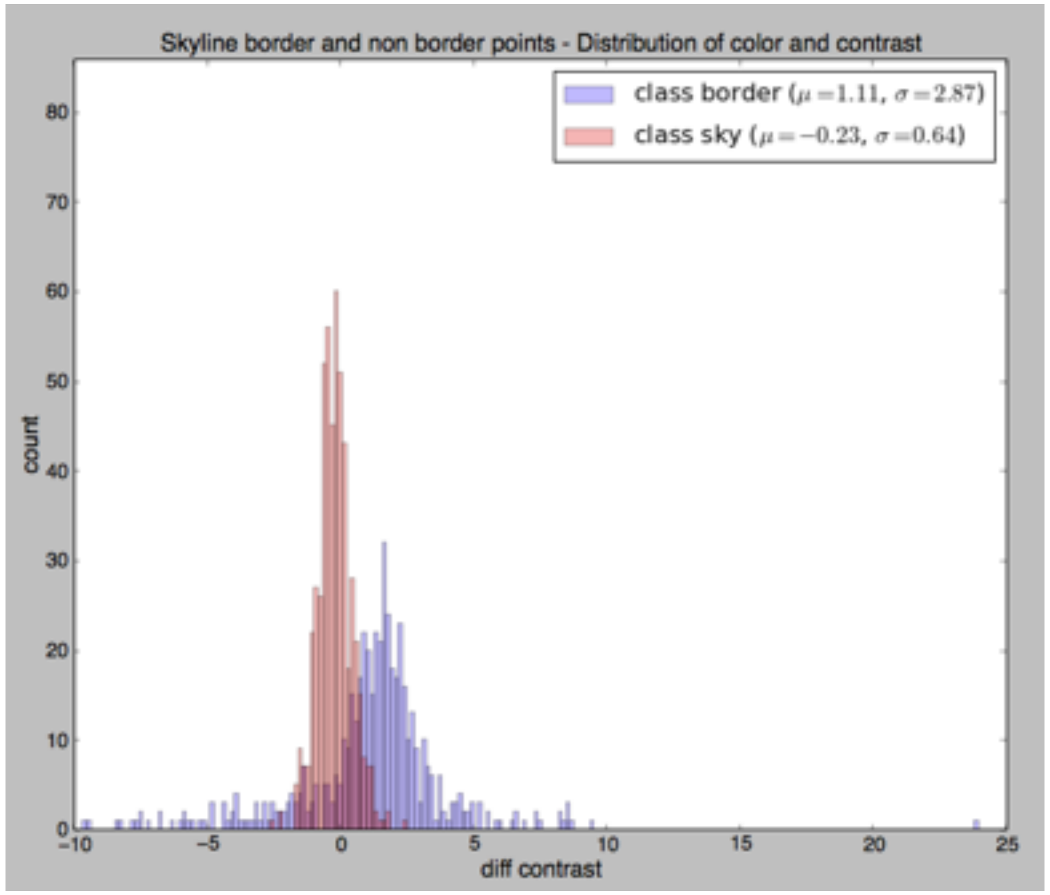
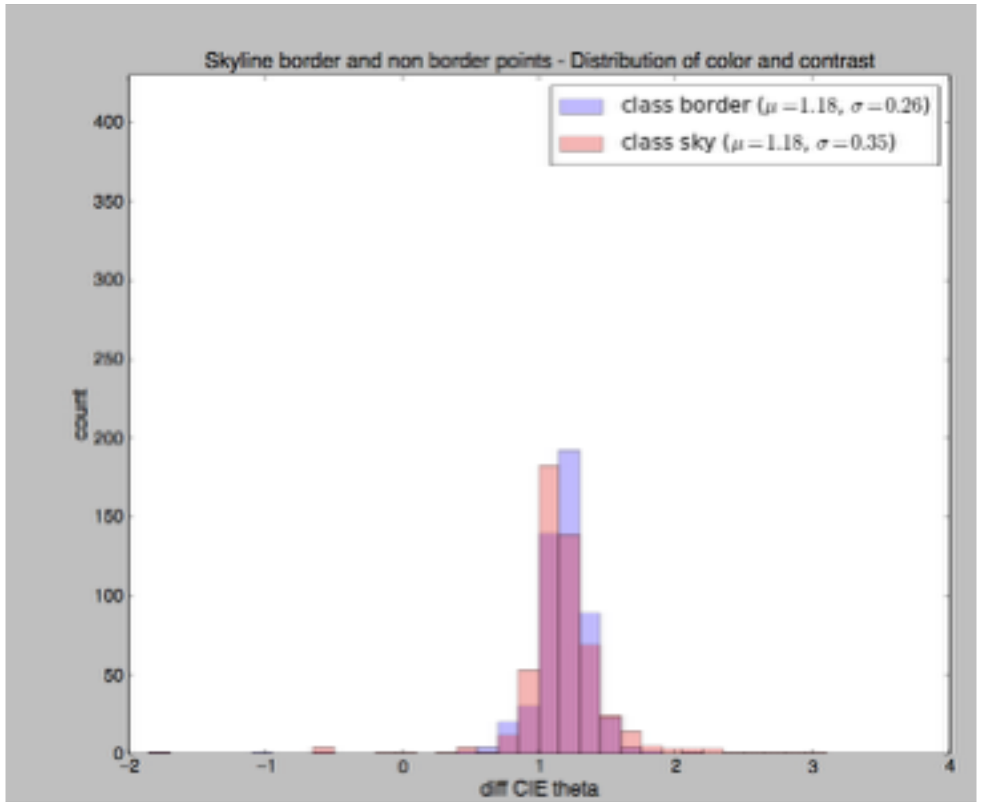
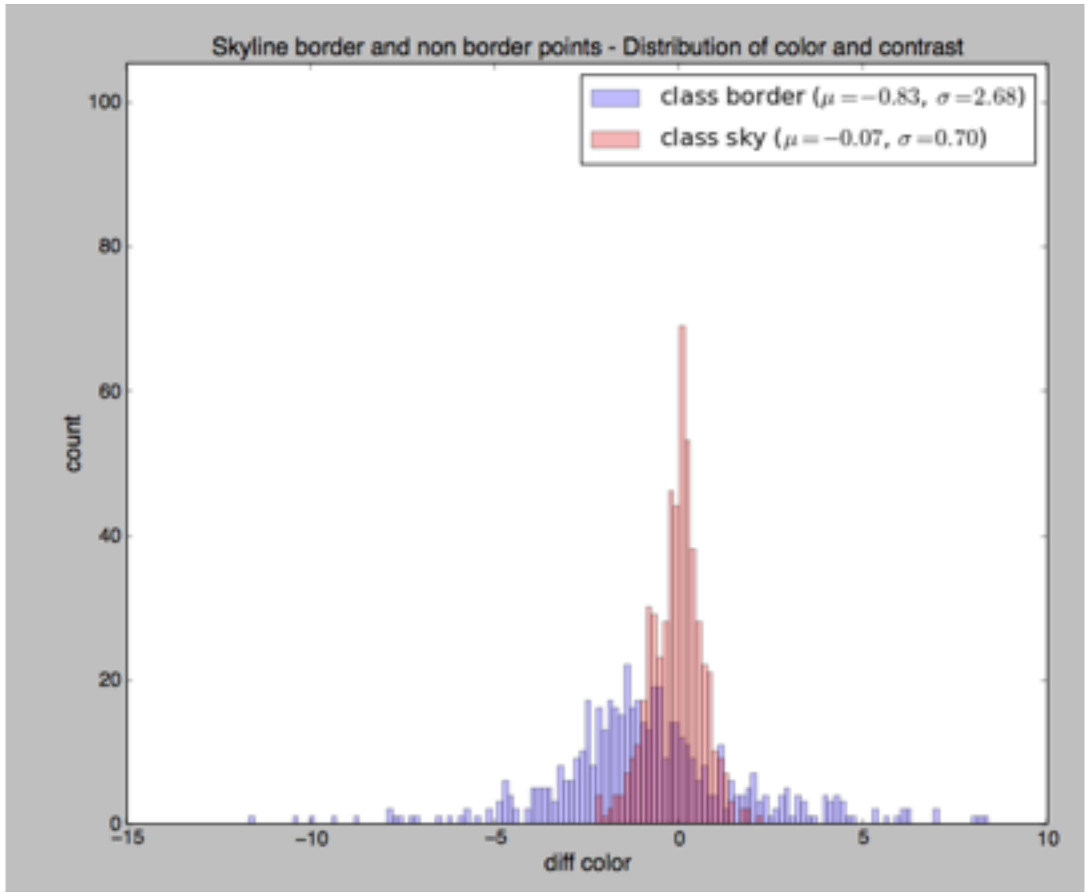
LDA look at difference in contrast, hue, blue or red, and CIE theta, all divided by their respective standard deviations.

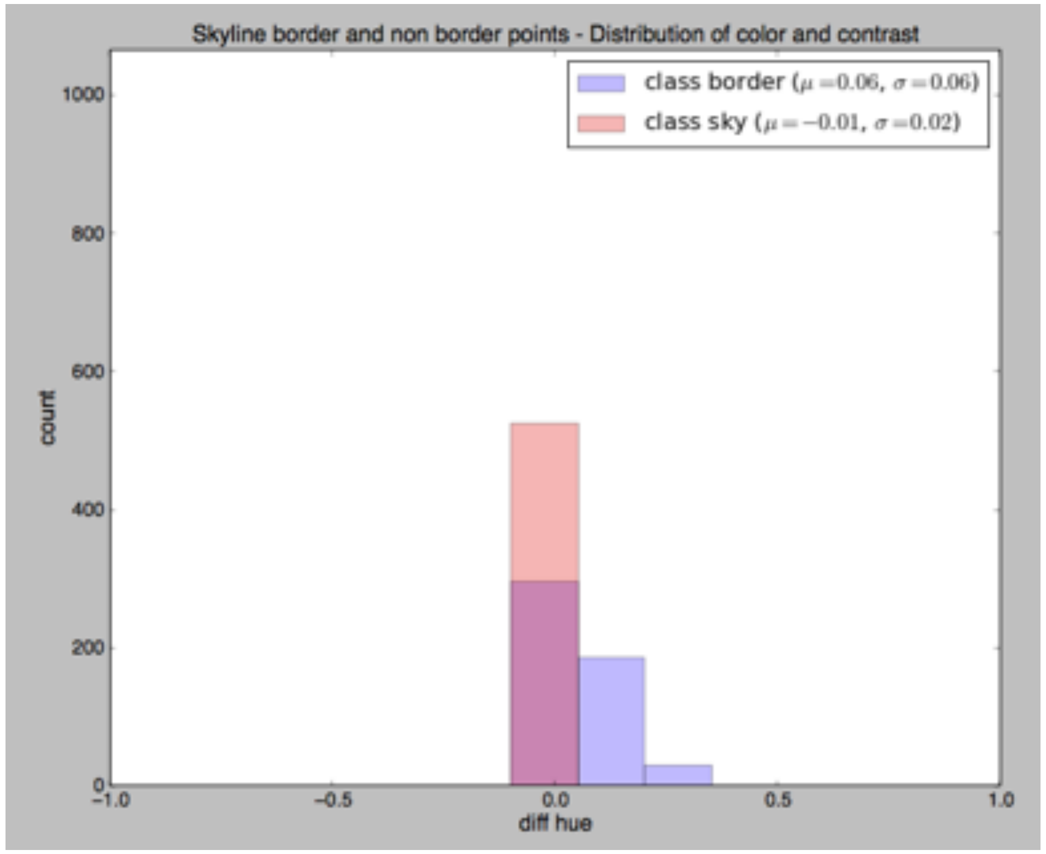
Brown & Lowe 2003, image 1



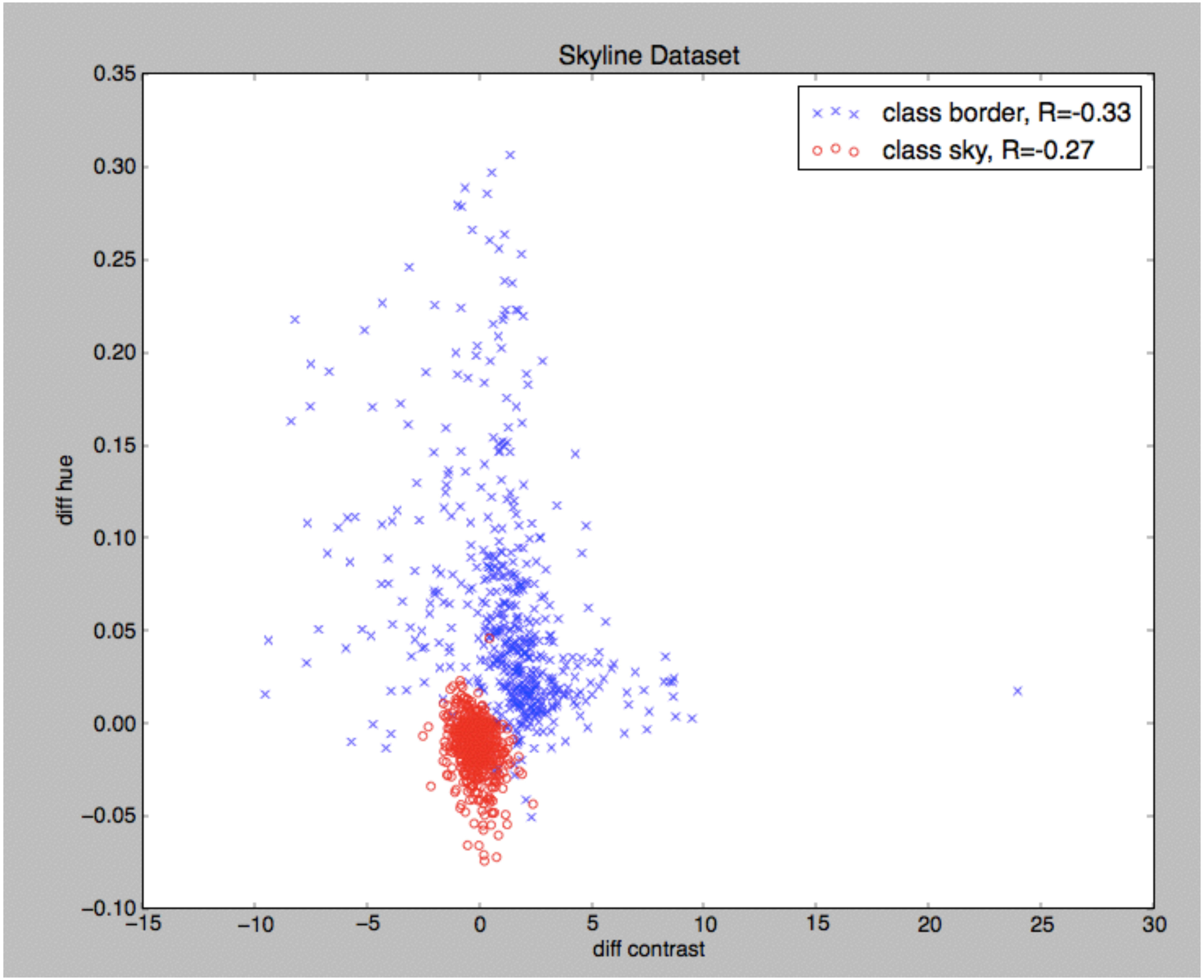
*note: the largest contrasts were removed from analysis for plot visibility



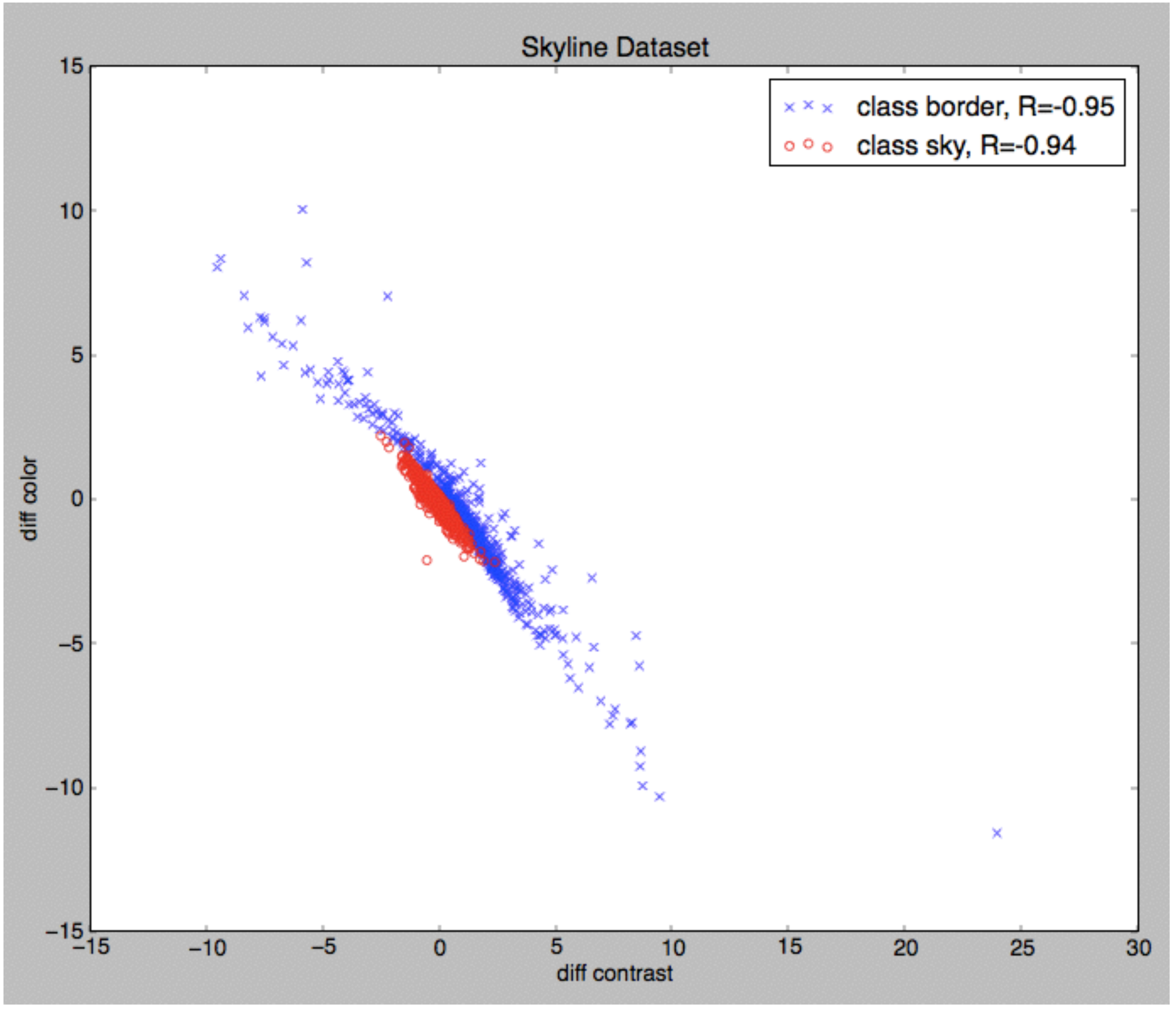




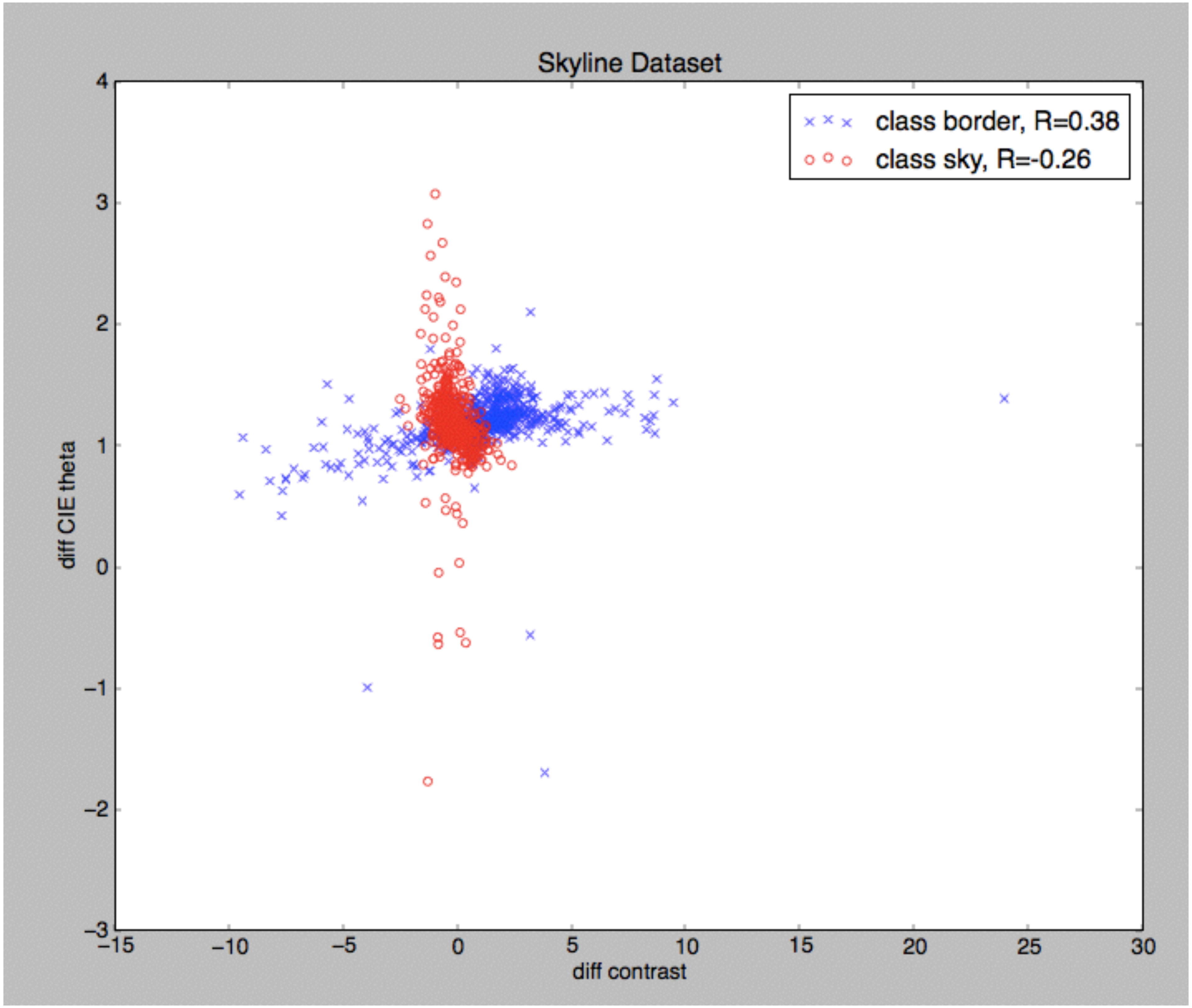
[Brown & Lowe 2003, image 1]



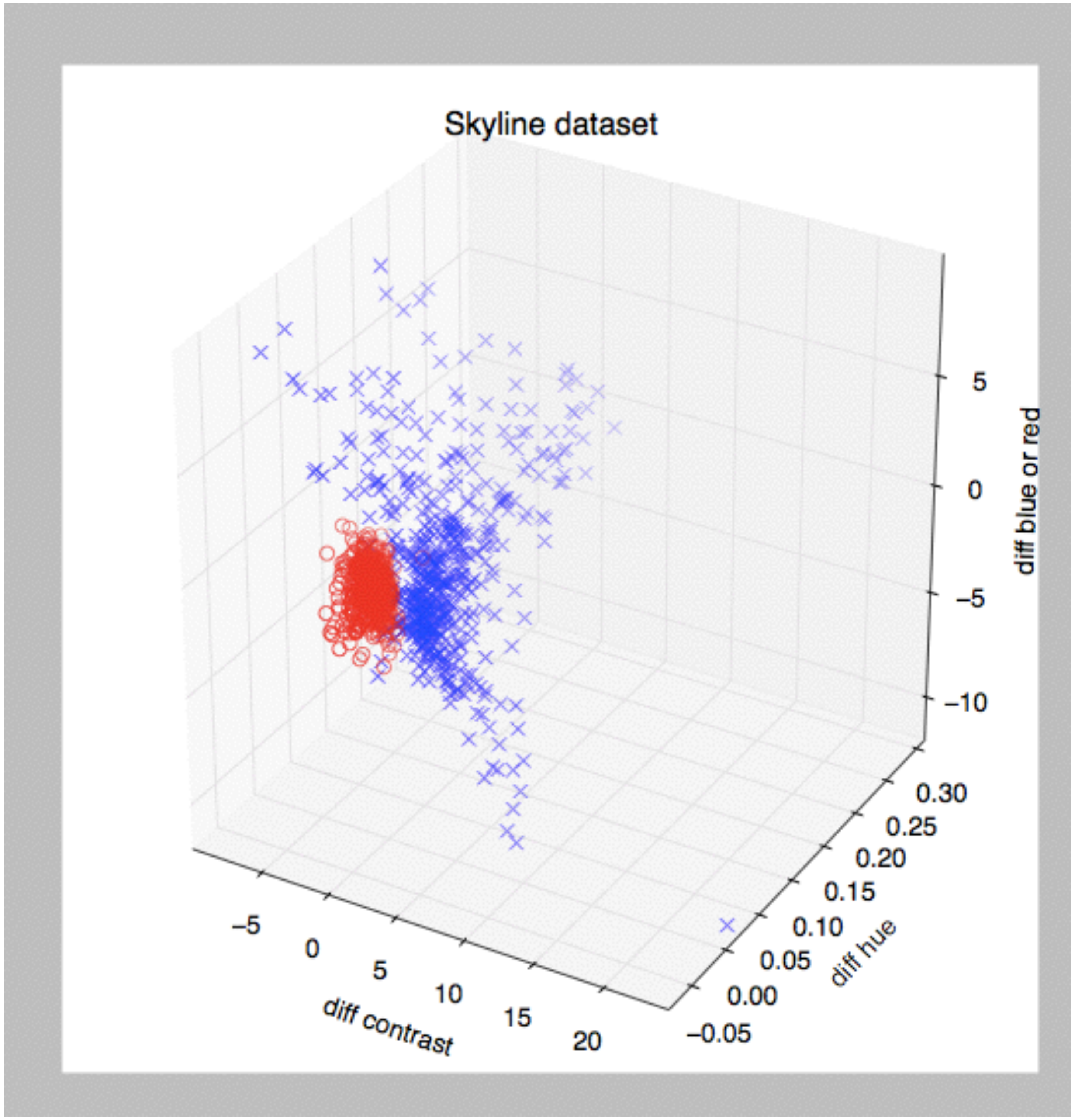
Brown & Lowe 2003, image 1



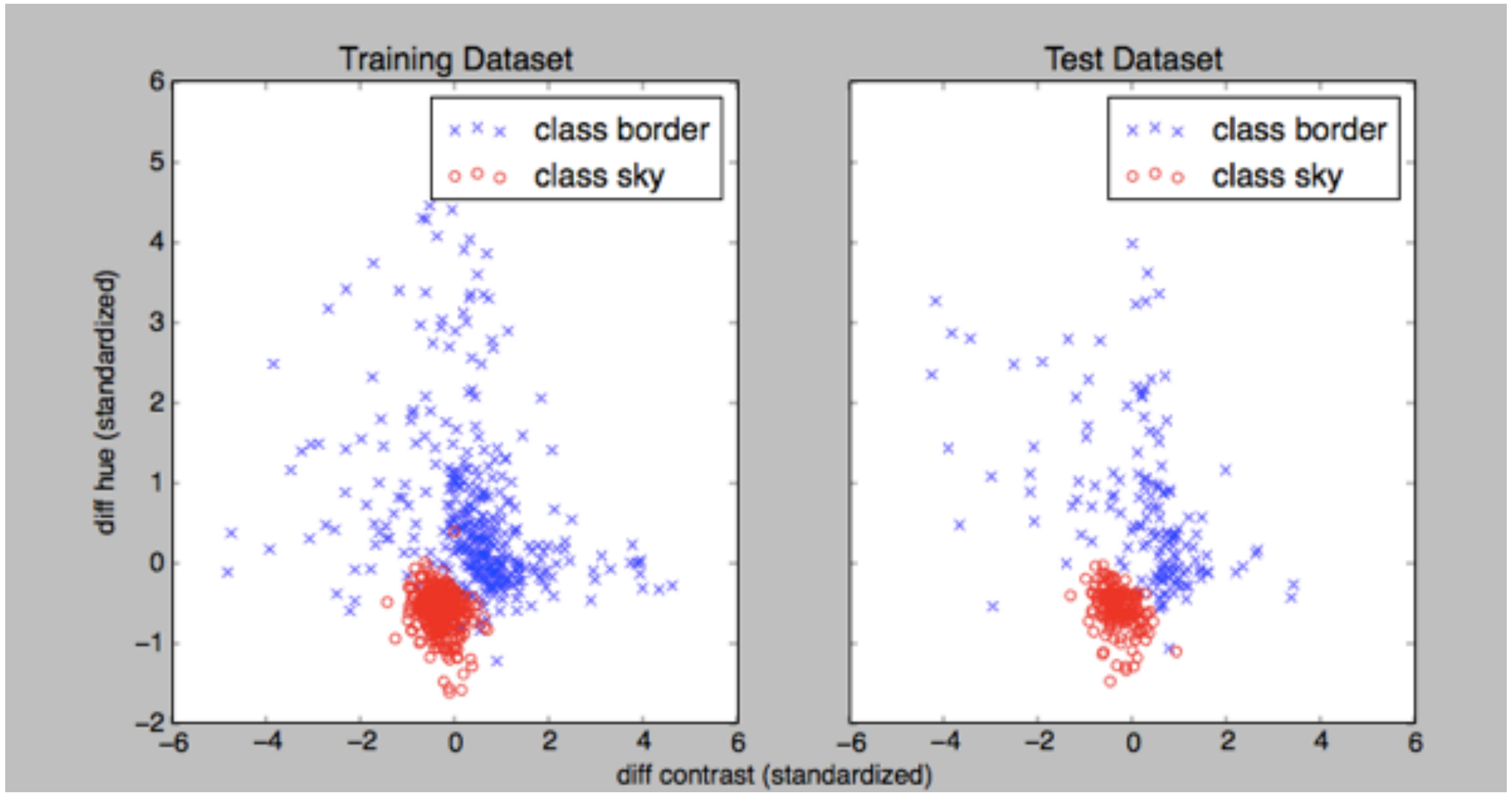
Brown & Lowe 2003, image 1



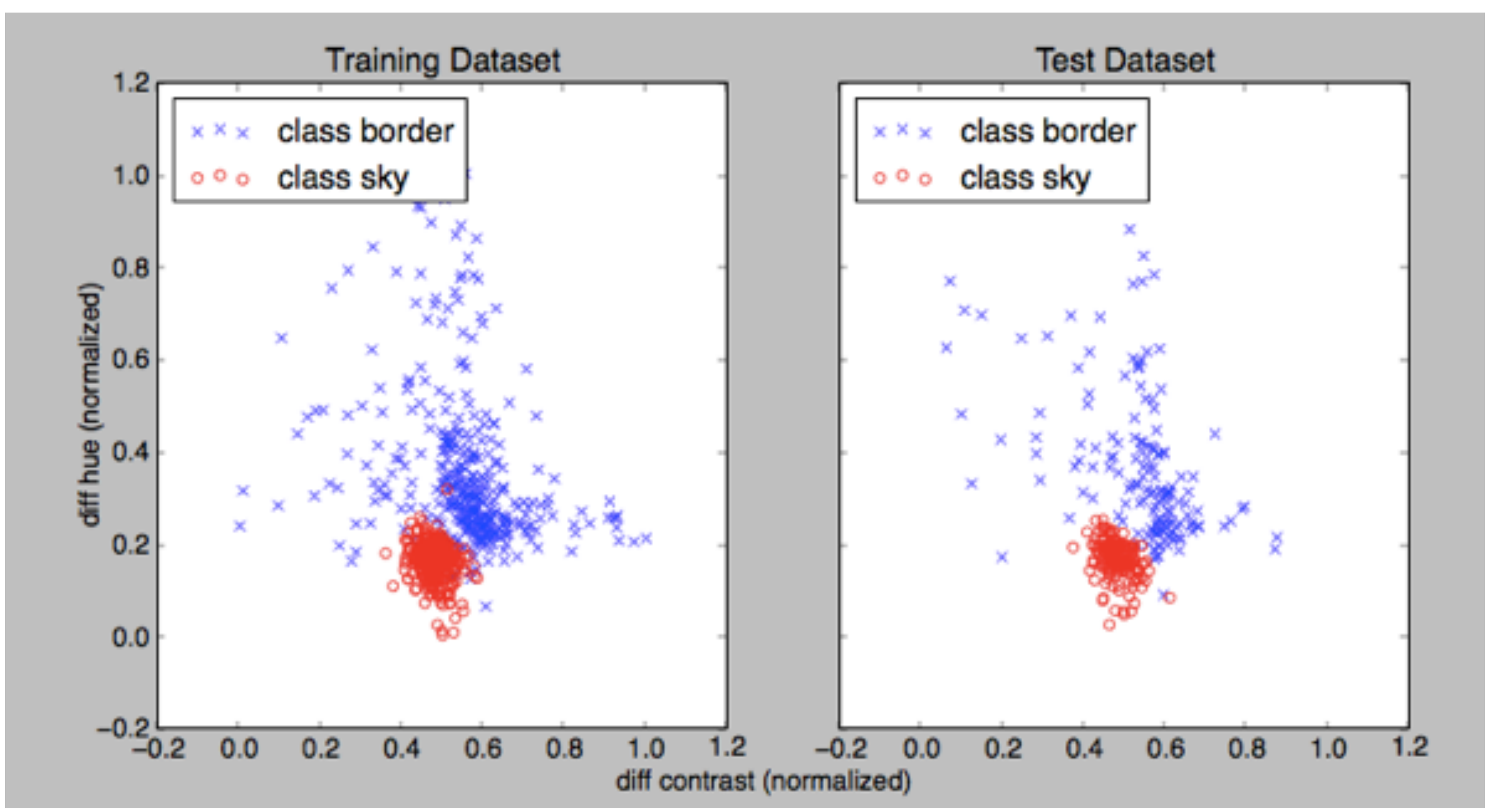
Brown & Lowe 2003, image 1



Brown & Lowe 2003, image 1



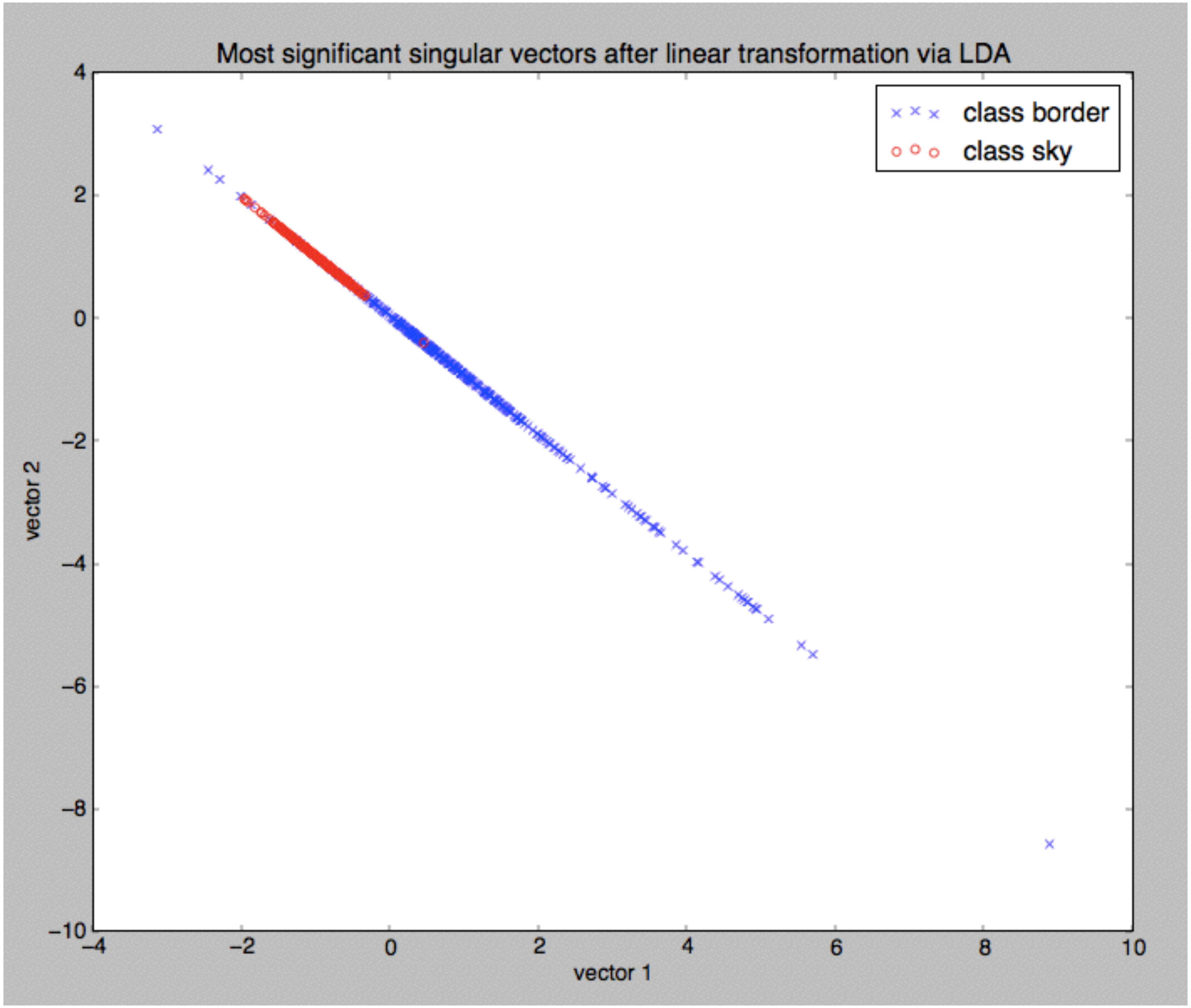
Z-score normalization: rescaled to mean $\mu = 0$ and standard deviation $\sigma = 1$



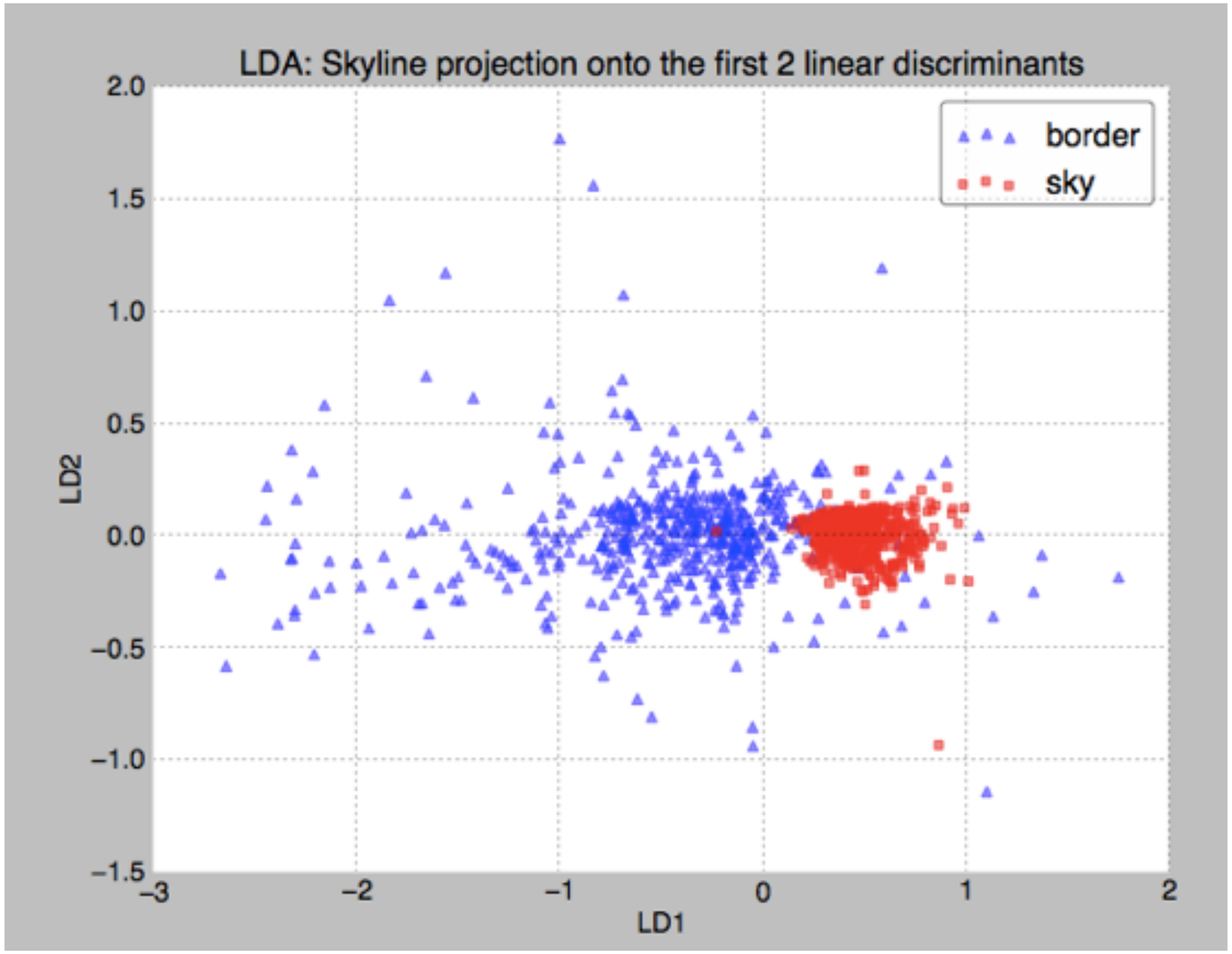
Min-max normalization: rescaled to a fixed range of 0 to 1 using:

```
X' = (X−X_min)
     /(X_max−X_min)
```

[Brown & Lowe 2003, image 1]()



Brown & Lowe 2003, image 1




```
                      contrast  hue     BorR
Mean Vector class 1: [ 0.3219  0.6334 -0.1949]
Mean Vector class 2: [-0.3127 -0.6153  0.1894]

('within-class Scatter Matrix:\n',
array([[ 929.0412, -256.3866, -924.4859],
       [-256.3866,  630.4283,  296.2583],
       [-924.4859,  296.2583,  994.8667]]))
('between-class Scatter Matrix:\n',
array([[  311.9914,   613.8395,  -188.773 ],
       [  613.8395,  1207.8298,  -371.5872],
       [ -188.773 ,  -371.5872,   114.5147]]))

Eigenvector 1:
[[-0.7296]
 [-0.5264]
 [-0.4365]]
Eigenvalue 1: 3.36e+00

Eigenvector 2:
[[-0.8083]
 [ 0.5043]
 [ 0.304 ]]
Eigenvalue 2: -1.78e-17

Eigenvector 3:
[[ 0.6804]
 [-0.1237]
 [ 0.7224]]
Eigenvalue 3: 4.66e-03
ok
Eigenvalues in decreasing order:

3.36159544502
0.00466279798653
1.7822517108e-17
Variance explained:

eigenvalue 1: 99.86%
eigenvalue 2: 0.14%
eigenvalue 3: 0.00%
('Matrix W:\n', array([[-0.7296, -0.5264, -0.4365],
       [ 0.6804, -0.1237,  0.7224]]))
```

http://sebastianraschka.com/Articles/2014_python_lda.html

"*within-class scattering matrix*": for each class i: S_i = summation_x in data((x-m_i)*(x-m_i)^T)
where m_i = (1/n_i) * summation_d in data(x_k)
==> S_w = summation_i in classes (S_i)

"*between-class scattering matrix*":
==> S_B = summation_i in classes (N * (m_i - m) * (m_i - m)^T)
where m is the overall mean, and m_i and N_i are the sample mean and sizes

Solving for A*nu = lambda * nu where A = *S_w^-1 dot S_B, nu is eigenvector ,and lambda is eigenvalue*
==> LD1 and LD2 are diff contrast and diff hue transformed by y = W^T * X (== W.T.dot(X.T).T)