
```

```
    db = 0.00055708 * x - 0.0020401 * y + 0.01057 * z;
```

```
    if(dr > 0.0031308)
```

```
        dr = exp(log(dr) / 2.4) * 1.055 - 0.055;
```

```
    else dr = dr*12.92;
```

```
    if(dg > 0.0031308)
```

```
        dg = exp(log(dg) / 2.4) * 1.055 - 0.055;
```

```
    else dg = dg*12.92;
```

```

if(db > 0.0031308)
    db = exp(log(db) / 2.4) * 1.055 - 0.055;
else db = db*12.92;

```

```

dr *= 255;
dg *= 255;
db *= 255;

```

```

dr = minmax<double>(0.0,dr, 255.0);
dg = minmax<double>(0.0,dg, 255.0);
db = minmax<double>(0.0,db, 255.0);

```

```

r = int(dr + 0.5); //?0.5
g = int(dg + 0.5); //?0.5
b = int(db + 0.5); //?0.5
}

```

```

void XYZtoCEILab(double x, double y, double z, double& l, double& a, double& b){

```

```

    y /= 100.000;      //ref_Y = 100.000
    z /= 108.883;      //ref_Z = 108.883
    double delta = 0.008856; //pow(6/29,3);
    double delta2 = 7.787; //pow(29/6, 2)/3;

```

```

    if (x > delta)
        x = pow(x, 1/3);
    else x = (delta2 * x) + (4 / 29);

```

```

    if (y > delta)
        y = pow(y, 1/3);
    else y = (delta2 * y) + (4 / 29);

```

```

    if (z > delta)
        z = pow(z, 1/3);
    else z = (delta2 * z) + (4 / 29);

```

```

    l = (116 * y) - 16;
    a = 500 * (x - y);
    b = 200 * (y - z);
}

```

```

void CEILabtoXYZ(double l, double a, double b, double& x, double& y, double& z){
    y = (l + 16) / 116;
    x = y + a / 500;
    z = y - b / 200;

```

```

    double delta = 0.20689655; //6/29;

```

```
double delta2 = 7.787; //pow(29/6, 2)/3;
```

```
if (x > delta)
    x = pow(x, 3);
else x = ((delta2 * x) - (4 / 29)) / delta2;
```

```
if (y > delta)
    y = pow(y, 3);
else y = ((delta2 * y) - (4 / 29)) / delta2;
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if (z > delta)
    z = pow(z, 3);
else z = ((delta2 * z) - (4 / 29)) / delta2;
}
```

```
void RGBtoCEILab(double r, double g, double b, double& l, double& a, double& lb){
    double x,y,z;
    RGBtoXYZ(r,g,b,x,y,z);
    XYZtoCEILab(x,y,z,l,a,lb);
}
```

```
void CEILabtoRGB(double l, double a, double lb, double& r, double& g, double& b){
    double x,y,z;
    CEILabtoXYZ(l,a,lb,x,y,z);
    RGBtoXYZ(x,y,z,r,g,b);
}
```

This functions I will use in histogram equalization of image according by:
http://en.wikipedia.org/wiki/Histogram_equalisation

HSV/HSL is not so exact as CIE $L^*a^*b^*$

Any comment are welcome!

Subject: Re: Add new color Standard conversions RGB <-> Cie XYZ <-> Cie $L^*a^*b^*$
Posted by [mirek](#) on Tue, 07 Jun 2011 18:57:23 GMT
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tojocky wrote on Tue, 03 May 2011 09:53Hello All (especialy Mirek),

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    db = 0.00055708 * x - 0.0020401 * y + 0.01057 * z;

    if(dr > 0.0031308)
        dr = exp(log(dr) / 2.4) * 1.055 - 0.055;
    else dr = dr*12.92;

    if(dg > 0.0031308)
        dg = exp(log(dg) / 2.4) * 1.055 - 0.055;
    else dg = dg*12.92;

    if(db > 0.0031308)
        db = exp(log(db) / 2.4) * 1.055 - 0.055;
    else db = db*12.92;

    dr *= 255;
    dg *= 255;
    db *= 255;

    dr = minmax<double>(0.0,dr, 255.0);
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    else y = ((delta2 * y) - (4 / 29)) / delta2;

```

```

    if (z > delta)
        z = pow(z, 3);

```

```
else z = ((delta2 * z) - (4 / 29)) / delta2;  
}
```

```
void RGBtoCEILab(double r, double g, double b, double& l, double& a, double& lb){  
    double x,y,z;  
    RGBtoXYZ(r,g,b,x,y,z);  
    XYZtoCEILab(x,y,z,l,a,lb);  
}
```

```
void CEILabtoRGB(double l, double a, double lb, double& r, double& g, double& b){  
    double x,y,z;  
    CEILabtoXYZ(l,a,lb,x,y,z);  
    RGBtoXYZ(x,y,z,r,g,b);  
}
```

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Any comment are welcome!

This is fine code, but I am afraid too specialised for Core (I guess Core is sort of overloaded now).

What about bazaar or plugin or maybe Geom? Or perhaps Painter?

Maybe we should start a new "high level" raster graphics package? I think the equalization code would fit nicely there.

Subject: Re: Add new color Standard conversions RGB <-> Cie XYZ <-> Cie L*a*b*
Posted by [tojocky](#) on Tue, 07 Jun 2011 21:03:59 GMT
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mirek wrote on Tue, 07 June 2011 21:57

This is fine code, but I am afraid too specialised for Core (I guess Core is sort of overloaded now).

What about bazaar or plugin or maybe Geom? Or perhaps Painter?

Maybe we should start a new "high level" raster graphics package? I think the equalization code would fit nicely there.

This code is not quite correct. I have the latest tested version. I used this code to autolevel color images (converted into CIE L*a*b*). HSV autolevel of color images loses some color (this problem persists in Photoshop too).

Ok, I can prepare a package and uploat into bazaar. But I think it is a better idea to include it in Painter.
