クロス集計表・分布表の双対尺度法

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1　目的

二次元クロス集計表から，双対尺度法による解析を行う。
R の **MASS** ライブラリに入っている corresp 関数と同じであるが，若干親切な出力をする。

2　使用法

```
import sys
sys.path.append("statlib")
from multi import dual
dual(tbl, max\_axis=5, verbose=True)
```

行スコアと列スコアのバイプロットを描く

```
import sys
sys.path.append("statlib")
from multi import dual_plot
dual_plot(obj, weighted=False, ax1=1, ax2=2, color="blue", color2="red", alpha=0.5)
```

2.1　引数

tbl	二次元クロス表
max_axis	解の個数を制限する（デフォルトは 5）
verbose	必要最小限のプリント出力をする
obj	dual() の戻り値
weighted	True を指定すれば重みつきの行・列スコアをプロットする
ax1	横軸にとる解の番号
ax2	縦軸にとる解の番号
color	列スコアに対する点とテキストの色（デフォルトは青）
color2	行スコアに対する点とテキストの色（デフォルトは赤）
alpha	アルファチャネル（デフォルトは 0.5）

2.2 戻り値の名前

"result"	結果表
"rs"	行スコア
"cs"	列スコア
"wrs"	重みつき行スコア
"wcs"	重みつき列スコア

3 使用例

```
tbl = [[2, 3, 5, 6],
       [5, 1, 7, 5],
       [5, 3, 4, 3]]

import sys
sys.path.append("statlib")
from multi import dual

a = dual(tbl)
```

```
Summary
                       Axis 1      Axis 2
eta square           0.049054    0.037657
correlation          0.221481    0.194053
contribution        56.572123   43.427877
cum. contr.         56.572123  100.000000
Chi square value     2.263408    1.727273
degrees of freedom   4.000000    2.000000
p value              0.687439    0.421626

Row score
      Axis 1    Axis 2
R1  1.435585 -0.039955
R2 -0.665093  1.131315
R3 -0.733178 -1.314959

Column score
      Axis 1    Axis 2
C1 -1.550240 -0.428633
C2  0.930182 -2.159520
C3 -0.115823  0.792178
C4  0.996055  0.541813
```

```
Weighted row score
      Axis 1    Axis 2
R1  1.435585 -0.039955
R2 -0.665093  1.131315
R3 -0.733178 -1.314959

Weighted column score
      Axis 1    Axis 2
C1 -1.550240 -0.428633
C2  0.930182 -2.159520
C3 -0.115823  0.792178
C4  0.996055  0.541813
```

```
import pandas as pd

dat = pd.read_csv("data/ooyama-okamoto.csv", index_col=0)

import sys
sys.path.append("statlib")
from multi import dual

a = dual(dat)
```

```
Summary
                       Axis 1     Axis 2     Axis 3     Axis 4     Axis 5
eta square           0.795495   0.696514   0.580795   0.448228   0.314787
correlation          0.891905   0.834574   0.762099   0.669498   0.561059
contribution        22.773618  19.939963  16.627136  12.831968   9.011788
cum. contr.         22.773618  42.713581  59.340718  72.172686  81.184474
Chi square value    45.234160  33.983963  24.777771  16.946669  10.773718
degrees of freedom  25.000000  23.000000  21.000000  19.000000  17.000000
p value              0.007863   0.065390   0.256917   0.593481   0.868082

Row score
             Axis 1    Axis 2    Axis 3    Axis 4    Axis 5
anger     -0.647286  0.619050 -0.159263  0.759045 -0.271959
jealousy  -0.584775  0.936736 -0.258833  1.549712  1.393995
sin       -1.797653 -0.826087  0.310674 -1.691387 -1.630901
eternity   0.980942 -1.273413 -1.229405  0.626209 -0.910561
happy      0.544964  1.522066  0.722808 -0.317164 -0.848015
lonely    -0.784685 -0.953140  0.355571 -0.319553  0.153121
calm       1.133635 -1.350364  0.322556  0.099561  0.635229
```

```
nostalgia  1.149231 -0.789359  2.106888  0.206966  0.337644
home       0.544964  1.522066  0.722808 -0.317164 -0.848015
love       0.084096  1.368666 -0.253590  0.373234 -0.437080
purity     0.573125 -0.544725 -1.749380  1.096666 -1.036131
dream      1.089055  0.527654 -1.510201 -2.513161  1.549823
anxiety   -1.476188 -0.271580  0.081475  0.227142  1.772751
fear      -1.192502 -0.224452 -0.164404  0.150905  0.027551
```

Column score

```
           Axis 1    Axis 2    Axis 3    Axis 4    Axis 5
red     -0.396307  0.516497 -0.678513  1.173883 -0.115362
orange  -0.013014  1.430331  0.203105  0.611701 -0.360417
black   -1.322633 -0.396899  0.111285 -0.261046  0.018024
purple  -1.155371  0.398500 -0.116362  1.327004  2.822117
gray    -1.471857 -0.681563  0.191352 -0.609745  0.143711
violet  -2.015520 -0.989830  0.407655 -2.526351 -2.906829
white    0.871206 -1.089261 -1.954329  1.286692 -1.734838
grnble   1.058620 -0.791076 -1.366761 -0.257926  0.106210
pink     0.634339  1.479932 -0.104375 -1.035946 -0.259905
yorange  0.836845  0.900569  1.553824 -0.212777 -0.807037
blue     0.694895 -1.307935  0.510304  0.228971  0.095994
green    1.279769 -1.281925  1.593916  0.228923  0.866998
ygrn     1.288513 -0.945822  2.764585  0.309136  0.601799
yellow   1.221044  0.632243 -1.981633 -3.753798  2.762320
```

Weighted row score

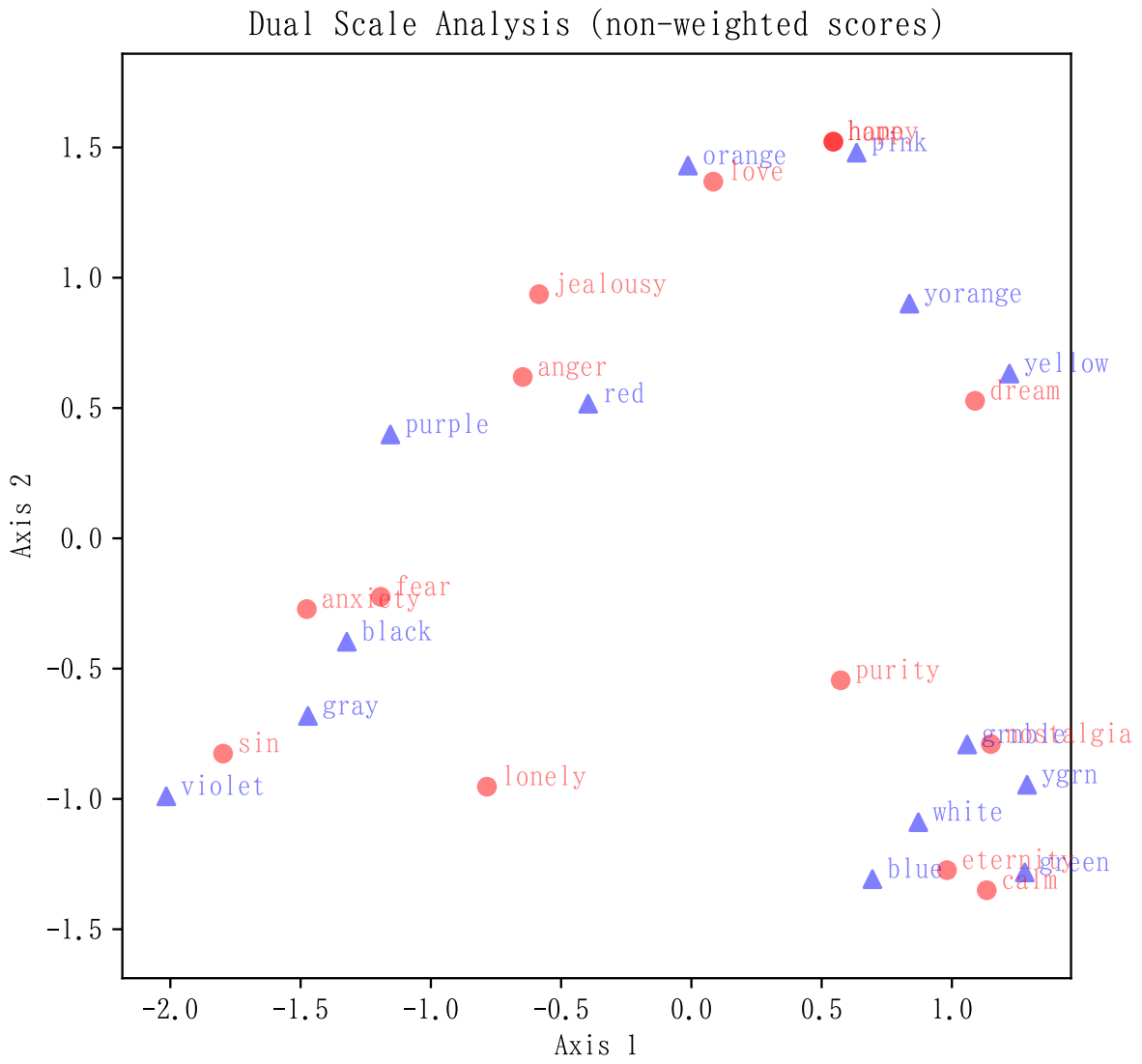
```
             Axis 1    Axis 2    Axis 3    Axis 4    Axis 5
anger     -0.647286  0.619050 -0.159263  0.759045 -0.271959
jealousy  -0.584775  0.936736 -0.258833  1.549712  1.393995
sin       -1.797653 -0.826087  0.310674 -1.691387 -1.630901
eternity   0.980942 -1.273413 -1.229405  0.626209 -0.910561
happy      0.544964  1.522066  0.722808 -0.317164 -0.848015
lonely    -0.784685 -0.953140  0.355571 -0.319553  0.153121
calm       1.133635 -1.350364  0.322556  0.099561  0.635229
nostalgia  1.149231 -0.789359  2.106888  0.206966  0.337644
home       0.544964  1.522066  0.722808 -0.317164 -0.848015
love       0.084096  1.368666 -0.253590  0.373234 -0.437080
purity     0.573125 -0.544725 -1.749380  1.096666 -1.036131
dream      1.089055  0.527654 -1.510201 -2.513161  1.549823
anxiety   -1.476188 -0.271580  0.081475  0.227142  1.772751
fear      -1.192502 -0.224452 -0.164404  0.150905  0.027551
```

Weighted column score

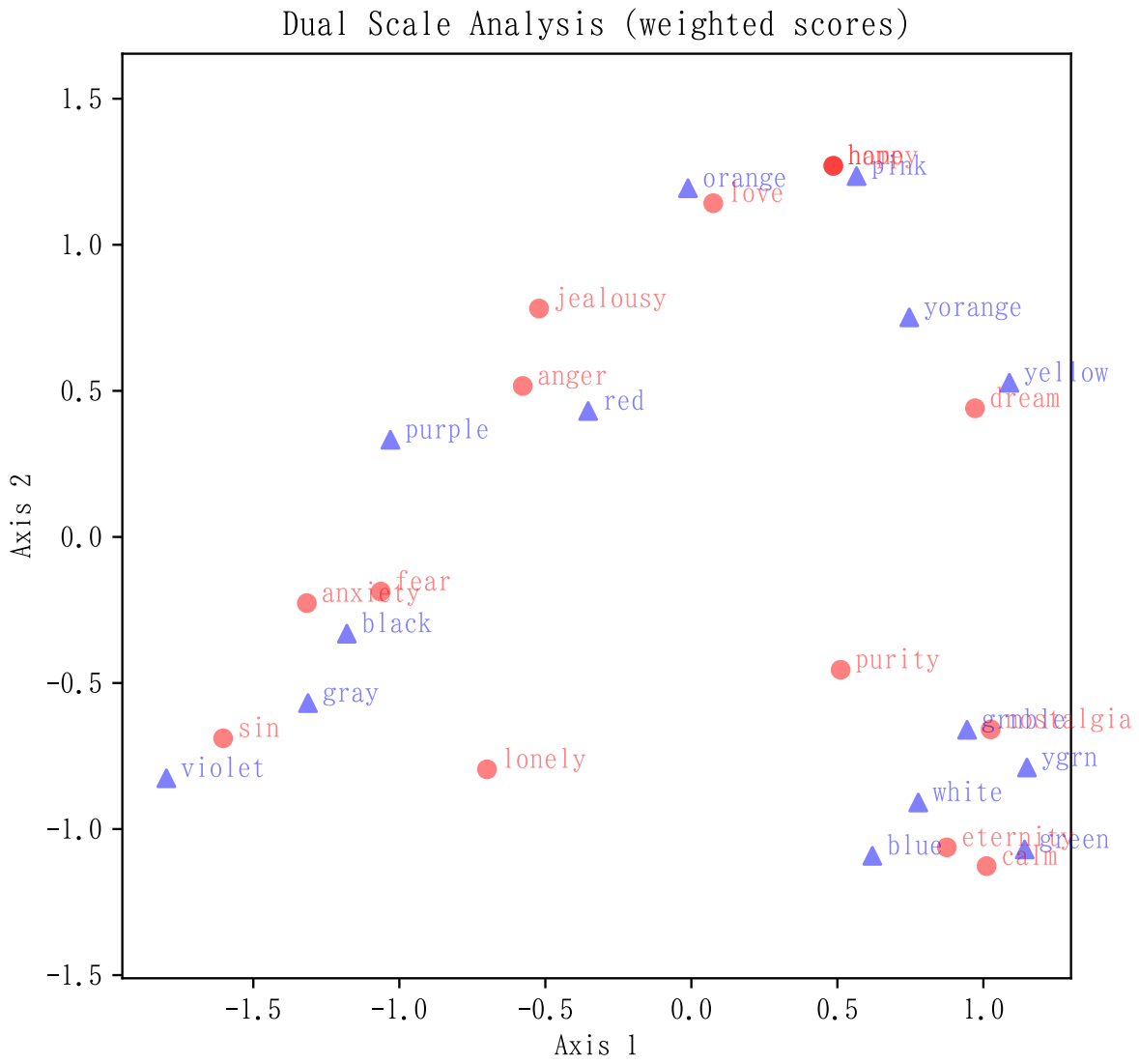
	Axis 1	Axis 2	Axis 3	Axis 4	Axis 5
red	-0.396307	0.516497	-0.678513	1.173883	-0.115362
orange	-0.013014	1.430331	0.203105	0.611701	-0.360417
black	-1.322633	-0.396899	0.111285	-0.261046	0.018024
purple	-1.155371	0.398500	-0.116362	1.327004	2.822117
gray	-1.471857	-0.681563	0.191352	-0.609745	0.143711
violet	-2.015520	-0.989830	0.407655	-2.526351	-2.906829
white	0.871206	-1.089261	-1.954329	1.286692	-1.734838
grnble	1.058620	-0.791076	-1.366761	-0.257926	0.106210
pink	0.634339	1.479932	-0.104375	-1.035946	-0.259905
yorange	0.836845	0.900569	1.553824	-0.212777	-0.807037
blue	0.694895	-1.307935	0.510304	0.228971	0.095994
green	1.279769	-1.281925	1.593916	0.228923	0.866998
ygrn	1.288513	-0.945822	2.764585	0.309136	0.601799
yellow	1.221044	0.632243	-1.981633	-3.753798	2.762320

```
import sys
sys.path.append("statlib")
from multi import dual_plot

dual_plot(a)
```




```
dual_plot(a, weighted=True)
```


Dual Scale Analysis (weighted scores)
Axis 2
Axis 1
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-1.5
-1.0
-0.5
0.0
0.5
1.0
orange
love
pink
jealousy
yorange
anger
red
yellow
dream
purple
fear
anxiety
black
purity
gray
sin
violet
lonely
white
blue
calm