PCA with FactoMineR + factoextra

Cheat Sheet

Basics

PCA (Principal component analysis) is a dimension-reduction method. The goal of PCA is to find a principal factors - orthogonal linear combinations of original variables that explain the maximum amount of variance.

1. TODO: describe more details

Example

This example uses data about Hollywood action movies from 2015. Six quantitative variables with movie ratings scrapped from Rotten Tomato and Metacritic websites.

Get the data from ….

```
> head(movies2015)
                     Rotten                Rotten Metacritic
                   Tomatoes Metacritic Audience   Audience
Spectre                  64         60       65         67
Furious 7                81         67       84         68
Terminator Genisys       25         38       59         63
San Andreas              50         43       56         55
Point Break               9         38       37         22
```

Use the **FactoMineR ::PCA()** function for PCA with supplementary quantitative and categorical variables. Missing values will be replaced by colMeans.

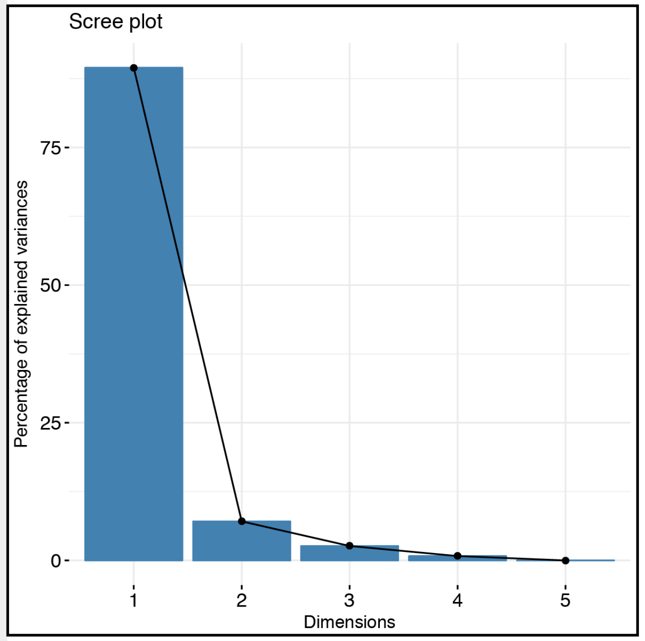
```
> library("FactoMineR")
> model <- PCA(movies2015)
> summary(model)
Eigenvalues
                       Dim.1   Dim.2   Dim.3   Dim.4  Dim.5
Variance               4.474   0.355   0.131   0.040   0.00
% of var.             89.481   7.093   2.627   0.798   0.00
Cumulative % of var.  89.481  96.574  99.202 100.000 100.00

Individuals
                            Dist    Dim.1    ctr   cos2
Spectre                 |  1.077 |  0.989  2.184  0.842 |
Furious 7               |  2.408 |  2.321 12.045  0.930 |
Terminator Genisys      |  1.694 | -1.394  4.341  0.677 |
San Andreas             |  0.811 | -0.704  1.108  0.754 |
Point Break             |  3.643 | -3.461 26.767  0.902 |
Run All Night           |  1.192 |  0.842  1.584  0.499 |
No Escape               |  1.076 | -0.508  0.577  0.223 |
...

Variables
                           Dim.1    ctr   cos2    Dim.2
Rotten.Tomatoes         |  0.988 21.836  0.977 | -0.059
Metacritic              |  0.931 19.389  0.867 | -0.330
Average.critics         |  0.986 21.721  0.972 | -0.156
Rotten.Tomatoes.Audience | 0.943 19.885  0.890 |  0.135
Metacritic.Audience     |  0.876 17.169  0.768 |  0.447
...
```

FactoMineR (for multivariate data analysis) and factoextra (for visualisation of PCA results)

Scree plot

Use the **factoextra::get_eig()** function to extract information about eigenvalues. The **factoextra::fviz_screeplot()** function will plot the percentage of variance explained by each principal factor.

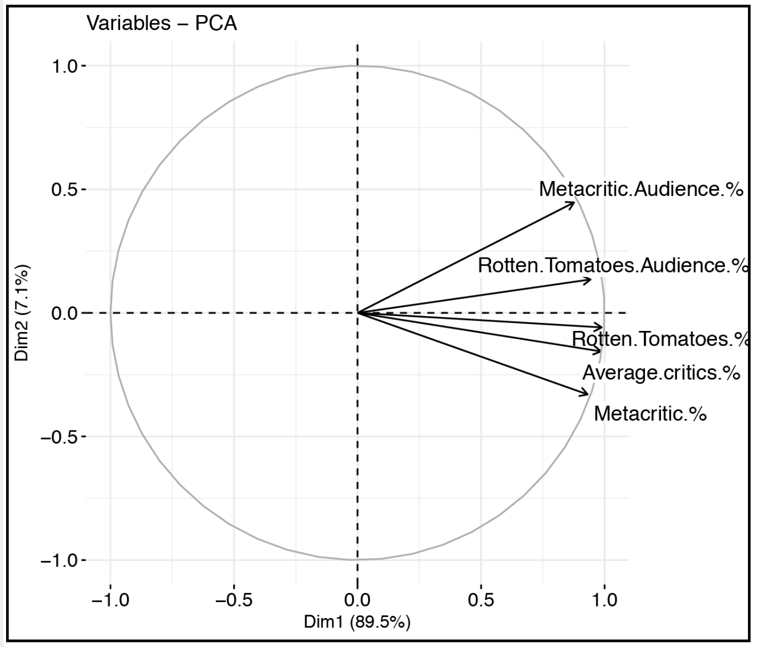
```
> get_eig(model)
      eigenvalue variance.percent cum.variance.percent
Dim.1 4.474039e+00       8.9480e+01                89.48
Dim.2 3.546706e-01       7.0934e+00                96.57
Dim.3 1.313722e-01       2.6273e+00                99.20
Dim.4 3.991824e-02       7.9836e-01               100.00
Dim.5 5.256294e-32       1.0512e-30               100.00
> fviz_screeplot(model)
```



PCA variables' plot

Use the **factoextra::fviz_pca_var()** function to plot contribution of original variables into selected (the **axes** argument) principal components . Show variables through text labels or arrows (the **geom** argument). Result of this function is the **ggplot2** plot.

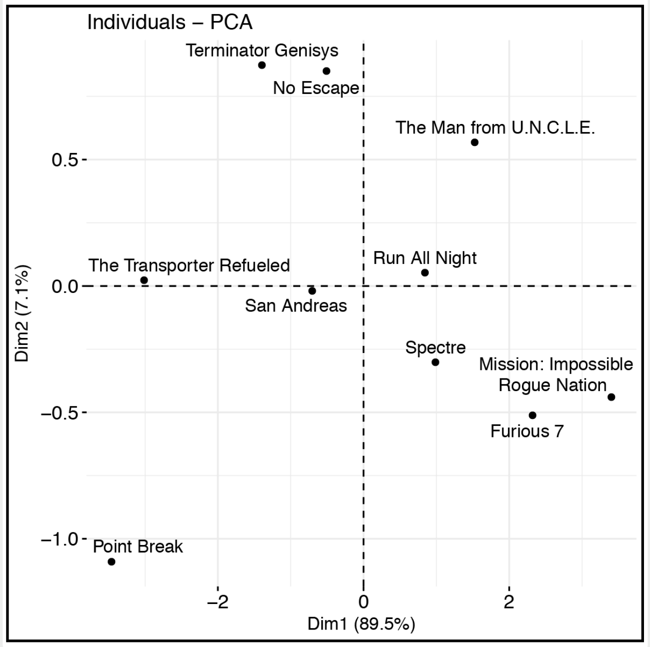
```
> fviz_pca_var(model)
```



PCA individuals' plot

Use the **factoextra::fviz_pca_ind()** function to plot observations with selected (the **axes** argument) principal coordinates. With the **habillage** argument one can select a grouping variable which will be color-coded in the plot. Use **addEllipses** to plot ellipses for each group.

```
> fviz_pca_ind(model)
```

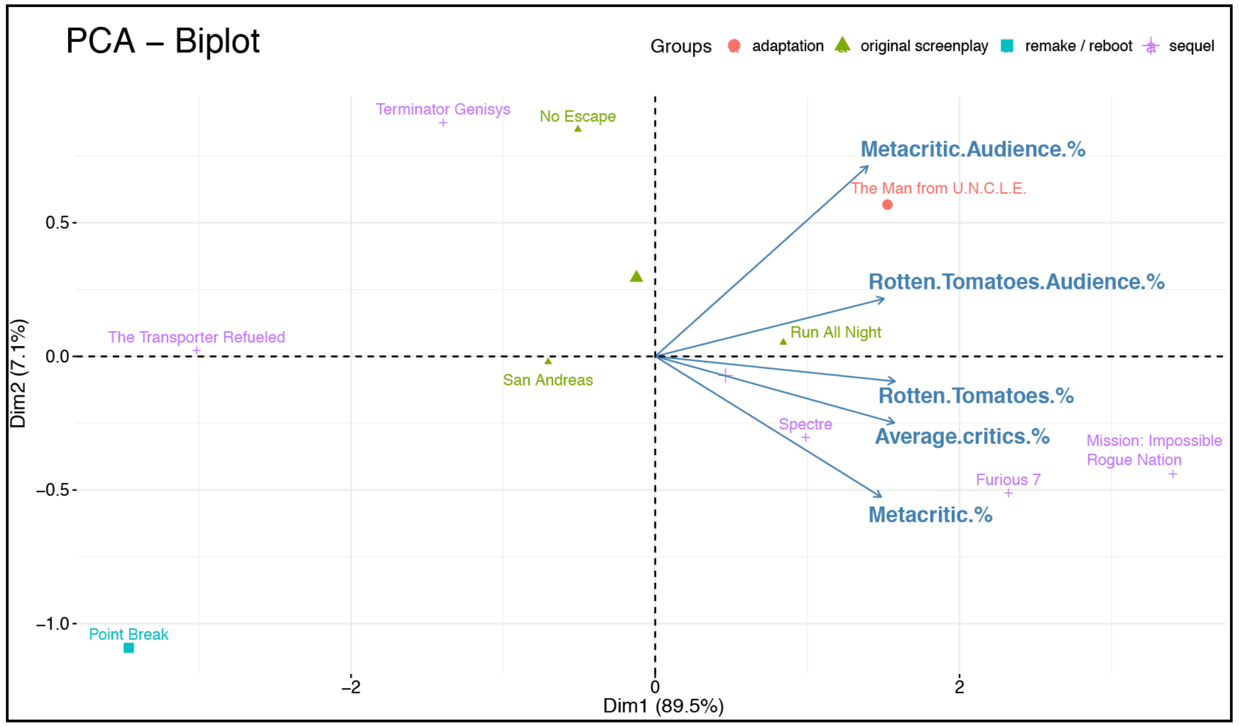


PCA - Biplot

Use the **factoextra::fviz_pca_biplot()** function to combine results for individuals and variables into a single bi-plot. With the **habillage** argument one can select a grouping variable which will be color-coded in the plot. Use **addEllipses** to plot ellipses for each group.

In the presented example, the first principal coordinate is highly correlated with average rating from all sources (audience and critics) while the second principal coordinate discriminate between audience and critics. Thus one can easily identify movies that are preferred by critics and these preferred by audience.

```
> fviz_pca_biplot(model, habillage = filmy2015$script.type) +
  theme(legend.position = "top")
```



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