Varimax Rotation

Varimax Rotation

- **Sometimes** factor loadings are **evenly spread** across factors

- So, it is possible to encounter variables that don't have **Factor Loadings** $F >= 0.5$

- $F >= 0.5$ means that the respective **factor** has **more** than **50%** of that **variable's weight**

- If variables will be grouped to form factors by **aggregating** variables with **high** factor **loadings**, it helps to fine tune the rotation so that loadings group together better

- It is possible to **rotate** the axes a bit further so that the factor **loadings** within each factor are **maximized**. This will cause variables to **load highly** on just **one factor**, rather than being spread across factors, making it easier to group variables with high loadings.

- It is customary to **rotate** the **axes** in factor analysis

- There are various **rotation methods** (some are even oblique, not orthogonal) – the **Varimax** method is very effective

Illustration Hitters{ISLR} data

- **Varimax** rotated **3-Factor solution**, **sorted** by loadings
- Much **easier** to **visualize** the variables to group into each factor

	PC1	PC2	PC3
Hitters.CAtBat	0.98	0.13	0.02
Hitters.CRuns	0.97	0.18	0.03
Hitters.CHits	0.97	0.15	0.01
Hitters.CRBI	0.95	0.11	0.23
Hitters.CWalks	0.94	0.12	0.01
Hitters.CHmRun	0.84	0.08	0.45
Hitters.Hits	0.08	0.95	0.14
Hitters.AtBat	0.09	0.95	0.17
Hitters.Runs	0.06	0.94	0.21
Hitters.Walks	0.24	0.78	0.05
Hitters.RBI	0.18	0.74	0.60
Hitters.HmRun	0.14	0.48	0.84

®Tips

`principal(){psych}` → Principal components function in the `{psych}` package, which works well for Factor Analysis

`factor.x.all=principal(x.dataFrame,`
`nfactors=12, scores=TRUE)` → To extract all principal components from the x data frame. `nfactors=p` when p is the total number of variables generates all p principal components

`factor.x.5=principal(x.dataFrame,`
`nfactors=5,scores=TRUE)` → To extract only 5 factors, for example

`factor.x.5=principal(x.dataFrame, nfactors=5,`
`rotate="varimax", scores=TRUE)` → To extract only 5 factors, for example, with "Varimax" rotation, which is highly recommended for Factor Analysis with survey data

`factor.x.5.sorted = fa.sort(factor.x.5)` → To sort and group variables into factors based on their factor loadings.

`factor.1=mean(x1, x2, x3, etc.)` → To aggregate (e.g., average) survey items that loaded together into a factor

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