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Week 1
by ***** - Wednesday, 13 March 2013, 2:47 PM

Assignment_1_*****.pdf

Week 1

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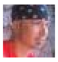

Re: Week 1
by Kimmo Vehkalahti - Wednesday, 13 March 2013, 11:11 PM

Very good, *****!

Just for curiosity, I compared the matrices with so called *transformation analysis*, which is a term unfortunately **not** much known outside the Finnish school of Factor Analysis (since the 1950s). It is really a sort of confirmatory factor analysis, with which you can easily compare different factor solutions to each other. The method was initially suggested by **Yrjö Ahmavaara** in his PhD thesis in 1954. The symmetric version based on Singular Value Decomposition was given by **Seppo Mustonen** in 1966. An internationally known method, which comes quite close to this, is called *Procrustes rotation*. It is the only statistical method that has got its (horrifying) name from the Greek mythology! :)

Here is my brief analysis (copied from Muste edit field):

```
The matrices are first taken from your report and then
copied in the edit field of Muste via clipboard. They
are edited a bit with TRIM and other tools, but they
do not need to be in straight columns, Muste will
understand them, anyway:

MATRIX MPLUS
/// F1 F2 F3 F4
Y1 0.637 0.008 0.074 -0.021
Y2 0.808 0.022 -0.005 0.041
Y3 0.631 -0.042 -0.058 -0.028
Y4 0.027 0.646 -0.002 -0.018
Y5 -0.029 0.760 -0.023 0.017
Y6 0.010 0.674 0.030 -0.012
Y7 -0.006 0.003 0.734 0.018
Y8 -0.040 0.002 0.727 -0.016
Y9 0.049 -0.007 0.707 -0.001
Y10 -0.037 0.006 -0.010 0.692
Y11 0.004 0.013 0.001 0.791
Y12 0.035 -0.036 0.008 0.658

MATRIX SAS
/// Factor1 Factor2 Factor3 Factor4
y1 0.08990 -0.02823 -0.00082 0.78509
y2 -0.00375 0.04793 0.01001 0.84561
y3 -0.07326 -0.02362 -0.04270 0.78506
y4 0.00075 -0.05245 0.78930 0.02072
y5 -0.01693 -0.02142 0.82996 -0.05439
y6 0.04365 -0.04883 0.80086 -0.00293
y7 0.82948 0.01085 0.01105 -0.00532
y8 0.82524 -0.03171 0.01512 -0.03388
y9 0.81737 -0.00397 0.00247 0.05162
y10 -0.01934 0.81222 -0.02669 -0.04631
y11 -0.00915 0.84714 -0.02609 0.00272
```

```
y12 0.00370 0.79587 -0.07193 0.03662
```

By the way, can you see that these matrices are pretty similar? I can't. :)

```
Let's save the matrices in Muste matrix files:

MAT SAVE MPLUS
MAT SAVE SAS

Run Symmetric Transformation Analysis, i.e., compare
the two factor matrices:

/TRAN-SYMMETR MPLUS,SAS
MAT LOAD L.M,###.###,END+2  / Transformation matrix
MAT LOAD E.M,###.###,END+2  / Residual matrix

MATRIX L.M
Transformation_matrix
///       Factor1 Factor2 Factor3 Factor4
F1         -0.002   0.005   0.007   1.000
F2         -0.002   0.000   1.000  -0.007
F3          1.000  -0.001   0.002   0.002
F4          0.001   1.000  -0.000  -0.005

The factors seem to appear in different order (otherwise
the ones would be on the diagonal of L.M). The order is
non-essential, of course. The correspondences are clear,
anyway, as the non-diagonal elements are just zeroes.

How about the residuals? Let's look at them, too:

MATRIX E.M
Residual_matrix
///       Factor1 Factor2 Factor3 Factor4
Y1         -0.017   0.010   0.014  -0.148
Y2         -0.003  -0.003   0.018  -0.038
Y3          0.014  -0.001   0.005  -0.154
Y4         -0.004   0.035  -0.143   0.002
Y5         -0.008   0.038  -0.070   0.020
Y6         -0.015   0.037  -0.127   0.008
Y7         -0.095   0.007  -0.007   0.001
Y8         -0.098   0.015  -0.012  -0.005
Y9         -0.110   0.003  -0.008  -0.001
Y10         0.010  -0.120   0.032   0.006
Y11         0.011  -0.056   0.039  -0.003
Y12         0.005  -0.138   0.036  -0.005

The residuals are small, and here they are probably
mostly caused by the fact that I did not have the
numbers in full (15-16 digit) precision, but only
with 3 (Mplus) and 5 (SAS) decimals.
```

More information on Symmetric Transformation Analysis
can be found in Mustonen's books that are available in
http://www.survo.fi/books/

(the best source being the Multivariate methods book,
which is available only in Finnish).
- Kimmo

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Re: Week 1
by ***** - Friday, 15 March 2013, 11:46 PM

Dear Kimmo,

I guess we are supposed to comment on your posts regarding our original submissions. So, if that is the case, here is my reply to you.

You mention the following: "By the way, can you see that these matrices are pretty similar? I can't. :)". I looked at the factor loadings and I thought the factors load in a similar fashion since both have identical factor groupings, albeit differently named. Also, the levels of numbers are pretty similar with variables generally having high horizontal row loadings for a single factor while having low loadings for the remaining factors on the same row.

In Mplus the factors are grouped in the following way as per the highest factor loadings on a single horizontal row:

F1: Y1, Y2, Y3
F2: Y4, Y5, Y6
F3: Y7, Y8, Y9
F4: Y10, Y11, Y12

Similar to the above the groupings for SAS are:

F4: Y1, Y2, Y3
F3: Y4, Y5, Y6
F1: Y7, Y8, Y9
F2: Y10, Y11, Y12

Thus, they appear to have identical factor groupings. This is according to the original post. As mentioned earlier, a person must simply rename them and all will be well. I hope that answers all your questions. Many thanks for the interest.

Best regards,

*****

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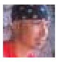

Re: Week 1
by Kimmo Vehkalahti - Monday, 18 March 2013, 7:58 AM

Thanks for the reply. I would like to extend my comments somewhat further.

Yes, perhaps in this case you can see the similarity quite easily. However, "looking at the factor loadings" does not help as a general method. I give a brief example using the famous demo data DECA (world's 48 best decathlon athletes in 1973, available in Muste and Survo as well as in http://www.survo.fi/data/Decathlon.txt) and its 3 factor ML solution.

Let us look at the factor loadings of the Varimax rotation:

```
MATRIX A1
///            F1       F2       F3
100m     -0.52905  0.77763  0.03843
L_jump   -0.27177  0.05621 -0.06877
Shot_put -0.13175 -0.15996  0.83099
Hi_jump   0.02978 -0.50850  0.12621
400m      0.06366  0.64196 -0.23521
Hurdles  -0.28847  0.21967  0.05967
Discus   -0.27359 -0.21342  0.79060
Pole_vlt -0.08939  0.01992 -0.25485
Javelin   0.01626 -0.26552  0.03614
1500m     0.90059  0.25461 -0.34513
```

Now, let us take another rotation, namely, Jennrich's (2004) orthogonal CLF (Component Loss Function) rotation:

```
MATRIX A2
///            F1       F2       F3
100m      0.05495 -0.20037 -0.91810
L_jump    0.00670 -0.24484 -0.14750
Shot_put  0.84694  0.11695  0.04995
Hi_jump   0.20042 -0.09571  0.47546
```

```
400m     -0.35440  0.18405 -0.55859
Hurdles   0.10282 -0.16238 -0.31320
Discus    0.86104 -0.03928  0.05013
Pole_vlt -0.21574 -0.15973 -0.03577
Javelin   0.07654 -0.05956  0.25033
1500m    -0.63822  0.75806  0.11411
```

Can you see that these matrices are pretty similar? :)

I bet you can't. And I certainly can't. But I would not suggest wasting time for comparing the matrices manually, as the transformation analysis does the job very easily. Here's the result:

```
MATRIX L.M
Transformation_matrix
///          F1     F2     F3
F1       -0.299  0.881  0.366
F2       -0.179  0.325 -0.929
F3        0.937  0.343 -0.061

MATRIX E.M
Residual_matrix
///          F1     F2     F3
100m     -0.000  0.000  0.000
L_jump   -0.000 -0.000  0.000
Shot_put -0.000 -0.000 -0.000
Hi_jump   0.000 -0.000 -0.000
400m     -0.000  0.000  0.000
Hurdles  -0.000  0.000  0.000
Discus    0.000  0.000 -0.000
Pole_vlt  0.000 -0.000  0.000
Javelin   0.000 -0.000 -0.000
1500m     0.000 -0.000 -0.000
```

The symmetric transformation analysis is nothing else but an application of the most important matrix tool, the **Singular Value Decomposition**. The above matrices L.M and E.M can be produced "manually", using the matrix interpreter of Muste as follows (A1 and A2 are the rotated factor matrices above):

```
MAT C=A1'*A2
MAT SVD OF C TO U,D,V
MAT L.M=U*V'
MAT E.M=A1*L-A2
```

- Kimmo

Reference:

Jennrich, R.I. (2004). Rotation to simple loadings using component loss functions: The orthogonal case. *Psychometrika*, **69**, 257-273.

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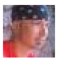

Re: Week 1

by Kimmo Vehkalahti - Monday, 18 March 2013, 8:04 AM

(just nitpicking my own text here...)

Of course the *matrices* are not similar, as they clearly look quite different (although they have the same dimensions as well as row and column names). The question should have been written in the form

Can you see that these matrices refer to the same factor structure?

- Kimmo

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Moodle Docs for this page

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