R Notebook

Code

Hide

```
library("readxl")
library("dplyr")
```

```
Attaching package: 'dplyr'

The following objects are masked from 'package:stats':

    filter, lag

The following objects are masked from 'package:base':

    intersect, setdiff, setequal, union
```

Baca data.

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```
ews_data <- read_excel("Data-EWS103Issuer.xlsx")
ews_data <- ews_data[order(ews_data$Rating),]
head(ews_data)
```

BONDS.NO. <dbl>	ISSUER <chr>	LR1 <dbl>	LR2 <dbl>	LR3 <dbl>	LR4 <dbl>	LR5 <dbl>	DR1 <dbl>	DR2 <dbl>
85	Issuer_85	0.7882077	0.7708158	1.7904885	36.28599	98.582854	0.5521560	1.5334284
23	Issuer_23	1.2448224	1.2321384	0.9331843	36.83118	82.994885	0.6224483	1.7031235
24	Issuer_24	1.2448224	1.2321384	0.9331843	36.83118	82.994885	0.6224483	1.7031235
25	Issuer_25	1.2448224	1.2321384	0.9331843	36.83118	82.994885	0.6224483	1.7031235
27	Issuer_27	5.6455453	2.4491011	0.2416376	98.93883	1.462389	0.4878503	0.9527693
28	Issuer_28	5.6455453	2.4491011	0.2416376	98.93883	1.462389	0.4878503	0.9527693

6 rows | 1-9 of 25 columns

Siapkan variabel bebas numerik untuk PCA

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```
# Independent variable (LR, DR, AR, PR, RR)
ews <- ews_data[c(3:24)]
head(ews)
```

LR1 <dbl>	LR2 <dbl>	LR3 <dbl>	LR4 <dbl>	LR5 <dbl>	DR1 <dbl>	DR2 <dbl>	DR3 <dbl>	AR1 <dbl>
0.7882077	0.7708158	1.7904885	36.28599	98.582854	0.5521560	1.5334284	0.4890418	10.058979
1.2448224	1.2321384	0.9331843	36.83118	82.994885	0.6224483	1.7031235	0.5609999	9.910080
1.2448224	1.2321384	0.9331843	36.83118	82.994885	0.6224483	1.7031235	0.5609999	9.910080
1.2448224	1.2321384	0.9331843	36.83118	82.994885	0.6224483	1.7031235	0.5609999	9.910080
5.6455453	2.4491011	0.2416376	98.93883	1.462389	0.4878503	0.9527693	0.4879067	3.689148
5.6455453	2.4491011	0.2416376	98.93883	1.462389	0.4878503	0.9527693	0.4879067	3.689148

6 rows | 1-9 of 22 columns

Principal Component Analysis

Karena data sudah *centered dan scaled* (standardized) standard deviasi pada hasil PCA berikut adalah eigenvalues. Eigenvalue > 1 terdapat pada PCA 1 - PCA 7 sehingga kita akan menggunakan PCA 7 yang menjelaskan 92% variansi.

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```
fit <- princomp(ews, cor=TRUE) # performs a principal components analysis
summary(fit)
```

```
Importance of components:
                          Comp.1    Comp.2    Comp.3    Comp.4    Comp.5    Comp.6
Standard deviation     2.6464990 2.0503501 1.7497005 1.5737802 1.1239806 1.0987697
Proportion of Variance 0.3183617 0.1910880 0.1391712 0.1125811 0.0574242 0.0548768
Cumulative Proportion  0.3183617 0.5094497 0.6486209 0.7612020 0.8186262 0.8735226
                          Comp.7    Comp.8    Comp.9    Comp.10    Comp.11
Standard deviation     1.0145654 7.79157585 0.56494999 0.46971559 0.420494566
Proportion of Variance 0.0467883Z 0.02848147 0.01450766 0.01002876 0.008037076
Cumulative Proportion  0.9202958 0.94877205 0.96327971 0.97330847 0.981345545
                         Comp.12    Comp.13     Comp.14     Comp.15     Comp.16
Standard deviation     0.3565929316 0.301121420 0.260032239 0.229457520 0.181044197
Proportion of Variance 0.0057799320 0.00412155 0.003973489 0.002393216 0.001489864
Cumulative Proportion  0.9871254770 0.99124703 0.994326917 0.996713733 0.998203597
                         Comp.17     Comp.18 Comp.19 Comp.20 Comp.21 Comp.22
Standard deviation     0.156707507 0.1223259217       0       0       0       0
Proportion of Variance 0.001161838 0.0006801651       0       0       0       0
Cumulative Proportion  0.999319835 1.0000000000       1       1       1       1
```

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```
#loadings(fit) # Extract or print loadings in principal components analysis
```

Dari hasil scree plot kelompok kami memilih untuk menggunakan PCA 1 - 7 dimana eigenvaluenya lebih dari 1.

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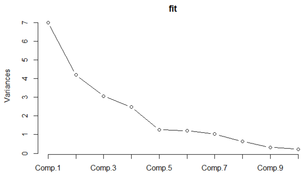
```
plot(fit, type="line") # scree plot
```



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```
scores <- as.data.frame(fit$scores) # PCA Score
scores
```

Comp.1 <dbl>	Comp.2 <dbl>	Comp.3 <dbl>	Comp.4 <dbl>	Comp.5 <dbl>	Comp.6 <dbl>	Comp.7 <dbl>
2.65586216	-4.36370386	-2.218261881	1.17423340	-1.02933768	-1.79527703	0.542250645
1.70203998	-3.32334493	-1.306828876	1.82214107	-0.03595816	-1.82596832	0.007756831
1.70203998	-3.32334493	-1.306828876	1.82214107	-0.03595816	-1.82596832	0.007756831
1.70203998	-3.32334493	-1.306828876	1.82214107	-0.03595816	-1.82596832	0.007756831
1.78283744	-0.28533462	4.930135422	0.67906522	2.32616179	-3.22696787	0.373772960
1.78283744	-0.28533462	4.930135422	0.67906522	2.32616179	-3.22696787	0.373772960
1.78283744	-0.28533462	4.930135422	0.67906522	2.32616179	-3.22696787	0.373772960
1.96468686	-3.55443617	-0.724997965	0.52400730	-1.20905974	-0.26041753	0.449990615
1.96468686	-3.55443617	-0.724997965	0.52400730	-1.20905974	-0.26041753	0.449990615
1.96468686	-3.55443617	-0.724997965	0.52400730	-1.20905974	-0.26041753	0.449990615

1-10 of 103 rows | 1-7 of 22 columns

Previous 1 2 3 4 5 6 … 11 Next

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```
require(foreign)
```

```
Loading required package: foreign
```

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```
require(ggplot2)
```

```
Loading required package: ggplot2
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```
require(MASS)
```

```
Loading required package: MASS

Attaching package: 'MASS'

The following object is masked from 'package:dplyr':

    select
```

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```
require(Hmisc)
```

```
Loading required package: Hmisc
there is no package called 'Rfa'Hmisc'
```

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```
require(reshape2)
```

```
Loading required package: reshape2
package 'Rfa'reshape2'Rfa' was built under R version 4.0.4
```

Ordinal Logistic Regression

Hasil coefficient table.

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```
# Logistic Regression
model <- polr(as.factor(ews_data$Rating) ~ scores$Comp.1 + scores$Comp.2 +
                scores$Comp.3 + scores$Comp.4 + scores$Comp.5 + scores$Comp.6 +
                scores$Comp.7,
              data=ews_data, method="logistic", Hess=T)

# Coefficient Table
ctable <- coef(summary(model))

# Store p values
p <- pnorm(abs(ctable[, "t value"]), lower.tail = FALSE) * 2

# Combined tables
(ctable <- cbind(ctable, "p value" = p))
```

```
                  Value Std. Error    t value      p value
scores$Comp.1  -0.53121900 0.09113119 -5.8291675 5.570456e-09
scores$Comp.2   0.92882853 0.16374275  5.6724866 1.407396e-08
scores$Comp.3   0.20996895 0.12518035  1.6773315 9.347767e-02
scores$Comp.4 -0.06602596 0.14329525 -0.4189971 6.752914e-01
scores$Comp.5 -0.19099015 0.20430286 -0.9348383 3.498716e-01
scores$Comp.6  1.21649102 0.24816583  4.9019280 9.490061e-07
scores$Comp.7 -0.24128679 0.29751790 -1.1627276 2.449400e-01
1|2           -8.66180313 1.48023031 -5.8516591 4.866935e-09
2|3           -3.51342951 0.61053932 -5.7546326 8.683042e-09
3|4            1.76346192 0.35509459  4.9661752 6.828628e-07
4|5            4.03340339 0.51771048  7.7908474 6.656125e-15
5|6            4.82989602 0.63786066  7.5720237 3.674546e-14
```

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```
data <- ews_data[,3:9]
hasil <- c()
for (x in 1:nrow(data)) {
  angka = 0
  for (i in (1:7)) {
    angka = angka + (data[x,i] * ctable[i,1])
  }
  hasil[x] <- angka
}

ews_data$value <- abs(as.numeric(hasil))
COLOR <- c(1:6)

ews_sort <- ews_data[order(-ews_data$value, ews_data$Rating) , ]

op <- par(mar=c(4,4,1,1), ps=10)
plot(ews_sort$value, col=COLOR[ews_sort$Rating] )
legend("topright", legend=levels(as.factor(ews_sort$Rating)), fill = COLOR, border=COLOR)
```

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```
par(op)
```