

```

> ##Importing Data and initial analyses
> #Importing csv file from a location
> attr<- read.csv(file="MVA/Attrition Dataset.csv", header=TRUE, sep=",")
> attr <- as.data.frame(attr)
> glimpse(attr)

```

Observations: 1,470

Variables: 35

\$ Age	<int> 41, 49, 37, 33, 27, 32, 59, 30, 38, 36, 35, 29, 31, 34, 28
, 29, 32, 22, 5...	
\$ Attrition	<fct> Yes, No, Yes, No, No, No, No, No, No, No, No, No, No, No,
Yes, No, No, No...	
\$ BusinessTravel	<fct> Travel_Rarely, Travel_Frequently, Travel_Rarely, Travel_Fr
requently, Trave...	
\$ DailyRate	<int> 1102, 279, 1373, 1392, 591, 1005, 1324, 1358, 216, 1299, 8
09, 153, 670, 1...	
\$ Department	<fct> Sales, Research & Development, Research & Development, Res
earch & Develop...	
\$ DistanceFromHome	<int> 1, 8, 2, 3, 2, 2, 3, 24, 23, 27, 16, 15, 26, 19, 24, 21, 5
, 16, 2, 2, 11,...	
\$ Education	<int> 2, 1, 2, 4, 1, 2, 3, 1, 3, 3, 3, 2, 1, 2, 3, 4, 2, 2, 4, 3
, 2, 4, 4, 2, 1...	
\$ EducationField	<fct> Life Sciences, Life Sciences, Other, Life Sciences, Medica
l, Life Science...	
\$ EmployeeCount	<int> 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1
, 1, 1, 1, 1, 1...	
\$ EmployeeNumber	<int> 1, 2, 4, 5, 7, 8, 10, 11, 12, 13, 14, 15, 16, 18, 19, 20,
21, 22, 23, 24,...	
\$ EnvironmentSatisfaction	<int> 2, 3, 4, 4, 1, 4, 3, 4, 4, 3, 1, 4, 1, 2, 3, 2, 1, 4, 1, 4
, 1, 3, 1, 3, 2...	
\$ Gender	<fct> Female, Male, Male, Female, Male, Male, Female, Male, Male
, Male, Male, F...	
\$ HourlyRate	<int> 94, 61, 92, 56, 40, 79, 81, 67, 44, 94, 84, 49, 31, 93, 50
, 51, 80, 96, 7...	
\$ JobInvolvement	<int> 3, 2, 2, 3, 3, 3, 4, 3, 2, 3, 4, 2, 3, 3, 2, 4, 4, 4, 2, 3
, 4, 2, 3, 3, 3...	
\$ JobLevel	<int> 2, 2, 1, 1, 1, 1, 1, 1, 3, 2, 1, 2, 1, 1, 1, 3, 1, 1, 4, 1
, 2, 1, 3, 1, 1...	
\$ JobRole	<fct> Sales Executive, Research Scientist, Laboratory Technician
, Research Scie...	
\$ JobSatisfaction	<int> 4, 2, 3, 3, 2, 4, 1, 3, 3, 3, 2, 3, 3, 4, 3, 1, 2, 4, 4, 4
, 3, 1, 2, 4, 1...	
\$ MaritalStatus	<fct> Single, Married, Single, Married, Married, Single, Married
, Divorced, Sin...	
\$ MonthlyIncome	<int> 5993, 5130, 2090, 2909, 3468, 3068, 2670, 2693, 9526, 5237
, 2426, 4193, 2...	
\$ MonthlyRate	<int> 19479, 24907, 2396, 23159, 16632, 11864, 9964, 13335, 8787
, 16577, 16479,...	
\$ NumCompaniesWorked	<int> 8, 1, 6, 1, 9, 0, 4, 1, 0, 6, 0, 0, 1, 0, 5, 1, 0, 1, 2, 5
, 0, 7, 0, 1, 2...	
\$ Over18	<fct> Y, Y, Y, Y, Y, Y, Y, Y, Y, Y, Y, Y, Y, Y, Y, Y, Y, Y, Y, Y
, Y, Y, Y, Y...	
\$ OverTime	<fct> Yes, No, Yes, Yes, No, No, Yes, No, No, No, No, Yes, No, N
o, Yes, No, Yes...	
\$ PercentSalaryHike	<int> 11, 23, 15, 11, 12, 13, 20, 22, 21, 13, 13, 12, 17, 11, 14
, 11, 12, 13, 1...	
\$ PerformanceRating	<int> 3, 4, 3, 3, 3, 3, 4, 4, 4, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3
, 3, 4, 3, 3, 3...	
\$ RelationshipsSatisfaction	<int> 1, 4, 2, 3, 4, 3, 1, 2, 2, 2, 3, 4, 4, 3, 2, 3, 4, 2, 3, 3
, 4, 2, 3, 4, 3...	
\$ StandardHours	<int> 80, 80, 80, 80, 80, 80, 80, 80, 80, 80, 80, 80, 80, 80, 80
, 80, 80, 80, 8...	
\$ StockOptionLevel	<int> 0, 1, 0, 0, 1, 0, 3, 1, 0, 2, 1, 0, 1, 1, 0, 1, 2, 2, 0, 0
, 1, 0, 0, 0, 0...	

```
$ TotalWorkingYears      <int> 8, 10, 7, 8, 6, 8, 12, 1, 10, 17, 6, 10, 5, 3, 6, 10, 7, 1
, 31, 6, 5, 10,...
$ TrainingTimesLastYear  <int> 0, 3, 3, 3, 3, 2, 3, 2, 2, 3, 5, 3, 1, 2, 4, 1, 5, 2, 3, 3
, 5, 4, 4, 6, 2...
$ WorkLifeBalance        <int> 1, 3, 3, 3, 3, 2, 2, 3, 3, 2, 3, 3, 2, 3, 3, 2, 2, 3, 3
, 2, 3, 3, 3, 3...
$ YearsAtCompany          <int> 6, 10, 0, 8, 2, 7, 1, 1, 9, 7, 5, 9, 5, 2, 4, 10, 6, 1, 25
, 3, 4, 5, 12, ...
$ YearsInCurrentRole      <int> 4, 7, 0, 7, 2, 7, 0, 0, 7, 7, 4, 5, 2, 2, 2, 9, 2, 0, 8, 2
, 2, 3, 6, 0, 2...
$ YearsSinceLastPromotion <int> 0, 1, 0, 3, 2, 3, 0, 0, 1, 7, 0, 0, 4, 1, 0, 8, 0, 0, 3, 1
, 1, 0, 2, 0, 1...
$ YearsWithCurrManager    <int> 5, 7, 0, 0, 2, 6, 0, 0, 8, 7, 3, 8, 3, 2, 3, 8, 5, 0, 7, 2
, 3, 3, 11, 0, ...
```

```
> #Dimension of the dataset
> dim(attr)
[1] 1470    35
```

```
> #view the first 5 rows of the dataset
> head(attr)
```

Age	Attrition	BusinessTravel	DailyRate	Department	DistanceFromHome	Education
1	41	Yes	Travel_Rarely	1102	Sales	1
2	Life Sciences					
2	49	No	Travel_Frequently	279	Research & Development	8
1	Life Sciences					
3	37	Yes	Travel_Rarely	1373	Research & Development	2
2	Other					
4	33	No	Travel_Frequently	1392	Research & Development	3
4	Life Sciences					
5	27	No	Travel_Rarely	591	Research & Development	2
1	Medical					
6	32	No	Travel_Frequently	1005	Research & Development	2
2	Life Sciences					
EmployeeCount	EmployeeNumber	EnvironmentsSatisfaction	Gender	HourlyRate	JobInvolvement	JobLevel
1	1	1	2 Female	94		3
2						
2	1	2	3 Male	61		2
2						
3	1	4	4 Male	92		2
1						
4	1	5	4 Female	56		3
1						
5	1	7	1 Male	40		3
1						
6	1	8	4 Male	79		3
1						
JobRole	JobsSatisfaction	MaritalStatus	MonthlyIncome	MonthlyRate	NumCompaniesworked	Over18
1	Sales Executive		4	Single	5993	19479
8	Y					
2	Research Scientist		2	Married	5130	24907
1	Y					
3	Laboratory Technician		3	Single	2090	2396
6	Y					
4	Research Scientist		3	Married	2909	23159
1	Y					
5	Laboratory Technician		2	Married	3468	16632
9	Y					
6	Laboratory Technician		4	Single	3068	11864
0	Y					

OverTime	PercentSalaryHike	PerformanceRating	RelationshipSatisfaction	StandardHours	StockOptionLevel
1	Yes	11	3	1	80
2	No	23	4	4	80
3	Yes	15	3	2	80
4	Yes	11	3	3	80
5	No	12	3	4	80
6	No	13	3	3	80

TotalWorkingYears	TrainingTimesLastYear	WorkLifeBalance	YearsAtCompany	YearsInCurrentRole
1	8	0	1	6
2	10	3	3	10
3	7	3	3	0
4	8	3	3	8
5	6	3	3	2
6	8	2	2	7

YearsSinceLastPromotion	YearsWithCurrManager
1	0
2	1
3	0
4	3
5	2
6	3

> summary(attr)

Age	Attrition	BusinessTravel	DailyRate	Department
Min. : 18.00	No : 1233	Non-Travel : 150	Min. : 102.0	Human Resources
1st Qu.: 30.00	Yes: 237	Travel_Frequently: 277	1st Qu.: 465.0	Research & Development
Median : 36.00		Travel_Rarely : 1043	Median : 802.0	Sales
Mean : 36.92			Mean : 802.5	
3rd Qu.: 43.00			3rd Qu.: 1157.0	
Max. : 60.00			Max. : 1499.0	

DistanceFromHome	Education	EducationField	EmployeeCount	EmployeeNumber
Min. : 1.000	Min. : 1.000	Human Resources : 27	Min. : 1	Min. : 1.0
1st Qu.: 2.000	1st Qu.: 2.000	Life Sciences : 606	1st Qu.: 1	1st Qu.: 491.2
Median : 7.000	Median : 3.000	Marketing : 159	Median : 1	Median : 1020.5
Mean : 9.193	Mean : 2.913	Medical : 464	Mean : 1	Mean : 1024.9
3rd Qu.: 14.000	3rd Qu.: 4.000	Other : 82	3rd Qu.: 1	3rd Qu.: 1555.8
Max. : 29.000	Max. : 5.000	Technical Degree: 132	Max. : 1	Max. : 2068.0

EnvironmentSatisfaction	Gender	HourlyRate	JobInvolvement	JobLevel
Min. : 1.000	Female: 588	Min. : 30.00	Min. : 1.00	Min. : 1.000
1st Qu.: 2.000	Male : 882	1st Qu.: 48.00	1st Qu.: 2.00	1st Qu.: 1.000
Median : 3.000		Median : 66.00	Median : 3.00	Median : 2.000
Mean : 2.722		Mean : 65.89	Mean : 2.73	Mean : 2.064
3rd Qu.: 4.000		3rd Qu.: 83.75	3rd Qu.: 3.00	3rd Qu.: 3.000
Max. : 4.000		Max. : 100.00	Max. : 4.00	Max. : 5.000

JobRole	JobSatisfaction	MaritalStatus	MonthlyIncome	MonthlyRate
Sales Executive	: 326	Min. : 1.000	Divorced: 327	Min. : 1009
Research Scientist	: 292	1st Qu.: 2.000	Married : 673	1st Qu.: 2911
Laboratory Technician	: 259	Median : 3.000	Single : 470	Median : 4919

Manufacturing Director	:145	Mean	:2.729	Mean	: 6503	Mean	:1431
Healthcare Representative	:131	3rd Qu.	:4.000	3rd Qu.	: 8379	3rd Qu.	:2046
Manager	:102	Max.	:4.000	Max.	:19999	Max.	:2699
(Other)	:215						

NumCompaniesWorked	Over18	OverTime	PercentSalaryHike	PerformanceRating	RelationshipSatisfaction
Min. :0.000	Y:1470	No :1054	Min. :11.00	Min. :3.000	Min. :1.000
1st Qu.:1.000		Yes: 416	1st Qu.:12.00	1st Qu.:3.000	1st Qu.:2.000
Median :2.000			Median :14.00	Median :3.000	Median :3.000
Mean :2.693			Mean :15.21	Mean :3.154	Mean :2.712
3rd Qu.:4.000			3rd Qu.:18.00	3rd Qu.:3.000	3rd Qu.:4.000
Max. :9.000			Max. :25.00	Max. :4.000	Max. :4.000

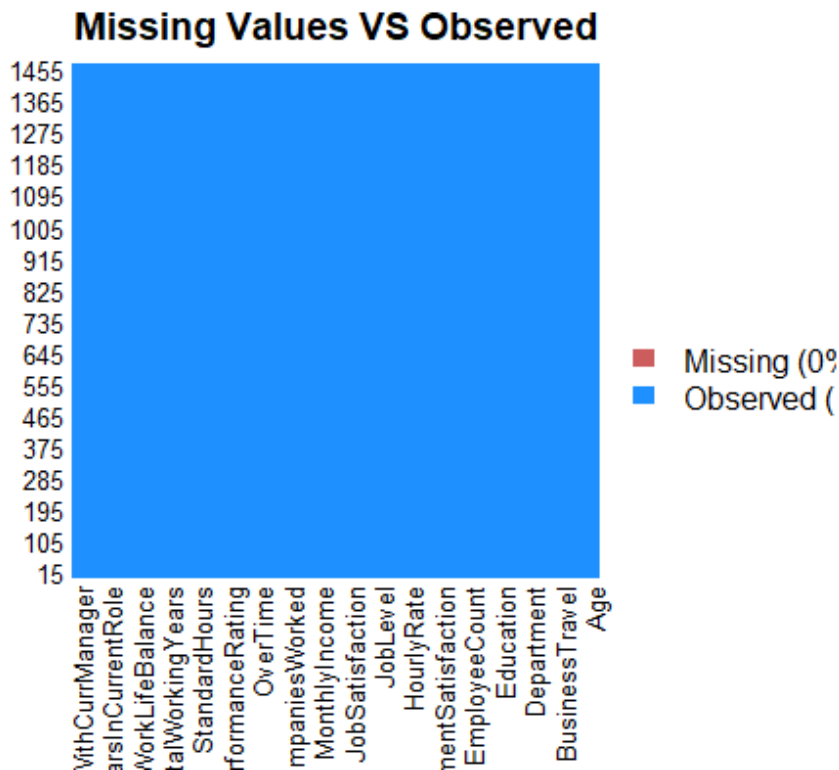
StandardHours	StockOptionLevel	TotalWorkingYears	TrainingTimesLastYear	WorkLifeBalance	YearsAtCompany
Min. :80	Min. :0.0000	Min. : 0.00	Min. :0.000	Min. :1.000	Min. :0.000
1st Qu.:80	1st Qu.:0.0000	1st Qu.: 6.00	1st Qu.:2.000	1st Qu.:2.000	1st Qu.:3.000
Median :80	Median :1.0000	Median :10.00	Median :3.000	Median :3.000	Median :5.000
Mean :80	Mean :0.7939	Mean :11.28	Mean :2.799	Mean :2.761	Mean :7.008
3rd Qu.:80	3rd Qu.:1.0000	3rd Qu.:15.00	3rd Qu.:3.000	3rd Qu.:3.000	3rd Qu.:9.000
Max. :80	Max. :3.0000	Max. :40.00	Max. :6.000	Max. :4.000	Max. :40.000

YearsInCurrentRole	YearsSinceLastPromotion	YearsWithCurrManager
Min. : 0.000	Min. : 0.000	Min. : 0.000
1st Qu.: 2.000	1st Qu.: 0.000	1st Qu.: 2.000
Median : 3.000	Median : 1.000	Median : 3.000
Mean : 4.229	Mean : 2.188	Mean : 4.123
3rd Qu.: 7.000	3rd Qu.: 3.000	3rd Qu.: 7.000
Max. :18.000	Max. :15.000	Max. :17.000

```
> #Rename the Age column
> colnames(attr)[1] <- "Age"
> #Calculating the number of null values in each of the columns
> colSums(sapply(attr,is.na))
```

Age	Attrition	BusinessTravel	DailyRate
0	0	0	0
Department	DistanceFromHome	Education	EducationField
0	0	0	0
EmployeeCount	EmployeeNumber	EnvironmentSatisfaction	Gender
0	0	0	0
HourlyRate	JobInvolvement	JobLevel	JobRole
0	0	0	0
JobSatisfaction	MaritalStatus	MonthlyIncome	MonthlyRate
0	0	0	0
NumCompaniesWorked	Over18	OverTime	PercentSalaryHike
0	0	0	0
PerformanceRating	RelationshipSatisfaction	StandardHours	StockOptionLevel
0	0	0	0
TotalWorkingYears	TrainingTimesLastYear	WorkLifeBalance	YearsAtCompany
0	0	0	0

```
YearsInCurrentRole  YearsSinceLastPromotion  YearsWithCurrManager
0                  0                        0
> missmap(attr,main="Missing Values VS Observed")
```



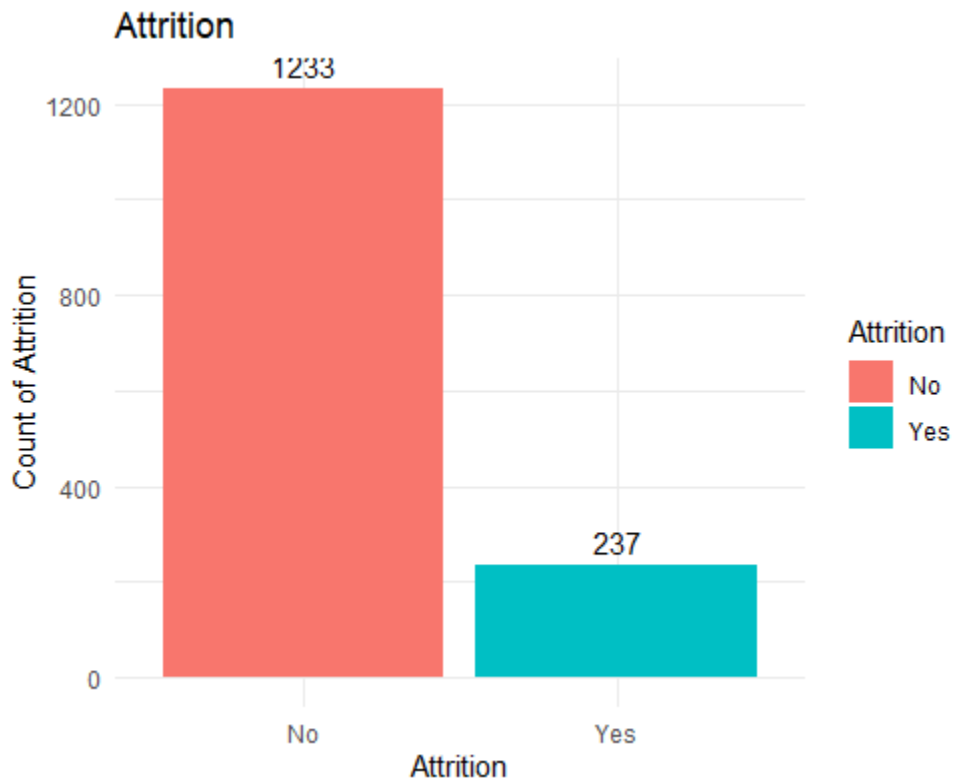
```
> #Removing redundant columns
> attr$EmployeeNumber<- NULL
> attr$StandardHours <- NULL
> attr$Over18 <- NULL
> attr$EmployeeCount <- NULL
> #Converting data type of categorical column
> attr$Education <- factor(attr$Education)
> attr$EnvironmentSatisfaction <- factor(attr$EnvironmentSatisfaction)
> attr$JobInvolvement <- factor(attr$JobInvolvement)
> attr$JobLevel <- factor(attr$JobLevel)
> attr$JobSatisfaction <- factor(attr$JobSatisfaction)
> attr$PerformanceRating <- factor(attr$PerformanceRating)
> attr$RelationshipSatisfaction <- factor(attr$RelationshipSatisfaction)
> attr$StockOptionLevel <- factor(attr$StockOptionLevel)
> attr$WorkLifeBalance <- factor(attr$WorkLifeBalance)
> #Assigning categorical and numerical variable to temporary variable
> catvar<-c('BusinessTravel','Department','Education','EducationField','EnvironmentSatisfac
tion','Gender',
+          'JobRole','JobInvolvement','JobLevel','JobSatisfaction',
+          'MaritalStatus','PerformanceRating','RelationshipSatisfaction','StockOptionLeve
l','WorkLifeBalance')
> numvar<-c('Age','DailyRate','DistanceFromHome','HourlyRate',
+          'MonthlyIncome','MonthlyRate','NumCompaniesWorked','PercentsSalaryHike','TotalWo
rkingYears',
+          'TrainingTimesLastYear','YearsAtCompany',
+          'YearsInCurrentRole','YearsSinceLastPromotion','YearsWithCurrManager')

> ##Exploratory Data Analysis
>
> #Vizualization of Attrition
```

```

> attr %>%
+   group_by(Attrition) %>%
+   tally() %>%
+   ggplot(aes(x =Attrition,y = n,fill=Attrition)) +
+   geom_bar(stat = "identity") +
+   theme_minimal()+
+   labs(x="Attrition", y="Count of Attrition")+
+   ggtitle("Attrition")+
+   geom_text(aes(label = n), vjust = -0.5, position = position_dodge(0.9))

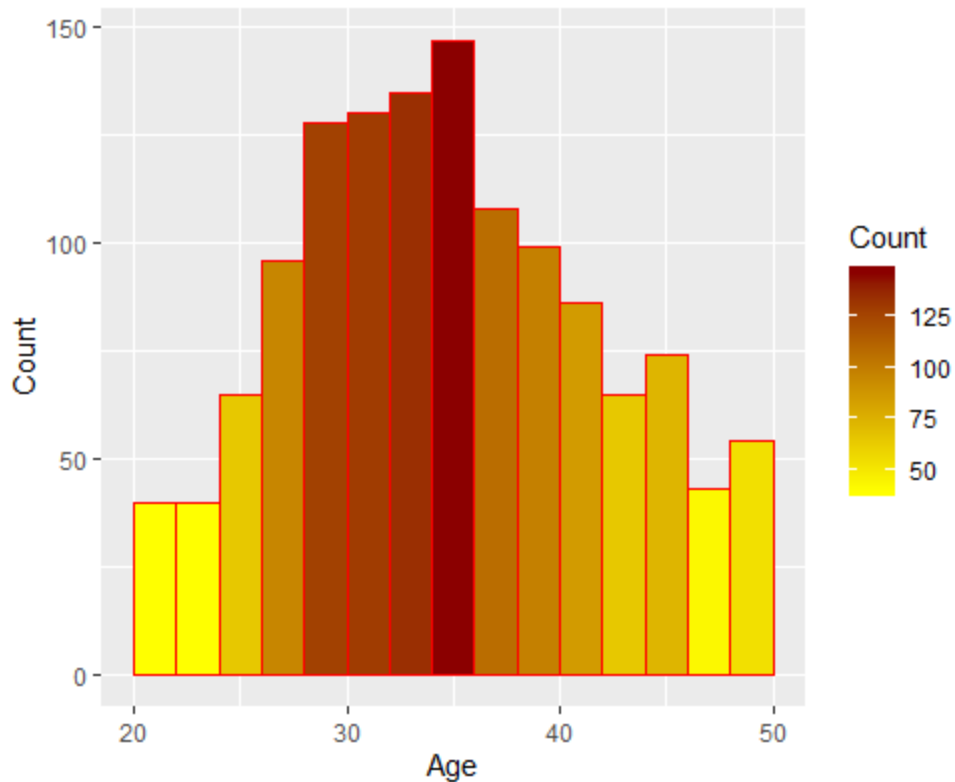
```



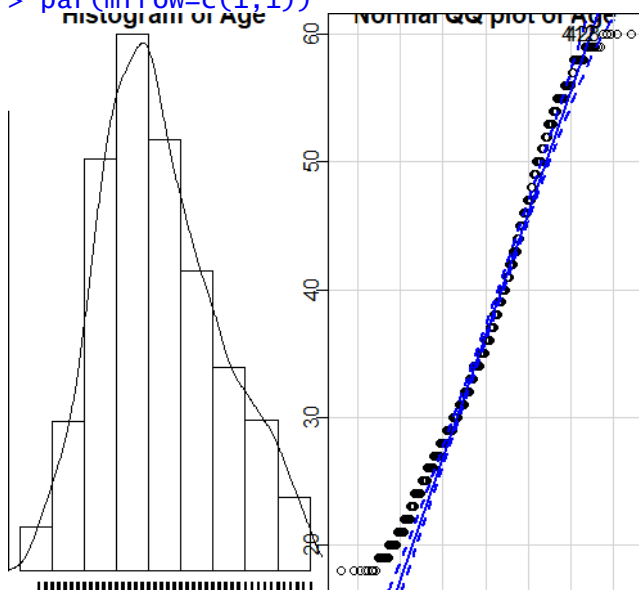
```

#Influence of features on Attrition
> ggplot(data=attr, aes(attr$Age)) +
+   geom_histogram(breaks=seq(20, 50, by=2),
+                 col="red",
+                 aes(fill=..count..))+
+   labs(x="Age", y="Count")+
+   scale_fill_gradient("Count", low="yellow", high="dark red")

```

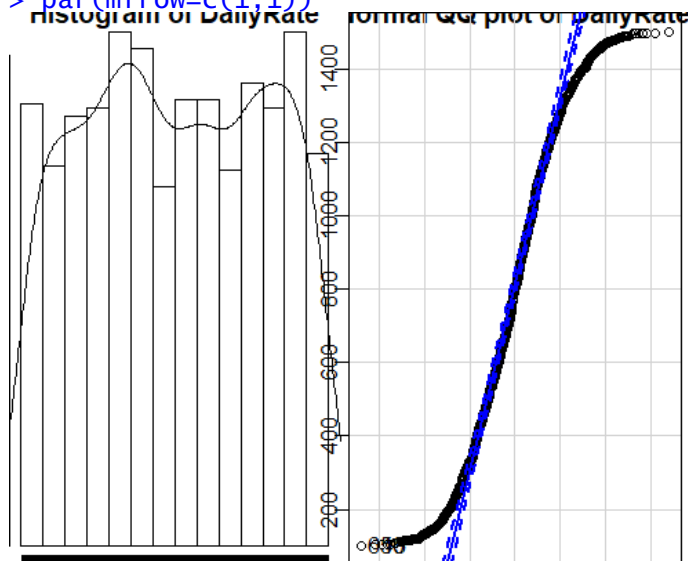


```
> #Checking for distributions in numerical columns
> #The qqPlot show a few extreme outliers which break the assumption of 95% confidence
> #normal distribution
> par(mfrow = c(1,2))
> hist(attr$Age,xlab='',main = 'Histogram of Age',freq = FALSE)
> lines(density(attr$Age,na.rm = T))
> rug(jitter(attr$Age))
> qqPlot(attr$Age,main='Normal QQ plot of Age')
[1] 412 428
> par(mfrow=c(1,1))
```

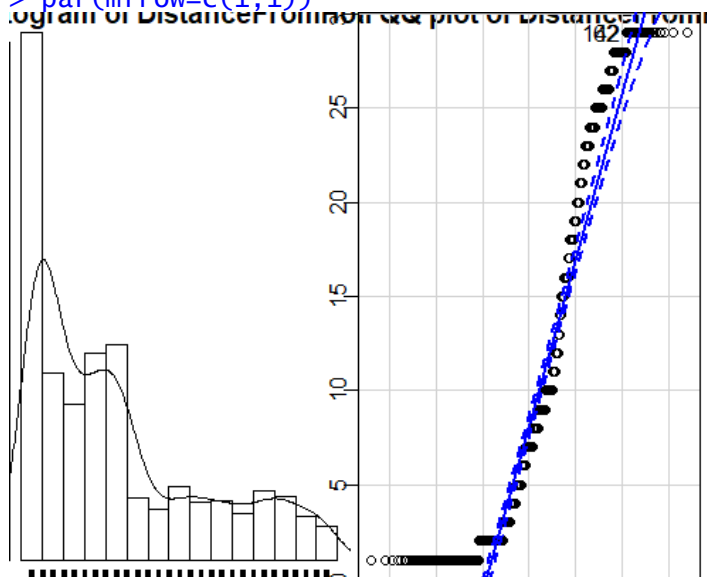


```
> par(mfrow = c(1,2))
```

```
> hist(attr$DailyRate,xlab='',main = 'Histogram of DailyRate',freq = FALSE)
> lines(density(attr$DailyRate,na.rm = T))
> rug(jitter(attr$DailyRate))
> qqPlot(attr$DailyRate,main='Normal QQ plot of DailyRate')
[1] 650 15
> par(mfrow=c(1,1))
```



```
> par(mfrow = c(1,2))
> hist(attr$DistanceFromHome,xlab='',main = 'Histogram of DistanceFromHome',freq = FALSE)
> lines(density(attr$DistanceFromHome,na.rm = T))
> rug(jitter(attr$DistanceFromHome))
> qqPlot(attr$DistanceFromHome,main='Normal QQ plot of DistanceFromHome')
[1] 62 142
> par(mfrow=c(1,1))
```

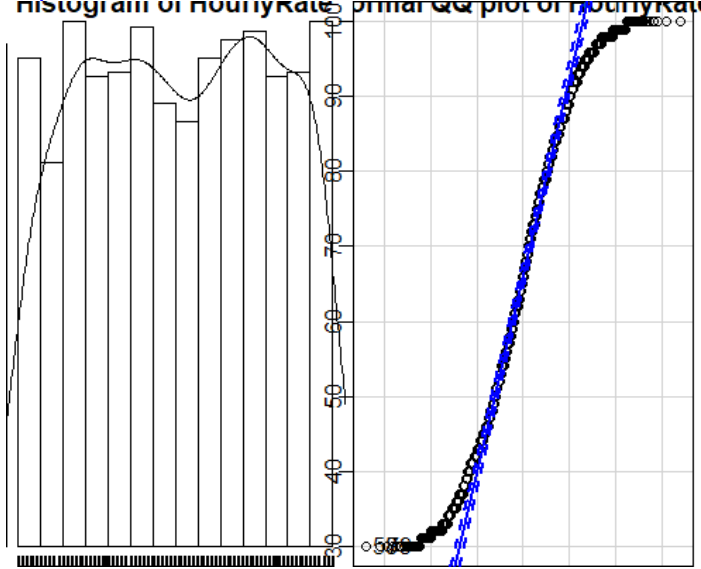


```
> par(mfrow = c(1,2))
> hist(attr$HourlyRate,xlab='',main = 'Histogram of HourlyRate',freq = FALSE)
> lines(density(attr$HourlyRate,na.rm = T))
> rug(jitter(attr$HourlyRate))
> qqPlot(attr$HourlyRate,main='Normal QQ plot of HourlyRate')
```



```
[1] 58 79
```

```
> par(mfrow=c(1,1))
```



```
> par(mfrow = c(1,2))
```

```
> hist(attr$MonthlyIncome,xlab='',main = 'Histogram of Monthly Income',freq = FALSE)
```

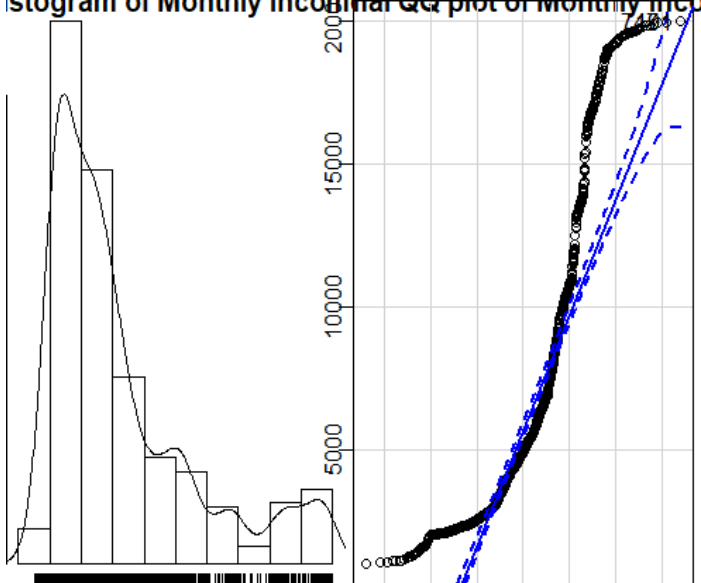
```
> lines(density(attr$MonthlyIncome,na.rm = T))
```

```
> rug(jitter(attr$MonthlyIncome))
```

```
> qqPlot(attr$MonthlyIncome,main='Normal QQ plot of Monthly Income')
```

```
[1] 191 747
```

```
> par(mfrow=c(1,1))
```



```
> par(mfrow = c(1,2))
```

```
> hist(attr$NumCompaniesWorked,xlab='',main = 'Histogram of NumCompaniesWorked',freq = FALSE)
```

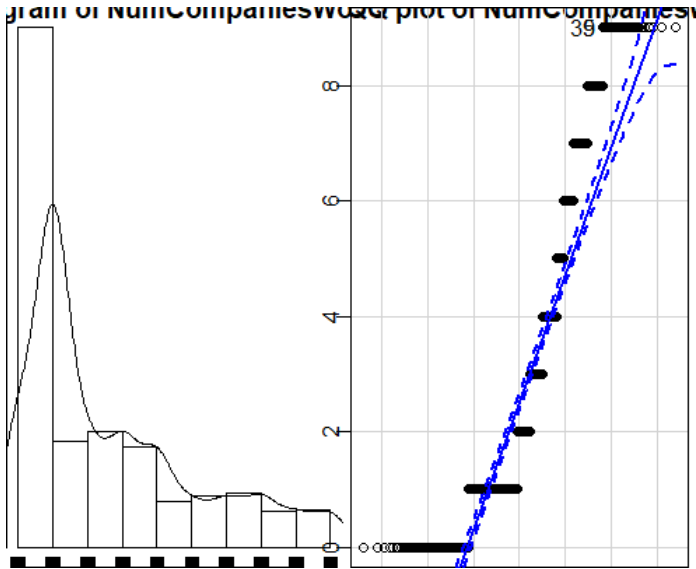
```
> lines(density(attr$NumCompaniesWorked,na.rm = T))
```

```
> rug(jitter(attr$NumCompaniesWorked))
```

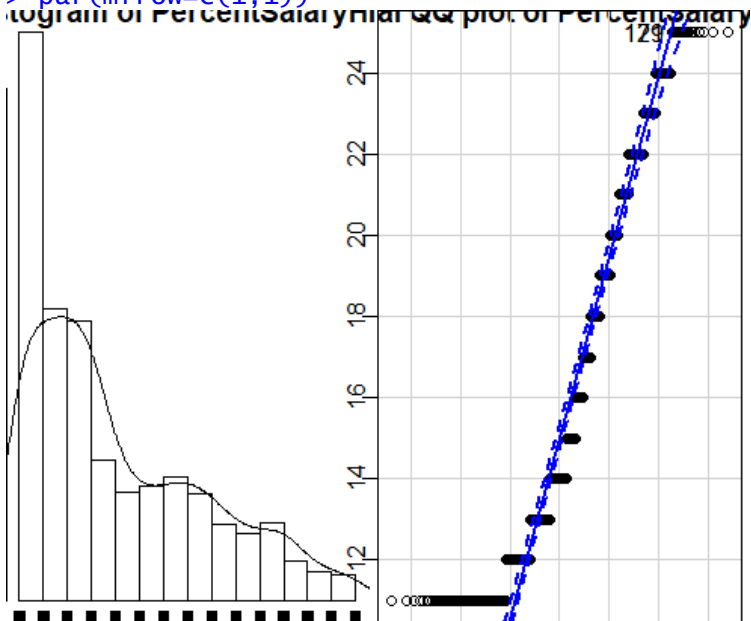
```
> qqPlot(attr$NumCompaniesWorked,main='Normal QQ plot of NumCompaniesWorked')
```

```
[1] 5 39
```

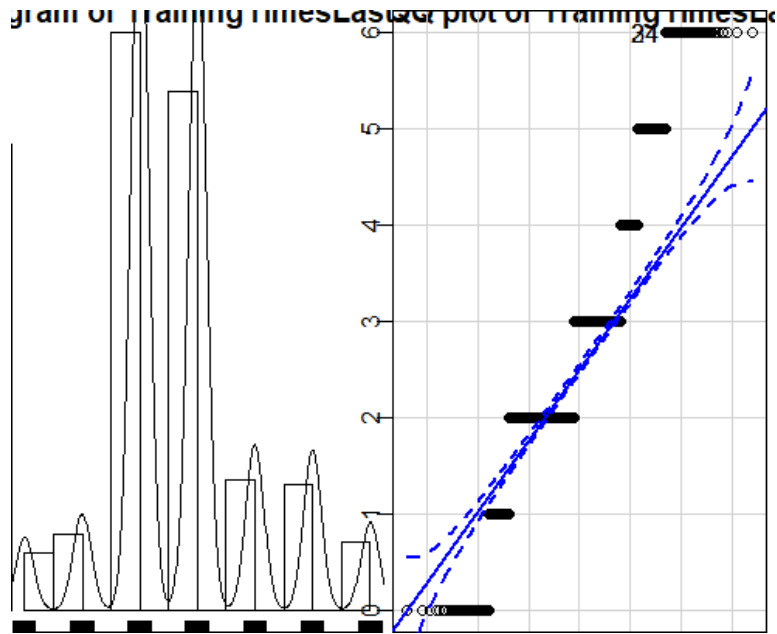
```
> par(mfrow=c(1,1))
```



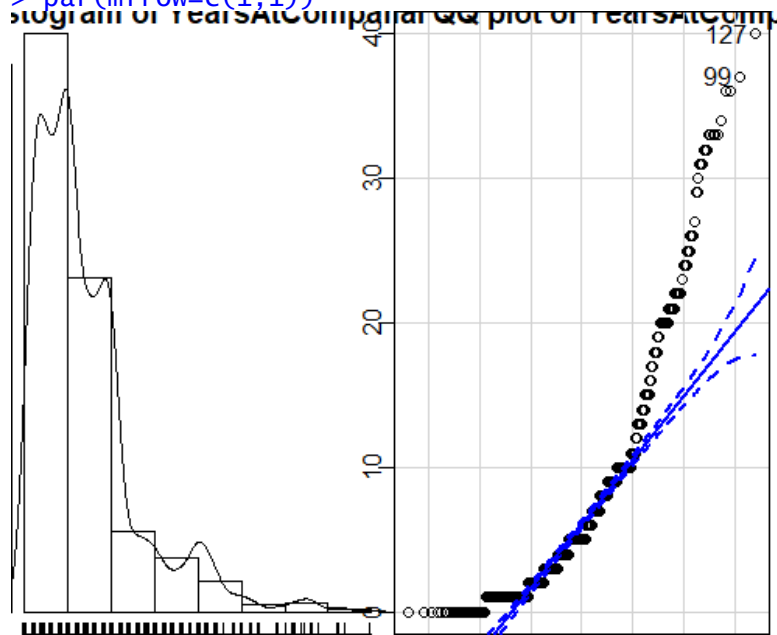
```
> par(mfrow = c(1,2))
> hist(attr$PercentSalaryHike,xlab='',main = 'Histogram of PercentSalaryHike',freq = FALSE)
> lines(density(attr$PercentSalaryHike,na.rm = T))
> rug(jitter(attr$PercentSalaryHike))
> qqPlot(attr$PercentSalaryHike,main='Normal QQ plot of PercentSalaryHike')
[1] 121 179
> par(mfrow=c(1,1))
```



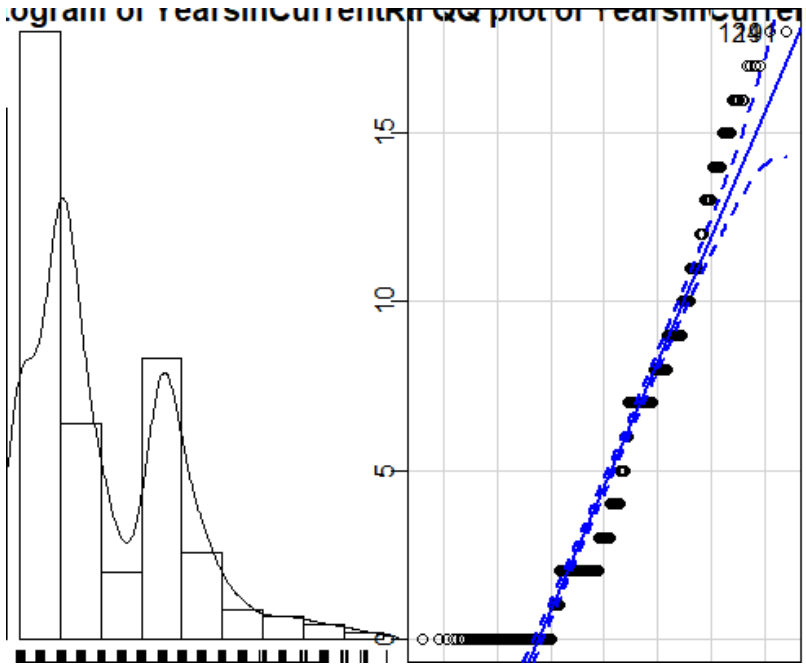
```
> par(mfrow = c(1,2))
> hist(attr$TrainingTimesLastYear,xlab='',main = 'Histogram of TrainingTimesLastYear',freq
= FALSE)
> lines(density(attr$TrainingTimesLastYear,na.rm = T))
> rug(jitter(attr$TrainingTimesLastYear))
> qqPlot(attr$TrainingTimesLastYear,main='Normal QQ plot of TrainingTimesLastYear')
[1] 24 34
> par(mfrow=c(1,1))
```



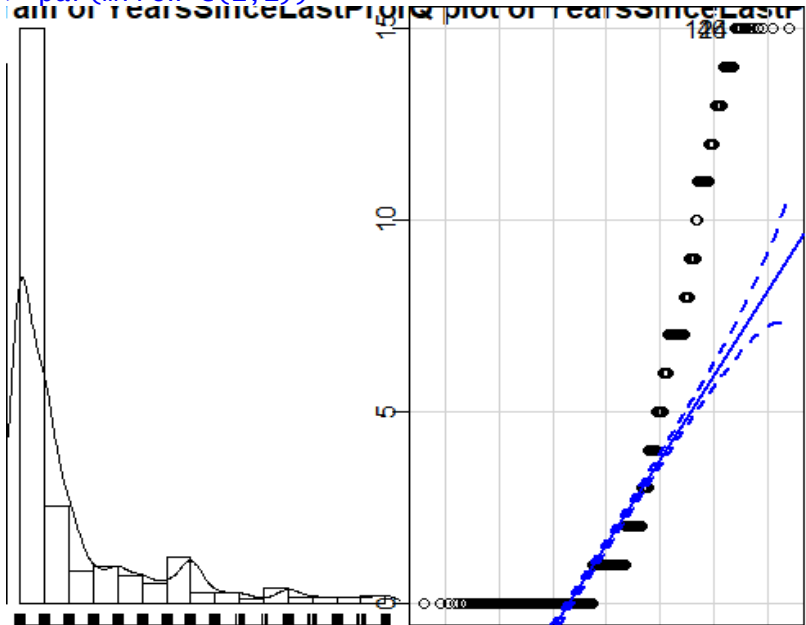
```
> par(mfrow = c(1,2))
> hist(attr$YearsAtCompany,xlab='',main = 'Histogram of YearsAtCompany',freq = FALSE)
> lines(density(attr$YearsAtCompany,na.rm = T))
> rug(jitter(attr$YearsAtCompany))
> qqPlot(attr$YearsAtCompany,main='Normal QQ plot of YearsAtCompany')
[1] 127 99
> par(mfrow=c(1,1))
```



```
> par(mfrow = c(1,2))
> hist(attr$YearsInCurrentRole,xlab='',main = 'Histogram of YearsInCurrentRole',freq = FALSE)
> lines(density(attr$YearsInCurrentRole,na.rm = T))
> rug(jitter(attr$YearsInCurrentRole))
> qqPlot(attr$YearsInCurrentRole,main='Normal QQ plot of YearsInCurrentRole')
[1] 124 191
> par(mfrow=c(1,1))
```

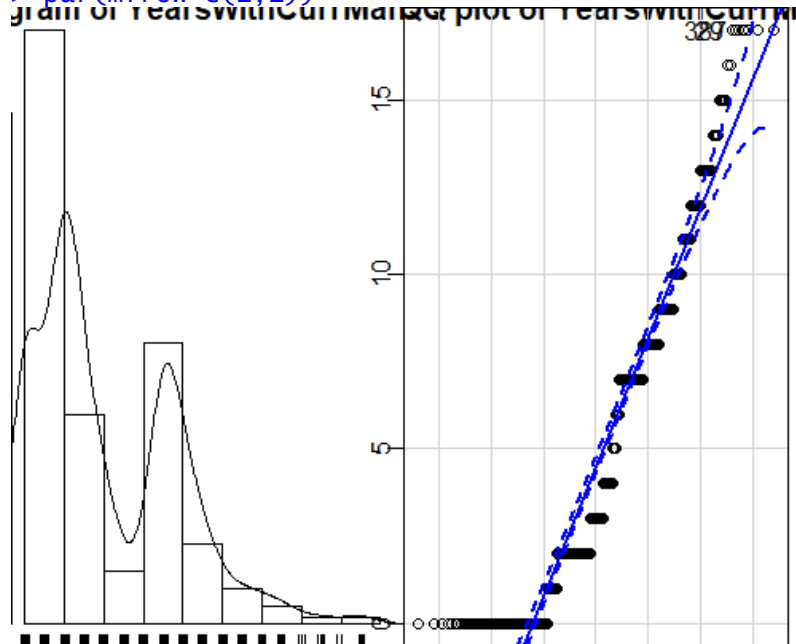


```
> par(mfrow = c(1,2))
> hist(attr$YearsSinceLastPromotion,xlab='',main = 'Histogram of YearsSinceLastPromotion',f
req = FALSE)
> lines(density(attr$YearsSinceLastPromotion,na.rm = T))
> rug(jitter(attr$YearsSinceLastPromotion))
> qqPlot(attr$YearsSinceLastPromotion,main='Normal QQ plot of YearsSinceLastPromotion')
[1] 46 124
> par(mfrow=c(1,1))
```

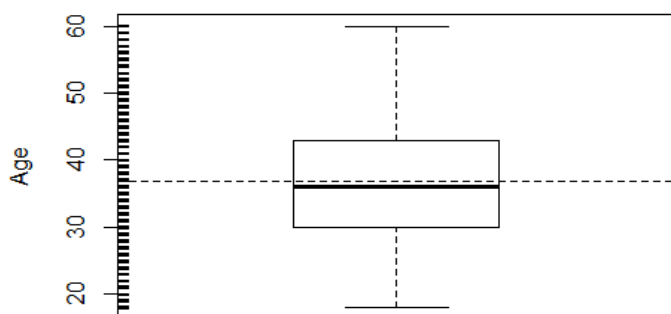


```
> par(mfrow = c(1,2))
> hist(attr$YearsWithCurrManager,xlab='',main = 'Histogram of YearsWithCurrManager',freq =
FALSE)
> lines(density(attr$YearsWithCurrManager,na.rm = T))
> rug(jitter(attr$YearsWithCurrManager))
> qqPlot(attr$YearsWithCurrManager,main='Normal QQ plot of YearsWithCurrManager')
[1] 29 387
```

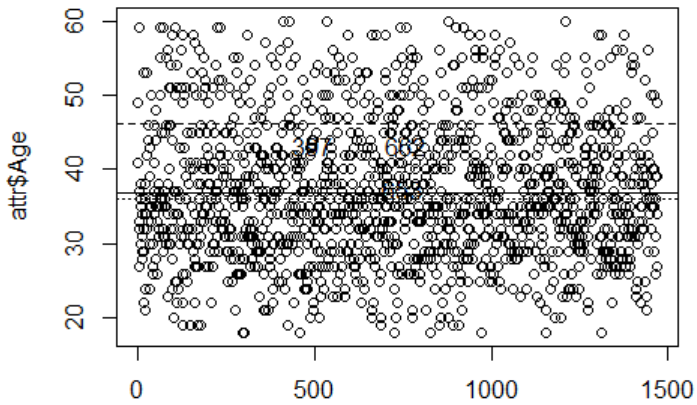
```
> par(mfrow=c(1,1))
```



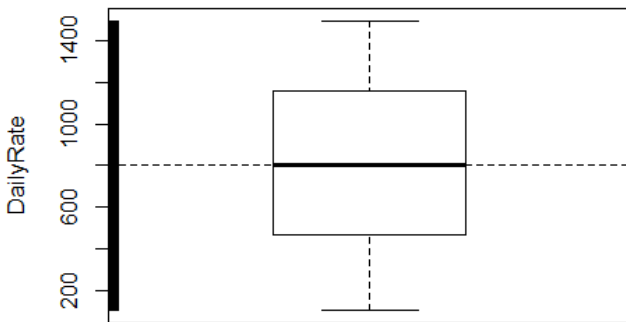
```
> #Boxplot distributions for our numeric columns
> #The dashed line shows the mean and the dark center line shows the median
> #Difference between these two lines depict the deviation from the central limit theorem
> #Boxplot distributions for Age
> boxplot(attr$Age, ylab = "Age")
> rug(jitter(attr$Age), side = 2)
> abline(h = mean(attr$Age, na.rm = T), lty = 2)
```



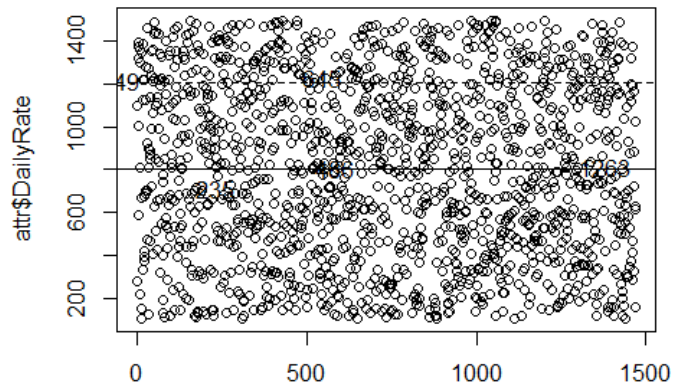
```
> #Plotting the Age with 3 lines for mean, median and mean+std
> plot(attr$Age, xlab = "")
> abline(h = mean(attr$Age, na.rm = T), lty = 1)
> abline(h = mean(attr$Age, na.rm = T) + sd(attr$Age, na.rm = T), lty = 2)
> abline(h = median(attr$Age, na.rm = T), lty = 3)
> identify(attr$Age)
[1] 286 696 709 720 1174 1323
```



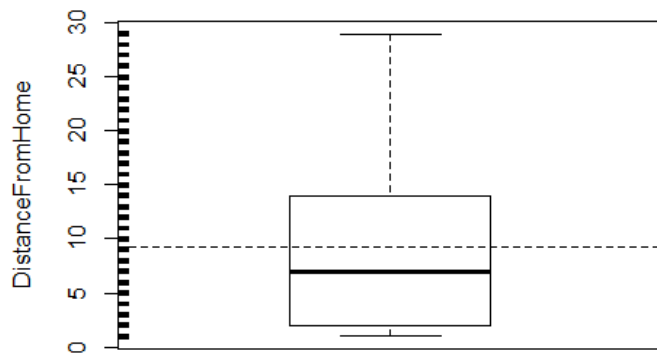
```
> #Boxplot distributions for Daily rate
> boxplot(attr$DailyRate, ylab = "DailyRate",outline = TRUE)
> rug(jitter(attr$DailyRate), side = 2)
> abline(h = mean(attr$DailyRate, na.rm = T), lty = 2)
```



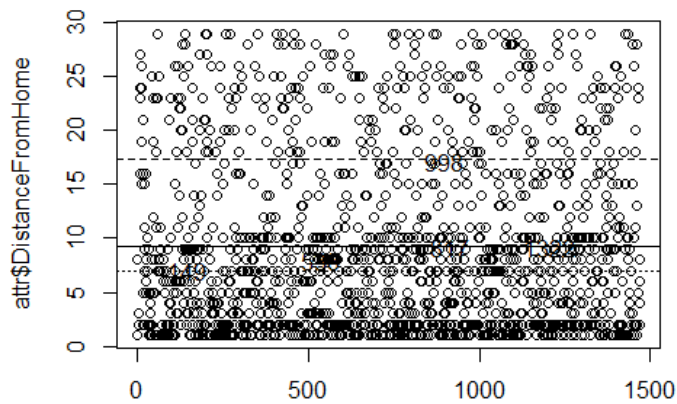
```
> #Plotting the DailyRate with 3 lines for mean, median and mean+std
> plot(attr$DailyRate, xlab = "")
> abline(h = mean(attr$DailyRate, na.rm = T), lty = 1)
> abline(h = mean(attr$DailyRate, na.rm = T) + sd(attr$DailyRate, na.rm = T), lty = 2)
> abline(h = median(attr$DailyRate, na.rm = T), lty = 3)
> identify(attr$DailyRate)
[1] 49 235 486 645 1263
```



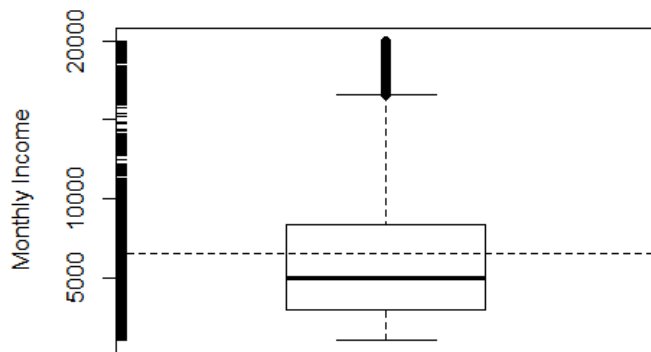
```
> #Boxplot distributions for Distance from home
> boxplot(attr$DistanceFromHome, ylab = "DistanceFromHome",outline = TRUE)
> rug(jitter(attr$DistanceFromHome), side = 2)
> abline(h = mean(attr$DistanceFromHome, na.rm = T), lty = 2)
```



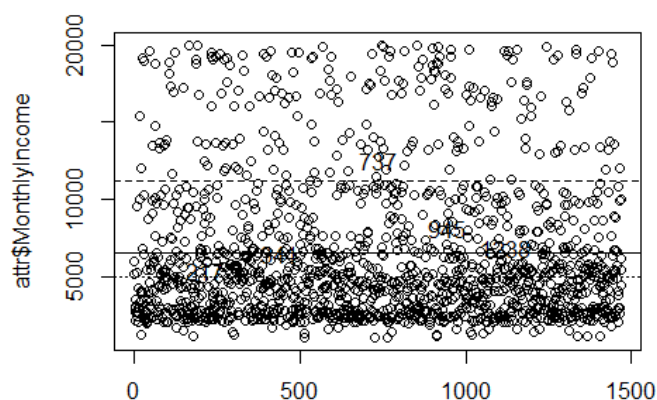
```
> plot(attr$DistanceFromHome, xlab = "")
> abline(h = mean(attr$DistanceFromHome, na.rm = T), lty = 1)
> abline(h = mean(attr$DistanceFromHome, na.rm = T) + sd(attr$DistanceFromHome, na.rm = T),
lty = 2)
> abline(h = median(attr$DistanceFromHome, na.rm = T), lty = 3)
> identify(attr$DistanceFromHome)
[1] 149 538 817 998 1322
```



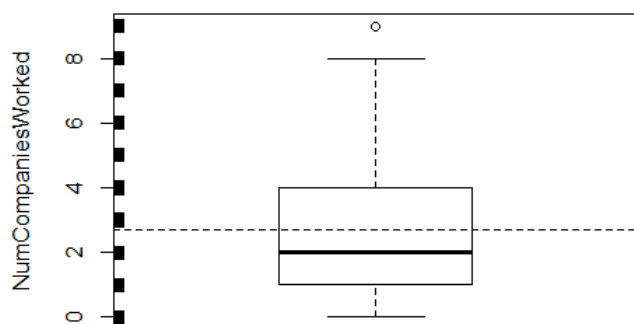
```
> #Boxplot distributions for Monthly Income
> boxplot(attr$MonthlyIncome, ylab = "Monthly Income")
> rug(jitter(attr$MonthlyIncome), side = 2)
> abline(h = mean(attr$MonthlyIncome, na.rm = T), lty = 2)
```



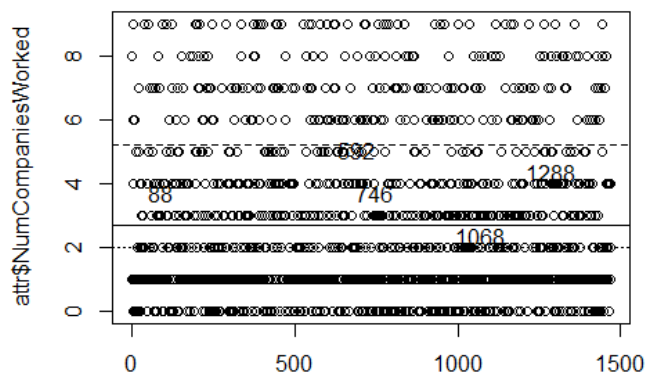
```
> #Plotting the Monthly Income and Age with 3 lines for mean, median and mean+std
> plot(attr$MonthlyIncome, xlab = "")
> abline(h = mean(attr$MonthlyIncome, na.rm = T), lty = 1)
> abline(h = mean(attr$MonthlyIncome, na.rm = T) + sd(attr$MonthlyIncome, na.rm = T), lty = 2)
> abline(h = median(attr$MonthlyIncome, na.rm = T), lty = 3)
> identify(attr$MonthlyIncome)
[1] 217 341 737 945 1238
```

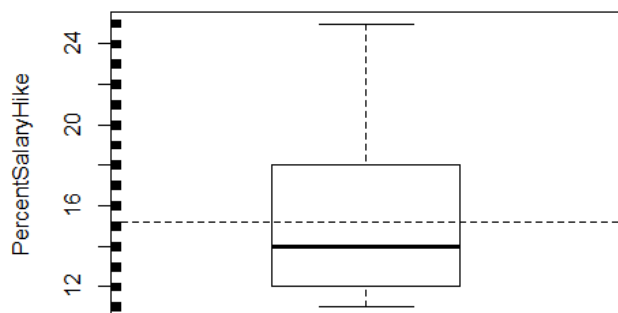
```
> #Boxplot distributions for NumCompaniesworked
> boxplot(attr$NumCompaniesworked, ylab = "NumCompaniesworked")
> rug(jitter(attr$NumCompaniesworked), side = 2)
> abline(h = mean(attr$NumCompaniesworked, na.rm = T), lty = 2)
```



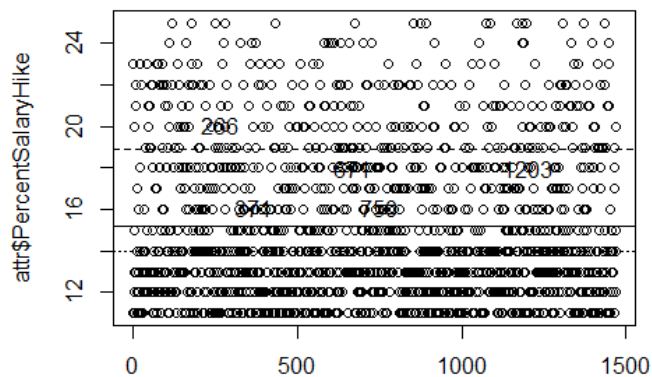
```
> #Plotting the NumCompaniesworked with 3 lines for mean, median and mean+std
> plot(attr$NumCompaniesWorked, xlab = "")
> abline(h = mean(attr$NumCompaniesworked, na.rm = T), lty = 1)
> abline(h = mean(attr$NumCompaniesworked, na.rm = T) + sd(attr$NumCompaniesworked, na.rm =
T), lty = 2)
> abline(h = median(attr$NumCompaniesworked, na.rm = T), lty = 3)
> identify(attr$NumCompaniesworked)
[1] 88 592 746 1068 1288
```



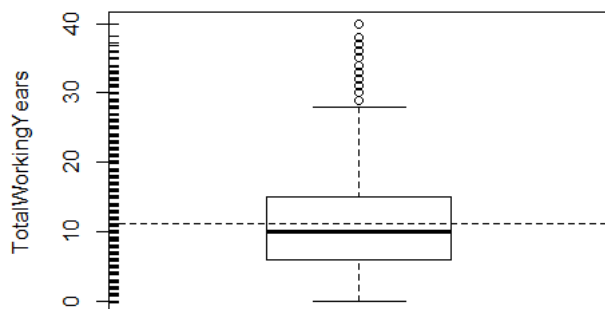
```
> #Boxplot distributions for PercentSalaryHike
> boxplot(attr$PercentSalaryHike, ylab = "PercentSalaryHike")
> rug(jitter(attr$PercentSalaryHike), side = 2)
> abline(h = mean(attr$PercentSalaryHike, na.rm = T), lty = 2)
```



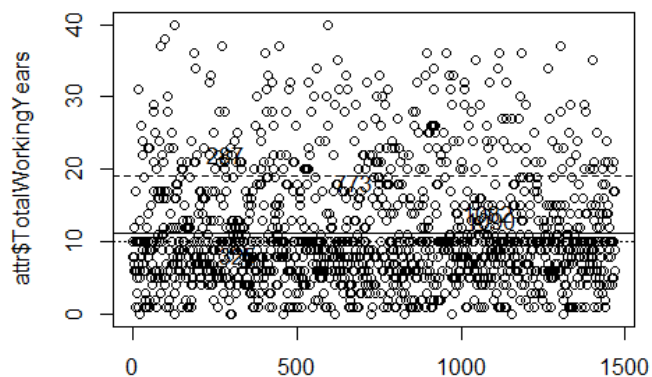
```
> #Plotting the PercentSalaryHike with 3 lines for mean, median and mean+std
> plot(attr$PercentSalaryHike, xlab = "")
> abline(h = mean(attr$PercentSalaryHike, na.rm = T), lty = 1)
> abline(h = mean(attr$PercentSalaryHike, na.rm = T) + sd(attr$PercentSalaryHike, na.rm = T), lty = 2)
> abline(h = median(attr$PercentSalaryHike, na.rm = T), lty = 3)
> identify(attr$PercentSalaryHike)
[1] 266 371 671 750 1203
```



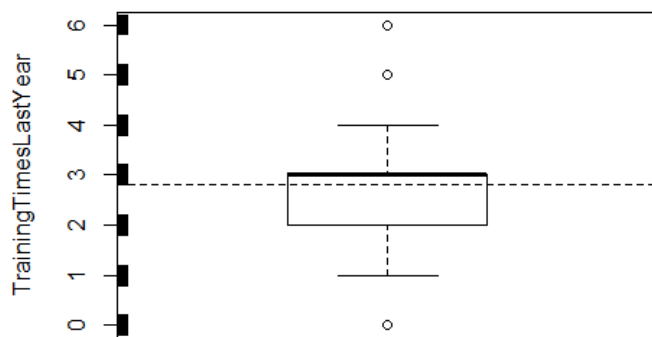
```
> #Boxplot distributions for TotalWorkingYears
> boxplot(attr$TotalWorkingYears, ylab = "TotalWorkingYears")
> rug(jitter(attr$TotalWorkingYears), side = 2)
> abline(h = mean(attr$TotalWorkingYears, na.rm = T), lty = 2)
```



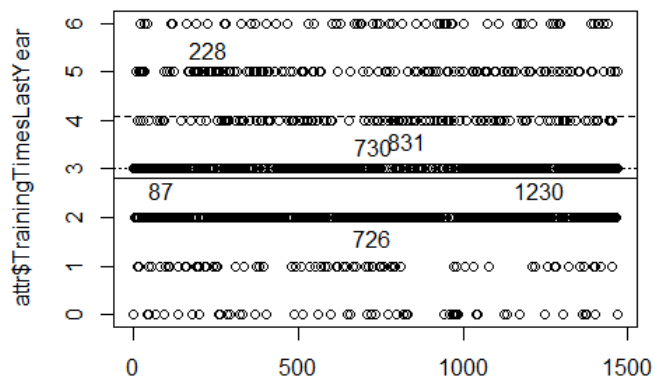
```
> #Plotting the TotalWorkingYears with 3 lines for mean, median and mean+std
> plot(attr$TotalWorkingYears, xlab = "")
> abline(h = mean(attr$TotalWorkingYears, na.rm = T), lty = 1)
> abline(h = mean(attr$TotalWorkingYears, na.rm = T) + sd(attr$TotalWorkingYears, na.rm = T), lty = 2)
> abline(h = median(attr$TotalWorkingYears, na.rm = T), lty = 3)
> identify(attr$TotalWorkingYears)
[1] 287 325 773 1082 1090
```



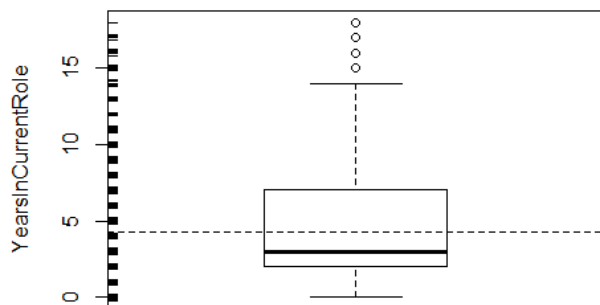
```
> #Boxplot distributions for TrainingTimesLastYear
> boxplot(attr$TrainingTimesLastYear, ylab = "TrainingTimesLastYear")
> rug(jitter(attr$TrainingTimesLastYear), side = 2)
> abline(h = mean(attr$TrainingTimesLastYear, na.rm = T), lty = 2)
```



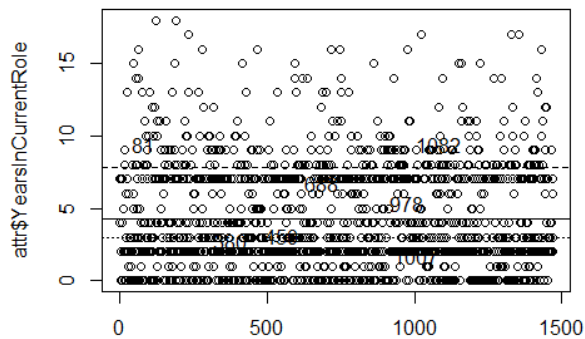
```
> #Plotting the TrainingTimesLastYear with 3 lines for mean, median and mean+std
> plot(attr$TrainingTimesLastYear, xlab = "")
> abline(h = mean(attr$TrainingTimesLastYear, na.rm = T), lty = 1)
> abline(h = mean(attr$TrainingTimesLastYear, na.rm = T) + sd(attr$TrainingTimesLastYear, n
a.rm = T), lty = 2)
> abline(h = median(attr$TrainingTimesLastYear, na.rm = T), lty = 3)
> identify(attr$TrainingTimesLastYear)
[1] 87 228 726 730 831 1230
```



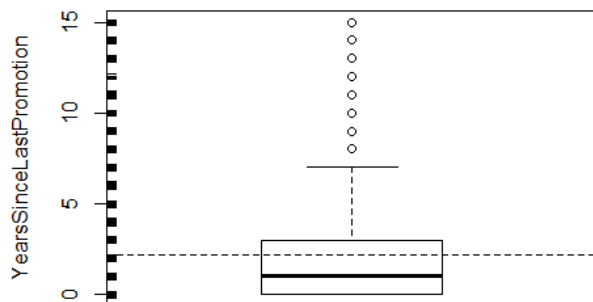
```
> #Boxplot distributions for YearsInCurrentRole
> boxplot(attr$YearsInCurrentRole, ylab = "YearsInCurrentRole")
> rug(jitter(attr$YearsInCurrentRole), side = 2)
> abline(h = mean(attr$YearsInCurrentRole, na.rm = T), lty = 2)
```



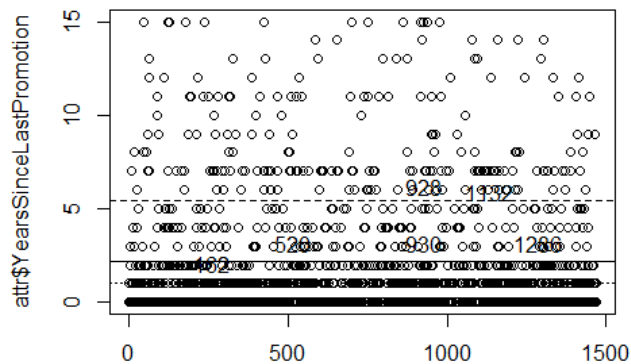
```
> #Plotting the YearsInCurrentRole with 3 lines for mean, median and mean+std
> plot(attr$YearsInCurrentRole, xlab = "")
> abline(h = mean(attr$YearsInCurrentRole, na.rm = T), lty = 1)
> abline(h = mean(attr$YearsInCurrentRole, na.rm = T) + sd(attr$YearsInCurrentRole, na.rm =
T), lty = 2)
> abline(h = median(attr$YearsInCurrentRole, na.rm = T), lty = 3)
> identify(attr$YearsInCurrentRole)
[1] 81 380 450 688 978 1007 1082
```



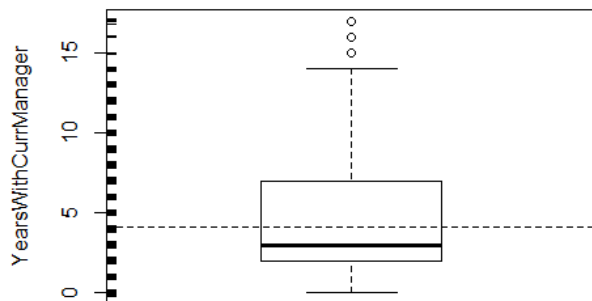
```
> #Boxplot distributions for YearsSinceLastPromotion
> boxplot(attr$YearsSinceLastPromotion, ylab = "YearsSinceLastPromotion")
> rug(jitter(attr$YearsSinceLastPromotion), side = 2)
> abline(h = mean(attr$YearsSinceLastPromotion, na.rm = T), lty = 2)
```



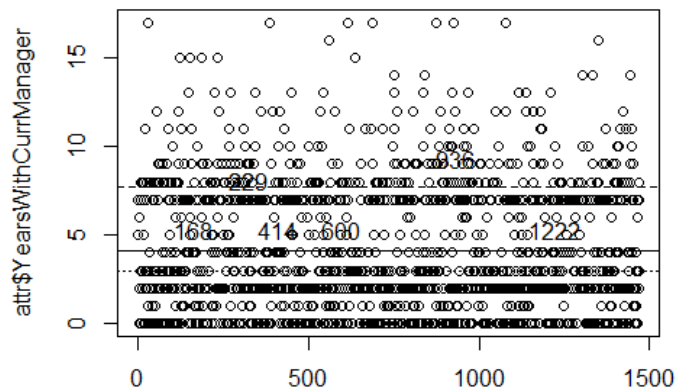
```
> #Plotting the YearsSinceLastPromotion with 3 lines for mean, median and mean+std
> plot(attr$YearsSinceLastPromotion, xlab = "")
> abline(h = mean(attr$YearsSinceLastPromotion, na.rm = T), lty = 1)
> abline(h = mean(attr$YearsSinceLastPromotion, na.rm = T) + sd(attr$YearsSinceLastPromotion, na.rm = T), lty = 2)
> abline(h = median(attr$YearsSinceLastPromotion, na.rm = T), lty = 3)
> identify(attr$YearsSinceLastPromotion)
[1] 162 520 928 930 1132 1286
```



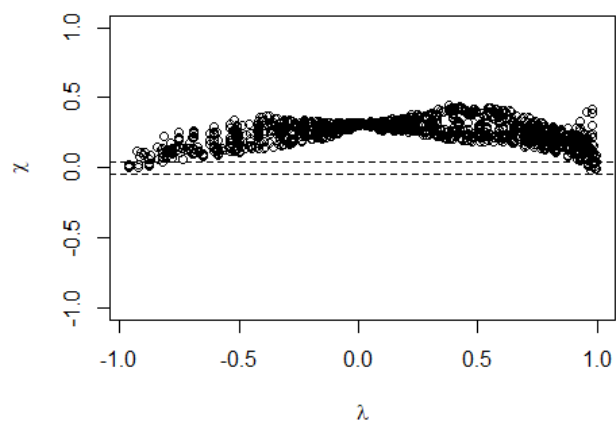
```
> #Boxplot distributions for YearsWithCurrManager
> boxplot(attr$YearsWithCurrManager, ylab = "YearsWithCurrManager")
> rug(jitter(attr$YearsWithCurrManager), side = 2)
> abline(h = mean(attr$YearsWithCurrManager, na.rm = T), lty = 2)
```



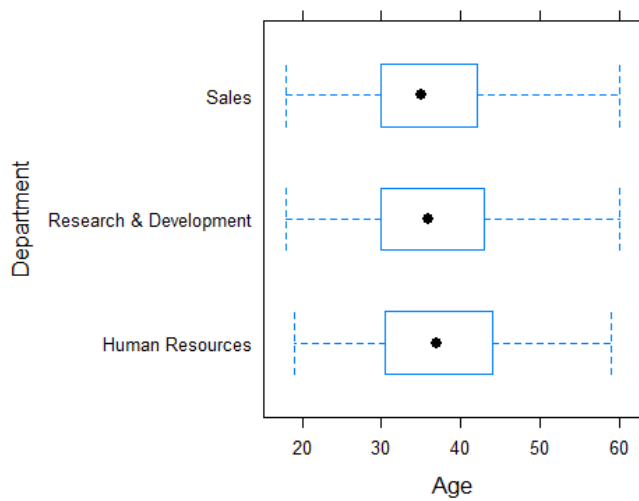
```
> #Boxplot distributions for YearsWithCurrManager
> plot(attr$YearsWithCurrManager, xlab = "")
> abline(h = mean(attr$YearsWithCurrManager, na.rm = T), lty = 1)
> abline(h = mean(attr$YearsWithCurrManager, na.rm = T) + sd(attr$YearsWithCurrManager, na.
rm = T), lty = 2)
> abline(h = median(attr$YearsWithCurrManager, na.rm = T), lty = 3)
> identify(attr$YearsWithCurrManager)
[1] 168 229 414 600 936 1222
```



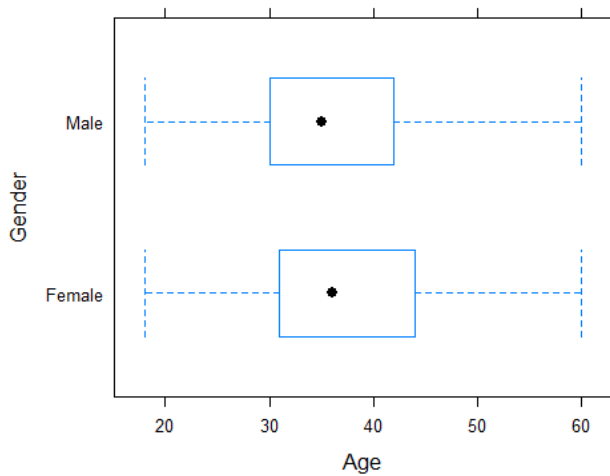
```
> #Chi Plot for inspecting the independence
> chi.plot(attr$MonthlyIncome,attr$Age)
```



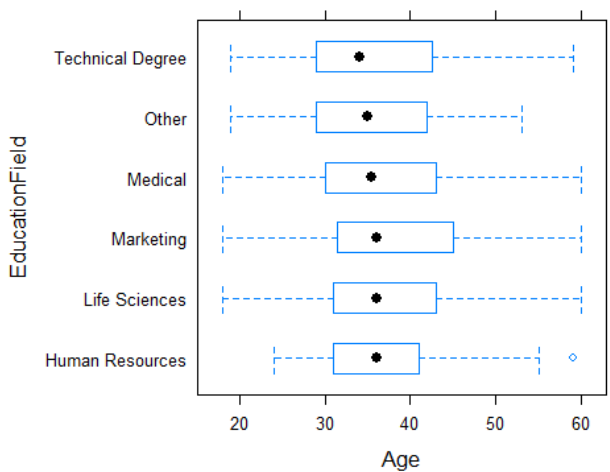
```
> #Plotting joint boxplots for various categories wrt Age
> bwplot(attr$Department ~ attr$Age, data=attr, ylab='Department',xlab='Age')
```

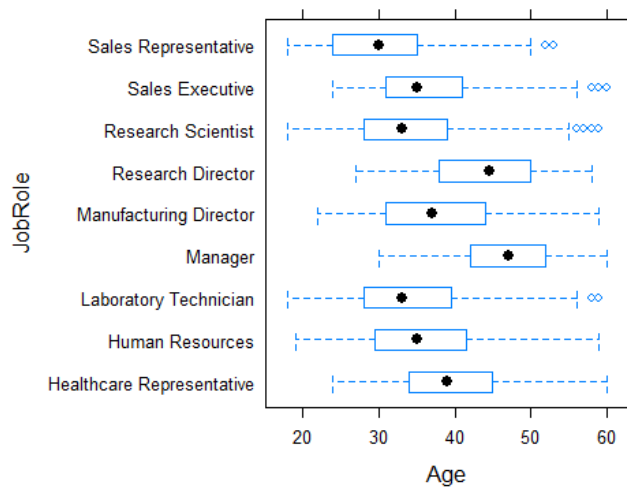
```
> bwplot(attr$Gender ~ attr$Age, data=attr, ylab='Gender',xlab='Age')
```



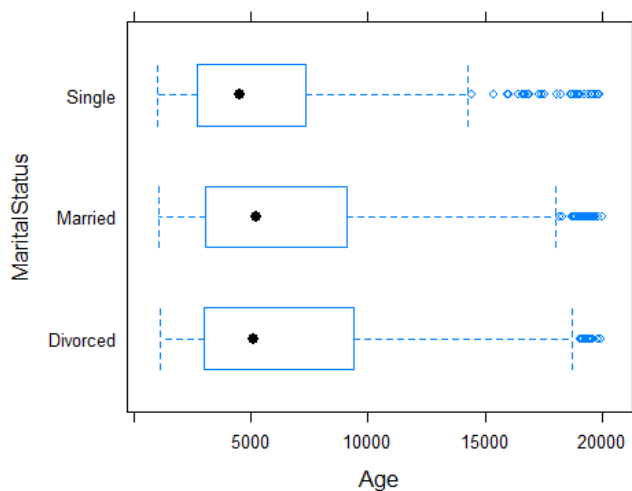
```
> bwplot(attr$EducationField ~ attr$Age, data=attr, ylab='EducationField',xlab='Age')
```



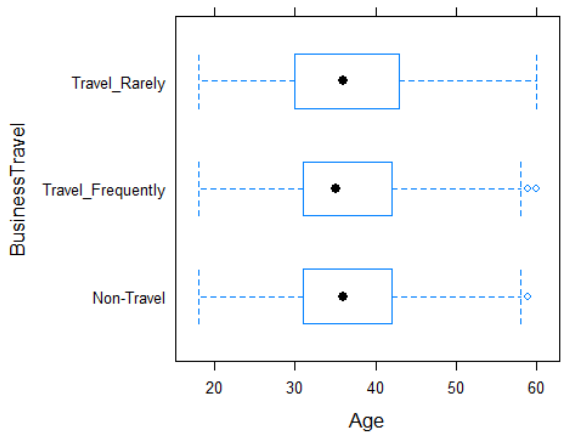
```
> bwplot(attr$JobRole ~ attr$Age, data=attr, ylab='JobRole',xlab='Age')
```



```
> bwplot(attr$MaritalStatus ~ attr$MonthlyIncome, data=attr, ylab='MaritalStatus',xlab='Age')
```

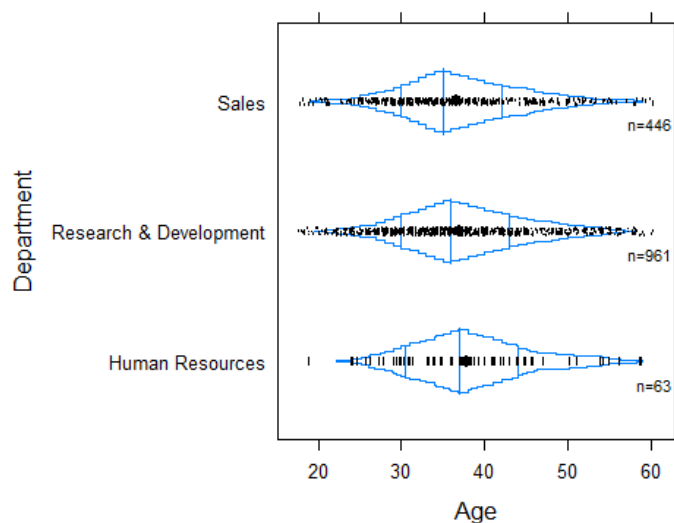


```
> bwplot(attr$BusinessTravel ~ attr$Age, data=attr, ylab='BusinessTravel',xlab='Age')
```

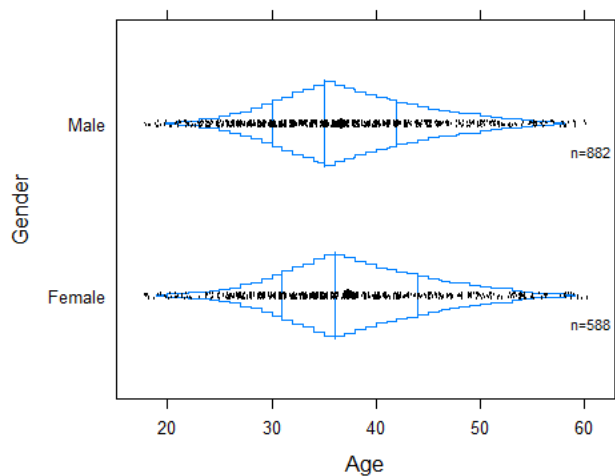


#Plotting stripplots for various categories wrt numerical column TotalCharges

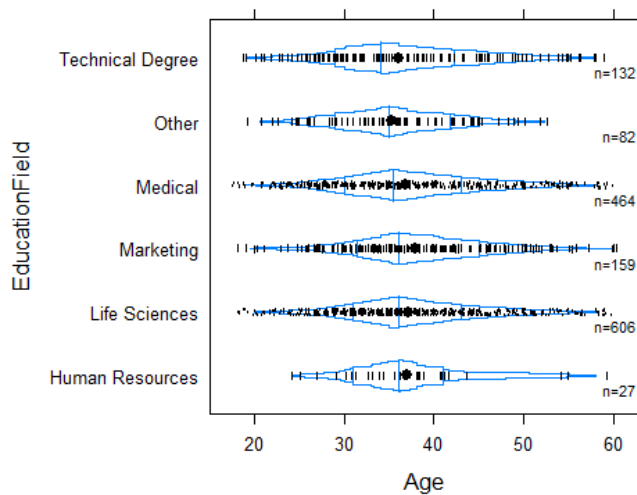
```
> bwplot(attr$Department ~ attr$Age, data=attr, panel=panel.bpplot,
+         probs=seq(.01,.49,by=.01), datadensity=TRUE, ylab='Department', xlab='Age')
```



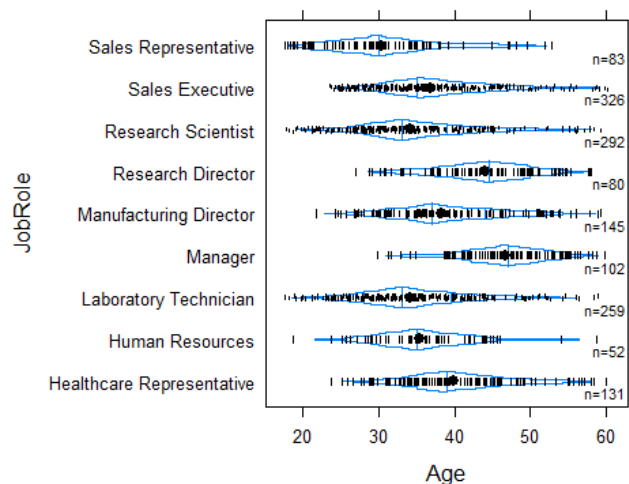
```
> bwplot(attr$Gender ~ attr$Age, data=attr, panel=panel.bpplot,
+         probs=seq(.01,.49,by=.01), datadensity=TRUE, ylab='Gender', xlab='Age')
```



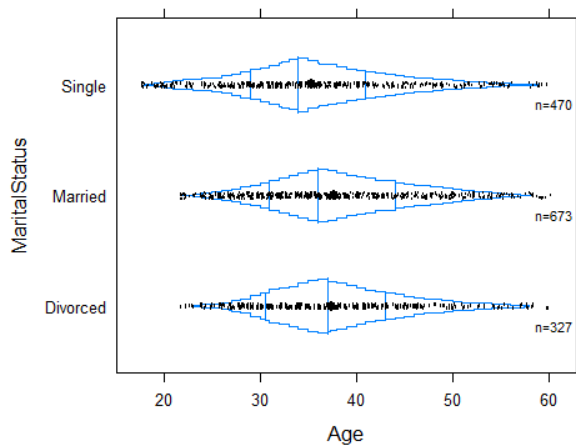
```
> bwplot(attr$EducationField ~ attr$Age, data=attr, panel=panel.bpplot,
+         probs=seq(.01,.49,by=.01), datadensity=TRUE, ylab='EducationField', xlab='Age')
```



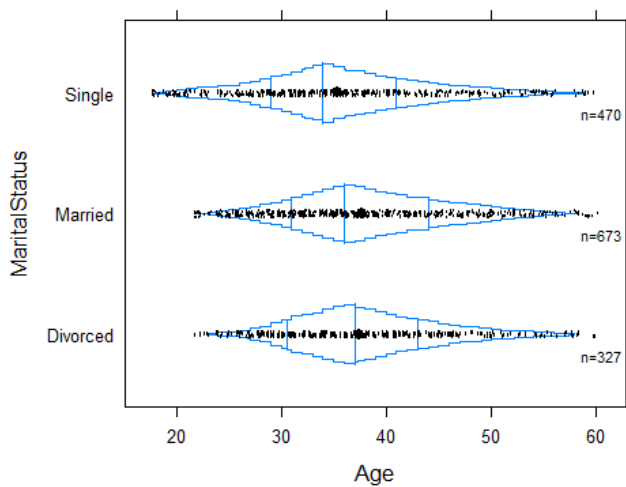
```
> bwplot(attr$JobRole ~ attr$Age, data=attr, panel=panel.bwplot,
+        probs=seq(.01,.49,by=.01), datadensity=TRUE, ylab='JobRole', xlab='Age')
```



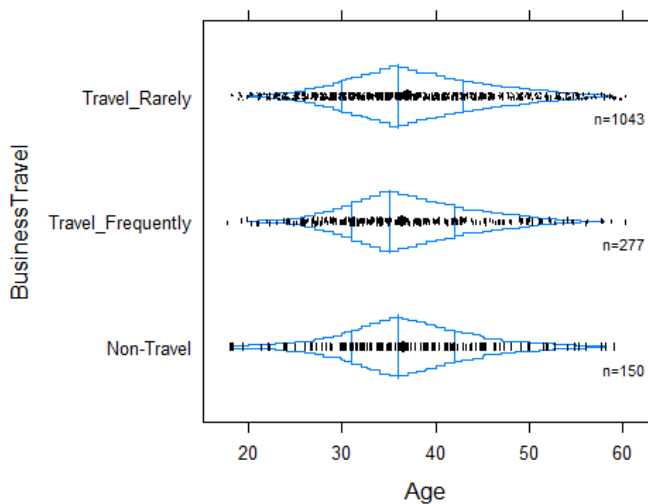
```
> bwplot(attr$MaritalStatus ~ attr$Age, data=attr, panel=panel.bwplot,
+        probs=seq(.01,.49,by=.01), datadensity=TRUE, ylab='MaritalStatus', xlab='Age')
```



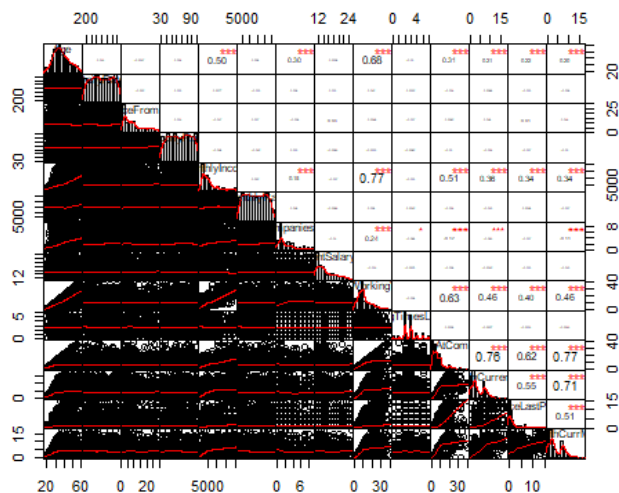
```
> bwplot(attr$MaritalStatus ~ attr$Age, data=attr, panel=panel.bpplot,
+        probs=seq(.01,.49,by=.01), datadensity=TRUE, ylab='MaritalStatus',xlab='Age')
```



```
> bwplot(attr$BusinessTravel ~ attr$Age, data=attr, panel=panel.bpplot,
+        probs=seq(.01,.49,by=.01), datadensity=TRUE, ylab='BusinessTravel',xlab='Age')
```



```
> data<-attr[,c('Age','DailyRate','DistanceFromHome','HourlyRate',
+              'MonthlyIncome','MonthlyRate','NumCompaniesWorked','PercentsSalaryHike','TotalWorl
+              'TrainingTimesLastYear','YearsAtCompany',
+              'YearsInCurrentRole','YearsSinceLastPromotion','YearsWithCurrManager')]
> chart.correlation(data,histogram = TRUE,pch=19)
```



```
#-----
> ##Creating Temporary Variables
> #-----
>
> #Converting double/int columns to numeric
> numeric_col <- c("Age","DailyRate","DistanceFromHome","HourlyRate",
+                 "MonthlyIncome","MonthlyRate","NumCompaniesWorked","PercentSalaryHike","TotalW
+                 "TrainingTimesLastYear","YearsAtCompany",
+                 "YearsInCurrentRole","YearsSinceLastPromotion","YearsWithCurrManager")
> attr[numeric_col] <- sapply(attr[numeric_col], as.numeric)

> #Take out the numeric columns from categorical columns and storing them as a separate dataframe
> attr_i <- attr[,c("Age","DailyRate","DistanceFromHome","HourlyRate",
+                 "MonthlyIncome","MonthlyRate","NumCompaniesWorked","PercentSalaryHike","TotalW
+                 "TrainingTimesLastYear","YearsAtCompany",
+                 "YearsInCurrentRole","YearsSinceLastPromotion","YearsWithCurrManager")]
> attr_i <- data.frame(scale(attr_i))

> #Creating temporary variables for the categorical data
> attr_c <- attr[, -c(2,3,5,8,10,11,12,13,14,15,19,21,22,23)]
> temporary <- data.frame(sapply(attr_c, function(x) data.frame(model.matrix(~x-1, data = attr_c))[, 1]))
> head(temporary)
Education.x2 Education.x3 Education.x4 Education.x5 EnvironmentSatisfaction.x2 EnvironmentSatisfaction.x3
1           1           0           0           0               1               0
2           0           0           0           0               0               0
3           1           0           0           0               0               0
4           0           0           1           0               0               0
5           0           0           0           0               0               0
6           1           0           0           0               0               0
EnvironmentSatisfaction.x4 MaritalStatus.xMarried MaritalStatus.xSingle OverTime StockOptionLevel.x2
1                   0                   0                   1                   1
2                   0                   1                   0                   0
3                   1                   0                   1                   1
4                   1                   1                   0                   1
5                   0                   1                   0                   0
6                   1                   0                   1                   0
StockOptionLevel.x2 StockOptionLevel.x3 WorkLifeBalance.x2 WorkLifeBalance.x3 WorkLifeBalance.x4
1                   0                   0                   0                   0
2                   0                   0                   0                   1
3                   0                   0                   0                   1
4                   0                   0                   0                   1
5                   0                   0                   0                   1
6                   0                   0                   1                   0
```

```
> view(attr)
```

```
> #Combining the temporary and the numeric columns and create the final dataset
> attr_final <- cbind(attr_i,temporary)
> head(attr_final)
```

	Age	DailyRate	DistanceFromHome	HourlyRate	MonthlyIncome	MonthlyRate	NumCompaniesWorked	
1	0.44619856	0.7422739	-1.0105654	1.3826677	-0.1083127	0.7257730	2.124413	
2	1.32191535	-1.2973331	-0.1470997	-0.2405949	-0.2916193	1.4883696	-0.677818	
3	0.00834016	1.4138821	-0.8872132	1.2842882	-0.9373347	-1.6742711	1.323775	
4	-0.42951824	1.4609690	-0.7638609	-0.4865438	-0.7633739	1.2427877	-0.677818	
5	-1.08630583	-0.5241163	-0.8872132	-1.2735802	-0.6446387	0.3257890	2.524731	
6	-0.53898284	0.5018828	-0.8872132	0.6448211	-0.7296013	-0.3440822	-1.078137	
	PercentSalaryHike	TotalWorkingYears	TrainingTimesLastYear	YearsAtCompany	YearsInCurrentRole			
1	-1.15016269	-0.4214990	-2.1712429	-0.164557109	-0.06327437			
2	2.12858163	-0.1644554	0.1556541	0.488341541	0.76473737			
3	-0.05724792	-0.5500208	0.1556541	-1.143905083	-1.16729002			
4	-1.15016269	-0.4214990	0.1556541	0.161892216	0.76473737			
5	-0.87693400	-0.6785426	0.1556541	-0.817455758	-0.61528219			
6	-0.60370530	-0.4214990	-0.6199782	-0.001332446	0.76473737			
	YearsSinceLastPromotion	YearsWithCurrManager	Education.x2	Education.x3	Education.x4	Education.x5		
1	-0.67891464	0.2457504	1	0	0			
2	-0.36858985	0.8062671	0	0	0			
3	-0.67891464	-1.1555415	1	0	0			
4	0.25205973	-1.1555415	0	0	1			
5	-0.05826506	-0.5950247	0	0	0			
6	0.25205973	0.5260087	1	0	0			
	EnvironmentSatisfaction.x2	EnvironmentSatisfaction.x3	EnvironmentSatisfaction.x4	MaritalStatus.x1				
1	1	0	0	0				
2	0	1	0	0				
3	0	0	0	1				
4	0	0	0	1				
5	0	0	0	0				
6	0	0	0	1				
	MaritalStatus.xSingle	OverTime	StockOptionLevel.x1	StockOptionLevel.x2	StockOptionLevel.x3			
1	1	1	0	0	0			
2	0	0	1	0	0			
3	1	1	0	0	0			
4	0	1	0	0	0			
5	0	0	1	0	0			
6	1	0	0	0	0			
	WorkLifeBalance.x2	WorkLifeBalance.x3	WorkLifeBalance.x4					
1	0	0	0					
2	0	1	0					
3	0	1	0					
4	0	1	0					
5	0	1	0					
6	1	0	0					

```
> glimpse(attr_final)
```

```
Observations: 1,470
```

```
Variables: 30
```

```
$ Age          <dbl> 0.44619856, 1.32191535, 0.00834016, -0.42951824, -1.08630583,
$ DailyRate    <dbl> 0.74227393, -1.29733311, 1.41388208, 1.46096900, -0.52411634,
$ DistanceFromHome <dbl> -1.01056544, -0.14709966, -0.88721318, -0.76386093, -0.887213
$ HourlyRate    <dbl> 1.38266773, -0.24059489, 1.28428818, -0.48654378, -1.27358020
$ MonthlyIncome <dbl> -0.108312654, -0.291619349, -0.937334707, -0.763373892, -0.64
$ MonthlyRate   <dbl> 0.7257730, 1.4883696, -1.6742711, 1.2427877, 0.3257890, -0.34
$ NumCompaniesWorked <dbl> 2.1244130, -0.6778187, 1.3237753, -0.6778187, 2.5247318, -1.0
$ PercentSalaryHike <dbl> -1.15016269, 2.12858163, -0.05724792, -1.15016269, -0.87693400
$ TotalWorkingYears <dbl> -0.42149902, -0.16445544, -0.55002081, -0.42149902, -0.678542
$ TrainingTimesLastYear <dbl> -2.1712429, 0.1556541, 0.1556541, 0.1556541, 0.1556541, -0.61
$ YearsAtCompany <dbl> -0.164557109, 0.488341541, -1.143905083, 0.161892216, -0.8174
$ YearsInCurrentRole <dbl> -0.06327437, 0.76473737, -1.16729002, 0.76473737, -0.61528219
$ YearsSinceLastPromotion <dbl> -0.67891464, -0.36858985, -0.67891464, 0.25205973, -0.05826506
$ YearsWithCurrManager <dbl> 0.2457504, 0.8062671, -1.1555415, -1.1555415, -0.5950247, 0.5260087
```

```

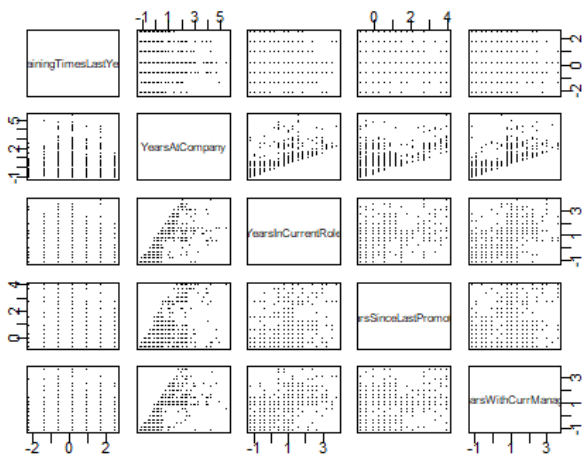
$ Education.x2          <dbl> 1, 0, 1, 0, 0, 1, 0, 0, 0, 0, 0, 0, 1, 0, 1, 0, 0, 1, 1, 0, 0, 1
$ Education.x3          <dbl> 0, 0, 0, 0, 0, 0, 0, 1, 0, 1, 1, 1, 0, 0, 0, 0, 1, 0, 0, 0, 0, 1
$ Education.x4          <dbl> 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 1, 0, 0
$ Education.x5          <dbl> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0
$ EnvironmentSatisfaction.x2 <dbl> 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 1, 0, 0, 0, 0, 0
$ EnvironmentSatisfaction.x3 <dbl> 0, 1, 0, 0, 0, 0, 1, 0, 0, 1, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0
$ EnvironmentSatisfaction.x4 <dbl> 0, 0, 1, 1, 0, 1, 0, 1, 1, 0, 0, 1, 0, 0, 0, 0, 0, 0, 1, 0, 1, 0
$ MaritalStatus.xMarried <dbl> 0, 1, 0, 1, 1, 0, 1, 0, 0, 1, 1, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0
$ MaritalStatus.xSingle <dbl> 1, 0, 1, 0, 0, 1, 0, 0, 1, 0, 0, 1, 0, 0, 1, 0, 0, 0, 0, 1, 0, 0
$ OverTime              <dbl> 1, 0, 1, 1, 0, 0, 1, 0, 0, 1, 0, 0, 1, 0, 0, 1, 0, 1, 1, 0, 1, 0
$ StockOptionLevel.x1    <dbl> 0, 1, 0, 0, 1, 0, 0, 1, 0, 0, 1, 0, 0, 1, 1, 0, 1, 0, 0, 0, 0, 1
$ StockOptionLevel.x2    <dbl> 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 1, 1, 0, 0, 0
$ StockOptionLevel.x3    <dbl> 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0
$ WorkLifeBalance.x2     <dbl> 0, 0, 0, 0, 0, 1, 1, 0, 0, 1, 0, 0, 1, 0, 0, 0, 1, 1, 0, 0, 1, 0
$ WorkLifeBalance.x3     <dbl> 0, 1, 1, 1, 1, 0, 0, 1, 1, 0, 1, 1, 0, 1, 1, 1, 0, 0, 1, 1, 0, 0
$ WorkLifeBalance.x4     <dbl> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0

```

```

##Matrix Plots, Covariance and Correlations Plots
#ScatterPlot matrix
pairs(attr_final[,10:14],pch=".",cex=1.5)

```



```
##Test of Significance
```

```
#T-Test
```

```
#Null Hypothesis - The two means are equal
```

```
#Alternate Hypothesis - Difference in the two means is not zero
```

```
#pvalue >= 0.05, accept null hypothesis
```

```
#Or
```

```
#else accept the alternate hypothesis
```

```
#Univariate mean comparison using t test
```

```
> #Monthly Income and Attrition
```

```
> with(data=attr,t.test(attr$MonthlyIncome[attr$Attrition=="Yes"],attr$MonthlyIncome[attr$Attrition=="No"],
qual=TRUE))
```

```
Two Sample t-test
```

```
data: attr$MonthlyIncome[attr$Attrition == "Yes"] and attr$MonthlyIncome[attr$Attrition == "No"]
```

```
t = -6.2039, df = 1468, p-value = 7.147e-10
```

```
alternative hypothesis: true difference in means is not equal to 0
```

```
95 percent confidence interval:
```



```
-2692.446 -1398.847
sample estimates:
mean of x mean of y
4787.093  6832.740
```

```
> #HourlyRate and Attrition
> with(data=attr,t.test(attr$HourlyRate[attr$Attrition=="Yes"],attr$HourlyRate[attr$Attrition=="No"],var.equal=TRUE))
```

Two Sample t-test

```
data: attr$HourlyRate[attr$Attrition == "Yes"] and attr$HourlyRate[attr$Attrition == "No"]
t = -0.26229, df = 1468, p-value = 0.7931
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
-3.207565  2.450946
sample estimates:
mean of x mean of y
65.57384  65.95215
```

```
> #Daily Rate and Attrition
> with(data=attr,t.test(attr$DailyRate[attr$Attrition=="Yes"],attr$DailyRate[attr$Attrition=="No"],var.equal=TRUE))
```

Two Sample t-test

```
data: attr$DailyRate[attr$Attrition == "Yes"] and attr$DailyRate[attr$Attrition == "No"]
t = -2.1741, df = 1468, p-value = 0.02986
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
-118.209251  -6.073932
sample estimates:
mean of x mean of y
750.3629  812.5045
```

```
> #Age and Attrition
> with(data=attr,t.test(attr$Age[attr$Attrition=="Yes"],attr$Age[attr$Attrition=="No"],var.equal=TRUE))
```

Two Sample t-test

```
data: attr$Age[attr$Attrition == "Yes"] and attr$Age[attr$Attrition == "No"]
t = -6.1787, df = 1468, p-value = 8.356e-10
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
-5.208825 -2.698450
sample estimates:
mean of x mean of y
33.60759  37.56123
```

```
> #DistanceFromHome and Attrition
> with(data = attr,t.test(attr$DistanceFromHome[attr$Attrition=="Yes"],attr$Age[attr$Attrition=="No"],var.equal=TRUE))
```

Two Sample t-test

```
data: attr$DistanceFromHome[attr$Attrition == "Yes"] and attr$Age[attr$Attrition == "No"]
t = -43.048, df = 1468, p-value < 2.2e-16
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
-28.15538 -25.70126
sample estimates:
mean of x mean of y
10.63291  37.56123
```

```
> #Monthly Income and Gender
> with(data = attr,t.test(attr$MonthlyIncome[attr$Gender=="Male"],attr$MonthlyIncome[attr$Gender=="Female"],var.equal = TRUE))
```

Two Sample t-test

```
data: attr$MonthlyIncome[attr$Gender == "Male"] and attr$MonthlyIncome[attr$Gender == "Female"]
t = -1.2213, df = 1468, p-value = 0.2222
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
-797.6470 185.5303
sample estimates:
mean of x mean of y
6380.508 6686.566
```

```
> #DistanceFromHome and Gender
> with(data = attr,t.test(attr$DistanceFromHome[attr$Gender=="Male"],attr$DistanceFromHome[attr$Gender=="Female"],var.equal = TRUE))
```

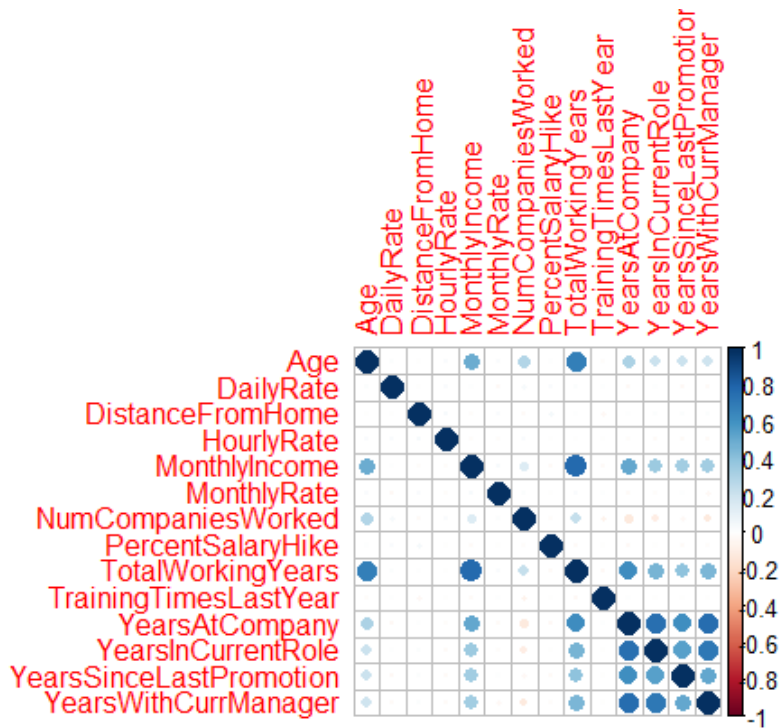
Two Sample t-test

```
data: attr$DistanceFromHome[attr$Gender == "Male"] and attr$DistanceFromHome[attr$Gender == "Female"]
t = -0.070902, df = 1468, p-value = 0.9435
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
-0.8775316 0.8163071
sample estimates:
mean of x mean of y
9.180272 9.210884
```

```
> #Monthly Income and gender
> t2testgender <- hotelling.test(attr$MonthlyIncome + attr$DistanceFromHome ~ attr$Gender, data=attr)
> cat("T2 statistic =",t2testgender$stat[[1]],"\n")
T2 statistic = 1.499903
> print(t2testgender)
Test stat: 0.74944
Numerator df: 2
Denominator df: 1467
P-value: 0.4728
```

```
> #Monthly Income and Attrition
> t2testattr <- hotelling.test(attr$MonthlyIncome + attr$DistanceFromHome ~ attr$Attrition, data=attr)
> cat("T2 statistic =",t2testattr$stat[[1]],"\n")
T2 statistic = 47.28597
> print(t2testattr)
Test stat: 23.627
Numerator df: 2
Denominator df: 1467
P-value: 7.957e-11
```

```
> #PCA
> #plot.new(); dev.off()
> #Considering the numeric columns that will help to get variance in data
> attr_pca <- attr[,numvar]
> #Plotting correlation plot to understand the how feature are related to each other
> correplot<-cor(attr_pca)
> corrplot(correplot,method="circle")
```



```
> #Finding the principal components of data
> attr_pca <- prcomp(attr_pca,scale=TRUE)
> attr_pca
```

Standard deviations (1, ..., p=14):

```
[1] 2.0041891 1.2846031 1.0336848 1.0257290 1.0046944 0.9962218 0.9763963 0.9578606 0.8499797 0.7516131
[11] 0.6854527 0.5321872 0.4397545 0.3742537
```

Rotation (n x k) = (14 x 14):

	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9	PC10	PC11	PC12
Age	0.280157344	-0.472170158	0.003362193	0.004488409	-0.039563410	-0.05870	-0.098196914	-0.05927715	-0.183114693	0.005033984	-0.74367068	-0.041550
DailyRate	-0.006815197	-0.077962430	-0.207301367	-0.609569867	-0.211568990	-0.1306	0.715405171	-0.02770642	-0.028707475	0.040304455	-0.01980752	0.040445
DistanceFromHome	0.004812032	0.041564987	-0.664884791	0.306131593	0.048941659	-0.1768	0.031447533	-0.65217193	0.037737577	0.002338630	0.02927699	0.003420
HourlyRate	-0.011288550	-0.062668026	-0.352147686	-0.255816205	0.602292088	-0.4816	-0.221010405	0.40142111	-0.004675476	0.018009772	0.03725997	-0.004074
MonthlyIncome	0.360622909	-0.290395305	0.052415102	0.025332267	-0.034941693	-0.0332	-0.012272736	-0.03685912	-0.377381332	0.104651321	0.61775910	-0.047499
MonthlyRate	0.001123298	-0.086158010	0.020312197	0.664085954	-0.101166486	-0.3712	0.482943083	0.40448871	0.056690883	-0.044889268	-0.01681584	0.023709
NumCompaniesWorked	0.030991906	-0.560133264	0.005628265	-0.041875610	0.017785645	0.1012	-0.032989593	-0.03355765	0.775796629	-0.129586743	0.19687866	0.021028
PercentSalaryHike	-0.015351368	0.004618486	-0.465841883	-0.055689609	-0.698726672	-0.0082	-0.376210309	0.38335261	0.012190972	0.019568502	0.04082482	0.014317
TotalWorkingYears	0.415285665	-0.318115831	0.009368263	0.007027664	-0.024159198	-0.0252	-0.029511945	-0.04398227	-0.196663458	-0.038585533	0.08301594	0.061109
TrainingTimesLastYear	-0.010993402	0.092457674	0.409028173	-0.138279489	-0.293982017	-0.7516	-0.217564575	-0.29622601	0.130785998	-0.017811234	0.02954240	-0.000289
YearsAtCompany	0.443443529	0.213079968	0.002115638	-0.010571214	0.024921329	-0.0019	0.005335572	0.01862614	-0.001551392	-0.104225054	0.03762072	0.079527
YearsInCurrentRole	0.391353065	0.279423881	-0.048111956	-0.038785223	-0.004927194	0.0145	0.062086964	0.05420752	0.201595025	-0.271683842	-0.04458982	-0.765806
YearsSinceLastPromotion	0.344322397	0.198658357	0.003993040	0.027659809	0.019935007	0.0186	0.022129234	0.03850513	0.306725567	0.845951303	-0.08053456	0.075946
YearsWithCurrManager	0.386171187	0.295138965	-0.031745944	-0.034459502	0.021898300	0.0286						

```

YearsWithCurrManager    0.011525930  0.04176204  0.161413516 -0.407140185 -0.06576770  0.625185
PC13                    PC14
Age                     0.1893016403  0.237072230
DailyRate              -0.0099081253  0.018837870
DistanceFromHome       0.0057709912  0.011991386
HourlyRate             0.0049037331 -0.003314012
MonthlyIncome          0.4041044054  0.279006032
MonthlyRate            -0.0083381972  0.009367738
NumCompaniesWorked     -0.0369554196  0.107234673
PercentSalaryHike      -0.0183445446  0.010585240
TotalWorkingYears      -0.4158888971 -0.705989494
TrainingTimesLastYear  0.0008431661 -0.012085362
YearsAtCompany         -0.6494086309  0.562584645
YearsInCurrentRole     0.1948014145 -0.130643692
YearsSinceLastPromotion 0.0977011821 -0.083447864
YearsWithCurrManager   0.3959144832 -0.121010943
> names(attr_pca)
[1] "sdev" "rotation" "center" "scale" "x"
> head(attr_pca)
$sdev
[1] 2.0041891 1.2846031 1.0336848 1.0257290 1.0046944 0.9962218 0.9763963 0.9578606 0.8499797 0.
[11] 0.6854527 0.5321872 0.4397545 0.3742537

```

```

$rotation
PC1      PC2      PC3      PC4      PC5      PC6
Age      0.280157344 -0.472170158  0.003362193  0.004488409 -0.039563410 -0.0587
DailyRate -0.006815197 -0.077962430 -0.207301367 -0.609569867 -0.211568990 -0.1306
DistanceFromHome 0.004812032  0.041564987 -0.664884791  0.306131593  0.048941659 -0.1768
HourlyRate -0.011288550 -0.062668026 -0.352147686 -0.255816205  0.602292088 -0.4816
MonthlyIncome 0.360622909 -0.290395305  0.052415102  0.025332267 -0.034941693 -0.0332
MonthlyRate 0.001123298 -0.086158010  0.020312197  0.664085954 -0.101166486 -0.3712
NumCompaniesWorked 0.030991906 -0.560133264  0.005628265 -0.041875610  0.017785645  0.1012
PercentSalaryHike -0.015351368  0.004618486 -0.465841883 -0.055689609 -0.698726672 -0.0082
TotalWorkingYears 0.415285665 -0.318115831  0.009368263  0.007027664 -0.024159198 -0.0252
TrainingTimesLastYear -0.010993402  0.092457674  0.409028173 -0.138279489 -0.293982017 -0.7516
YearsAtCompany 0.443443529  0.213079968  0.002115638 -0.010571214  0.024921329 -0.0019
YearsInCurrentRole 0.391353065  0.279423881 -0.048111956 -0.038785223 -0.004927194  0.0145
YearsSinceLastPromotion 0.344322397  0.198658357  0.003993040  0.027659809  0.019935007  0.0186
YearsWithCurrManager 0.386171187  0.295138965 -0.031745944 -0.034459502  0.021898300  0.0286
PC7      PC8      PC9      PC10     PC11     PC12
Age      -0.098196914 -0.05927715 -0.183114693  0.005033984 -0.74367068 -0.041550
DailyRate 0.715405171 -0.02770642 -0.028707475  0.040304455 -0.01980752  0.040445
DistanceFromHome 0.031447533 -0.65217193  0.037737577  0.002338630  0.02927699  0.003420
HourlyRate -0.221010405  0.40142111 -0.004675476  0.018009772  0.03725997 -0.004074
MonthlyIncome -0.012272736 -0.03685912 -0.377381332  0.104651321  0.61775910 -0.047499
MonthlyRate 0.482943083  0.40448871  0.056690883 -0.044889268 -0.01681584  0.023709
NumCompaniesWorked -0.032989593 -0.03355765  0.775796629 -0.129586743  0.19687866  0.021028
PercentSalaryHike -0.376210309  0.38335261  0.012190972  0.019568502  0.04082482  0.014317
TotalWorkingYears -0.029511945 -0.04398227 -0.196663458 -0.038585533  0.08301594  0.061109
TrainingTimesLastYear -0.217564575 -0.29622601  0.130785998 -0.017811234  0.02954240 -0.000289
YearsAtCompany 0.005335572  0.01862614 -0.001551392 -0.104225054  0.03762072  0.079527
YearsInCurrentRole 0.062086964  0.05420752  0.201595025 -0.271683842 -0.04458982 -0.765806
YearsSinceLastPromotion 0.022129234  0.03850513  0.306725567  0.845951303 -0.08053456  0.075946
YearsWithCurrManager 0.011525930  0.04176204  0.161413516 -0.407140185 -0.06576770  0.625185
PC13     PC14
Age      0.1893016403  0.237072230
DailyRate -0.0099081253  0.018837870
DistanceFromHome 0.0057709912  0.011991386
HourlyRate 0.0049037331 -0.003314012
MonthlyIncome 0.4041044054  0.279006032
MonthlyRate -0.0083381972  0.009367738
NumCompaniesWorked -0.0369554196  0.107234673
PercentSalaryHike -0.0183445446  0.010585240
TotalWorkingYears -0.4158888971 -0.705989494

```

TrainingTimesLastYear 0.0008431661 -0.012085362
YearsAtCompany -0.6494086309 0.562584645
YearsInCurrentRole 0.1948014145 -0.130643692
YearsSinceLastPromotion 0.0977011821 -0.083447864
YearsWithCurrManager 0.3959144832 -0.121010943

\$center

Age	DailyRate	DistanceFromHome	HourlyRate
36.923810	802.485714	9.192517	65.891156
MonthlyIncome	MonthlyRate	NumCompaniesWorked	PercentSalaryHike
6502.931293	14313.103401	2.693197	15.209524
TotalWorkingYears	TrainingTimesLastYear	YearsAtCompany	YearsInCurrentRole
11.279592	2.799320	7.008163	4.229252
YearsSinceLastPromotion	YearsWithCurrManager		
2.187755	4.123129		

\$scale

Age	DailyRate	DistanceFromHome	HourlyRate
9.135373	403.509100	8.106864	20.329428
MonthlyIncome	MonthlyRate	NumCompaniesWorked	PercentSalaryHike
4707.956783	7117.786044	2.498009	3.659938
TotalWorkingYears	TrainingTimesLastYear	YearsAtCompany	YearsInCurrentRole
7.780782	1.289271	6.126525	3.623137
YearsSinceLastPromotion	YearsWithCurrManager		
3.222430	3.568136		

\$x

PC1	PC2	PC3	PC4	PC5	PC6	PC7
[1,]	-0.243044079	-1.805296680	-0.3104169553	-0.384994275	2.0169575215	0.984793983
[2,]	0.854288163	0.381073595	-0.5252390003	1.608645799	-1.5927436292	-0.481865695
[3,]	-2.198275394	-1.413301606	-0.0582282745	-2.596801032	0.6022422032	-0.023230640
[4,]	-0.570845554	0.682294015	0.9530781591	-0.112517223	0.0144209522	-0.415235118
[5,]	-1.567685771	-0.965438549	1.6427717726	0.537047071	-0.0703157168	0.940560119
[6,]	-0.033228256	1.476192828	0.1768758528	-0.871158691	0.9282306482	0.367849216
[7,]	-1.176981984	-2.344142438	-0.5229233979	-1.666338771	-0.8793271137	-0.417767837
[8,]	-2.668563284	0.310022541	-2.6128166708	-0.330963952	-1.2486460778	-0.052250851
[9,]	0.910894519	1.213005861	-1.5039201417	1.144947290	-1.1238829367	1.049881443
[10,]	1.339778839	-0.208584655	-1.9076328247	-0.281672326	1.0866328829	-1.252674274
[11,]	-1.227202504	0.961999888	0.0613545738	0.034499533	0.4709461858	-2.043427871
[12,]	-0.073116546	1.760186112	0.5344916830	1.247906142	0.5189044912	0.442256861
[13,]	-1.087474516	1.023377864	-1.5147071841	1.573775407	-0.7475549471	1.511464717
[14,]	-1.814073316	0.601874393	-1.3014136722	-1.101977678	1.6522331947	-0.334506872
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[16,]	1.744251934	1.686663324	-1.1177364895	-0.381693162	0.6609099755	1.223658522
[17,]	-1.118546968	1.132058901	1.4189672811	0.273681898	0.7687430566	-1.460717606
[18,]	-2.875446285	0.684977918	-1.2101773533	-1.069482747	1.5219403902	-0.105065952
[19,]	4.306398521	-1.060188116	0.2102166478	-0.374474127	-0.3205736368	-1.006842601
[20,]	-1.274793286	-0.518252552	1.7607337154	-0.263605442	0.4775025923	1.296215086
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[22,]	-0.973935456	-1.013413533	-1.1120212000	-1.850388185	-1.3640205357	-0.666890243
[23,]	1.686994016	1.312303531	1.5096245660	1.224455487	0.2429059015	-0.652215366
[24,]	-3.186960204	1.127496005	0.4028852195	0.661084708	0.6427677466	-2.782189999
[25,]	-1.236420346	0.070998887	0.2998566707	0.248336464	1.5088956715	0.030328006
[26,]	4.335210193	-1.187855044	0.8439064948	-1.135518002	0.1502712115	0.089980426
[27,]	0.202667449	1.487707345	-1.0496066009	-1.510499974	-1.5194444667	-1.172856717
[28,]	0.522611662	0.517960123	0.7496484428	1.189509235	0.3725504816	0.467749272
[29,]	4.167497779	1.068632778	1.1917707595	-0.655936499	-0.3603395503	0.680646739
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[32,]	-0.628686779	-0.506577343	1.0557480273	-0.359363863	-1.2767722294	-1.259019980
[33,]	-0.585760317	1.290594877	1.0175278792	0.759970743	0.8434796204	-1.537202603
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[37,]	-1.354693336	-0.382172652	-0.0113330121	-1.423881781	1.0314915947	0.517495020	-0.7185384
[38,]	-1.788459375	0.520002398	0.3186189447	-1.168483914	1.3010327250	-0.499080505	-0.2923377
[39,]	-1.940888185	-1.947119717	0.3014065269	-0.616302576	0.6580712905	-0.112112477	-0.2315559
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[42,]	-2.775064596	0.699871648	2.2688244419	-0.255818018	-1.5958498425	-1.351223462	1.2317170
[43,]	-2.660977369	0.709039810	-1.1151323620	-0.173311857	0.1700305471	0.580484544	1.5358935
[44,]	0.494241988	1.355663630	-0.4558314906	-0.773576913	-0.0893201999	2.889936395	0.5730119
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[46,]	5.804951893	1.078091201	-0.6975281151	0.051444706	0.4337848886	1.614106696	2.3169509
[47,]	0.806658069	1.653442819	-2.3068106160	-0.295882847	-0.4722918379	0.134169049	-0.0542540
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[50,]	-2.418330657	0.297326189	-0.3513459999	-1.101751982	-1.5156578641	1.499053343	0.1728086
[51,]	-0.617002088	-3.634989196	0.3562096372	0.118216390	1.4389894618	-0.220229442	-0.3437186
[52,]	-1.874898008	0.830881805	0.6248015543	-1.142134976	-0.3600199657	0.329946720	1.3675018
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[55,]	-2.079810230	-0.955185144	-1.8161177942	0.441813227	-1.3960822450	0.253432093	1.6426596
[56,]	3.708466615	1.814109184	-0.0097541922	-0.036909451	2.1090226075	0.552998695	0.0715580
[57,]	0.809848967	1.103897503	-1.7108414088	-0.291327045	-1.1137226784	-0.318923581	-0.7706595
[58,]	-1.465681948	0.058005177	-0.5799431432	0.624721643	-1.1676958094	0.275086845	1.1479757
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[60,]	-0.134488687	0.774824505	0.0742047436	-1.668328387	-0.8320217703	1.458220908	-0.2098923
[61,]	1.154466224	1.922306493	0.5340354541	0.208456672	-2.0449281318	1.172737829	-1.1081902
[62,]	1.015549604	1.685679343	-1.0836803069	0.522264077	0.9425346951	0.960676995	0.0215977
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[67,]	-0.689313482	0.194433528	-0.4992692899	-0.091816631	0.9077818943	-1.467101142	1.1917945
[68,]	-0.360119052	-2.235551626	-0.3033093916	-0.208683127	-0.8858009134	0.057772762	1.0278813
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[70,]	-2.349000231	-0.024496709	-1.0212757577	1.625278907	0.8108621115	0.977055716	-0.2246999
[71,]	0.537061435	-3.049510452	0.9612799574	0.240109595	0.1951466351	0.179765350	1.7241143
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[3,]	0.1645450520	0.7037177946	0.2334286037	-0.2063109991	0.0757180104	-2.034191e-01	-3.0270
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[5,]	-0.2110090034	2.3132854086	-0.0092829889	0.7911383832	0.0932147601	-1.001822e-01	-1.4650
[6,]	0.8232618244	-0.2219554949	-0.0872069258	-0.4352547853	-0.2311142456	2.074828e-01	-3.4016
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[9,]	-0.9351740522	-0.8467583073	-0.7791175369	0.1173708729	-0.0207647030	7.178969e-01	2.0342
[10,]	-0.9887551265	1.8168832792	0.5496258442	0.0893646974	0.1719743118	1.482873e-01	-7.592
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[13,]	-1.2884619372	-0.0363538480	0.8308304610	-0.2190499489	0.3017206595	-5.138678e-02	6.517
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[16,]	-1.2962378063	0.1672283742	0.9190505173	0.6052322133	-0.1396419825	7.886224e-01	-8.889
[17,]	-0.0866130578	-0.4359922773	-0.4908235512	-0.1712840455	0.4964863948	-6.197885e-02	-8.960
[18,]	-0.3703968876	-0.4515944960	0.4707221281	0.6870011577	0.0480464742	-1.323742e-01	7.059
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[22,]	0.3446067836	1.3648622584	-0.4792426584	0.2130812121	0.0911878469	-3.605121e-01	6.632
[23,]	-0.2496196395	-0.6875524464	-0.9335162824	0.6027692112	0.8094891808	7.005028e-01	1.107
[24,]	-0.3520700093	0.2822430507	0.2555611279	0.6350192662	0.0179911182	-1.389628e-01	-1.118
[25,]	0.5077089246	-0.1612550579	-0.0186130089	-0.3041024579	0.2026623054	-1.190615e-01	-1.583
[26,]	-0.6259760526	-0.5375940379	-0.5583140528	0.3347066400	-1.0951792994	8.320370e-01	2.989
[27,]	-0.6537874675	0.3570074959	0.9290619928	-0.0189461399	1.1560600116	-2.554831e-01	-6.819
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[29,] -1.2648397307 0.3155536872 -1.1110140575 -0.1549320265 2.1008653026 -1.743973e-01 2.246
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[ reached getOption("max.print") -- omitted 1399 rows ]
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```
> summary(attr_pca)
Importance of components:
PC1    PC2    PC3    PC4    PC5    PC6    PC7    PC8    PC9    PC10   PC11
Standard deviation      2.0042 1.2846 1.03368 1.02573 1.0047 0.99622 0.9764 0.95786 0.8500 0.7284
Proportion of Variance 0.2869 0.1179 0.07632 0.07515 0.0721 0.07089 0.0681 0.06554 0.0516 0.0379
Cumulative Proportion 0.2869 0.4048 0.48111 0.55626 0.6284 0.69925 0.7673 0.83288 0.8845 0.9223
PC12    PC13    PC14
Standard deviation      0.53219 0.43975 0.3743
Proportion of Variance 0.02023 0.01381 0.0100
Cumulative Proportion 0.97618 0.99000 1.0000
> #Extract variance against features
> eigenvalues<-attr_pca$sdev^2
> eigenvalues
[1] 4.0167738 1.6502052 1.0685042 1.0521201 1.0094108 0.9924579 0.9533497 0.9174969 0.7224654 0.
[11] 0.4698454 0.2832233 0.1933840 0.1400658
> sum(eigenvalues)
[1] 14
> names(eigenvalues) <- paste("PC",1:14,sep="")
> eigenvalues
```


PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9	PC10
4.0167738	1.6502052	1.0685042	1.0521201	1.0094108	0.9924579	0.9533497	0.9174969	0.7224654	0.53069

PC12	PC13	PC14
0.2832233	0.1933840	0.1400658

```
> sumoflambdas <- sum(eigenvalues)
```

```
> sumoflambdas
```

```
[1] 14
```

```
> #Variance %
```

```
> pctvar<- (eigenvalues/sumoflambdas)*100
```

```
> pctvar
```

PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9	PC10
28.691241	11.787180	7.632173	7.515143	7.210077	7.088985	6.809641	6.553550	5.160467	3.7900

PC12	PC13	PC14
2.023023	1.381314	1.000470

```
> #Calculate cumulative of variance
```

```
> cumvar <- cumsum(pctvar)
```

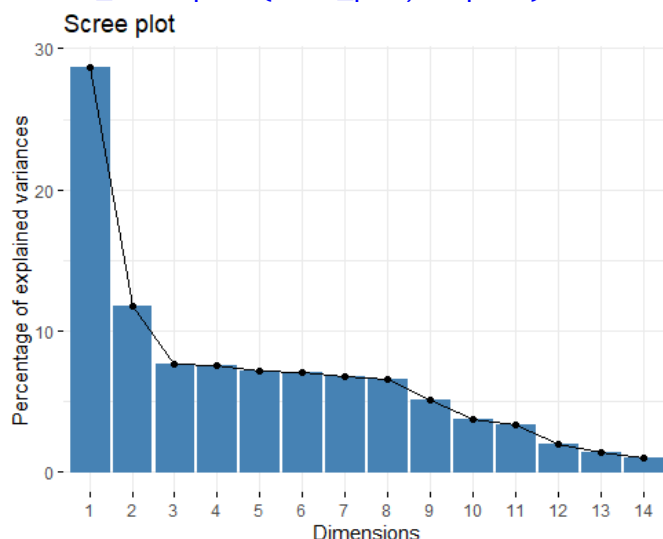
```
> cumvar
```

PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9	PC10
28.69124	40.47842	48.11059	55.62574	62.83581	69.92480	76.73444	83.28799	88.44846	92.239

PC12	PC13	PC14
97.61822	98.99953	100.00000

```
> #Visualize PCA using Scree plot
```

```
> fviz_screplot(attr_pca, ncp=14)
```



```
> summary(attr_pca)
```

```
Importance of components:
```

PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9	PC10	PC11
Standard deviation			2.0042	1.2846	1.03368	1.02573	1.0047	0.99622	0.9764	0.95786
Proportion of Variance			0.2869	0.1179	0.07632	0.07515	0.0721	0.07089	0.0681	0.06554
Cumulative Proportion			0.2869	0.4048	0.48111	0.55626	0.6284	0.69925	0.7673	0.83288

PC12	PC13	PC14
Standard deviation		
Proportion of Variance		
Cumulative Proportion		

```
> #PCA
```

```
> #plot.new(); dev.off()
```

```
> #Considering the numeric columns that will help to get variance in data
```

```
> attr_pca <- attr[,numvar]
```

```
> # solve the error "Figure margins too large"
```

```
> par("mar")
```

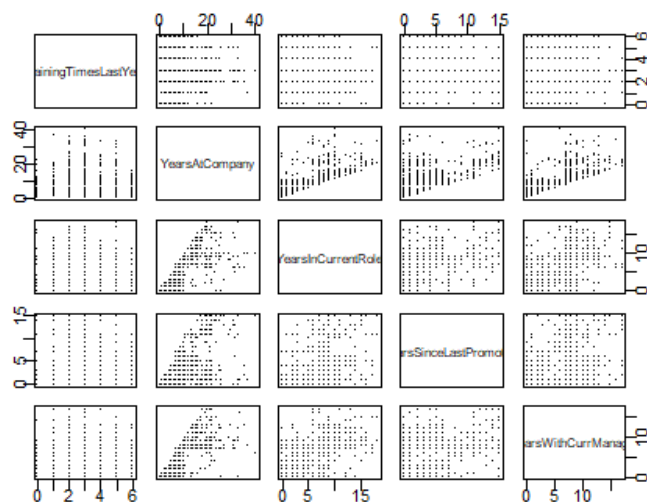
```
[1] 5.1 4.1 4.1 2.1
```



```

> par(mar=c(1,1,1,1))
> #graphics.off()
> #dev.off()
> ##Matrix Plots, Covariance and Correlations Plots
> #ScatterPlot matrix
> pairs(attr_pca[,10:14],pch=".",cex=1.5)

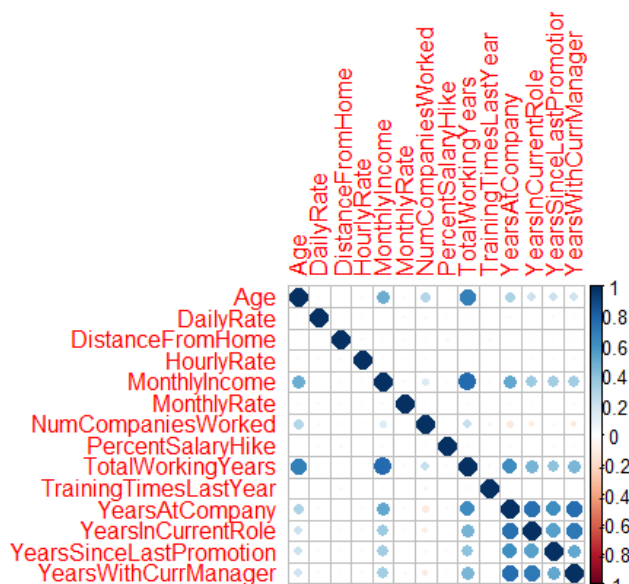
```



```

> #Plotting correlation plot to understand the how feature are related to each other
> correplot<-cor(attr_pca)
> corrplot(correplot,method="circle")

```



```

> #Finding the principal components of data
> attr_pca_done <- prcomp(attr_pca,scale=TRUE)
> attr_pca_done

```

Standard deviations (1, ..., p=14):

```

[1] 2.0041891 1.2846031 1.0336848 1.0257290 1.0046944 0.9962218 0.9763963 0.9578606 0.8499797 0.7411111
[11] 0.6854527 0.5321872 0.4397545 0.3742537

```

Rotation (n x k) = (14 x 14):

```

PC1      PC2      PC3      PC4      PC5      PC6
Age      0.280157344 -0.472170158 0.003362193 0.004488409 -0.039563410 -0.05870
DailyRate -0.006815197 -0.077962430 -0.207301367 -0.609569867 -0.211568990 -0.13062
DistanceFromHome 0.004812032 0.041564987 -0.664884791 0.306131593 0.048941659 -0.17684
HourlyRate -0.011288550 -0.062668026 -0.352147686 -0.255816205 0.602292088 -0.48163
MonthlyIncome 0.360622909 -0.290395305 0.052415102 0.025332267 -0.034941693 -0.03322
MonthlyRate 0.001123298 -0.086158010 0.020312197 0.664085954 -0.101166486 -0.37122
NumCompaniesWorked 0.030991906 -0.560133264 0.005628265 -0.041875610 0.017785645 0.10122
PercentsSalaryHike -0.015351368 0.004618486 -0.465841883 -0.055689609 -0.698726672 -0.00822
TotalWorkingYears 0.415285665 -0.318115831 0.009368263 0.007027664 -0.024159198 -0.02522
TrainingTimesLastYear -0.010993402 0.092457674 0.409028173 -0.138279489 -0.293982017 -0.75163
YearsAtCompany 0.443443529 0.213079968 0.002115638 -0.010571214 0.024921329 -0.00193
YearsInCurrentRole 0.391353065 0.279423881 -0.048111956 -0.038785223 -0.004927194 0.01453
YearsSinceLastPromotion 0.344322397 0.198658357 0.003993040 0.027659809 0.019935007 0.01863
YearsWithCurrManager 0.386171187 0.295138965 -0.031745944 -0.034459502 0.021898300 0.02863
PC7      PC8      PC9      PC10     PC11     PC12
Age      -0.098196914 -0.05927715 -0.183114693 0.005033984 -0.74367068 -0.041550
DailyRate 0.715405171 -0.02770642 -0.028707475 0.040304455 -0.01980752 0.040445
DistanceFromHome 0.031447533 -0.65217193 0.037737577 0.002338630 0.02927699 0.003420
HourlyRate -0.221010405 0.40142111 -0.004675476 0.018009772 0.03725997 -0.004074
MonthlyIncome -0.012272736 -0.03685912 -0.377381332 0.104651321 0.61775910 -0.047499
MonthlyRate 0.482943083 0.40448871 0.056690883 -0.044889268 -0.01681584 0.023709
NumCompaniesWorked -0.032989593 -0.03355765 0.775796629 -0.129586743 0.19687866 0.021028
PercentsSalaryHike -0.376210309 0.38335261 0.012190972 0.019568502 0.04082482 0.014317
TotalWorkingYears -0.029511945 -0.04398227 -0.196663458 -0.038585533 0.08301594 0.061109
TrainingTimesLastYear -0.217564575 -0.29622601 0.130785998 -0.017811234 0.02954240 -0.000289
YearsAtCompany 0.005335572 0.01862614 -0.001551392 -0.104225054 0.03762072 0.079527
YearsInCurrentRole 0.062086964 0.05420752 0.201595025 -0.271683842 -0.04458982 -0.765806
YearsSinceLastPromotion 0.022129234 0.03850513 0.306725567 0.845951303 -0.08053456 0.075946
YearsWithCurrManager 0.011525930 0.04176204 0.161413516 -0.407140185 -0.06576770 0.625185
PC13     PC14
Age      0.1893016403 0.237072230
DailyRate -0.0099081253 0.018837870
DistanceFromHome 0.0057709912 0.011991386
HourlyRate 0.0049037331 -0.003314012
MonthlyIncome 0.4041044054 0.279006032
MonthlyRate -0.0083381972 0.009367738
NumCompaniesWorked -0.0369554196 0.107234673
PercentsSalaryHike -0.0183445446 0.010585240
TotalWorkingYears -0.4158888971 -0.705989494
TrainingTimesLastYear 0.0008431661 -0.012085362
YearsAtCompany -0.6494086309 0.562584645
YearsInCurrentRole 0.1948014145 -0.130643692
YearsSinceLastPromotion 0.0977011821 -0.083447864
YearsWithCurrManager 0.3959144832 -0.121010943
> names(attr_pca_done)
[1] "sdev" "rotation" "center" "scale" "x"
> head(attr_pca_done)
$sdev
[1] 2.0041891 1.2846031 1.0336848 1.0257290 1.0046944 0.9962218 0.9763963 0.9578606 0.8499797 0.7
[11] 0.6854527 0.5321872 0.4397545 0.3742537

```

```

$rotation
PC1      PC2      PC3      PC4      PC5      PC6
Age      0.280157344 -0.472170158 0.003362193 0.004488409 -0.039563410 -0.05870
DailyRate -0.006815197 -0.077962430 -0.207301367 -0.609569867 -0.211568990 -0.13062
DistanceFromHome 0.004812032 0.041564987 -0.664884791 0.306131593 0.048941659 -0.17684
HourlyRate -0.011288550 -0.062668026 -0.352147686 -0.255816205 0.602292088 -0.48163
MonthlyIncome 0.360622909 -0.290395305 0.052415102 0.025332267 -0.034941693 -0.03322
MonthlyRate 0.001123298 -0.086158010 0.020312197 0.664085954 -0.101166486 -0.37122
NumCompaniesWorked 0.030991906 -0.560133264 0.005628265 -0.041875610 0.017785645 0.10122
PercentsSalaryHike -0.015351368 0.004618486 -0.465841883 -0.055689609 -0.698726672 -0.00822
TotalWorkingYears 0.415285665 -0.318115831 0.009368263 0.007027664 -0.024159198 -0.02522
TrainingTimesLastYear -0.010993402 0.092457674 0.409028173 -0.138279489 -0.293982017 -0.75163

```

YearsAtCompany	0.443443529	0.213079968	0.002115638	-0.010571214	0.024921329	-0.0019
YearsInCurrentRole	0.391353065	0.279423881	-0.048111956	-0.038785223	-0.004927194	0.0145
YearsSinceLastPromotion	0.344322397	0.198658357	0.003993040	0.027659809	0.019935007	0.0186
YearsWithCurrManager	0.386171187	0.295138965	-0.031745944	-0.034459502	0.021898300	0.0286
PC7	PC8	PC9	PC10	PC11	PC12	
Age	-0.098196914	-0.05927715	-0.183114693	0.005033984	-0.74367068	-0.041550
DailyRate	0.715405171	-0.02770642	-0.028707475	0.040304455	-0.01980752	0.040445
DistanceFromHome	0.031447533	-0.65217193	0.037737577	0.002338630	0.02927699	0.003420
HourlyRate	-0.221010405	0.40142111	-0.004675476	0.018009772	0.03725997	-0.004074
MonthlyIncome	-0.012272736	-0.03685912	-0.377381332	0.104651321	0.61775910	-0.047499
MonthlyRate	0.482943083	0.40448871	0.056690883	-0.044889268	-0.01681584	0.023709
NumCompaniesWorked	-0.032989593	-0.03355765	0.775796629	-0.129586743	0.19687866	0.021028
PercentSalaryHike	-0.376210309	0.38335261	0.012190972	0.019568502	0.04082482	0.014317
TotalWorkingYears	-0.029511945	-0.04398227	-0.196663458	-0.038585533	0.08301594	0.061109
TrainingTimesLastYear	-0.217564575	-0.29622601	0.130785998	-0.017811234	0.02954240	-0.000289
YearsAtCompany	0.005335572	0.01862614	-0.001551392	-0.104225054	0.03762072	0.079527
YearsInCurrentRole	0.062086964	0.05420752	0.201595025	-0.271683842	-0.04458982	-0.765806
YearsSinceLastPromotion	0.022129234	0.03850513	0.306725567	0.845951303	-0.08053456	0.075946
YearsWithCurrManager	0.011525930	0.04176204	0.161413516	-0.407140185	-0.06576770	0.625185
PC13	PC14					

Age	0.1893016403	0.237072230
DailyRate	-0.0099081253	0.018837870
DistanceFromHome	0.0057709912	0.011991386
HourlyRate	0.0049037331	-0.003314012
MonthlyIncome	0.4041044054	0.279006032
MonthlyRate	-0.0083381972	0.009367738
NumCompaniesWorked	-0.0369554196	0.107234673
PercentSalaryHike	-0.0183445446	0.010585240
TotalWorkingYears	-0.4158888971	-0.705989494
TrainingTimesLastYear	0.0008431661	-0.012085362
YearsAtCompany	-0.6494086309	0.562584645
YearsInCurrentRole	0.1948014145	-0.130643692
YearsSinceLastPromotion	0.0977011821	-0.083447864
YearsWithCurrManager	0.3959144832	-0.121010943

\$center

Age	DailyRate	DistanceFromHome	HourlyRate
36.923810	802.485714	9.192517	65.891156
MonthlyIncome	MonthlyRate	NumCompaniesWorked	PercentSalaryHike
6502.931293	14313.103401	2.693197	15.209524
TotalWorkingYears	TrainingTimesLastYear	YearsAtCompany	YearsInCurrentRole
11.279592	2.799320	7.008163	4.229252
YearsSinceLastPromotion	YearsWithCurrManager		
2.187755	4.123129		

\$scale

Age	DailyRate	DistanceFromHome	HourlyRate
9.135373	403.509100	8.106864	20.329428
MonthlyIncome	MonthlyRate	NumCompaniesWorked	PercentSalaryHike
4707.956783	7117.786044	2.498009	3.659938
TotalWorkingYears	TrainingTimesLastYear	YearsAtCompany	YearsInCurrentRole
7.780782	1.289271	6.126525	3.623137
YearsSinceLastPromotion	YearsWithCurrManager		
3.222430	3.568136		

\$x

PC1	PC2	PC3	PC4	PC5	PC6	PC7
[1,]	-0.243044079	-1.805296680	-0.3104169553	-0.384994275	2.0169575215	0.984793983
[2,]	0.854288163	0.381073595	-0.5252390003	1.608645799	-1.5927436292	-0.481865695
[3,]	-2.198275394	-1.413301606	-0.0582282745	-2.596801032	0.6022422032	-0.023230640
[4,]	-0.570845554	0.682294015	0.9530781591	-0.112517223	0.0144209522	-0.415235118
[5,]	-1.567685771	-0.965438549	1.6427717726	0.537047071	-0.0703157168	0.940560119
[6,]	-0.033228256	1.476192828	0.1768758528	-0.871158691	0.9282306482	0.367849216
[7,]	-1.176981984	-2.344142438	-0.5229233979	-1.666338771	-0.8793271137	-0.417767837

[8,]	-2.668563284	0.310022541	-2.6128166708	-0.330963952	-1.2486460778	-0.052250851	0.440465950
[9,]	0.910894519	1.213005861	-1.5039201417	1.144947290	-1.1238829367	1.049881443	-1.508985300
[10,]	1.339778839	-0.208584655	-1.9076328247	-0.281672326	1.0866328829	-1.252674274	1.028329400
[11,]	-1.227202504	0.961999888	0.0613545738	0.034499533	0.4709461858	-2.043427871	-0.093631000
[12,]	-0.073116546	1.760186112	0.5344916830	1.247906142	0.5189044912	0.442256861	-0.615918400
[13,]	-1.087474516	1.023377864	-1.5147071841	1.573775407	-0.7475549471	1.511464717	0.475439700
[14,]	-1.814073316	0.601874393	-1.3014136722	-1.101977678	1.6522331947	-0.334506872	0.948471100
[15,]	-1.659410211	0.292702788	-0.0672556843	1.527211158	0.0369416431	-0.176183833	-1.143260100
[16,]	1.744251934	1.686663324	-1.1177364895	-0.381693162	0.6609099755	1.223658522	1.944601100
[17,]	-1.118546968	1.132058901	1.4189672811	0.273681898	0.7687430566	-1.460717606	-0.929694000
[18,]	-2.875446285	0.684977918	-1.2101773533	-1.069482747	1.5219403902	-0.105065952	0.280152800
[19,]	4.306398521	-1.060188116	0.2102166478	-0.374474127	-0.3205736368	-1.006842601	0.820229800
[20,]	-1.274793286	-0.518252552	1.7607337154	-0.263605442	0.4775025923	1.296215086	-0.917978800
[21,]	-1.707674413	1.416074395	-0.2866612249	-0.911443288	0.0740619531	-1.694982203	-1.468499300
[22,]	-0.973935456	-1.013413533	-1.1120212000	-1.850388185	-1.3640205357	-0.666890243	-1.015226700
[23,]	1.686994016	1.312303531	1.5096245660	1.224455487	0.2429059015	-0.652215366	0.257183300
[24,]	-3.186960204	1.127496005	0.4028852195	0.661084708	0.6427677466	-2.782189999	-0.969929100
[25,]	-1.236420346	0.070998887	0.2998566707	0.248336464	1.5088956715	0.030328006	0.384609900
[26,]	4.335210193	-1.187855044	0.8439064948	-1.135518002	0.1502712115	0.089980426	0.978384300
[27,]	0.202667449	1.487707345	-1.0496066009	-1.510499974	-1.5194444667	-1.172856717	-1.104354300
[28,]	0.522611662	0.517960123	0.7496484428	1.189509235	0.3725504816	0.467749272	1.065069400
[29,]	4.167497779	1.068632778	1.1917707595	-0.655936499	-0.3603395503	0.680646739	-1.267017500
[30,]	0.855668649	-2.594944348	0.7337329455	0.725830150	0.9881939586	-0.389610046	0.426736300
[31,]	-2.101453288	-0.598109160	0.9218830885	-1.261397525	1.1285699242	0.185406411	-0.101164700
[32,]	-0.628686779	-0.506577343	1.0557480273	-0.359363863	-1.2767722294	-1.259019980	1.508911900
[33,]	-0.585760317	1.290594877	1.0175278792	0.759970743	0.8434796204	-1.537202603	-1.362410500
[34,]	-1.453000790	-0.878346751	1.6553451372	-1.466979255	-0.7652620288	-1.050427892	-1.055547000
[35,]	-2.295426038	0.497391245	0.3961407175	-1.173667681	0.0495687553	1.396660954	-0.584942200
[36,]	-0.832994065	0.042990012	0.7006144001	-0.308495224	0.3417332881	-0.722274641	1.508031000
[37,]	-1.354693336	-0.382172652	-0.0113330121	-1.423881781	1.0314915947	0.517495020	-0.718538400
[38,]	-1.788459375	0.520002398	0.3186189447	-1.168483914	1.3010327250	-0.499080505	-0.292337700
[39,]	-1.940888185	-1.947119717	0.3014065269	-0.616302576	0.6580712905	-0.112112477	-0.231555900
[40,]	-0.826827035	0.269317986	0.4683770185	-1.617065750	-1.5424619460	1.078602496	-0.325345700
[41,]	-2.540242339	0.231335668	0.9249250633	-0.019213294	1.0357898965	0.023182442	-0.666297100
[42,]	-2.775064596	0.699871648	2.2688244419	-0.255818018	-1.5958498425	-1.351223462	1.231717000
[43,]	-2.660977369	0.709039810	-1.1151323620	-0.173311857	0.1700305471	0.580484544	1.535893500
[44,]	0.494241988	1.355663630	-0.4558314906	-0.773576913	-0.0893201999	2.889936395	0.573011900
[45,]	0.755465347	1.607572626	-0.5109637132	-0.506888091	-1.4233075836	1.057147451	-0.811641300
[46,]	5.804951893	1.078091201	-0.6975281151	0.051444706	0.4337848886	1.614106696	2.316950900
[47,]	0.806658069	1.653442819	-2.3068106160	-0.295882847	-0.4722918379	0.134169049	-0.054254000
[48,]	-1.995881882	-0.926896408	-1.9960316143	0.633599363	-0.1729888148	1.021151201	-1.410077200
[49,]	0.844245935	-0.616849916	-0.8194206960	-0.921810229	-0.7717068286	-1.818536061	-0.116483700
[50,]	-2.418330657	0.297326189	-0.3513459999	-1.101751982	-1.5156578641	1.499053343	0.172808600
[51,]	-0.617002088	-3.634989196	0.3562096372	0.118216390	1.4389894618	-0.220229442	-0.343718600
[52,]	-1.874898008	0.830881805	0.6248015543	-1.142134976	-0.3600199657	0.329946720	1.367503800
[53,]	-0.595964470	-1.218466650	-0.8408839570	-2.447215614	-0.9399446833	0.774272087	-0.205494200
[54,]	-0.697653611	-0.440311397	-0.1001609790	-1.002941201	0.6741005136	-0.305412825	0.117924700
[55,]	-2.079810230	-0.955185144	-1.8161177942	0.441813227	-1.3960822450	0.253432093	1.642659600
[56,]	3.708466615	1.814109184	-0.0097541922	-0.036909451	2.1090226075	0.552998695	0.071558000
[57,]	0.809848967	1.103897503	-1.7108414088	-0.291327045	-1.1137226784	-0.318923581	-0.770659500
[58,]	-1.465681948	0.058005177	-0.5799431432	0.624721643	-1.1676958094	0.275086845	1.147975700
[59,]	0.172118882	0.857390902	-0.3222266947	-0.286150650	-1.6974104391	0.722818482	-1.017406900
[60,]	-0.134488687	0.774824505	0.0742047436	-1.668328387	-0.8320217703	1.458220908	-0.209892300
[61,]	1.154466224	1.922306493	0.5340354541	0.208456672	-2.0449281318	1.172737829	-1.108190200
[62,]	1.015549604	1.685679343	-1.0836803069	0.522264077	0.9425346951	0.960676995	0.021597700
[63,]	5.230825960	-1.151655660	0.8119758029	0.364485427	-0.0405314789	0.826552609	1.010839600
[64,]	5.030282900	-0.755218265	-1.7678975054	-2.044562287	1.6478909242	-0.737221001	0.312351400
[65,]	3.788984539	1.946298043	-0.0945560272	-1.067010987	0.3184679516	0.860439229	1.020481200
[66,]	0.660742882	-2.427444222	0.7464731633	1.051907583	-0.8666771968	0.700339962	0.699484200
[67,]	-0.689313482	0.194433528	-0.4992692899	-0.091816631	0.9077818943	-1.467101142	1.191794500
[68,]	-0.360119052	-2.235551626	-0.3033093916	-0.208683127	-0.8858009134	0.057772762	1.027881300
[69,]	-1.590660053	-0.244778958	0.5118655703	-0.944308747	1.1711060680	0.909011154	-0.649052600
[70,]	-2.349000231	-0.024496709	-1.0212757577	1.625278907	0.8108621115	0.977055716	-0.224699900
[71,]	0.537061435	-3.049510452	0.9612799574	0.240109595	0.1951466351	0.179765350	1.724114300

PC8	PC9	PC10	PC11	PC12	PC13	PC14
[1,]	1.5917738507	1.1863471823	-0.8721216003	-0.0964053395	0.1652689774	2.697995e-01
[2,]	1.4396138690	-0.2915207036	-0.9133153760	-1.2704956060	-0.1223848585	3.003787e-01
[3,]	0.1645450520	0.7037177946	0.2334286037	-0.2063109991	0.0757180104	-2.034191e-01
[4,]	0.3788485663	-0.0232142896	0.4483748666	-0.4255970757	-1.1905425766	-5.888785e-01
[5,]	-0.2110090034	2.3132854086	-0.0092829889	0.7911383832	0.0932147601	-1.001822e-01
[6,]	0.8232618244	-0.2219554949	-0.0872069258	-0.4352547853	-0.2311142456	2.074828e-01
[7,]	0.6783978017	-0.4439152914	0.2850426885	-1.9955214056	0.0476998780	-7.608564e-02
[8,]	-0.3684730529	-0.4875080936	0.4800518063	0.0543954145	0.1020736714	-4.659415e-02
[9,]	-0.9351740522	-0.8467583073	-0.7791175369	0.1173708729	-0.0207647030	7.178969e-01
[10,]	-0.9887551265	1.8168832792	0.5496258442	0.0893646974	0.1719743118	1.482873e-01
[11,]	-0.7428933771	-0.3487121205	-0.3578297611	-0.5029560805	-0.2422407358	-3.914638e-02
[12,]	-1.0813690872	-0.3767620037	-1.1058405989	0.0965394361	0.4399899746	-2.594555e-02
[13,]	-1.2884619372	-0.0363538480	0.8308304610	-0.2190499489	0.3017206595	-5.138678e-02
[14,]	-0.8195524226	-0.7310455341	0.3812739185	-0.4949317648	-0.0110627441	2.587105e-01
[15,]	-1.9271549894	1.2343495139	-0.5198251249	0.4250203594	0.1772497877	-2.805626e-01
[16,]	-1.2962378063	0.1672283742	0.9190505173	0.6052322133	-0.1396419825	7.886224e-01
[17,]	-0.0866130578	-0.4359922773	-0.4908235512	-0.1712840455	0.4964863948	-6.197885e-02
[18,]	-0.3703968876	-0.4515944960	0.4707221281	0.6870011577	0.0480464742	-1.323742e-01
[19,]	1.1419762947	-1.3201148540	-0.5553725566	-0.0202145544	0.0106513546	-1.330532e+00
[20,]	-0.9326540622	0.6299363640	-0.0098247146	-0.2880597580	-0.0739027515	1.175321e-01
[21,]	0.0042898132	-0.3112305780	0.1801517860	0.6691640181	0.1912063602	-6.152712e-02
[22,]	0.3446067836	1.3648622584	-0.4792426584	0.2130812121	0.0911878469	-3.605121e-01
[23,]	-0.2496196395	-0.6875524464	-0.9335162824	0.6027692112	0.8094891808	7.005028e-01
[24,]	-0.3520700093	0.2822430507	0.2555611279	0.6350192662	0.0179911182	-1.389628e-01
[25,]	0.5077089246	-0.1612550579	-0.0186130089	-0.3041024579	0.2026623054	-1.190615e-01
[26,]	-0.6259760526	-0.5375940379	-0.5583140528	0.3347066400	-1.0951792994	8.320370e-01
[27,]	-0.6537846675	0.3570074959	0.9290619928	-0.0189461399	1.1560600116	-2.554831e-01
[28,]	-0.0648482848	-0.7354981588	0.5503138531	-0.7380133792	-0.9496643546	8.389053e-03
[29,]	-1.2648397307	0.3155536872	-1.1110140575	-0.1549320265	2.1008653026	-1.743973e-01
[30,]	0.9457428880	-1.6915126800	0.7155359778	1.0274567321	-0.2257845320	7.444228e-01
[31,]	-0.1895100955	0.2414887412	0.1464112473	-0.0495438258	-0.1690167656	-2.514129e-01
[32,]	-1.1586344712	-0.3666531671	0.0562237019	-0.6611355034	0.2298295473	2.991824e-01
[33,]	-0.1491699406	0.0895757307	-0.5992509197	-0.0332054293	1.5600371817	-5.381913e-01
[34,]	-1.5329294741	-0.2065832996	0.1820633909	-0.4482305144	0.1077454163	-8.54825e-01
[35,]	0.2134201607	-0.1299260602	0.8657952064	0.4687972163	0.1202434785	-4.949487e-01
[36,]	0.7203396398	-0.3895527430	-0.1574012260	-1.2429413892	0.1954059923	1.912162e-01
[37,]	0.2688390818	-0.9067448813	0.0479551510	-1.6866316116	-0.1441330064	4.304295e-01
[38,]	0.6935995880	-0.2003120841	0.5271573093	-0.6067308937	-0.0279386513	2.824748e-01
[39,]	0.2429085978	1.7646246196	-0.1129573297	0.2507919469	-0.1314289782	-1.482093e-01
[40,]	-0.1179524881	-0.3580190226	0.0556865761	0.1396045303	0.0353093528	-1.389953e-01
[41,]	0.0181823818	-0.5107722810	0.3263458397	-0.5465772678	-0.0602546854	5.658773e-02
[42,]	-0.7388494377	-0.0587506994	0.2787045616	0.0926434197	0.0901210156	-1.196858e-01
[43,]	-1.9884712967	-0.3763602810	0.3022550599	0.1729522027	0.2552767122	-3.327794e-03
[44,]	-0.3462124514	-0.6086221030	-0.7113741266	0.7779144715	-0.3180020334	4.068577e-01
[45,]	1.5058488466	0.0966839023	-0.4001732785	0.0586933619	-0.1521141805	-3.945470e-01
[46,]	0.0542470485	-0.2605203348	2.2309102556	0.7861699813	-1.1179707031	4.072934e-01
[47,]	-0.3676769926	0.0803763634	1.3065788470	-0.3439303856	0.5396748825	1.926447e-01
[48,]	0.0379981462	0.0139823408	0.2379323987	-0.1482978143	0.0345722067	-2.626249e-01
[49,]	1.5880220441	0.4128727770	-1.2321509722	-0.6278155609	0.3533099316	1.678164e-01
[50,]	-0.4960323101	-0.6439180110	0.3515209761	-0.5484838822	0.2054958400	1.408071e-01
[51,]	1.1704670085	0.8200564211	-0.1123759892	-0.2977384011	0.1285674151	-6.899389e-01
[52,]	-0.3941110717	-0.1764307635	0.5591763859	0.0448168714	0.0596852002	2.356005e-01
[53,]	0.8857772453	0.2519075061	0.0130817786	-0.4850733698	0.0278447233	1.985134e-01
[54,]	-0.6111756017	-0.7690695559	0.6284517406	0.6011938058	0.6113545988	3.056229e-01
[55,]	-0.5984018598	1.3970676765	-0.0643320469	0.9721652618	-0.1949743264	-3.069309e-01
[56,]	1.7422401316	0.1408058227	-0.0199461188	0.7410413537	-0.5297862525	1.093202e+00
[57,]	-0.0108146406	-0.3106679951	-0.8493487541	0.3863867848	-0.1458192162	6.892529e-01
[58,]	-1.8215348214	0.3621471351	0.4006851921	-0.2172714122	0.0608335537	2.928318e-01
[59,]	0.3335120551	0.4740138563	-0.8411057977	0.4163000283	-0.0858083206	2.931242e-01
[60,]	0.2284006406	-0.6348604010	-0.7475512841	-0.2920548376	0.2496513450	4.888034e-01
[61,]	0.7408606053	0.5122781140	0.5793496320	-0.0105572994	-0.0042066309	5.488545e-01
[62,]	-2.4733087118	0.5540510535	1.2979592812	-0.9935329529	1.2766076994	1.734229e-01
[63,]	-0.4001018830	0.0656254162	2.1963468297	0.5895255433	1.4470277217	-1.086096e+00

```
[64,] -1.7992385929  1.6436332545 -0.5355851584 -1.3269684512 -1.2755865234 -5.269145e-01 -1.0402
[65,] -0.1566109309  0.5395449026  1.4430413025  0.0325762440 -1.0121301749  2.073019e-01 -2.1102
[66,] -0.5389467786 -2.0662901268  0.1446763110 -0.3168046990  0.3722514197  2.468134e-01  1.594
[67,]  0.6267828319 -0.5362398552 -0.3750836045 -0.0545365082 -0.4224485744  2.452230e-01  3.754
[68,]  0.3270971145 -1.6969908177  0.3987065997 -0.0530068030  0.1509487886 -4.247686e-01 -1.035
[69,]  0.3792991801  0.4293974391  0.0802128266 -0.3229283966 -0.0234897322 -3.881229e-02  1.049
[70,]  1.5255487349 -1.1502222404  0.3958031962 -0.5136583440 -0.0367616655  1.303524e-01  3.312
[71,]  0.4884620531  0.4469007175 -0.3625035208 -1.6091056814  0.0695982865 -7.853735e-02 -2.395
[ reached getOption("max.print") -- omitted 1399 rows ]
```

```
> summary(attr_pca_done)
```

```
Importance of components:
```

PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9	PC10	PC11
Standard deviation	2.0042	1.2846	1.03368	1.02573	1.0047	0.99622	0.9764	0.95786	0.8500	0.7284
Proportion of Variance	0.2869	0.1179	0.07632	0.07515	0.0721	0.07089	0.0681	0.06554	0.0516	0.0379
Cumulative Proportion	0.2869	0.4048	0.48111	0.55626	0.6284	0.69925	0.7673	0.83288	0.8845	0.9223

PC12	PC13	PC14	
Standard deviation	0.53219	0.43975	0.3743
Proportion of Variance	0.02023	0.01381	0.0100
Cumulative Proportion	0.97618	0.99000	1.0000

```
> #Extract variance against features
```

```
> eigenvalues<-attr_pca_done$sdev^2
```

```
> eigenvalues
```

```
[1] 4.0167738 1.6502052 1.0685042 1.0521201 1.0094108 0.9924579 0.9533497 0.9174969 0.7224654 0.5306965
[11] 0.4698454 0.2832233 0.1933840 0.1400658
```

```
> sum(eigenvalues)
```

```
[1] 14
```

```
> names(eigenvalues) <- paste("PC",1:14,sep="")
```

```
> eigenvalues
```

PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9	PC10
4.0167738	1.6502052	1.0685042	1.0521201	1.0094108	0.9924579	0.9533497	0.9174969	0.7224654	0.5306965

PC12	PC13	PC14
0.2832233	0.1933840	0.1400658

```
> sumoflambdas <- sum(eigenvalues)
```

```
> sumoflambdas
```

```
[1] 14
```

```
> #Variance %
```

```
> pctvar<- (eigenvalues/sumoflambdas)*100
```

```
> pctvar
```

PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9	PC10
28.691241	11.787180	7.632173	7.515143	7.210077	7.088985	6.809641	6.553550	5.160467	3.790696

PC12	PC13	PC14
2.023023	1.381314	1.000470

```
> #Calculate cumulative of variance
```

```
> cumvar <- cumsum(pctvar)
```

```
> cumvar
```

PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9	PC10
28.69124	40.47842	48.11059	55.62574	62.83581	69.92480	76.73444	83.28799	88.44846	92.23915

PC12	PC13	PC14
97.61822	98.99953	100.00000

```
> matlambdas <- rbind(eigenvalues,pctvar,cumvar)
```

```
> matlambdas
```

PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9
eigenvalues	4.016774	1.650205	1.068504	1.052120	1.009411	0.9924579	0.9533497	0.9174969
pctvar	28.691241	11.787180	7.632173	7.515143	7.210077	7.0889848	6.8096407	6.5535496
cumvar	28.691241	40.478422	48.110594	55.625738	62.835815	69.9247997	76.7344404	83.2879900

PC10	PC11	PC12	PC13	PC14
eigenvalues	0.5306975	0.4698454	0.2832233	0.193384
pctvar	3.7906965	3.3560388	2.0230233	1.381314
cumvar	92.2391537	95.5951925	97.6182158	98.999530

```
> rownames(matlambdas) <- c("Eigenvalues","Prop. variance","Cum. prop. variance")
```

```
> round(matlambdas,4)
```

PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9	PC10	PC11
Eigenvalues			4.0168	1.6502	1.0685	1.0521	1.0094	0.9925	0.9533	0.9175

```

Prop. variance      28.6912 11.7872  7.6322  7.5151  7.2101  7.0890  6.8096  6.5535  5.1605  3.7
Cum. prop. variance 28.6912 40.4784 48.1106 55.6257 62.8358 69.9248 76.7344 83.2880 88.4485 92.2
PC12      PC13      PC14
Eigenvalues      0.2832  0.1934  0.1401
Prop. variance    2.0230  1.3813  1.0005
Cum. prop. variance 97.6182 98.9995 100.0000

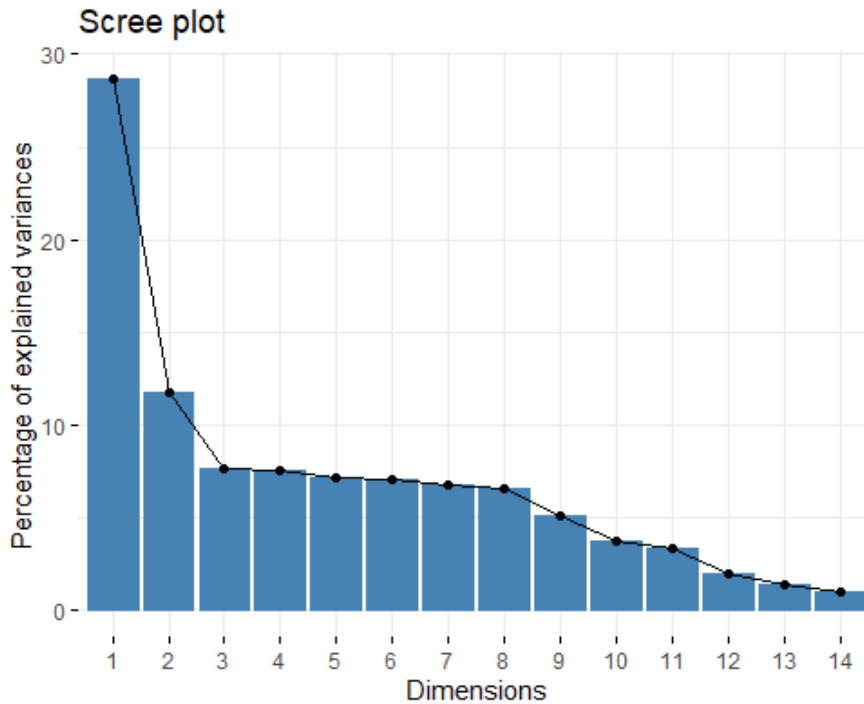
```

```
> attr_pca_done$rotation
```

	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9	PC10	PC11	PC12	PC13	PC14
Age			0.280157344	-0.472170158	0.003362193	0.004488409	-0.039563410	-0.05870	-0.098196914	-0.05927715	-0.183114693	0.005033984	-0.74367068	-0.041550
DailyRate			-0.006815197	-0.077962430	-0.207301367	-0.609569867	-0.211568990	-0.1306	0.715405171	-0.02770642	-0.028707475	0.040304455	-0.01980752	0.040445
DistanceFromHome			0.004812032	0.041564987	-0.664884791	0.306131593	0.048941659	-0.1768	0.031447533	-0.65217193	0.037737577	0.002338630	0.02927699	0.003420
HourlyRate			-0.011288550	-0.062668026	-0.352147686	-0.255816205	0.602292088	-0.4816	-0.221010405	0.40142111	-0.004675476	0.018009772	0.03725997	-0.004074
MonthlyIncome			0.360622909	-0.290395305	0.052415102	0.025332267	-0.034941693	-0.0332	-0.012272736	-0.03685912	-0.377381332	0.104651321	0.61775910	-0.047499
MonthlyRate			0.001123298	-0.086158010	0.020312197	0.664085954	-0.101166486	-0.3712	0.482943083	0.40448871	0.056690883	-0.044889268	-0.01681584	0.023709
NumCompaniesWorked			0.030991906	-0.560133264	0.005628265	-0.041875610	0.017785645	0.1012	-0.032989593	-0.03355765	0.775796629	-0.129586743	0.19687866	0.021028
PercentSalaryHike			-0.015351368	0.004618486	-0.465841883	-0.055689609	-0.698726672	-0.0082	-0.376210309	0.38335261	0.012190972	0.019568502	0.04082482	0.014317
TotalWorkingYears			0.415285665	-0.318115831	0.009368263	0.007027664	-0.024159198	-0.0252	-0.029511945	-0.04398227	-0.196663458	-0.038585533	0.08301594	0.061109
TrainingTimesLastYear			-0.010993402	0.092457674	0.409028173	-0.138279489	-0.293982017	-0.7516	-0.217564575	-0.29622601	0.130785998	-0.017811234	0.02954240	-0.000289
YearsAtCompany			0.443443529	0.213079968	0.002115638	-0.010571214	0.024921329	-0.0019	0.005335572	0.01862614	-0.001551392	-0.104225054	0.03762072	0.079527
YearsInCurrentRole			0.391353065	0.279423881	-0.048111956	-0.038785223	-0.004927194	0.0145	0.062086964	0.05420752	0.201595025	-0.271683842	-0.04458982	-0.765806
YearsSinceLastPromotion			0.344322397	0.198658357	0.003993040	0.027659809	0.019935007	0.0186	0.022129234	0.03850513	0.306725567	0.845951303	-0.08053456	0.075946
YearsWithCurrManager			0.386171187	0.295138965	-0.031745944	-0.034459502	0.021898300	0.0286	0.011525930	0.04176204	0.161413516	-0.407140185	-0.06576770	0.625185
Age			0.1893016403	0.237072230										
DailyRate			-0.0099081253	0.018837870										
DistanceFromHome			0.0057709912	0.011991386										
HourlyRate			0.0049037331	-0.003314012										
MonthlyIncome			0.4041044054	0.279006032										
MonthlyRate			-0.0083381972	0.009367738										
NumCompaniesWorked			-0.0369554196	0.107234673										
PercentSalaryHike			-0.0183445446	0.010585240										
TotalWorkingYears			-0.4158888971	-0.705989494										
TrainingTimesLastYear			0.0008431661	-0.012085362										
YearsAtCompany			-0.6494086309	0.562584645										
YearsInCurrentRole			0.1948014145	-0.130643692										
YearsSinceLastPromotion			0.0977011821	-0.083447864										
YearsWithCurrManager			0.3959144832	-0.121010943										

```
> #Visualize PCA using scree plot
```

```
> fviz_screplot(attr_pca_done, ncp=14)
```

```
> summary(attr_pca_done)
Importance of components:
PC1      PC2      PC3      PC4      PC5      PC6      PC7      PC8      PC9      PC10     PC11
Standard deviation      2.0042  1.2846  1.03368  1.02573  1.0047  0.99622  0.9764  0.95786  0.8500  0.7284
Proportion of Variance  0.2869  0.1179  0.07632  0.07515  0.0721  0.07089  0.0681  0.06554  0.0516  0.0379
Cumulative Proportion  0.2869  0.4048  0.48111  0.55626  0.6284  0.69925  0.7673  0.83288  0.8845  0.9223
PC12     PC13     PC14
Standard deviation      0.53219  0.43975  0.3743
Proportion of Variance  0.02023  0.01381  0.0100
Cumulative Proportion  0.97618  0.99000  1.0000

> #Sample scores stored in attr_pca$x
> #we need to calculate the scores on each of these components for each individual in our sample
> attr_pca_done$x
```

	PC1	PC2	PC3	PC4	PC5	PC6	PC7
[1,]	-0.243044079	-1.805296680	-0.3104169553	-0.384994275	2.0169575215	0.984793983	1.33213032
[2,]	0.854288163	0.381073595	-0.5252390003	1.608645799	-1.5927436292	-0.481865695	-1.04322462
[3,]	-2.198275394	-1.413301606	-0.0582282745	-2.596801032	0.6022422032	-0.023230640	-0.24482174
[4,]	-0.570845554	0.682294015	0.9530781591	-0.112517223	0.0144209522	-0.415235118	2.25467789
[5,]	-1.567685771	-0.965438549	1.6427717726	0.537047071	-0.0703157168	0.940560119	0.33261104
[6,]	-0.033228256	1.476192828	0.1768758528	-0.871158691	0.9282306482	0.367849216	0.55347104
[7,]	-1.176981984	-2.344142438	-0.5229233979	-1.666338771	-0.8793271137	-0.417767837	-0.43837159
[8,]	-2.668563284	0.310022541	-2.6128166708	-0.330963952	-1.2486460778	-0.052250851	0.44046595
[9,]	0.910894519	1.213005861	-1.5039201417	1.144947290	-1.1238829367	1.049881443	-1.50898530
[10,]	1.339778839	-0.208584655	-1.9076328247	-0.281672326	1.0866328829	-1.252674274	1.0283294
[11,]	-1.227202504	0.961999888	0.0613545738	0.034499533	0.4709461858	-2.043427871	-0.0936310
[12,]	-0.073116546	1.760186112	0.5344916830	1.247906142	0.5189044912	0.442256861	-0.6159184
[13,]	-1.087474516	1.023377864	-1.5147071841	1.573775407	-0.7475549471	1.511464717	0.4754397
[14,]	-1.814073316	0.601874393	-1.3014136722	-1.101977678	1.6522331947	-0.334506872	0.9484714
[15,]	-1.659410211	0.292702788	-0.0672556843	1.527211158	0.0369416431	-0.176183833	-1.1432601
[16,]	1.744251934	1.686663324	-1.1177364895	-0.381693162	0.6609099755	1.223658522	1.9446011
[17,]	-1.118546968	1.132058901	1.4189672811	0.273681898	0.7687430566	-1.460717606	-0.9296940
[18,]	-2.875446285	0.684977918	-1.2101773533	-1.069482747	1.5219403902	-0.105065952	0.2801528
[19,]	4.306398521	-1.060188116	0.2102166478	-0.374474127	-0.3205736368	-1.006842601	0.8202298
[20,]	-1.274793286	-0.518252552	1.7607337154	-0.263605442	0.4775025923	1.296215086	-0.9179788
[21,]	-1.707674413	1.416074395	-0.2866612249	-0.911443288	0.0740619531	-1.694982203	-1.4684993

[22,]	-0.973935456	-1.013413533	-1.1120212000	-1.850388185	-1.3640205357	-0.666890243	-1.01522670
[23,]	1.686994016	1.312303531	1.5096245660	1.224455487	0.2429059015	-0.652215366	0.25718331
[24,]	-3.186960204	1.127496005	0.4028852195	0.661084708	0.6427677466	-2.782189999	-0.96992911
[25,]	-1.236420346	0.070998887	0.2998566707	0.248336464	1.5088956715	0.030328006	0.38460999
[26,]	4.335210193	-1.187855044	0.8439064948	-1.135518002	0.1502712115	0.089980426	0.97838431
[27,]	0.202667449	1.487707345	-1.0496066009	-1.510499974	-1.5194444667	-1.172856717	-1.10435431
[28,]	0.522611662	0.517960123	0.7496484428	1.189509235	0.3725504816	0.467749272	1.06506941
[29,]	4.167497779	1.068632778	1.1917707595	-0.655936499	-0.3603395503	0.680646739	-1.26701751
[30,]	0.855668649	-2.594944348	0.7337329455	0.725830150	0.9881939586	-0.389610046	0.42673631
[31,]	-2.101453288	-0.598109160	0.9218830885	-1.261397525	1.1285699242	0.185406411	-0.10116471
[32,]	-0.628686779	-0.506577343	1.0557480273	-0.359363863	-1.2767722294	-1.259019980	1.50891191
[33,]	-0.585760317	1.290594877	1.0175278792	0.759970743	0.8434796204	-1.537202603	-1.36241051
[34,]	-1.453000790	-0.878346751	1.6553451372	-1.466979255	-0.7652620288	-1.050427892	-1.05554701
[35,]	-2.295426038	0.497391245	0.3961407175	-1.173667681	0.0495687553	1.396660954	-0.58494221
[36,]	-0.832994065	0.042990012	0.7006144001	-0.308495224	0.3417332881	-0.722274641	1.50803101
[37,]	-1.354693336	-0.382172652	-0.0113330121	-1.423881781	1.0314915947	0.517495020	-0.71685381
[38,]	-1.788459375	0.520002398	0.3186189447	-1.168483914	1.3010327250	-0.499080505	-0.29233771
[39,]	-1.940888185	-1.947119717	0.3014065269	-0.616302576	0.6580712905	-0.112112477	-0.23155591
[40,]	-0.826827035	0.269317986	0.4683770185	-1.617065750	-1.5424619460	1.078602496	-0.32534571
[41,]	-2.540242339	0.231335668	0.9249250633	-0.019213294	1.0357898965	0.023182442	-0.66629711
[42,]	-2.775064596	0.699871648	2.2688244419	-0.255818018	-1.5958498425	-1.351223462	1.23171701
[43,]	-2.660977369	0.709039810	-1.1151323620	-0.173311857	0.1700305471	0.580484544	1.53589351
[44,]	0.494241988	1.355663630	-0.4558314906	-0.773576913	-0.0893201999	2.889936395	0.57301191
[45,]	0.755465347	1.607572626	-0.5109637132	-0.506888091	-1.4233075836	1.057147451	-0.81164131
[46,]	5.804951893	1.078091201	-0.6975281151	0.051444706	0.4337848886	1.614106696	2.31695091
[47,]	0.806658069	1.653442819	-2.3068106160	-0.295882847	-0.4722918379	0.134169049	-0.05425401
[48,]	-1.995881882	-0.926896408	-1.9960316143	0.633599363	-0.1729888148	1.021151201	-1.41007721
[49,]	0.844245935	-0.616849916	-0.8194206960	-0.921810229	-0.7717068286	-1.818536061	-0.11648371
[50,]	-2.418330657	0.297326189	-0.3513459999	-1.101751982	-1.5156578641	1.499053343	0.17280861
[51,]	-0.617002088	-3.634989196	0.3562096372	0.118216390	1.4389894618	-0.220229442	-0.34371861
[52,]	-1.874898008	0.830881805	0.6248015543	-1.142134976	-0.3600199657	0.329946720	1.36750381
[53,]	-0.595964470	-1.218466650	-0.8408839570	-2.447215614	-0.9399446833	0.774272087	-0.20549421
[54,]	-0.697653611	-0.440311397	-0.1001609790	-1.002941201	0.6741005136	-0.305412825	0.11792471
[55,]	-2.079810230	-0.955185144	-1.8161177942	0.441813227	-1.3960822450	0.253432093	1.64265961
[56,]	3.708466615	1.814109184	-0.0097541922	-0.036909451	2.1090226075	0.552998695	0.07155801
[57,]	0.809848967	1.103897503	-1.7108414088	-0.291327045	-1.1137226784	-0.318923581	-0.77065951
[58,]	-1.465681948	0.058005177	-0.5799431432	0.624721643	-1.1676958094	0.275086845	1.14797571
[59,]	0.172118882	0.857390902	-0.3222266947	-0.286150650	-1.6974104391	0.722818482	-1.01740691
[60,]	-0.134488687	0.774824505	0.0742047436	-1.668328387	-0.8320217703	1.458220908	-0.20989231
[61,]	1.154466224	1.922306493	0.5340354541	0.208456672	-2.0449281318	1.172737829	-1.10819021
[62,]	1.015549604	1.685679343	-1.0836803069	0.522264077	0.9425346951	0.960676995	0.02159771
[63,]	5.230825960	-1.151655660	0.8119758029	0.364485427	-0.0405314789	0.826552609	1.01083961
[64,]	5.030282900	-0.755218265	-1.7678975054	-2.044562287	1.6478909242	-0.737221001	0.31235141
[65,]	3.788984539	1.946298043	-0.0945560272	-1.067010987	0.3184679516	0.860439229	1.02048121
[66,]	0.660742882	-2.427444222	0.7464731633	1.051907583	-0.8666771968	0.700339962	0.69948421
[67,]	-0.689313482	0.194433528	-0.4992692899	-0.091816631	0.9077818943	-1.467101142	1.19179451
[68,]	-0.360119052	-2.235551626	-0.3033093916	-0.208683127	-0.8858009134	0.057772762	1.02788131
[69,]	-1.590660053	-0.244778958	0.5118655703	-0.944308747	1.1711060680	0.909011154	-0.64905261
[70,]	-2.349000231	-0.024496709	-1.0212757577	1.625278907	0.8108621115	0.977055716	-0.22469991
[71,]	0.537061435	-3.049510452	0.9612799574	0.240109595	0.1951466351	0.179765350	1.72411431
PC8	PC9	PC10	PC11	PC12	PC13	PC14	
[1,]	1.5917738507	1.1863471823	-0.8721216003	-0.0964053395	0.1652689774	2.697995e-01	5.61691e-01
[2,]	1.4396138690	-0.2915207036	-0.9133153760	-1.2704956060	-0.1223848585	3.003787e-01	3.92641e-01
[3,]	0.1645450520	0.7037177946	0.2334286037	-0.2063109991	0.0757180104	-2.034191e-01	-3.02701e-01
[4,]	0.3788485663	-0.0232142896	0.4483748666	-0.4255970757	-1.1905425766	-5.888785e-01	3.76051e-01
[5,]	-0.2110090034	2.3132854086	-0.0092829889	0.7911383832	0.0932147601	-1.001822e-01	-1.46501e-01
[6,]	0.8232618244	-0.2219554949	-0.0872069258	-0.4352547853	-0.2311142456	2.074828e-01	-3.40161e-01
[7,]	0.6783978017	-0.4439152914	0.2850426885	-1.9955214056	0.0476998780	-7.608564e-02	1.52721e-01
[8,]	-0.3684730529	-0.4875080936	0.4800518063	0.0543954145	0.1020736714	-4.659415e-02	3.25331e-01
[9,]	-0.9351740522	-0.8467583073	-0.7791175369	0.1173708729	-0.0207647030	7.178969e-01	2.03421e-01
[10,]	-0.9887551265	1.8168832792	0.5496258442	0.0893646974	0.1719743118	1.482873e-01	-7.59211e-01
[11,]	-0.7428933771	-0.3487121205	-0.3578297611	-0.5029560805	-0.2422407358	-3.914638e-02	-2.62411e-01
[12,]	-1.0813690872	-0.3767620037	-1.1058405989	0.0965394361	0.4399899746	-2.594555e-02	-2.94011e-01
[13,]	-1.2884619372	-0.0363538480	0.8308304610	-0.2190499489	0.3017206595	-5.138678e-02	6.51711e-01

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[14,] -0.8195524226 -0.7310455341 0.3812739185 -0.4949317648 -0.0110627441 2.587105e-01 7.8802
[15,] -1.9271549894 1.2343495139 -0.5198251249 0.4250203594 0.1772497877 -2.805626e-01 -4.452
[16,] -1.2962378063 0.1672283742 0.9190505173 0.6052322133 -0.1396419825 7.886224e-01 -8.889
[17,] -0.0866130578 -0.4359922773 -0.4908235512 -0.1712840455 0.4964863948 -6.197885e-02 -8.960
[18,] -0.3703968876 -0.4515944960 0.4707221281 0.6870011577 0.0480464742 -1.323742e-01 7.059
[19,] 1.1419762947 -1.3201148540 -0.5553725566 -0.0202145544 0.0106513546 -1.330532e+00 5.419
[20,] -0.9326540622 0.6299363640 -0.0098247146 -0.2880597580 -0.0739027515 1.175321e-01 2.148
[21,] 0.0042898132 -0.3112305780 0.1801517860 0.6691640181 0.1912063602 -6.152712e-02 -1.847
[22,] 0.3446067836 1.3648622584 -0.4792426584 0.2130812121 0.0911878469 -3.605121e-01 6.632
[23,] -0.2496196395 -0.6875524464 -0.9335162824 0.6027692112 0.8094891808 7.005028e-01 1.107
[24,] -0.3520700093 0.2822430507 0.2555611279 0.6350192662 0.0179911182 -1.389628e-01 -1.118
[25,] 0.5077089246 -0.1612550579 -0.0186130089 -0.3041024579 0.2026623054 -1.190615e-01 -1.583
[26,] -0.6259760526 -0.5375940379 -0.5583140528 0.3347066400 -1.0951792994 8.320370e-01 2.989
[27,] -0.6537874675 0.3570074959 0.9290619928 -0.0189461399 1.1560600116 -2.554831e-01 -6.819
[28,] -0.0648482848 -0.7354981588 0.5503138531 -0.7380133792 -0.9496643546 8.389053e-03 2.596
[29,] -1.2648397307 0.3155536872 -1.1110140575 -0.1549320265 2.1008653026 -1.743973e-01 2.246
[30,] 0.9457428880 -1.6915126800 0.7155359778 1.0274567321 -0.2257845320 7.444228e-01 -2.638
[31,] -0.1895100955 0.2414887412 0.1464112473 -0.0495438258 -0.1690167656 -2.514129e-01 -1.647
[32,] -1.1586344712 -0.3666531671 0.0562237019 -0.6611355034 0.2298295473 2.991824e-01 2.466
[33,] -0.1491699406 0.0895757307 -0.5992509197 -0.0332054293 1.5600371817 -5.381913e-01 -1.237
[34,] -1.5329294741 -0.2065832996 0.1820633909 -0.4482305144 0.1077454163 -8.542825e-01 -1.146
[35,] 0.2134201607 -0.1299260602 0.8657952064 0.6487972163 0.1202434785 -4.949487e-01 -3.141
[36,] 0.7203396398 -0.3895527430 -0.1574012260 -1.2429413892 0.1954059923 1.912162e-01 2.394
[37,] 0.2688390818 -0.9067448813 0.0479551510 -1.6866316116 -0.1441330064 4.304295e-01 6.133
[38,] 0.6935995880 -0.2003120841 0.5271573093 -0.6067308937 -0.0279386513 2.824748e-01 1.247
[39,] 0.2429085978 1.7646246196 -0.1129573297 0.2507919469 -0.1314289782 -1.482093e-01 2.907
[40,] -0.1179524881 -0.3580190226 0.0556865761 0.1396045303 0.0353093528 -1.389953e-01 -1.514
[41,] 0.0181823818 -0.5107722810 0.3263458397 -0.5465772678 -0.0602546854 5.658773e-02 2.970
[42,] -0.7388494377 -0.0587506994 0.2787045616 0.0926434197 0.0901210156 -1.196858e-01 1.389
[43,] -1.9884712967 -0.3763602810 0.3022550599 0.1729522027 0.2552767122 -3.327794e-03 1.358
[44,] -0.3462124514 -0.6086221030 -0.7113741266 0.7779144715 -0.3180020334 4.068577e-01 1.109
[45,] 1.5058488466 0.0966839023 -0.4001732785 0.0586933619 -0.1521141805 -3.945470e-01 -2.508
[46,] 0.0542470485 -0.2605203348 2.2309102556 0.7861699813 -1.1179707031 4.072934e-01 3.200
[47,] -0.3676769926 0.0803763634 1.3065788470 -0.3439303856 0.5396748825 1.926447e-01 -2.356
[48,] 0.0379981462 0.0139823408 0.2379323987 -0.1482978143 0.0345722067 -2.626249e-01 -3.020
[49,] 1.5880220441 0.4128727770 -1.2321509722 -0.6278155609 0.3533099316 1.678164e-01 6.690
[50,] -0.4960323101 -0.6439180110 0.3515209761 -0.5484838822 0.2054958400 1.408071e-01 3.516
[51,] 1.1704670085 0.8200564211 -0.1123759892 -0.2977384011 0.1285674151 -6.899389e-01 -7.924
[52,] -0.3941110717 -0.1764307635 0.5591763859 0.0448168714 0.0596852002 2.356005e-01 6.709
[53,] 0.8857772453 0.2519075061 0.0130817786 -0.4850733698 0.0278447233 1.985134e-01 2.933
[54,] -0.6111756017 -0.7690695559 0.6284517406 0.6011938058 0.6113545988 3.056229e-01 1.541
[55,] -0.5984018598 1.3970676765 -0.0643320469 0.9721652618 -0.1949743264 -3.069309e-01 2.303
[56,] 1.7422401316 0.1408058227 -0.0199461188 0.7410413537 -0.5297862525 1.093202e+00 -1.580
[57,] -0.0108146406 -0.3106679951 -0.8493487541 0.3863867848 -0.1458192162 6.892529e-01 2.105
[58,] -1.8215348214 0.3621471351 0.4006851921 -0.2172714122 0.0608335537 2.928318e-01 2.154
[59,] 0.3335120551 0.4740138563 -0.8411057977 0.4163000283 -0.0858083206 2.931242e-01 -2.225
[60,] 0.2284006406 -0.6348604010 -0.7475512841 -0.2920548376 0.2496513450 4.888034e-01 2.230
[61,] 0.7408606053 0.5122781140 0.5793496320 -0.0105572994 -0.0042066309 5.488545e-01 -2.340
[62,] -2.4733087118 0.5540510535 1.2979592812 -0.9935329529 1.2766076994 1.734229e-01 -1.856
[63,] -0.4001018830 0.0656254162 2.1963468297 0.5895255433 1.4470277217 -1.086096e+00 1.034
[64,] -1.7992385929 1.6436332545 -0.5355851584 -1.3269684512 -1.2755865234 -5.269145e-01 -1.040
[65,] -0.1566109309 0.5395449026 1.4430413025 0.0325762440 -1.0121301749 2.073019e-01 -2.110
[66,] -0.5389467786 -2.0662901268 0.1446763110 -0.3168046990 0.3722514197 2.468134e-01 1.594
[67,] 0.6267828319 -0.5362398552 -0.3750836045 -0.0545365082 -0.4224485744 2.452230e-01 3.754
[68,] 0.3270971145 -1.6969908177 0.3987065997 -0.0530068030 0.1509487886 -4.247686e-01 -1.035
[69,] 0.3792991801 0.4293974391 0.0802128266 -0.3229283966 -0.0234897322 -3.881229e-02 1.049
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> typ_pca

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1	Yes	-0.24304408	-1.80529668	-0.310416955	-0.38499428	2.01695752	0.98479398	1.3321303
2	No	0.85428816	0.38107360	-0.525239000	1.60864580	-1.59274363	-0.48186570	-1.0432246
3	Yes	-2.19827539	-1.41330161	-0.058228274	-2.59680103	0.60224220	-0.02323064	-0.2448217

4	No	-0.57084555	0.68229402	0.953078159	-0.11251722	0.01442095	-0.41523512	2.25467788
5	No	-1.56768577	-0.96543855	1.642771773	0.53704707	-0.07031572	0.94056012	0.33261104
6	No	-0.03322826	1.47619283	0.176875853	-0.87115869	0.92823065	0.36784922	0.55347101
7	No	-1.17698198	-2.34414244	-0.522923398	-1.66633877	-0.87932711	-0.41776784	-0.43837151
8	No	-2.66856328	0.31002254	-2.612816671	-0.33096395	-1.24864608	-0.05225085	0.44046591
9	No	0.91089452	1.21300586	-1.503920142	1.14494729	-1.12388294	1.04988144	-1.50898531
10	No	1.33977884	-0.20858466	-1.907632825	-0.28167233	1.08663288	-1.25267427	1.02832911
11	No	-1.22720250	0.96199989	0.061354574	0.03449953	0.47094619	-2.04342787	-0.09363101
12	No	-0.07311655	1.76018611	0.534491683	1.24790614	0.51890449	0.44225686	-0.61591841
13	No	-1.08747452	1.02337786	-1.514707184	1.57377541	-0.74755495	1.51146472	0.47543971
14	No	-1.81407332	0.60187439	-1.301413672	-1.10197768	1.65223319	-0.33450687	0.94847141
15	Yes	-1.65941021	0.29270279	-0.067255684	1.52721116	0.03694164	-0.17618383	-1.14326011
16	No	1.74425193	1.68666332	-1.117736489	-0.38169316	0.66090998	1.22365852	1.94460111
17	No	-1.11854697	1.13205890	1.418967281	0.27368190	0.76874306	-1.46071761	-0.92969401
18	No	-2.87544628	0.68497792	-1.210177353	-1.06948275	1.52194039	-0.10506595	0.28015281
19	No	4.30639852	-1.06018812	0.210216648	-0.37447413	-0.32057364	-1.00684260	0.82022981
20	No	-1.27479329	-0.51825255	1.760733715	-0.26360544	0.47750259	1.29621509	-0.91797881
21	No	-1.70767441	1.41607440	-0.286661225	-0.91144329	0.07406195	-1.69498220	-1.46849931
22	Yes	-0.97393546	-1.01341353	-1.112021200	-1.85038818	-1.36402054	-0.66689024	-1.01522671
23	No	1.68699402	1.31230353	1.509624566	1.22445549	0.24290590	-0.65221537	0.25718331
24	No	-3.18696020	1.12749600	0.402885220	0.66108471	0.64276775	-2.78219000	-0.96992911
25	Yes	-1.23642035	0.07099889	0.299856671	0.24833646	1.50889567	0.03032801	0.38460991
26	No	4.33521019	-1.18785504	0.843906495	-1.13551800	0.15027121	0.08998043	0.97838441
27	Yes	0.20266745	1.48770734	-1.049606601	-1.51049997	-1.51944447	-1.17285672	-1.10435431
28	No	0.52261166	0.51796012	0.749648443	1.18950923	0.37255048	0.46774927	1.06506941
29	No	4.16749778	1.06863278	1.191770760	-0.65593650	-0.36033955	0.68064674	-1.26701751
30	No	0.85566865	-2.59494435	0.733732945	0.72583015	0.98819396	-0.38961005	0.42673631
31	No	-2.10145329	-0.59810916	0.921883088	-1.26139753	1.12856992	0.18540641	-0.10116471
32	No	-0.62868678	-0.50657734	1.055748027	-0.35936386	-1.27677223	-1.25901998	1.50891201
33	No	-0.58576032	1.29059488	1.017527879	0.75997074	0.84347962	-1.53720260	-1.36241051
34	Yes	-1.45300079	-0.87834675	1.655345137	-1.46697925	-0.76526203	-1.05042789	-1.05554711
35	Yes	-2.29542604	0.49739124	0.396140718	-1.17366768	0.04956876	1.39666095	-0.58494221
36	No	-0.83299406	0.04299001	0.700614400	-0.30849522	0.34173329	-0.72227464	1.50803101
37	Yes	-1.35469334	-0.38217265	-0.011333012	-1.42388178	1.03149159	0.51749502	-0.71853841
38	No	-1.78845938	0.52000240	0.318618945	-1.16848391	1.30103272	-0.49908050	0.29233771
39	No	-1.94088819	-1.94711972	0.301406527	-0.61630258	0.65807129	-0.11211248	-0.23155591
40	No	-0.82682704	0.26931799	0.468377019	-1.61706575	-1.54246195	1.07860250	-0.32534581
41	No	-2.54024234	0.23133567	0.924925063	-0.01921329	1.03578990	0.02318244	-0.66629711
42	No	-2.77506460	0.69987165	2.268824442	-0.25581802	-1.59584984	-1.35122346	1.23171701
43	Yes	-2.66097737	0.70903981	-1.115132362	-0.17331186	0.17003055	0.58048454	1.53589351
44	No	0.49424199	1.35566363	-0.455831491	-0.77357691	-0.08932020	2.88993639	0.57301191
45	No	0.75546535	1.60757263	-0.510963713	-0.50688809	-1.42330758	1.05714745	-0.81164131
46	Yes	5.80495189	1.07809120	-0.697528115	0.05144471	0.43378489	1.61410670	2.31695091
47	No	0.80665807	1.65344282	-2.306810616	-0.29588285	-0.47229184	0.13416905	-0.05425401
48	No	-1.99588188	-0.92689641	-1.996031614	0.63359936	-0.17298881	1.02115120	-1.41007721
49	No	0.84424593	-0.61684992	-0.819420696	-0.92181023	-0.77170683	-1.81853606	-0.11648371
50	No	-2.41833066	0.29732619	-0.351346000	-1.10175198	-1.51565786	1.49905334	0.17280861
51	Yes	-0.61700209	-3.63498920	0.356209637	0.11821639	1.43898946	-0.22022944	-0.34371861
52	Yes	-1.87489801	0.83088181	0.624801554	-1.14213498	-0.36001997	0.32994672	1.36750381
53	No	-0.59596447	-1.21846665	-0.840883957	-2.44721561	-0.93994468	0.77427209	-0.20549421
54	No	-0.69765361	-0.44031140	-0.100160979	-1.00294120	0.67410051	-0.30541283	0.11792471
55	No	-2.07981023	-0.95518514	-1.816117794	0.44181323	-1.39608225	0.25343209	1.64265961
56	No	3.70846662	1.81410918	-0.009754192	-0.03690945	2.10902261	0.55299870	0.07155811
57	No	0.80984897	1.10389750	-1.710841409	-0.29132705	-1.11372268	-0.31892358	-0.77065951
58	No	-1.46568195	0.05800518	-0.579943143	0.62472164	-1.16769581	0.27508684	1.14797571
59	No	0.17211888	0.85739090	-0.322226695	-0.28615065	-1.69741044	0.72281848	-1.01740691
60	No	-0.13448869	0.77482451	0.074204744	-1.66832839	-0.83202177	1.45822091	-0.20989231
61	No	1.15446622	1.92230649	0.534035454	0.20845667	-2.04492813	1.17273783	-1.10819021
62	No	1.01554960	1.68567934	-1.083680307	0.52226408	0.94253470	0.96067700	0.02159771
63	No	5.23082596	-1.15165566	0.811975803	0.36448543	-0.04053148	0.82655261	1.01083961
64	No	5.03028290	-0.75521827	-1.767897505	-2.04456229	1.64789092	-0.73722100	0.31235141
65	No	3.78898454	1.94629804	-0.094556027	-1.06701099	0.31846795	0.86043923	1.02048131
66	No	0.66074288	-2.42744422	0.746473163	1.05190758	-0.86667720	0.70033996	0.69948421

PC9

PC10

PC11

PC12

PC13

PC14

1	1.18634718	-0.872121600	-0.09640534	0.165268977	0.269799504	0.56169756
2	-0.29152070	-0.913315376	-1.27049561	-0.122384858	0.300378690	0.39264772
3	0.70371779	0.233428604	-0.20631100	0.075718010	-0.203419065	-0.03027029
4	-0.02321429	0.448374867	-0.42559708	-1.190542577	-0.588878508	0.03760515
5	2.31328541	-0.009282989	0.79113838	0.093214760	-0.100182192	-0.01465031
6	-0.22195549	-0.087206926	-0.43525479	-0.231114246	0.207482785	-0.34016769
7	-0.44391529	0.285042689	-1.99552141	0.047699878	-0.076085636	0.15272680
8	-0.48750809	0.480051806	0.05439541	0.102073671	-0.046594152	0.32533830
9	-0.84675831	-0.779117537	0.11737087	-0.020764703	0.717896928	0.20342651
10	1.81688328	0.549625844	0.08936470	0.171974312	0.148287350	-0.75927968
11	-0.34871212	-0.357829761	-0.50295608	-0.242240736	-0.039146384	-0.02624589
12	-0.37676200	-1.105840599	0.09653944	0.439989975	-0.025945549	-0.29403497
13	-0.03635385	0.830830461	-0.21904995	0.301720660	-0.051386781	0.06517152
14	-0.73104553	0.381273918	-0.49493176	-0.011062744	0.258710503	0.07880223
15	1.23434951	-0.519825125	0.42502036	0.177249788	-0.280562634	-0.04452694
16	0.16722837	0.919050517	0.60523221	-0.139641983	0.788622438	-0.08889241
17	-0.43599228	-0.490823551	-0.17128405	0.496486395	-0.061978852	-0.08960470
18	-0.45159450	0.470722128	0.68700116	0.048046474	-0.132374244	0.07059914
19	-1.32011485	-0.555372557	-0.02021455	0.010651355	-1.330532123	0.54193113
20	0.62993636	-0.009824715	-0.28805976	-0.073902751	0.117532074	0.21483103
21	-0.31123058	0.180151786	0.66916402	0.191206360	-0.061527117	-0.18474214
22	1.36486226	-0.479242658	0.21308121	0.091187847	-0.360512122	0.06632427
23	-0.68755245	-0.933516282	0.60276921	0.809489181	0.700502805	0.11071287
24	0.28224305	0.255561128	0.63501927	0.017991118	-0.138962804	-0.11188786
25	-0.16125506	-0.018613009	-0.30410246	0.202662305	-0.119061534	-0.15837894
26	-0.53759404	-0.558314053	0.33470664	-1.095179299	0.832036960	0.02989736
27	0.35700750	0.929061993	-0.01894614	1.156060012	-0.255483067	-0.06819902
28	-0.73549816	0.550313853	-0.73801338	-0.949664355	0.008389053	0.25967553
29	0.31555369	-1.111014058	-0.15493203	2.100865303	-0.174397307	0.02246194
30	-1.69151268	0.715535978	1.02745673	-0.225784532	0.744422810	-0.26383596
31	0.24148874	0.146411247	-0.04954383	-0.169016766	-0.251412918	-0.16472346
32	-0.36665317	0.056223702	-0.66113550	0.229829547	0.299182395	0.24667601
33	0.08957573	-0.599250920	-0.03320543	1.560037182	-0.538191327	-0.12374741
34	-0.20658330	0.182063391	-0.44823051	0.107745416	-0.854282470	-1.14616948
35	-0.12992606	0.865795206	0.46879722	0.120243478	-0.494948660	-0.31419900
36	-0.38955274	-0.157401226	-1.24294139	0.195405992	0.191216222	0.23944677
37	-0.90674488	0.047955151	-1.68663161	-0.144133006	0.430429526	0.61334413
38	-0.20031208	0.527157309	-0.60673089	-0.027938651	0.282474819	0.12472443
39	1.76462462	-0.112957330	0.25079195	-0.131428978	-0.148209341	0.29073071
40	-0.35801902	0.055686576	0.13960453	0.035309353	-0.138995276	-0.15147123
41	-0.51077228	0.326345840	-0.54657727	-0.060254685	0.056587730	0.29700932
42	-0.05875070	0.278704562	0.09264342	0.090121016	-0.119685794	0.13898868
43	-0.37636028	0.302255060	0.17295220	0.255276712	-0.003327794	0.13586788
44	-0.60862210	-0.711374127	0.77791447	-0.318002033	0.406857687	0.01109437
45	0.09668390	-0.400173278	0.05869336	-0.152114181	-0.394547025	-0.25084901
46	-0.26052033	2.230910256	0.78616998	-1.117970703	0.407293367	0.32005748
47	0.08037636	1.306578847	-0.34393039	0.539674882	0.192644669	-0.23562251
48	0.01398234	0.237932399	-0.14829781	0.034572207	-0.262624929	-0.03020186
49	0.41287278	-1.232150972	-0.62781556	0.353309932	0.167816354	0.06690825
50	-0.64391801	0.351520976	-0.54848388	0.205495840	0.140807097	0.35162772
51	0.82005642	-0.112375989	-0.29773840	0.128567415	-0.689938913	-0.79242652
52	-0.17643076	0.559176386	0.04481687	0.059685200	0.235600513	0.06709468
53	0.25190751	0.013081779	-0.48507337	0.027844723	0.198513442	0.29335630
54	-0.76906956	0.628451741	0.60119381	0.611354599	0.305622885	0.15411449
55	1.39706768	-0.064332047	0.97216526	-0.194974326	-0.306930947	0.23036887
56	0.14080582	-0.019946119	0.74104135	-0.529786253	1.093201883	-0.15809731
57	-0.31066800	-0.849348754	0.38638678	-0.145819216	0.689252882	0.21050825
58	0.36214714	0.400685192	-0.21727141	0.060833554	0.292831786	0.21548050
59	0.47401386	-0.841105798	0.41630003	-0.085808321	0.293124207	-0.22251524
60	-0.63486040	-0.747551284	-0.29205484	0.249651345	0.488803355	0.22308994
61	0.51227811	0.579349632	-0.01055730	-0.004206631	0.548854514	-0.23403874
62	0.55405105	1.297959281	-0.99353295	1.276607699	0.173422905	-0.18562460
63	0.06562542	2.196346830	0.58952554	1.447027722	-1.086096447	1.03490915
64	1.64363325	-0.535585158	-1.32696845	-1.275586523	-0.526914507	-0.10402533

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65 0.53954490 1.443041303 0.03257624 -1.012130175 0.207301917 -0.21108226
66 -2.06629013 0.144676311 -0.31680470 0.372251420 0.246813433 0.15949383
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 $ PC1      : num  -0.243 0.854 -2.198 -0.571 -1.568 ...
 $ PC2      : num  -1.805 0.381 -1.413 0.682 -0.965 ...
 $ PC3      : num  -0.3104 -0.5252 -0.0582 0.9531 1.6428 ...
 $ PC4      : num  -0.385 1.609 -2.597 -0.113 0.537 ...
 $ PC5      : num  2.017 -1.5927 0.6022 0.0144 -0.0703 ...
 $ PC6      : num  0.9848 -0.4819 -0.0232 -0.4152 0.9406 ...
 $ PC7      : num  1.332 -1.043 -0.245 2.255 0.333 ...
 $ PC8      : num  1.592 1.44 0.165 0.379 -0.211 ...
 $ PC9      : num  1.1863 -0.2915 0.7037 -0.0232 2.3133 ...
 $ PC10     : num  -0.87212 -0.91332 0.23343 0.44837 -0.00928 ...
 $ PC11     : num  -0.0964 -1.2705 -0.2063 -0.4256 0.7911 ...
 $ PC12     : num  0.1653 -0.1224 0.0757 -1.1905 0.0932 ...
 $ PC13     : num  0.27 0.3 -0.203 -0.589 -0.1 ...
 $ PC14     : num  0.5617 0.3926 -0.0303 0.0376 -0.0147 ...
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> #typ_pca
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> typ_pca
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Attrition		PC1	PC2	PC3	PC4	PC5	PC6	PC7
1	Yes	-0.24304408	-1.80529668	-0.310416955	-0.38499428	2.01695752	0.98479398	1.3321303
2	No	0.85428816	0.38107360	-0.525239000	1.60864580	-1.59274363	-0.48186570	-1.0432246
3	Yes	-2.19827539	-1.41330161	-0.058228274	-2.59680103	0.60224220	-0.02323064	-0.2448217
4	No	-0.57084555	0.68229402	0.953078159	-0.11251722	0.01442095	-0.41523512	2.2546778
5	No	-1.56768577	-0.96543855	1.642771773	0.53704707	-0.07031572	0.94056012	0.3326110
6	No	-0.03322826	1.47619283	0.176875853	-0.87115869	0.92823065	0.36784922	0.5534710
7	No	-1.17698198	-2.34414244	-0.522923398	-1.66633877	-0.87932711	-0.41776784	-0.4383715
8	No	-2.66856328	0.31002254	-2.612816671	-0.33096395	-1.24864608	-0.05225085	0.4404659
9	No	0.91089452	1.21300586	-1.503920142	1.14494729	-1.12388294	1.04988144	-1.5089853
10	No	1.33977884	-0.20858466	-1.907632825	-0.28167233	1.08663288	-1.25267427	1.0283294
11	No	-1.22720250	0.96199989	0.061354574	0.03449953	0.47094619	-2.04342787	-0.0936310
12	No	-0.07311655	1.76018611	0.534491683	1.24790614	0.51890449	0.44225686	-0.6159184
13	No	-1.08747452	1.02337786	-1.514707184	1.57377541	-0.74755495	1.51146472	0.4754397
14	No	-1.81407332	0.60187439	-1.301413672	-1.10197768	1.65223319	-0.33450687	0.9484714
15	Yes	-1.65941021	0.29270279	-0.067255684	1.52721116	0.03694164	-0.17618383	-1.1432601
16	No	1.74425193	1.68666332	-1.117736489	-0.38169316	0.66090998	1.22365852	1.9446011
17	No	-1.11854697	1.13205890	1.418967281	0.27368190	0.76874306	-1.46071761	-0.9296940
18	No	-2.87544628	0.68497792	-1.210177353	-1.06948275	1.52194039	-0.10506595	0.2801528
19	No	4.30639852	-1.06018812	0.210216648	-0.37447413	-0.32057364	-1.00684260	0.8202298
20	No	-1.27479329	-0.51825255	1.760733715	-0.26360544	0.47750259	1.29621509	-0.9179788
21	No	-1.70767441	1.41607440	-0.286661225	-0.91144329	0.07406195	-1.69498220	-1.4684993
22	Yes	-0.97393546	-1.01341353	-1.112021200	-1.85038818	-1.36402054	-0.66689024	-1.0152267
23	No	1.68699402	1.31230353	1.509624566	1.22445549	0.24290590	-0.65221537	0.2571833
24	No	-3.18696020	1.12749600	0.402885220	0.66108471	0.64276775	-2.78219000	-0.9699291
25	Yes	-1.23642035	0.07099889	0.299856671	0.24833646	1.50889567	0.03032801	0.3846099
26	No	4.33521019	-1.18785504	0.843906495	-1.13551800	0.15027121	0.08998043	0.9783844
27	Yes	0.20266745	1.48770734	-1.049606601	-1.51049997	-1.51944447	-1.17285672	-1.1043543
28	No	0.52261166	0.51796012	0.749648443	1.18950923	0.37255048	0.46774927	1.0650694
29	No	4.16749778	1.06863278	1.191770760	-0.65593650	-0.36033955	0.68064674	-1.2670175
30	No	0.85566865	-2.59494435	0.733732945	0.72583015	0.98819396	-0.38961005	0.4267363
31	No	-2.10145329	-0.59810916	0.921883088	-1.26139753	1.12856992	0.18540641	-0.1011647
32	No	-0.62868678	-0.50657734	1.055748027	-0.35936386	-1.27677223	-1.25901998	1.5089120
33	No	-0.58576032	1.29059488	1.017527879	0.75997074	0.84347962	-1.53720260	-1.3624105
34	Yes	-1.45300079	-0.87834675	1.655345137	-1.46697925	-0.76526203	-1.05042789	-1.0555471
35	Yes	-2.29542604	0.49739124	0.396140718	-1.17366768	0.04956876	1.39666095	-0.5849422
36	No	-0.83299406	0.04299001	0.700614400	-0.30849522	0.34173329	-0.72227464	1.5080310
37	Yes	-1.35469334	-0.38217265	-0.011333012	-1.42388178	1.03149159	0.51749502	-0.7185384
38	No	-1.78845938	0.52000240	0.318618945	-1.16848391	1.30103272	-0.49908050	-0.2923377
39	No	-1.94088819	-1.94711972	0.301406527	-0.61630258	0.65807129	-0.11211248	-0.2315559
40	No	-0.82682704	0.26931799	0.468377019	-1.61706575	-1.54246195	1.07860250	-0.3253458
41	No	-2.54024234	0.23133567	0.924925063	-0.01921329	1.03578990	0.02318244	-0.6662971

42	No	-2.77506460	0.69987165	2.268824442	-0.25581802	-1.59584984	-1.35122346	1.23171702
43	Yes	-2.66097737	0.70903981	-1.115132362	-0.17331186	0.17003055	0.58048454	1.53589355
44	No	0.49424199	1.35566363	-0.455831491	-0.77357691	-0.08932020	2.88993639	0.57301192
45	No	0.75546535	1.60757263	-0.510963713	-0.50688809	-1.42330758	1.05714745	-0.81164133
46	Yes	5.80495189	1.07809120	-0.697528115	0.05144471	0.43378489	1.61410670	2.31695096
47	No	0.80665807	1.65344282	-2.306810616	-0.29588285	-0.47229184	0.13416905	-0.05425406
48	No	-1.99588188	-0.92689641	-1.996031614	0.63359936	-0.17298881	1.02115120	-1.41007722
49	No	0.84424593	-0.61684992	-0.819420696	-0.92181023	-0.77170683	-1.81853606	-0.11648374
50	No	-2.41833066	0.29732619	-0.351346000	-1.10175198	-1.51565786	1.49905334	0.17280863
51	Yes	-0.61700209	-3.63498920	0.356209637	0.11821639	1.43898946	-0.22022944	-0.34371866
52	Yes	-1.87489801	0.83088181	0.624801554	-1.14213498	-0.36001997	0.32994672	1.36750381
53	No	-0.59596447	-1.21846665	-0.840883957	-2.44721561	-0.93994468	0.77427209	-0.20549421
54	No	-0.69765361	-0.44031140	-0.100160979	-1.00294120	0.67410051	-0.30541283	0.11792471
55	No	-2.07981023	-0.95518514	-1.816117794	0.44181323	-1.39608225	0.25343209	1.64265962
56	No	3.70846662	1.81410918	-0.009754192	-0.03690945	2.10902261	0.55299870	0.07155811
57	No	0.80984897	1.10389750	-1.710841409	-0.29132705	-1.11372268	-0.31892358	-0.77065951
58	No	-1.46568195	0.05800518	-0.579943143	0.62472164	-1.16769581	0.27508684	1.14797570
59	No	0.17211888	0.85739090	-0.322226695	-0.28615065	-1.69741044	0.72281848	-1.01740691
60	No	-0.13448869	0.77482451	0.074204744	-1.66832839	-0.83202177	1.45822091	-0.20989234
61	No	1.15446622	1.92230649	0.534035454	0.20845667	-2.04492813	1.17273783	-1.10819021
62	No	1.01554960	1.68567934	-1.083680307	0.52226408	0.94253470	0.96067700	0.02159772
63	No	5.23082596	-1.15165566	0.811975803	0.36448543	-0.04053148	0.82655261	1.01083963
64	No	5.03028290	-0.75521827	-1.767897505	-2.04456229	1.64789092	-0.73722100	0.31235146
65	No	3.78898454	1.94629804	-0.094556027	-1.06701099	0.31846795	0.86043923	1.02048133
66	No	0.66074288	-2.42744422	0.746473163	1.05190758	-0.86667720	0.70033996	0.69948421
PC9		PC10	PC11	PC12	PC13	PC14		
1		1.18634718	-0.872121600	-0.09640534	0.165268977	0.269799504	0.56169756	
2		-0.29152070	-0.913315376	-1.27049561	-0.122384858	0.300378690	0.39264772	
3		0.70371779	0.233428604	-0.20631100	0.075718010	-0.203419065	-0.03027029	
4		-0.02321429	0.448374867	-0.42559708	-1.190542577	-0.588878508	0.03760515	
5		2.31328541	-0.009282989	0.79113838	0.093214760	-0.100182192	-0.01465031	
6		-0.22195549	-0.087206926	-0.43525479	-0.231114246	0.207482785	-0.34016769	
7		-0.44391529	0.285042689	-1.99552141	0.047699878	-0.076085636	0.15272680	
8		-0.48750809	0.480051806	0.05439541	0.102073671	-0.046594152	0.32533830	
9		-0.84675831	-0.779117537	0.11737087	-0.020764703	0.717896928	0.20342651	
10		1.81688328	0.549625844	0.08936470	0.171974312	0.148287350	-0.75927968	
11		-0.34871212	-0.357829761	-0.50295608	-0.242240736	-0.039146384	-0.02624589	
12		-0.37676200	-1.105840599	0.09653944	0.439989975	-0.025945549	-0.29403497	
13		-0.03635385	0.830830461	-0.21904995	0.301720660	-0.051386781	0.06517152	
14		-0.73104553	0.381273918	-0.49493176	-0.011062744	0.258710503	0.07880223	
15		1.23434951	-0.519825125	0.42502036	0.177249788	-0.280562634	-0.04452694	
16		0.16722837	0.919050517	0.60523221	-0.139641983	0.788622438	-0.08889241	
17		-0.43599228	-0.490823551	-0.17128405	0.496486395	-0.061978852	-0.08960470	
18		-0.45159450	0.470722128	0.68700116	0.048046474	-0.132374244	0.07059914	
19		-1.32011485	-0.555372557	-0.02021455	0.010651355	-1.330532123	0.54193113	
20		0.62993636	-0.009824715	-0.28805976	-0.073902751	0.117532074	0.21483103	
21		-0.31123058	0.180151786	0.66916402	0.191206360	-0.061527117	-0.18474214	
22		1.36486226	-0.479242658	0.21308121	0.091187847	-0.360512122	0.06632427	
23		-0.68755245	-0.933516282	0.60276921	0.809489181	0.700502805	0.11071287	
24		0.28224305	0.255561128	0.63501927	0.017991118	-0.138962804	-0.11188786	
25		-0.16125506	-0.018613009	-0.30410246	0.202662305	-0.119061534	-0.15837894	
26		-0.53759404	-0.558314053	0.33470664	-1.095179299	0.832036960	0.02989736	
27		0.35700750	0.929061993	-0.01894614	1.156060012	-0.255483067	-0.06819902	
28		-0.73549816	0.550313853	-0.73801338	-0.949664355	0.008389053	0.25967553	
29		0.31555369	-1.111014058	-0.15493203	2.100865303	-0.174397307	0.02246194	
30		-1.69151268	0.715535978	1.02745673	-0.225784532	0.744422810	-0.26383596	
31		0.24148874	0.146411247	-0.04954383	-0.169016766	-0.251412918	-0.16472346	
32		-0.36665317	0.056223702	-0.66113550	0.229829547	0.299182395	0.24667601	
33		0.08957573	-0.599250920	-0.03320543	1.560037182	-0.538191327	-0.12374748	
34		-0.20658330	0.182063391	-0.44823051	0.107745416	-0.854282470	-1.14616941	
35		-0.12992606	0.865795206	0.46879722	0.120243478	-0.494948660	-0.31419900	
36		-0.38955274	-0.157401226	-1.24294139	0.195405992	0.191216222	0.23944677	
37		-0.90674488	0.047955151	-1.68663161	-0.144133006	0.430429526	0.61334413	
38		-0.20031208	0.527157309	-0.60673089	-0.027938651	0.282474819	0.12472443	


```

39  1.76462462 -0.112957330  0.25079195 -0.131428978 -0.148209341  0.29073071
40 -0.35801902  0.055686576  0.13960453  0.035309353 -0.138995276 -0.15147123
41 -0.51077228  0.326345840 -0.54657727 -0.060254685  0.056587730  0.29700932
42 -0.05875070  0.278704562  0.09264342  0.090121016 -0.119685794  0.13898868
43 -0.37636028  0.302255060  0.17295220  0.255276712 -0.003327794  0.13586788
44 -0.60862210 -0.711374127  0.77791447 -0.318002033  0.406857687  0.01109437
45  0.09668390 -0.400173278  0.05869336 -0.152114181 -0.394547025 -0.25084901
46 -0.26052033  2.230910256  0.78616998 -1.117970703  0.407293367  0.32005748
47  0.08037636  1.306578847 -0.34393039  0.539674882  0.192644669 -0.23562251
48  0.01398234  0.237932399 -0.14829781  0.034572207 -0.262624929 -0.03020186
49  0.41287278 -1.232150972 -0.62781556  0.353309932  0.167816354  0.06690825
50 -0.64391801  0.351520976 -0.54848388  0.205495840  0.140807097  0.35162772
51  0.82005642 -0.112375989 -0.29773840  0.128567415 -0.689938913 -0.79242652
52 -0.17643076  0.559176386  0.04481687  0.059685200  0.235600513  0.06709468
53  0.25190751  0.013081779 -0.48507337  0.027844723  0.198513442  0.29335630
54 -0.76906956  0.628451741  0.60119381  0.611354599  0.305622885  0.15411449
55  1.39706768 -0.064332047  0.97216526 -0.194974326 -0.306930947  0.23036887
56  0.14080582 -0.019946119  0.74104135 -0.529786253  1.093201883 -0.15809731
57 -0.31066800 -0.849348754  0.38638678 -0.145819216  0.689252882  0.21050825
58  0.36214714  0.400685192 -0.21727141  0.060833554  0.292831786  0.21548050
59  0.47401386 -0.841105798  0.41630003 -0.085808321  0.293124207 -0.22251524
60 -0.63486040 -0.747551284 -0.29205484  0.249651345  0.488803355  0.22308994
61  0.51227811  0.579349632 -0.01055730 -0.004206631  0.548854514 -0.23403874
62  0.55405105  1.297959281 -0.99353295  1.276607699  0.173422905 -0.18562460
63  0.06562542  2.196346830  0.58952554  1.447027722 -1.086096447  1.03490915
64  1.64363325 -0.535585158 -1.32696845 -1.275586523 -0.526914507 -0.10402533
65  0.53954490  1.443041303  0.03257624 -1.012130175  0.207301917 -0.21108226
66 -2.06629013  0.144676311 -0.31680470  0.372251420  0.246813433  0.15949383
[ reached 'max' / getOption("max.print") -- omitted 1404 rows ]

```

```

> str(typ_pca)
'data.frame':      1470 obs. of  15 variables:
 $ Attrition: Factor w/ 2 levels "No","Yes": 2 1 2 1 1 1 1 1 1 1 ...
 $ PC1      : num  -0.243 0.854 -2.198 -0.571 -1.568 ...
 $ PC2      : num  -1.805 0.381 -1.413 0.682 -0.965 ...
 $ PC3      : num  -0.3104 -0.5252 -0.0582 0.9531 1.6428 ...
 $ PC4      : num  -0.385 1.609 -2.597 -0.113 0.537 ...
 $ PC5      : num  2.017 -1.5927 0.6022 0.0144 -0.0703 ...
 $ PC6      : num  0.9848 -0.4819 -0.0232 -0.4152 0.9406 ...
 $ PC7      : num  1.332 -1.043 -0.245 2.255 0.333 ...
 $ PC8      : num  1.592 1.44 0.165 0.379 -0.211 ...
 $ PC9      : num  1.1863 -0.2915 0.7037 -0.0232 2.3133 ...
 $ PC10     : num  -0.87212 -0.91332 0.23343 0.44837 -0.00928 ...
 $ PC11     : num  -0.0964 -1.2705 -0.2063 -0.4256 0.7911 ...
 $ PC12     : num  0.1653 -0.1224 0.0757 -1.1905 0.0932 ...
 $ PC13     : num  0.27 0.3 -0.203 -0.589 -0.1 ...
 $ PC14     : num  0.5617 0.3926 -0.0303 0.0376 -0.0147 ...
> #typ_pca
> #T-Test-- We see that true difference in all the means is different from zero.
> t.test(PC1~attr$Attrition,data=typ_pca)

```

welch Two Sample t-test

```

data: PC1 by attr$Attrition
t = 7.0668, df = 332.39, p-value = 9.363e-12
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 0.7147174 1.2660970
sample estimates:
mean in group No mean in group Yes
0.1596779      -0.8307293

```

```
> t.test(PC2~attr$Attrition,data=typ_pca)
```

welch Two Sample t-test

```
data: PC2 by attr$Attrition
t = -0.85944, df = 359.22, p-value = 0.3907
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
-0.23869831 0.09351411
sample estimates:
mean in group No mean in group Yes
-0.01170362 0.06088848
```

```
> t.test(PC3~attr$Attrition,data=typ_pca)
```

```
welch Two Sample t-test
```

```
data: PC3 by attr$Attrition
t = 1.9682, df = 330.99, p-value = 0.04988
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
0.0000754401 0.2902563607
sample estimates:
mean in group No mean in group Yes
0.0234043 -0.1217616
```

```
> t.test(PC4~attr$Attrition,data=typ_pca)
```

```
welch Two Sample t-test
```

```
data: PC4 by attr$Attrition
t = -2.9421, df = 316.05, p-value = 0.003501
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
-0.37886461 -0.07520897
sample estimates:
mean in group No mean in group Yes
-0.03660389 0.19043290
```

```
> t.test(PC5~attr$Attrition,data=typ_pca)
```

```
welch Two Sample t-test
```

```
data: PC5 by attr$Attrition
t = -1.8185, df = 335.9, p-value = 0.06988
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
-0.26708955 0.01048367
sample estimates:
mean in group No mean in group Yes
-0.02068558 0.10761736
```

```
> t.test(PC6~attr$Attrition,data=typ_pca)
```

```
welch Two Sample t-test
```

```
data: PC6 by attr$Attrition
t = -2.045, df = 337.68, p-value = 0.04163
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
-0.27902161 -0.00542244
sample estimates:
mean in group No mean in group Yes
-0.02292967 0.11929235
```

```
> t.test(PC7~attr$Attrition,data=typ_pca)
```


welch Two Sample t-test

```
data: PC7 by attr$Attrition
t = 0.12903, df = 338.09, p-value = 0.8974
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
-0.1252946 0.1428859
sample estimates:
mean in group No mean in group Yes
0.001418073 -0.007377570
```

```
> t.test(PC8~attr$Attrition,data=typ_pca)
```

welch Two Sample t-test

```
data: PC8 by attr$Attrition
t = 1.2417, df = 333.18, p-value = 0.2152
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
-0.04925478 0.21789000
sample estimates:
mean in group No mean in group Yes
0.01359406 -0.07072355
```

```
> t.test(PC9~attr$Attrition,data=typ_pca)
```

welch Two Sample t-test

```
data: PC9 by attr$Attrition
t = -4.0487, df = 341.99, p-value = 6.374e-05
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
-0.3508967 -0.1214329
sample estimates:
mean in group No mean in group Yes
-0.03807555 0.19808925
```

```
> t.test(PC10~attr$Attrition,data=typ_pca)
```

welch Two Sample t-test

```
data: PC10 by attr$Attrition
t = -4.7135, df = 407.32, p-value = 3.348e-06
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
-0.2874191 -0.1182375
sample estimates:
mean in group No mean in group Yes
-0.03270088 0.17012739
```

```
> t.test(PC11~attr$Attrition,data=typ_pca)
```

welch Two Sample t-test

```
data: PC11 by attr$Attrition
t = -1.716, df = 344.09, p-value = 0.08705
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
-0.17290429 0.01177642
sample estimates:
mean in group No mean in group Yes
-0.01298888 0.06757505
```

```
> t.test(PC12~attr$Attrition,data=typ_pca)
```

welch Two Sample t-test

```
data: PC12 by attr$Attrition
t = -1.3139, df = 419.64, p-value = 0.1896
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
-0.10145603 0.02016025
sample estimates:
mean in group No mean in group Yes
-0.006553436      0.034094458
```

```
> t.test(PC13~attr$Attrition,data=typ_pca)
```

welch Two Sample t-test

```
data: PC13 by attr$Attrition
t = 2.8529, df = 328.06, p-value = 0.004608
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
0.02802803 0.15253970
sample estimates:
mean in group No mean in group Yes
0.01455597      -0.07572789
```

```
> t.test(PC14~attr$Attrition,data=typ_pca)
```

welch Two Sample t-test

```
data: PC14 by attr$Attrition
t = -1.1951, df = 362.54, p-value = 0.2328
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
-0.07713631 0.01882051
sample estimates:
mean in group No mean in group Yes
-0.004700967      0.024456932
```

```
> #F-Test #Testing Variation
```

```
>
```

```
>
```

```
> #Variance Test- Test for variance
```

```
> var.test(PC1~attr$Attrition,data=typ_pca)
```

F test to compare two variances

```
data: PC1 by attr$Attrition
F = 0.99326, num df = 1232, denom df = 236, p-value = 0.9282
alternative hypothesis: true ratio of variances is not equal to 1
95 percent confidence interval:
0.8099491 1.2018726
sample estimates:
ratio of variances
0.9932578
```

```
> var.test(PC2~attr$Attrition,data=typ_pca)
```

F test to compare two variances

```
data: PC2 by attr$Attrition
F = 1.2515, num df = 1232, denom df = 236, p-value = 0.03136
alternative hypothesis: true ratio of variances is not equal to 1
95 percent confidence interval:
1.020537 1.514360
```

```
sample estimates:  
ratio of variances  
1.251506
```

```
> var.test(PC3~attr$Attrition,data=typ_pca)
```

F test to compare two variances

```
data: PC3 by attr$Attrition  
F = 0.97956, num df = 1232, denom df = 236, p-value = 0.8191  
alternative hypothesis: true ratio of variances is not equal to 1  
95 percent confidence interval:  
0.7987755 1.1852922  
sample estimates:  
ratio of variances  
0.9795553
```

```
> var.test(PC4~attr$Attrition,data=typ_pca)
```

F test to compare two variances

```
data: PC4 by attr$Attrition  
F = 0.8328, num df = 1232, denom df = 236, p-value = 0.06007  
alternative hypothesis: true ratio of variances is not equal to 1  
95 percent confidence interval:  
0.6791035 1.0077126  
sample estimates:  
ratio of variances  
0.832799
```

```
> var.test(PC5~attr$Attrition,data=typ_pca)
```

F test to compare two variances

```
data: PC5 by attr$Attrition  
F = 1.0274, num df = 1232, denom df = 236, p-value = 0.8065  
alternative hypothesis: true ratio of variances is not equal to 1  
95 percent confidence interval:  
0.8377538 1.2431317  
sample estimates:  
ratio of variances  
1.027355
```

```
> var.test(PC6~attr$Attrition,data=typ_pca)
```

F test to compare two variances

```
data: PC6 by attr$Attrition  
F = 1.0446, num df = 1232, denom df = 236, p-value = 0.6821  
alternative hypothesis: true ratio of variances is not equal to 1  
95 percent confidence interval:  
0.8518521 1.2640519  
sample estimates:  
ratio of variances  
1.044644
```

```
> var.test(PC7~attr$Attrition,data=typ_pca)
```

F test to compare two variances

```
data: PC7 by attr$Attrition  
F = 1.0486, num df = 1232, denom df = 236, p-value = 0.6552  
alternative hypothesis: true ratio of variances is not equal to 1
```

95 percent confidence interval:
0.8550597 1.2688116
sample estimates:
ratio of variances
1.048578

```
> var.test(PC8~attr$Attrition,data=typ_pca)
```

F test to compare two variances

data: PC8 by attr\$Attrition
F = 1.0009, num df = 1232, denom df = 236, p-value = 0.9893
alternative hypothesis: true ratio of variances is not equal to 1
95 percent confidence interval:
0.8162071 1.2111588
sample estimates:
ratio of variances
1.000932

```
> var.test(PC9~attr$Attrition,data=typ_pca)
```

F test to compare two variances

data: PC9 by attr\$Attrition
F = 1.0863, num df = 1232, denom df = 236, p-value = 0.4278
alternative hypothesis: true ratio of variances is not equal to 1
95 percent confidence interval:
0.8858151 1.3144492
sample estimates:
ratio of variances
1.086294

```
> var.test(PC10~attr$Attrition,data=typ_pca)
```

F test to compare two variances

data: PC10 by attr\$Attrition
F = 1.702, num df = 1232, denom df = 236, p-value = 7.271e-07
alternative hypothesis: true ratio of variances is not equal to 1
95 percent confidence interval:
1.387916 2.059510
sample estimates:
ratio of variances
1.702031

```
> var.test(PC11~attr$Attrition,data=typ_pca)
```

F test to compare two variances

data: PC11 by attr\$Attrition
F = 1.1066, num df = 1232, denom df = 236, p-value = 0.3303
alternative hypothesis: true ratio of variances is not equal to 1
95 percent confidence interval:
0.9023918 1.3390472
sample estimates:
ratio of variances
1.106622

```
> var.test(PC12~attr$Attrition,data=typ_pca)
```

F test to compare two variances

data: PC12 by attr\$Attrition

```
F = 1.8153, num df = 1232, denom df = 236, p-value = 3.477e-08
alternative hypothesis: true ratio of variances is not equal to 1
95 percent confidence interval:
1.480290 2.196582
sample estimates:
ratio of variances
1.815311
```

```
> var.test(PC13~attr$Attrition,data=typ_pca)
```

F test to compare two variances

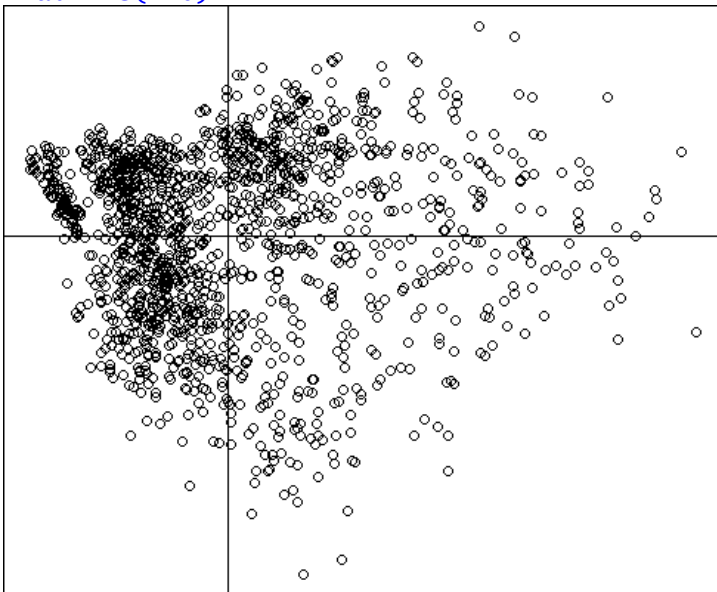
```
data: PC13 by attr$Attrition
F = 0.95092, num df = 1232, denom df = 236, p-value = 0.5988
alternative hypothesis: true ratio of variances is not equal to 1
95 percent confidence interval:
0.7754288 1.1506484
sample estimates:
ratio of variances
0.9509248
```

```
> var.test(PC14~attr$Attrition,data=typ_pca)
```

F test to compare two variances

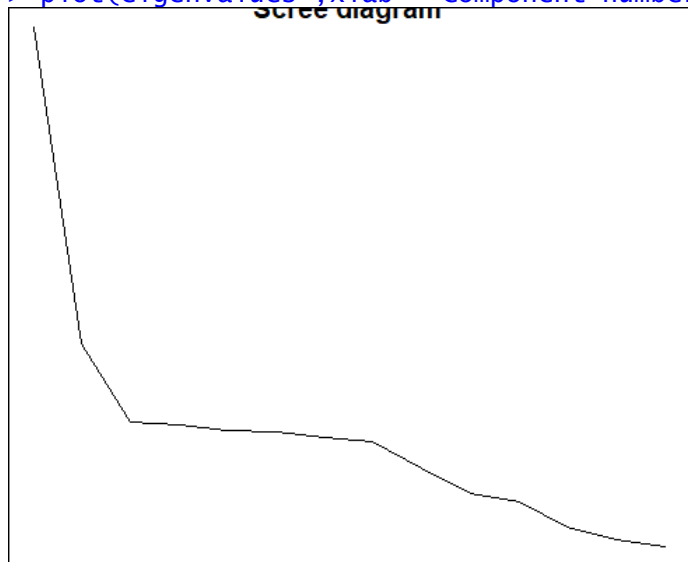
```
data: PC14 by attr$Attrition
F = 1.2831, num df = 1232, denom df = 236, p-value = 0.01698
alternative hypothesis: true ratio of variances is not equal to 1
95 percent confidence interval:
1.046275 1.552554
sample estimates:
ratio of variances
1.28307
```

```
> #Plotting the scores of Principal Component 1 and Principal component 2
> plot(typ_pca$PC1, typ_pca$PC2,xlab="PC1:", ylab="PC2")
> abline(h=0)
> abline(v=0)
```

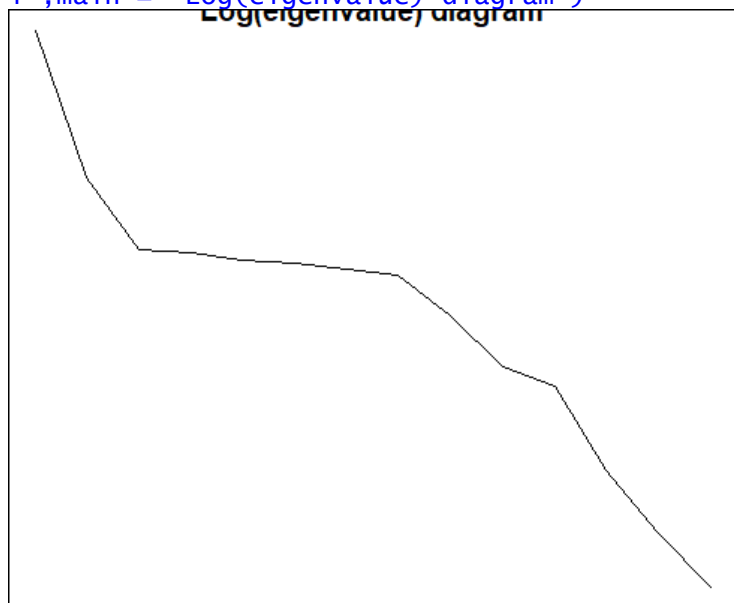


```
> #Plotting the Variance of Principal Components
```

```
> plot(eigenvalues ,xlab= "Component number", ylab = "Component variance", type = "l", main = "Scree diagram")
```



```
> #Plotting the Log variance of Components
> plot(log(eigenvalues), xlab = "Component number",ylab = "log(Component variance)", type="l",main = "Log(eigenvalue) diagram")
```

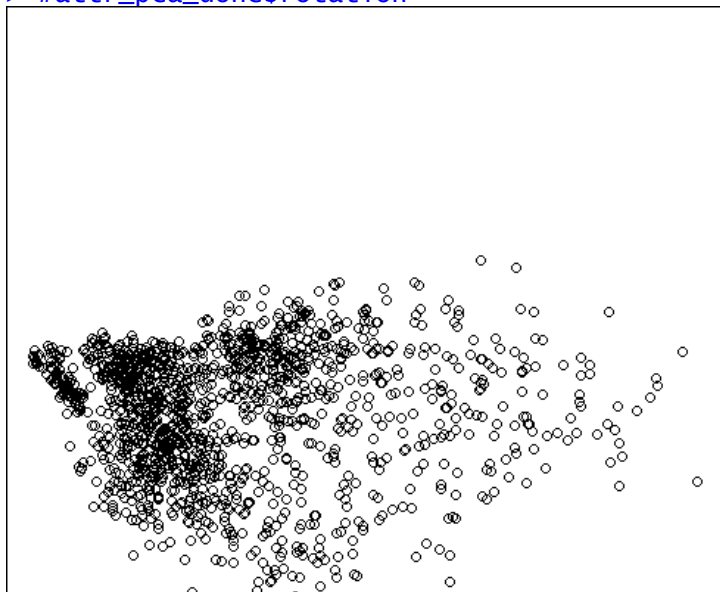


```
> #Variance of the principal components
>
> #View(attr_pca_done)
> diag(cov(attr_pca_done$x))
```

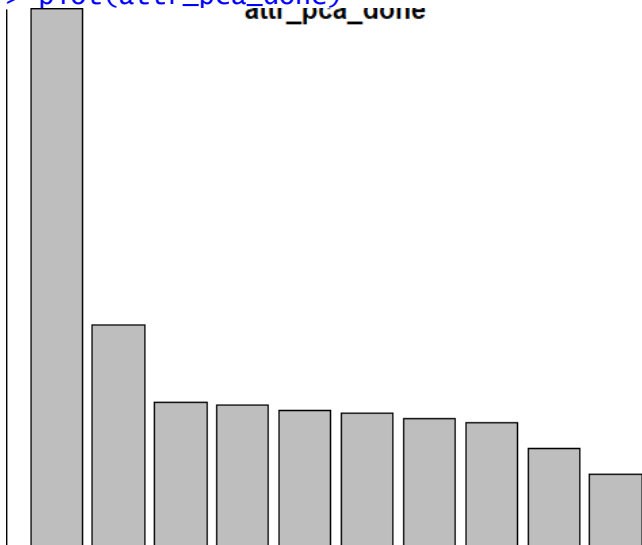
PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9	PC10	PC11	PC12	PC13	PC14
4.0167738	1.6502052	1.0685042	1.0521201	1.0094108	0.9924579	0.9533497	0.9174969	0.7224654	0.5306975	0.4698454	0.2832233	0.1933840	0.1400658

```
> #x_pca$x[,1]
> #x_pca$x
> #Plotting the scores
>
> xlim <- range(attr_pca_done$x[,1])
```

```
> plot(attr_pca_done$x,xlim=xlim,ylim=xlim)
> #attr_pca_done$rotation[,1]
> #attr_pca_done$rotation
```



```
> #Variance plot for each component. We can see that all components play a dominant role.
> plot(attr_pca_done)
```



```
> #get the original value of the data based on PCA
> center <- attr_pca_done$center
> scale <- attr_pca_done$scale
> new_attrition <- as.matrix(attr[, -2])
> new_attrition
```

	Age	BusinessTravel	DailyRate	Department	DistanceFromHome	Education
[1,]	"41"	"Travel_Rarely"	"1102"	"Sales"	"1"	"2"
[2,]	"49"	"Travel_Frequently"	"279"	"Research & Development"	"8"	"1"
[3,]	"37"	"Travel_Rarely"	"1373"	"Research & Development"	"2"	"2"
[4,]	"33"	"Travel_Frequently"	"1392"	"Research & Development"	"3"	"4"
[5,]	"27"	"Travel_Rarely"	"591"	"Research & Development"	"2"	"1"
[6,]	"32"	"Travel_Frequently"	"1005"	"Research & Development"	"2"	"2"
[7,]	"59"	"Travel_Rarely"	"1324"	"Research & Development"	"3"	"3"
[8,]	"30"	"Travel_Rarely"	"1358"	"Research & Development"	"24"	"1"
[9,]	"38"	"Travel_Frequently"	"216"	"Research & Development"	"23"	"3"
[10,]	"36"	"Travel_Rarely"	"1299"	"Research & Development"	"27"	"3"

[11,]	"35"	"Travel_Rarely"	" 809"	"Research & Development"	"16"	"3"
[12,]	"29"	"Travel_Rarely"	" 153"	"Research & Development"	"15"	"2"
[13,]	"31"	"Travel_Rarely"	" 670"	"Research & Development"	"26"	"1"
[14,]	"34"	"Travel_Rarely"	"1346"	"Research & Development"	"19"	"2"
[15,]	"28"	"Travel_Rarely"	" 103"	"Research & Development"	"24"	"3"
[16,]	"29"	"Travel_Rarely"	"1389"	"Research & Development"	"21"	"4"
[17,]	"32"	"Travel_Rarely"	" 334"	"Research & Development"	" 5"	"2"
[18,]	"22"	"Non-Travel"	"1123"	"Research & Development"	"16"	"2"
[19,]	"53"	"Travel_Rarely"	"1219"	"Sales"	" 2"	"4"
[20,]	"38"	"Travel_Rarely"	" 371"	"Research & Development"	" 2"	"3"
[21,]	"24"	"Non-Travel"	" 673"	"Research & Development"	"11"	"2"
[22,]	"36"	"Travel_Rarely"	"1218"	"Sales"	" 9"	"4"
[23,]	"34"	"Travel_Rarely"	" 419"	"Research & Development"	" 7"	"4"
[24,]	"21"	"Travel_Rarely"	" 391"	"Research & Development"	"15"	"2"
[25,]	"34"	"Travel_Rarely"	" 699"	"Research & Development"	" 6"	"1"
[26,]	"53"	"Travel_Rarely"	"1282"	"Research & Development"	" 5"	"3"
[27,]	"32"	"Travel_Frequently"	"1125"	"Research & Development"	"16"	"1"
[28,]	"42"	"Travel_Rarely"	" 691"	"Sales"	" 8"	"4"
[29,]	"44"	"Travel_Rarely"	" 477"	"Research & Development"	" 7"	"4"
[30,]	"46"	"Travel_Rarely"	" 705"	"Sales"	" 2"	"4"
[31,]	"33"	"Travel_Rarely"	" 924"	"Research & Development"	" 2"	"3"
[32,]	"44"	"Travel_Rarely"	"1459"	"Research & Development"	"10"	"4"
[33,]	"30"	"Travel_Rarely"	" 125"	"Research & Development"	" 9"	"2"

EducationField	EnvironmentSatisfaction	Gender	HourlyRate	JobInvolvement	JobLevel
[1,] "Life Sciences"	"2"	"Female"	" 94"	"3"	"2"
[2,] "Life Sciences"	"3"	"Male"	" 61"	"2"	"2"
[3,] "Other"	"4"	"Male"	" 92"	"2"	"1"
[4,] "Life Sciences"	"4"	"Female"	" 56"	"3"	"1"
[5,] "Medical"	"1"	"Male"	" 40"	"3"	"1"
[6,] "Life Sciences"	"4"	"Male"	" 79"	"3"	"1"
[7,] "Medical"	"3"	"Female"	" 81"	"4"	"1"
[8,] "Life Sciences"	"4"	"Male"	" 67"	"3"	"1"
[9,] "Life Sciences"	"4"	"Male"	" 44"	"2"	"3"
[10,] "Medical"	"3"	"Male"	" 94"	"3"	"2"
[11,] "Medical"	"1"	"Male"	" 84"	"4"	"1"
[12,] "Life Sciences"	"4"	"Female"	" 49"	"2"	"2"
[13,] "Life Sciences"	"1"	"Male"	" 31"	"3"	"1"
[14,] "Medical"	"2"	"Male"	" 93"	"3"	"1"
[15,] "Life Sciences"	"3"	"Male"	" 50"	"2"	"1"
[16,] "Life Sciences"	"2"	"Female"	" 51"	"4"	"3"
[17,] "Life Sciences"	"1"	"Male"	" 80"	"4"	"1"
[18,] "Medical"	"4"	"Male"	" 96"	"4"	"1"
[19,] "Life Sciences"	"1"	"Female"	" 78"	"2"	"4"
[20,] "Life Sciences"	"4"	"Male"	" 45"	"3"	"1"
[21,] "Other"	"1"	"Female"	" 96"	"4"	"2"
[22,] "Life Sciences"	"3"	"Male"	" 82"	"2"	"1"
[23,] "Life Sciences"	"1"	"Female"	" 53"	"3"	"3"
[24,] "Life Sciences"	"3"	"Male"	" 96"	"3"	"1"
[25,] "Medical"	"2"	"Male"	" 83"	"3"	"1"
[26,] "Other"	"3"	"Female"	" 58"	"3"	"5"
[27,] "Life Sciences"	"2"	"Female"	" 72"	"1"	"1"
[28,] "Marketing"	"3"	"Male"	" 48"	"3"	"2"
[29,] "Medical"	"1"	"Female"	" 42"	"2"	"3"
[30,] "Marketing"	"2"	"Female"	" 83"	"3"	"5"
[31,] "Medical"	"3"	"Male"	" 78"	"3"	"1"
[32,] "Other"	"4"	"Male"	" 41"	"3"	"2"
[33,] "Medical"	"4"	"Male"	" 83"	"2"	"1"
JobRole	Jobsatisfaction	MaritalStatus	MonthlyIncome	MonthlyRate	NumComp
aniesworked					
[1,] "Sales Executive"	"4"	"Single"	" 5993"	"19479"	"8"
[2,] "Research Scientist"	"2"	"Married"	" 5130"	"24907"	"1"

[3,]	"Laboratory Technician"	"3"	"Single"	" 2090"	" 2396"	"6"
[4,]	"Research Scientist"	"3"	"Married"	" 2909"	"23159"	"1"
[5,]	"Laboratory Technician"	"2"	"Married"	" 3468"	"16632"	"9"
[6,]	"Laboratory Technician"	"4"	"Single"	" 3068"	"11864"	"0"
[7,]	"Laboratory Technician"	"1"	"Married"	" 2670"	" 9964"	"4"
[8,]	"Laboratory Technician"	"3"	"Divorced"	" 2693"	"13335"	"1"
[9,]	"Manufacturing Director"	"3"	"Single"	" 9526"	" 8787"	"0"
[10,]	"Healthcare Representative"	"3"	"Married"	" 5237"	"16577"	" "
[11,]	"Laboratory Technician"	"2"	"Married"	" 2426"	"16479"	" "
[12,]	"Laboratory Technician"	"3"	"Single"	" 4193"	"12682"	" "
[13,]	"Research Scientist"	"3"	"Divorced"	" 2911"	"15170"	" "
[14,]	"Laboratory Technician"	"4"	"Divorced"	" 2661"	" 8758"	" "
[15,]	"Laboratory Technician"	"3"	"Single"	" 2028"	"12947"	" "
[16,]	"Manufacturing Director"	"1"	"Divorced"	" 9980"	"10195"	" "
[17,]	"Research Scientist"	"2"	"Divorced"	" 3298"	"15053"	" "
[18,]	"Laboratory Technician"	"4"	"Divorced"	" 2935"	" 7324"	" "
[19,]	"Manager"	"4"	"Married"	"15427"	"22021"	" "
[20,]	"Research Scientist"	"4"	"Single"	" 3944"	" 4306"	" "
[21,]	"Manufacturing Director"	"3"	"Divorced"	" 4011"	" 8232"	" "
[22,]	"Sales Representative"	"1"	"Single"	" 3407"	" 6986"	" "
[23,]	"Research Director"	"2"	"Single"	"11994"	"21293"	" "
[24,]	"Research Scientist"	"4"	"Single"	" 1232"	"19281"	" "
[25,]	"Research Scientist"	"1"	"Single"	" 2960"	"17102"	" "
[26,]	"Manager"	"3"	"Divorced"	"19094"	"10735"	" "
[27,]	"Research Scientist"	"1"	"Single"	" 3919"	" 4681"	" "
[28,]	"Sales Executive"	"2"	"Married"	" 6825"	"21173"	" "
[29,]	"Healthcare Representative"	"4"	"Married"	"10248"	" 2094"	" "
[30,]	"Manager"	"1"	"Single"	"18947"	"22822"	" "
[31,]	"Laboratory Technician"	"4"	"Single"	" 2496"	" 6670"	" "
[32,]	"Healthcare Representative"	"4"	"Married"	" 6465"	"19121"	" "
[33,]	"Laboratory Technician"	"3"	"Single"	" 2206"	"16117"	" "

OverTime	PercentSalaryHike	PerformanceRating	RelationshipSatisfaction	StockOptionLevel	
[1,]	"Yes"	"11"	"3"	"1"	"0"

[2,]	"No"	"23"	"4"	"4"	"1"
[3,]	"Yes"	"15"	"3"	"2"	"0"
[4,]	"Yes"	"11"	"3"	"3"	"0"
[5,]	"No"	"12"	"3"	"4"	"1"
[6,]	"No"	"13"	"3"	"3"	"0"
[7,]	"Yes"	"20"	"4"	"1"	"3"
[8,]	"No"	"22"	"4"	"2"	"1"
[9,]	"No"	"21"	"4"	"2"	"0"
[10,]	"No"	"13"	"3"	"2"	"2"
[11,]	"No"	"13"	"3"	"3"	"1"
[12,]	"Yes"	"12"	"3"	"4"	"0"
[13,]	"No"	"17"	"3"	"4"	"1"
[14,]	"No"	"11"	"3"	"3"	"1"
[15,]	"Yes"	"14"	"3"	"2"	"0"
[16,]	"No"	"11"	"3"	"3"	"1"
[17,]	"Yes"	"12"	"3"	"4"	"2"
[18,]	"Yes"	"13"	"3"	"2"	"2"
[19,]	"No"	"16"	"3"	"3"	"0"
[20,]	"Yes"	"11"	"3"	"3"	"0"
[21,]	"No"	"18"	"3"	"4"	"1"
[22,]	"No"	"23"	"4"	"2"	"0"
[23,]	"No"	"11"	"3"	"3"	"0"
[24,]	"No"	"14"	"3"	"4"	"0"
[25,]	"No"	"11"	"3"	"3"	"0"
[26,]	"No"	"11"	"3"	"4"	"1"
[27,]	"Yes"	"22"	"4"	"2"	"0"
[28,]	"No"	"11"	"3"	"4"	"1"
[29,]	"No"	"14"	"3"	"4"	"1"
[30,]	"No"	"12"	"3"	"4"	"0"
[31,]	"No"	"11"	"3"	"4"	"0"
[32,]	"Yes"	"13"	"3"	"4"	"0"
[33,]	"No"	"13"	"3"	"1"	"0"
TotalWorkingYears TrainingTimesLastYear WorkLifeBalance YearsAtCompany YearsInCurrentRole					
[1,]	" 8"	"0"	"1"	" 6"	" 4"
[2,]	"10"	"3"	"3"	"10"	" 7"
[3,]	" 7"	"3"	"3"	" 0"	" 0"
[4,]	" 8"	"3"	"3"	" 8"	" 7"
[5,]	" 6"	"3"	"3"	" 2"	" 2"
[6,]	" 8"	"2"	"2"	" 7"	" 7"
[7,]	"12"	"3"	"2"	" 1"	" 0"
[8,]	" 1"	"2"	"3"	" 1"	" 0"
[9,]	"10"	"2"	"3"	" 9"	" 7"
[10,]	"17"	"3"	"2"	" 7"	" 7"
[11,]	" 6"	"5"	"3"	" 5"	" 4"
[12,]	"10"	"3"	"3"	" 9"	" 5"
[13,]	" 5"	"1"	"2"	" 5"	" 2"
[14,]	" 3"	"2"	"3"	" 2"	" 2"
[15,]	" 6"	"4"	"3"	" 4"	" 2"
[16,]	"10"	"1"	"3"	"10"	" 9"
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```

[865] -1.694006753 -0.930261463 -1.625781834 -2.565543396 1.143691500 -2.900696534 -0.1886
29805 0.774776820
[873] 0.769710196 1.366970161 2.205826944 2.912812860 1.476151058 -0.531774967 -1.5125
47826 0.255021570
[881] 0.863329108 0.493868424 0.566730435 2.571738400 -1.402021735 0.974544158 1.8794
96181 -1.817146074
[889] 0.282595032 2.140026931 -3.186542503 1.011376168 1.101740089 0.821801343 -2.1547
99129 0.281011823
[897] 1.284042243 -1.958870135 -1.667331648 -2.888220529 1.352165617 -1.729894773 0.9463
47812 0.119271676
[905] -3.589861627 0.205507718 0.320568170 -1.157182430 1.218452381 1.081773710 0.9360
87694 1.052826050
[913] 1.265668267 -0.253877062 -0.117743653 1.278727250 -1.175011090 0.693400158 -0.2452
88304 -2.167305191
[921] 1.003050594 1.058588976 0.948234680 0.721555833 0.796882461 -1.996086917 1.4592
44489 0.474921323
[929] 0.213835796 0.913024261 0.825876322 -0.261549249 1.311149791 0.572968919 1.1358
71854 1.388433823
[937] -2.460102481 -0.446967250 -0.746971777 0.348847161 0.320911276 1.586772180 0.3771
49133 -0.525933102
[945] 1.896676090 -2.824252329 -0.462978817 -1.677706981 0.297657326 1.563448209 1.7615
26611 1.245765405
[953] 0.739778837 -0.962039268 0.435410396 -0.382159830 -2.897456049 -1.980587913 0.8597
05214 1.369469220
[961] 0.714977119 0.705616525 -0.250102356 0.223683709 1.776657658 0.656231086 -2.1359
07972 -0.207573580
[969] 1.608540593 0.274435098 -1.191804496 -2.807291532 0.971948342 0.443529382 -0.0339
95378 -1.567980309
[977] -0.371907292 0.397392501 0.364272767 0.728723037 -1.152437211 0.437515868 0.3147
90710 1.831260375
[985] 0.725716171 1.153724997 -0.126986304 -1.142008579 -0.445127086 -0.898134615 -1.1429
60124 0.796077351
[993] -0.619061781 0.326989090 -1.759930469 0.652537049 1.165257302 1.694508000 1.1957
86083 0.416643969

```

```
[ reached getOption("max.print") -- omitted 470 entries ]
```

```

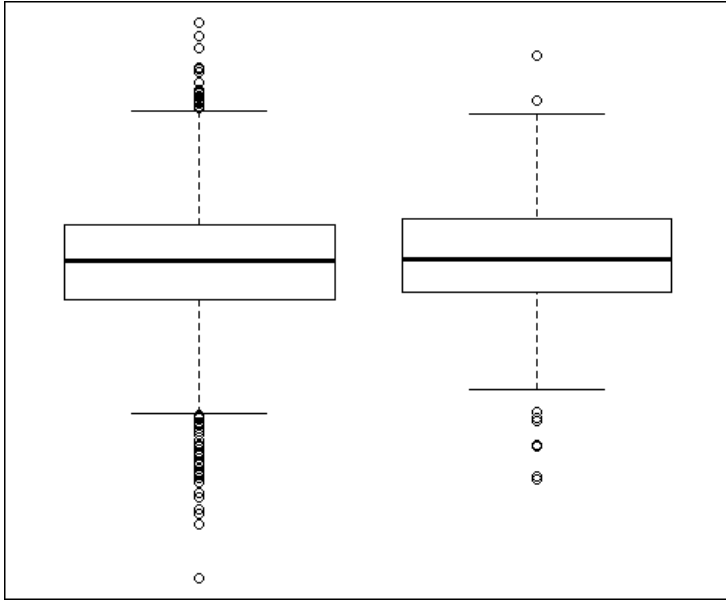
> #The aboved two gives us the same thing. predict is a good function to know.
> out <- sapply(10:14, function(i){plot(attr$Attrition,attr_pca_done$x[,i],xlab=paste("PC",
i,sep=""),ylab="Attrition")})
> out

```

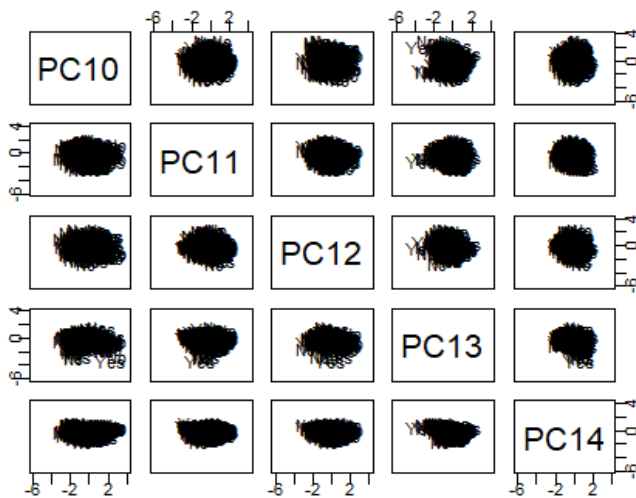
```

[,1]      [,2]      [,3]      [,4]      [,5]
stats  Numeric,10  Numeric,10  Numeric,10  Numeric,10  Numeric,10
n      Numeric,2   Numeric,2   Numeric,2   Numeric,2   Numeric,2
conf   Numeric,4   Numeric,4   Numeric,4   Numeric,4   Numeric,4
out    Numeric,59  Numeric,31  Numeric,233 Numeric,66  Numeric,68
group  Numeric,59  Numeric,31  Numeric,233 Numeric,66  Numeric,68
names  Character,2  Character,2  Character,2  Character,2  Character,2

```



```
> pairs(attr_pca_done$x[,10:14], ylim = c(-6,4),xlim = c(-6,4),panel=function(x,y,...){text(x,y,attr$Attrition)})
```



```
> # K-means, k=2, 3, 4, 5, 6
> # Centers (k's) are numbers thus, 10 random sets are chosen
> (kmeans2_attr_std <- kmeans(attr_std,2,nstart = 10))
K-means clustering with 2 clusters of sizes 482, 988
```

Cluster means:

	Age	DailyRate	DistanceFromHome	HourlyRate	MonthlyIncome	MonthlyRate	NumCompaniesWorked	PercentSalaryHike
1	0.5608866	0.006781204	0.006450863	-0.05740890	0.8210216	0.001114956	-0.008405938	-0.0351402
2	-0.2736309	-0.003308239	-0.003147081	0.02800718	-0.4005389	-0.000543936	0.004100873	0.0171433

TotalWorkingYears TrainingTimesLastYear YearsAtCompany YearsInCurrentRole YearsSinceLastPromotion YearsWithCurrManager


```
> perc.var.2
Perc. 2 clus
81
> # Computing the percentage of variation accounted for. Three clusters
>
> (kmeans3_attr_std <- kmeans(attr_std,3,nstart = 10))
K-means clustering with 3 clusters of sizes 367, 705, 398
```

```
Cluster means:
Age      DailyRate DistanceFromHome  HourlyRate MonthlyIncome  MonthlyRate NumCompaniesWorked
PercentSalaryHike
1  0.5013783 -0.07679400      0.01893852 -0.02292678      0.7731900 -0.005035529      -0
.0942477      -0.020767791
2 -0.6413051 -0.06732578      -0.01639876 -0.02736942      -0.5304961 -0.074517134      -0
.5051990      -0.001439503
3  0.6736539  0.19007053      0.01158465  0.06962204      0.2267312  0.136639746      0
.9817944      0.021700073
TotalWorkingYears TrainingTimesLastYear YearsAtCompany YearsInCurrentRole YearsSinceLastPro
motion YearswithCurrManager
1      0.9127463      0.01828053      1.2848957      1.2422918      1
.1686594      1.2140545
2 -0.6577604      0.01483008      -0.3659833      -0.3459337      -0
.3628676      -0.3143688
3      0.3234753      -0.04312604      -0.5365289      -0.5327584      -0
.4348652      -0.5626331
```

```
Clustering vector:
[1] 3 1 3 2 3 2 3 2 1 1 2 2 2 2 2 1 2 2 1 2 2 3 1 2 2 1 2 2 1 3 2 3 2 3 2 2 2 2 3 2 2 2 2 2
2 1 1 2 3 2 3 2 3 2 3 1 1 2
[59] 2 2 1 1 1 1 1 1 3 2 3 2 2 3 2 2 2 2 2 1 3 3 3 2 2 3 1 2 3 2 3 1 1 1 2 2 1 1 3 2 2 1 3 2
2 2 1 3 3 3 2 2 2 1 2 3 2 3 2
[117] 1 1 3 1 2 2 3 1 1 2 1 2 2 1 3 3 2 3 2 3 3 1 2 1 3 3 3 2 2 2 2 1 2 2 1 2 3 1 1 2 3 3 1
2 2 2 2 3 2 3 1 1 3 2 2 2 2 1
[175] 3 3 2 2 1 2 3 2 2 2 3 2 1 1 1 3 1 2 2 3 1 2 2 2 3 2 2 3 2 3 3 2 2 2 3 3 1 1 2 1 2 3 2
2 1 3 1 2 1 1 2 3 1 2 2 2 3 1
[233] 3 3 2 1 3 1 2 2 3 2 3 1 1 3 2 1 3 3 3 1 2 3 2 2 1 1 2 2 2 1 2 1 2 2 2 2 1 1 1 1 2 3 2
3 3 2 2 1 3 1 2 1 2 1 3 3 2 2
[291] 3 2 2 2 2 1 2 1 2 3 1 2 2 1 1 3 1 3 3 2 2 1 2 1 1 2 3 1 2 1 2 2 3 2 2 1 1 3 2 3 2 2 3
3 1 2 2 2 2 3 1 1 2 1 2 3 3
[349] 3 2 2 2 3 1 3 2 3 2 3 1 3 2 2 2 3 3 1 3 2 2 2 3 3 2 2 3 3 2 2 2 2 1 3 1 3 2 3 1
3 3 3 1 3 3 2 1 2 1 1 2 2 2 2
[407] 3 2 3 3 2 1 1 2 2 2 2 1 2 2 2 2 2 1 3 1 1 1 3 3 2 3 2 3 1 1 3 2 3 3 3 3 1 2 1 1 1 1 1
2 2 1 2 2 2 3 3 2 3 2 2 2 1 2
[465] 3 3 1 1 1 3 2 3 3 1 2 2 2 1 2 2 2 2 2 2 2 1 2 3 2 2 3 2 1 3 3 2 2 2 3 2 2 2 2 1 1 2 2 1
2 1 1 1 3 2 2 1 2 2 2 2 3 2
[523] 2 1 1 3 1 2 3 2 2 1 1 1 3 1 3 2 1 3 2 3 3 2 1 1 2 3 3 2 2 3 3 2 3 2 3 2 1 3 2 1 1 2 2
2 3 2 3 2 2 2 2 2 3 2 2 1 2
[581] 2 2 2 3 1 2 2 3 3 2 1 2 1 2 2 1 2 3 2 2 1 3 3 2 1 2 2 1 1 3 2 3 2 2 2 2 1 3 2 2 2 1 2
3 3 3 3 3 3 2 2 2 3 2 2 1 2 2
[639] 2 3 2 2 2 3 2 2 3 1 3 1 3 1 2 1 3 2 2 2 2 2 3 3 2 2 1 2 2 3 2 3 2 2 3 2 3 2 2 1 3 2 2
1 2 2 3 2 1 1 2 2 1 3 2 1 2 1
[697] 2 2 2 1 3 1 1 2 1 2 3 1 3 2 1 2 2 3 3 2 1 3 2 2 2 1 2 3 2 2 2 2 3 1 2 2 2 2 3 1 3 1
2 2 3 3 3 3 1 1 3 3 1 1 1 1 1
[755] 2 3 3 2 3 2 1 3 2 2 2 2 1 2 1 2 3 3 3 1 1 3 2 2 1 3 2 2 2 2 1 1 2 3 2 1 2 1 1 2 2 2 2
2 2 1 2 3 2 2 3 1 3 2 2 2 1 3
[813] 3 1 1 2 3 1 2 2 2 3 2 2 3 2 2 2 2 2 2 3 2 2 2 1 1 1 3 3 2 2 2 2 3 1 1 2 3 2 3 2 2 3
1 2 2 1 2 2 1 2 2 3 3 3 2 3
[871] 3 2 2 2 1 1 2 3 3 3 2 2 1 1 3 2 1 3 1 2 3 1 2 2 1 2 2 3 1 3 2 3 2 2 3 1 2 1 2 2 2 2 2
1 1 2 1 2 1 1 1 2 1 1 2 3 1 1
[929] 2 2 2 3 2 2 2 2 3 1 3 2 2 2 2 3 1 3 2 3 2 2 1 1 2 3 1 1 1 3 2 1 2 2 1 2 1 2 1 2 1 1 3
3 2 2 2 1 1 2 1 1 3 2 2 1 2 2
[987] 2 3 3 3 2 3 2 3 1 2 2 2 1
[ reached getOption("max.print") -- omitted 470 entries ]
```

Within cluster sum of squares by cluster:

```
[1] 5205.277 6049.267 4071.095  
(between_SS / total_SS = 25.5 %)
```

Available components:

```
[1] "cluster"      "centers"      "totss"        "withinss"     "tot.withinss" "betweenss"  
"size"         "iter"  
[9] "ifault"
```

```
>  
> perc.var.3 <- round(100*(1 - kmeans3_attr_std$betweenss/kmeans3_attr_std$totss),1)  
>  
> names(perc.var.3) <- "Perc. 3 clus"  
>  
> perc.var.3  
Perc. 3 clus  
74.5
```

```
> # Computing the percentage of variation accounted for. Four clusters
```

```
>  
> (kmeans4_attr_std <- kmeans(attr_std,4,nstart = 10))  
K-means clustering with 4 clusters of sizes 370, 560, 156, 384
```

Cluster means:

	Age	DailyRate	DistanceFromHome	HourlyRate	MonthlyIncome	MonthlyRate	NumCompaniesWorked	P ercentSalaryHike
1	0.7707463	0.22961595	0.008257502	0.03633025	0.2669399	0.09802993	0.	
9613245	0.009213117							
2	-0.7192085	-0.11199075	-0.020883872	0.03636112	-0.6095477	-0.03790853	-0.	
4054590	-0.022606422							
3	1.0047487	-0.10884912	-0.068027703	0.03341739	1.7607150	-0.02802579	0.	
1176866	-0.006455403							
4	-0.1019796	-0.01370473	0.050135454	-0.10160815	-0.0835745	-0.02778716	-0.	
3827921	0.026712984							
	TotalWorkingYears	TrainingTimesLastYear	YearsAtCompany	YearsInCurrentRole	YearsSinceLastPro motion	YearsWithCurrManager		
1	0.39270390	-0.05607256	-0.5390915	-0.5548597	-0			
.4306548	-0.5829055							
2	-0.78847463	0.01576328	-0.5723273	-0.6147893	-0			
.4572541	-0.6265538							
3	1.78479174	-0.11283401	2.0923377	1.3928232	1			
.6166931	1.4170866							
4	0.04640063	0.07687895	0.5040689	0.8653638	0			
.4250011	0.8996866							

Clustering vector:

```
[1] 1 4 1 2 1 4 1 2 4 4 2 4 2 2 2 4 2 2 3 2 2 1 4 2 2 3 4 4 3 1 2 1 2 1 2 2 2 1 2 2 2 2 4  
4 3 4 2 4 2 1 2 1 2 2 3 4 2  
[59] 4 4 4 4 3 3 3 1 2 1 2 2 1 2 2 4 2 4 4 1 1 1 4 2 1 4 2 1 2 1 4 4 3 4 4 3 4 1 2 2 3 1 2  
2 2 4 1 1 1 2 2 2 3 4 1 2 1 1  
[117] 4 4 2 3 4 4 1 3 4 2 3 2 2 4 1 1 2 4 4 1 1 1 4 2 4 1 1 1 2 4 2 2 3 2 2 4 4 4 4 4 1 1 4  
2 2 2 2 1 2 1 4 4 1 2 2 2 4 4  
[175] 1 1 2 2 3 2 1 2 2 2 1 4 3 3 4 1 3 2 2 1 3 4 2 1 1 4 2 4 2 1 1 4 2 2 1 1 4 4 4 4 2 1 2  
2 3 1 4 2 4 4 2 1 4 4 4 2 1 3  
[233] 1 1 2 3 4 3 2 2 1 2 1 4 3 1 2 4 1 1 1 3 2 1 2 2 4 3 2 2 2 4 2 3 2 2 4 2 3 4 3 4 2 2 2  
1 1 4 2 3 1 3 4 4 2 4 1 1 2 2  
[291] 1 4 2 4 2 3 2 4 2 1 3 2 2 4 4 4 1 1 2 2 3 2 4 3 4 1 4 2 4 2 4 1 2 4 4 3 1 2 1 2 2 1  
1 4 2 4 2 4 1 4 4 4 4 2 1 1  
[349] 1 2 2 2 1 4 2 4 1 2 2 4 1 4 2 2 1 1 4 1 2 2 2 1 1 2 2 1 1 2 2 2 2 4 2 3 1 2 1 3  
1 1 1 4 1 1 2 4 2 3 3 2 4 2 2  
[407] 1 2 1 1 2 3 4 2 2 2 2 3 2 2 4 2 2 4 1 3 4 3 1 1 2 1 4 1 4 4 1 2 1 2 1 1 4 2 4 3 4 4 3  
4 2 4 4 2 2 1 1 2 1 4 2 2 4 2  
[465] 1 1 3 4 4 1 2 1 1 3 2 2 2 3 2 2 2 2 2 4 2 1 2 2 1 2 4 1 1 2 2 2 1 2 2 2 2 3 4 2 2 4  
2 3 4 4 1 2 2 4 2 2 2 4 4 1 2
```

```

[523] 2 4 4 2 3 4 1 4 4 4 4 3 1 3 1 4 3 1 4 1 1 2 3 4 2 1 1 2 2 1 1 2 1 2 1 2 4 1 2 3 4 2 4
2 1 2 1 4 2 2 2 2 2 1 2 2 4 2
[581] 2 2 4 1 3 2 2 1 1 2 4 2 3 4 4 3 2 1 2 2 4 1 1 2 4 2 2 4 4 1 4 4 4 2 4 2 3 1 2 4 2 4 2
1 1 1 2 1 1 2 2 2 1 2 2 3 4 2
[639] 2 1 2 4 2 1 2 2 1 4 1 3 1 4 4 3 1 2 2 2 4 2 1 2 2 2 4 2 2 1 2 1 2 2 1 2 1 4 4 3 1 2 2
3 2 2 1 4 4 4 2 2 4 1 4 4 2 3
[697] 4 2 2 3 1 3 4 2 4 4 1 4 4 2 4 2 2 1 1 2 3 1 4 1 2 3 2 1 2 2 2 2 1 4 4 2 2 2 2 1 3 1 3
2 2 1 1 1 1 4 3 1 2 3 3 4 3 3
[755] 2 1 4 4 1 2 3 1 2 2 2 2 3 2 4 2 1 1 1 4 3 1 2 2 4 1 4 2 2 4 4 4 2 1 4 3 2 4 4 2 2 2 4
2 2 3 2 1 2 2 1 4 1 4 4 4 3 1
[813] 1 3 3 2 1 4 2 2 2 1 2 2 1 2 2 2 2 2 2 1 2 2 2 4 3 3 1 1 2 2 4 2 1 4 4 2 1 2 1 4 2 1
4 2 2 3 2 2 3 2 2 1 1 1 1 2 1
[871] 4 2 2 4 4 3 2 1 1 4 2 4 4 4 1 2 4 1 4 4 1 4 2 2 3 2 4 1 3 1 4 1 2 2 1 4 2 3 4 2 2 2 2
3 3 2 3 2 3 1 4 2 3 4 2 1 3 3
[929] 4 2 4 1 4 2 2 4 1 3 1 2 2 4 4 4 4 1 2 1 4 4 4 3 2 1 3 3 3 1 4 4 4 2 3 4 4 2 3 2 4 4 2
1 2 2 2 3 3 2 3 4 2 2 2 4 2 4
[987] 1 1 1 1 1 2 1 2 1 4 2 4 2 3
[ reached getOption("max.print") -- omitted 470 entries ]

```

Within cluster sum of squares by cluster:

```

[1] 3753.165 4326.294 2322.362 3710.699
(between_SS / total_SS = 31.4 %)

```

Available components:

```

[1] "cluster"      "centers"      "totss"        "withinss"     "tot.withinss" "betweenss"
"size"         "iter"
[9] "ifault"

```

```

>
> perc.var.4 <- round(100*(1 - kmeans4_attr_std$betweenss/kmeans4_attr_std$totss),1)
>
> names(perc.var.4) <- "Perc. 4 clus"
>
> perc.var.4
Perc. 4 clus
68.6
> # Computing the percentage of variation accounted for. Five clusters
>
> (kmeans5_attr_std <- kmeans(attr_std,5,nstart = 10))
K-means clustering with 5 clusters of sizes 362, 121, 464, 385, 138

```

Cluster means:

	Age	DailyRate	DistanceFromHome	HourlyRate	MonthlyIncome	MonthlyRate	NumCompaniesWorked	PercentSalaryHike
1	0.29439958	0.12871318	-0.07860849	0.085796939	-0.34473854	-0.004242516		
2	1.42504729	0.15367721	0.01601076	0.005353989	1.72713466	0.218033124		
3	-0.80816195	-0.09282987	0.02676321	0.023482118	-0.61613188	-0.017337269	-	
4	-0.09401635	-0.01885408	0.06916728	-0.103630113	-0.08568613	-0.031458713	-	
5	0.95782658	-0.10766111	-0.09078668	-0.019597347	1.70062617	-0.033986375		
	TotalWorkingYears	TrainingTimesLastYear	YearsAtCompany	YearsInCurrentRole	YearsSinceLastPromotion	YearsWithCurrManager		
1	-0.19463320	-0.06075160	-0.5888511	-0.6168071			-0	
2	1.65396859	-0.06870235	-0.3331776	-0.2776906			-0	
3	-0.84002580	0.03529737	-0.5578441	-0.6027906			-0	
4	0.05219558	0.07708356	0.5108114	0.8629518			0	

```

5          1.73915719      -0.11413105      2.2873612      1.4807475      1
.7856938      1.5211290

```

Clustering vector:

```

[1] 1 4 1 3 1 4 1 3 4 4 3 4 3 3 3 4 3 3 5 1 3 1 4 3 3 5 4 4 5 2 1 1 3 1 3 3 1 3 1 3 3 3 3 4
4 5 4 1 4 3 1 3 1 3 1 5 4 3
[59] 4 4 4 4 5 5 5 2 3 2 1 3 2 3 3 4 3 4 4 2 2 1 3 3 2 4 3 2 3 1 4 4 5 4 4 5 4 2 3 3 5 1 1
3 3 4 1 2 2 3 3 3 5 4 2 3 1 1
[117] 4 4 1 5 4 4 1 5 4 3 5 3 3 4 1 2 3 4 4 1 2 4 3 4 1 1 1 3 4 1 3 2 1 3 4 4 4 4 4 1 1 4
1 3 1 3 2 3 2 4 4 1 3 3 3 4 4
[175] 1 1 3 3 5 3 1 3 3 1 1 4 5 5 4 2 5 3 3 1 5 4 1 1 1 4 1 4 3 1 1 4 3 3 1 1 4 4 4 2 1 2 1
3 5 1 4 1 4 4 3 1 4 4 4 3 1 5
[233] 1 2 1 5 4 5 3 3 1 3 1 4 5 1 3 4 1 1 1 5 3 1 3 3 4 5 1 3 3 4 3 5 3 3 4 3 5 4 5 4 3 1 3
2 1 4 3 2 2 5 4 4 3 4 1 1 3 3
[291] 2 4 3 4 3 5 3 4 1 1 5 3 3 4 4 4 2 1 3 3 5 3 4 5 4 2 4 3 4 3 4 1 1 4 4 5 1 3 2 3 3 2
1 4 1 4 3 4 4 1 4 4 4 3 1 1
[349] 2 3 3 3 2 4 1 4 1 3 1 4 1 4 3 3 1 1 4 2 3 3 3 1 1 3 3 2 4 1 1 2 3 3 3 3 4 1 5 1 1 1 5
1 2 1 4 1 1 3 4 3 5 2 3 4 3 3
[407] 2 1 2 1 3 5 4 3 3 3 3 5 3 1 4 1 3 4 2 5 4 5 1 2 3 1 4 1 4 4 1 3 1 3 1 1 4 3 4 5 4 4 5
4 1 4 4 3 3 1 1 3 2 4 3 3 4 3
[465] 1 2 5 4 4 1 3 1 1 5 3 3 3 5 3 3 3 3 3 1 4 3 1 3 3 2 1 4 2 1 3 3 3 2 3 3 3 3 5 4 3 3 4
3 5 4 2 1 3 3 3 4 3 3 3 4 4 1 3
[523] 1 4 4 1 5 4 2 4 4 4 4 5 2 5 1 4 5 1 4 1 1 3 5 4 3 1 1 1 3 1 2 3 1 3 1 1 4 1 3 5 4 3 4
3 1 3 2 4 3 3 3 1 3 1 3 3 4 3
[581] 3 3 4 1 5 3 3 1 2 3 4 1 5 4 4 5 1 1 1 1 4 1 1 3 4 3 3 4 4 2 4 4 4 3 4 3 5 1 1 4 3 4 3
1 2 2 1 2 1 3 1 1 1 3 3 5 4 3
[639] 3 1 3 4 3 1 3 1 2 4 1 5 1 4 4 5 1 3 3 1 4 3 1 1 3 3 4 1 3 1 1 1 3 3 1 3 2 4 4 5 1 3 3
5 1 3 1 4 4 4 3 3 4 1 4 4 3 5
[697] 4 3 3 5 1 5 4 3 4 4 2 4 4 3 4 1 3 1 2 3 5 1 4 1 3 2 3 2 3 3 3 2 4 4 3 3 3 3 1 5 1 5
3 3 2 1 2 1 4 5 1 1 5 5 4 5 4
[755] 3 2 4 4 2 3 5 1 1 3 3 1 2 3 4 3 2 2 1 4 2 1 3 3 4 1 4 3 3 4 4 4 3 2 4 5 1 4 4 3 3 3 4
3 1 5 3 1 3 3 2 4 2 4 4 4 5 1
[813] 2 5 5 3 1 4 3 3 2 3 3 1 3 3 3 3 3 3 1 3 3 3 4 5 5 1 1 1 3 4 3 1 4 4 3 1 3 2 4 3 1
4 3 3 2 3 3 5 3 3 1 1 1 2 3 2
[871] 4 3 3 4 4 5 3 1 1 4 3 4 4 4 1 3 4 2 4 4 2 4 3 3 2 3 4 1 2 2 4 1 3 3 2 4 3 5 4 3 3 3 3
5 5 3 2 3 5 2 4 3 5 4 3 1 5 5
[929] 4 3 4 1 4 3 3 4 2 5 1 3 3 4 4 4 4 2 3 1 4 4 4 5 3 1 5 5 2 1 4 4 4 3 5 4 4 3 5 1 4 4 1
2 3 3 3 5 5 3 5 4 1 3 3 4 3 4
[987] 1 2 1 1 1 3 1 3 2 4 3 4 3 5
[ reached getOption("max.print") -- omitted 470 entries ]

```

Within cluster sum of squares by cluster:

```

[1] 3047.750 1186.244 3451.050 3732.063 2002.454
(between_ss / total_ss = 34.7 %)

```

Available components:

```

[1] "cluster"      "centers"      "totss"        "withinss"     "tot.withinss" "betweenss"
"size"         "iter"
[9] "ifault"

```

```

>
> perc.var.5 <- round(100*(1 - kmeans5_attr_std$betweenss/kmeans5_attr_std$totss),1)
>
> names(perc.var.5) <- "Perc. 5 clus"
>
> perc.var.5
Perc. 5 clus
65.3
> # Computing the percentage of variation accounted for. Six clusters
> (kmeans6_attr_std <- kmeans(attr_std,6,nstart = 10))
K-means clustering with 6 clusters of sizes 315, 204, 117, 367, 133, 334

```

Cluster means:

Age	DailyRate	DistanceFromHome	HourlyRate	MonthlyIncome	MonthlyRate	NumCompaniesWorked
1	0.29572817	0.06720409	-0.37970677	0.083120684	-0.33509590	-0.05149656
2	-0.25566270	0.03786530	1.67053208	0.038629426	-0.32910387	0.24140707
3	1.44167150	0.14005703	-0.03745321	-0.018189835	1.75468907	0.18300839
4	-0.86588529	-0.05984460	-0.36052931	0.076390996	-0.66450191	-0.05898106
5	0.98035288	-0.09522849	-0.02745725	-0.003152513	1.75533922	-0.04414310
6	-0.06671192	-0.03189258	-0.24201442	-0.178297661	-0.06644952	-0.08060037
TotalWorkingYears	YearsWithCurrManager	TrainingTimesLastYear	YearsAtCompany	YearsInCurrentRole	YearsSinceLastPro	
1	-0.21096808	-0.02409561	-0.5941230	-0.6284252	-0	
2	-0.35912815	-0.27018326	-0.2701731	-0.2188648	-0	
3	1.70405369	-0.05648465	-0.3375473	-0.2826621	-0	
4	-0.88690899	0.09436436	-0.5835152	-0.6340835	-0	
5	1.76916941	-0.11260971	2.3500845	1.4931387	1	
6	0.09143376	0.14868735	0.5489399	0.9275301	0	

Clustering vector:

```

[1] 1 6 1 4 1 6 1 2 2 2 4 6 2 2 2 6 4 4 5 1 4 1 6 4 4 5 6 6 5 3 1 1 4 1 4 4 1 4 1 4 4 4 2 6
6 5 2 2 6 4 1 4 1 4 2 5 6 2
[59] 6 6 6 2 5 5 5 3 4 3 1 4 3 4 4 6 4 6 6 3 3 1 6 4 3 6 4 3 4 1 6 6 5 2 6 6 6 3 4 4 5 2 1
4 4 6 1 3 3 4 4 4 5 6 3 4 1 1
[117] 6 6 1 5 2 2 1 5 6 4 5 2 4 6 2 3 2 6 2 1 3 6 2 6 1 2 1 2 6 1 4 3 1 4 6 6 6 6 6 6 1 1 6
1 4 1 2 2 4 3 6 6 1 4 4 4 6 6
[175] 1 1 4 4 5 4 1 2 2 1 2 6 5 5 6 3 5 4 2 1 5 2 1 2 1 2 1 2 4 1 2 2 4 2 1 1 6 6 2 6 1 3 2
4 5 1 6 1 6 6 4 1 6 6 6 4 1 5
[233] 1 3 2 5 6 5 4 4 1 2 2 2 5 1 4 6 1 1 1 5 2 2 2 4 6 5 1 2 4 6 4 3 4 4 2 4 5 6 5 6 4 1 4
1 2 6 4 3 3 5 6 6 4 6 2 1 4 4
[291] 3 6 4 6 4 5 4 6 1 1 5 4 2 6 6 2 6 2 1 4 4 5 4 6 5 6 3 6 4 6 4 6 1 1 2 6 5 1 4 3 4 4 3
1 6 1 6 4 6 6 1 6 6 6 6 2 1 1
[349] 3 4 4 4 2 6 2 6 1 4 1 6 1 6 4 4 1 1 6 3 2 4 4 1 1 4 4 3 6 1 1 3 4 4 4 4 6 1 5 1 1 1 5
1 3 1 6 1 1 4 6 4 5 3 4 6 2 4
[407] 3 1 3 2 4 5 6 2 4 4 4 5 2 1 6 2 4 6 3 5 6 5 1 3 2 1 6 1 6 6 1 4 2 2 1 1 6 4 6 5 6 6 5
6 1 6 6 2 2 1 1 4 2 6 2 4 6 2
[465] 1 3 5 6 6 1 2 1 1 5 2 2 4 5 2 4 4 4 4 2 6 4 1 4 4 3 1 6 3 1 4 4 2 3 4 4 4 4 5 6 2 4 6
4 6 6 3 1 4 4 6 4 4 4 6 6 1 4
[523] 1 6 6 1 5 6 3 6 6 6 6 5 3 5 1 6 5 1 6 1 1 2 5 2 4 1 1 1 4 1 3 4 1 4 1 1 2 1 4 5 6 2 6
4 2 4 3 6 2 4 2 1 4 1 4 4 6 4
[581] 4 4 6 1 5 4 4 1 3 4 6 2 5 6 2 5 1 1 1 2 6 1 1 4 2 1 4 6 6 3 6 6 6 4 6 4 5 1 1 6 2 6 4
1 3 3 1 3 2 4 1 1 1 4 4 5 2 4
[639] 4 1 4 6 4 1 4 1 3 6 2 5 1 6 2 5 1 4 2 1 6 4 1 1 4 4 6 1 4 1 1 1 4 4 1 4 3 6 2 5 1 2 4
5 1 4 1 6 6 6 4 4 6 1 6 6 4 6
[697] 6 4 2 5 1 5 6 4 6 6 3 6 6 4 6 1 4 1 3 4 5 1 2 1 2 3 4 3 4 2 4 4 3 6 6 4 4 4 4 1 5 1 5
4 4 3 1 3 1 6 5 1 2 5 5 6 5 5
[755] 4 3 2 6 3 2 5 1 1 4 4 1 3 1 2 4 3 3 1 6 3 3 4 4 6 1 2 4 2 6 6 6 4 3 6 5 1 6 2 4 4 4 6
2 2 5 4 1 4 4 3 6 3 6 2 6 5 1
[813] 3 5 5 4 1 6 2 4 4 3 4 4 2 4 4 4 4 1 4 2 4 4 4 6 5 5 1 1 2 4 6 4 2 6 6 4 1 4 3 6 4 1
6 4 4 3 2 4 5 4 4 1 2 1 3 2 3
[871] 2 4 2 6 6 5 4 1 1 6 4 6 6 6 1 4 6 3 6 6 3 6 4 4 3 4 2 1 3 3 6 1 4 4 3 6 4 5 6 2 4 4 4
5 5 4 3 4 5 3 6 4 5 6 4 1 5 6
[929] 6 4 6 1 6 4 4 6 3 5 2 4 2 6 6 6 6 3 2 1 2 6 6 6 4 1 5 5 3 1 6 6 6 4 5 6 6 4 5 1 6 6 1
3 4 4 4 5 5 2 6 2 1 2 4 6 2 2

```

```
[987] 2 3 2 1 1 4 2 2 3 6 4 2 4 5
[ reached getOption("max.print") -- omitted 470 entries ]
```

Within cluster sum of squares by cluster:

```
[1] 2496.832 1801.395 1137.594 2452.579 1929.518 3105.339
(between_SS / total_SS = 37.2 %)
```

Available components:

```
[1] "cluster"      "centers"      "totss"        "withinss"     "tot.withinss" "betweenss"
"size"         "iter"
[9] "ifault"
```

```
>
> perc.var.6 <- round(100*(1 - kmeans6_attr_std$betweenss/kmeans6_attr_std$totss),1)
```

```
> names(perc.var.6) <- "Perc. 6 clus"
```

```
>
> perc.var.6
Perc. 6 clus
62.8
```

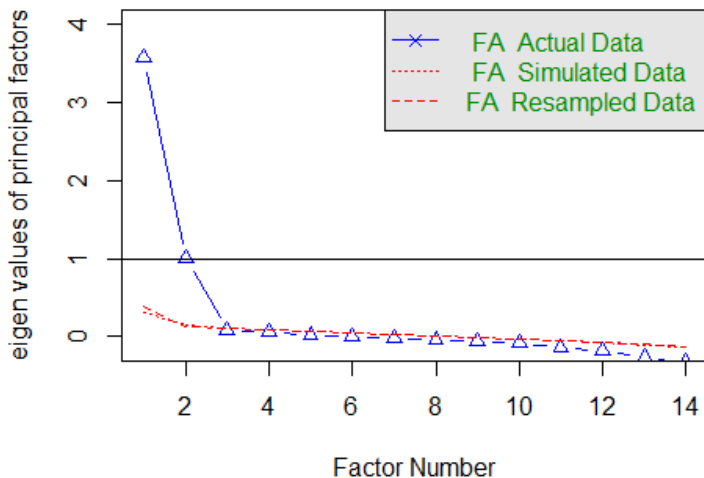
```
> #Factor Analysis
```

```
> #parallel analysis suggest factor recommendation
```

```
> parallel<-fa.parallel(attr_pca[,1:14],fm='minres',fa='fa')
```

Parallel analysis suggests that the number of factors = 2 and the number of components = NA

Parallel Analysis Scree Plots



```
> #The gap between simulated data and actual data tends to be between 3 and 4
```

```
> threefactor<-principal(attr_pca[,1:14],nfactors=3,rotate='varimax')
```

```
> print(threefactor)
```

Principal Components Analysis

Call: principal(r = attr_pca[, 1:14], nfactors = 3, rotate = "varimax")

Standardized loadings (pattern matrix) based upon correlation matrix

	RC1	RC2	RC3	h2	u2	com
Age	0.31	0.76	0.07	0.683	0.32	1.3
DailyRate	-0.04	0.06	0.23	0.056	0.94	1.2
DistanceFromHome	0.07	-0.12	0.68	0.475	0.52	1.1
HourlyRate	-0.03	0.03	0.37	0.139	0.86	1.0
MonthlyIncome	0.54	0.61	-0.02	0.664	0.34	2.0
MonthlyRate	-0.04	0.11	-0.01	0.013	0.99	1.3
NumCompaniesworked	-0.20	0.69	0.08	0.522	0.48	1.2
PercentSalaryHike	0.00	-0.07	0.48	0.233	0.77	1.0

TotalWorkingYears	0.63	0.68	0.03	0.860	0.14	2.0
TrainingTimesLastYear	0.00	-0.07	-0.43	0.193	0.81	1.1
YearsAtCompany	0.93	0.07	-0.05	0.865	0.14	1.0
YearsInCurrentRole	0.86	-0.06	0.00	0.747	0.25	1.0
YearsSinceLastPromotion	0.73	0.01	-0.04	0.541	0.46	1.0
YearsWithCurrManager	0.86	-0.08	-0.02	0.744	0.26	1.0

RC1	RC2	RC3	
SS loadings	3.71	1.95	1.08
Proportion Var	0.26	0.14	0.08
Cumulative Var	0.26	0.40	0.48
Proportion Explained	0.55	0.29	0.16
Cumulative Proportion	0.55	0.84	1.00

Mean item complexity = 1.2
 Test of the hypothesis that 3 components are sufficient.

The root mean square of the residuals (RMSR) is 0.08
 with the empirical chi square 1591.36 with prob < 6e-299

Fit based upon off diagonal values = 0.91> class(threefactor)

```
[1] "psych"      "principal"
> #Display factor values
> threefactor$values
[1] 4.0167738 1.6502052 1.0685042 1.0521201 1.0094108 0.9924579 0.9533497 0.9174969 0.72246
54 0.5306975
[11] 0.4698454 0.2832233 0.1933840 0.1400658
> #Display factor loadings
> threefactor$loadings
```

Loadings:

RC1	RC2	RC3
Age	0.307	0.765
DailyRate		0.225
DistanceFromHome	-0.122	0.675
HourlyRate		0.371
MonthlyIncome	0.538	0.612
MonthlyRate		0.106
NumCompaniesWorked	-0.199	0.689
PercentSalaryHike		0.477
TotalWorkingYears	0.630	0.680
TrainingTimesLastYear		-0.434
YearsAtCompany	0.926	
YearsInCurrentRole	0.862	
YearsSinceLastPromotion	0.734	
YearsWithCurrManager	0.859	

RC1	RC2	RC3	
SS loadings	3.707	1.951	1.078
Proportion Var	0.265	0.139	0.077
Cumulative Var	0.265	0.404	0.481

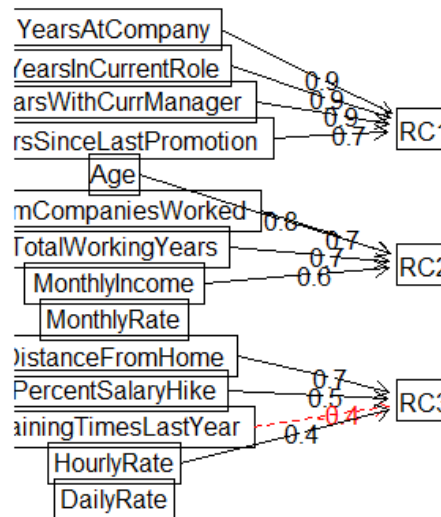
```
> #communalities
> threefactor$communality
Age                DailyRate                DistanceFromHome                HourlyRate
0.68318561         0.05613449                0.47529954                0.13949574
MonthlyIncome      MonthlyRate                NumCompaniesWorked                PercentSalaryHike
0.66447336         0.01269573                0.52164264                0.23285647
TotalWorkingYears  TrainingTimesLastYear                YearsAtCompany                YearsInCurrentRole
0.85983230         0.19335717                0.86479626                0.74651548
YearsSinceLastPromotion  YearsWithCurrManager
0.54136294         0.74383547
```

```
> #Rotated factor scores
> head(threefactor$scores)
RC1      RC2      RC3
```

```
[1,] -0.5982509  1.2242118  0.4724958
[2,]  0.5308061 -0.1775199  0.4632603
[3,] -1.4124116  0.6169246  0.2028231
[4,] -0.1259390 -0.4919472 -0.9774844
[5,] -1.0834488  0.5907171 -1.4763255
[6,]  0.3852668 -1.0510701 -0.3112959
```

```
> #round threefactor values
```

Components Analysis



```
> round(threefactor$values,3)
```

```
[1] 4.017 1.650 1.069 1.052 1.009 0.992 0.953 0.917 0.722 0.531 0.470 0.283 0.193 0.140
```

```
> #Visualize the relationship and factor recommendations for simple structure
```

```
> fa.diagram(threefactor)
```

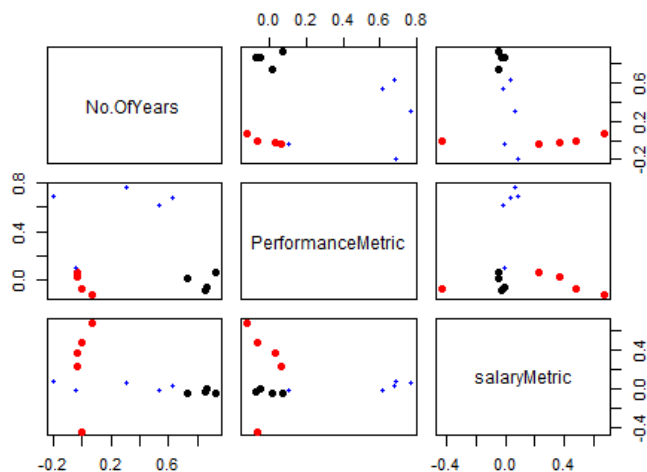
```
> colnames(threefactor$loadings) <- c("No.OfYears", "PerformanceMetric", "salaryMetric")
```

```
> colnames(threefactor$loadings)
```

```
[1] "No.OfYears" "PerformanceMetric" "salaryMetric"
```

```
> plot(threefactor)
```

Principal Component Analysis



```
> Multiple Regression
```

```

> #install.packages("GGally")
> #install.packages("FFally")
> attach(attr)
> attr[, c(2)] <- sapply(attr[, c(2)], as.numeric)
> fit_attr<- lm(Attrition~Age+DailyRate+DistanceFromHome+HourlyRate+MonthlyIncome
+
+MonthlyRate+NumCompaniesWorked+PercentSalaryHike+TotalWorkingYears+Trainin
gTimesLastYear
+
+YearsAtCompany+YearsInCurrentRole+YearsSinceLastPromotion+YearsWithCurrMan
ager)
> fit_attr

```

```

Call:
lm(formula = Attrition ~ Age + DailyRate + DistanceFromHome +
HourlyRate + MonthlyIncome + MonthlyRate + NumCompaniesWorked +
PercentSalaryHike + TotalWorkingYears + TrainingTimesLastYear +
YearsAtCompany + YearsInCurrentRole + YearsSinceLastPromotion +
YearsWithCurrManager)

```

```

Coefficients:
(Intercept)                Age                DailyRate                DistanceFromHome
1.475e+00             -4.842e-03             -4.622e-05                3.607e-03
-1.762e-04
MonthlyIncome            MonthlyRate            NumCompaniesWorked            PercentSalaryHike
-6.435e-06                6.944e-07                1.400e-02                -1.302e-03
-2.215e-03
TrainingTimesLastYear            YearsAtCompany            YearsInCurrentRole            YearsSinceLastProm
otion            YearsWithCurrManager
-1.642e-02                6.547e-03             -1.359e-02                1.211e-02
-1.202e-02

```

```

> summary(fit_attr)

```

```

Call:
lm(formula = Attrition ~ Age + DailyRate + DistanceFromHome +
HourlyRate + MonthlyIncome + MonthlyRate + NumCompaniesWorked +
PercentSalaryHike + TotalWorkingYears + TrainingTimesLastYear +
YearsAtCompany + YearsInCurrentRole + YearsSinceLastPromotion +
YearsWithCurrManager)

```

```

Residuals:
Min      1Q  Median      3Q      Max
-0.40687 -0.20911 -0.13209 -0.01769  1.12055

```

```

Coefficients:
Estimate Std. Error t value Pr(>|t|)
(Intercept)      1.475e+00  7.393e-02  19.953 < 2e-16 ***
Age             -4.842e-03  1.429e-03  -3.388 0.000723 ***
DailyRate       -4.622e-05  2.305e-05  -2.005 0.045171 *
DistanceFromHome 3.607e-03  1.146e-03   3.148 0.001678 **
HourlyRate      -1.762e-04  4.563e-04  -0.386 0.699459
MonthlyIncome   -6.435e-06  3.126e-06  -2.058 0.039722 *
MonthlyRate      6.944e-07  1.305e-06   0.532 0.594875
NumCompaniesWorked 1.400e-02  4.131e-03   3.390 0.000718 ***
PercentSalaryHike -1.302e-03  2.537e-03  -0.513 0.607844
TotalWorkingYears -2.215e-03  2.564e-03  -0.864 0.387788
TrainingTimesLastYear -1.642e-02  7.205e-03  -2.279 0.022830 *
YearsAtCompany    6.547e-03  3.227e-03   2.029 0.042676 *
YearsInCurrentRole -1.359e-02  4.186e-03  -3.246 0.001198 **
YearsSinceLastPromotion 1.211e-02  3.711e-03   3.264 0.001123 **
YearsWithCurrManager -1.202e-02  4.300e-03  -2.794 0.005268 **
---

```

signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.3547 on 1455 degrees of freedom
Multiple R-squared: 0.07892, Adjusted R-squared: 0.07006
F-statistic: 8.905 on 14 and 1455 DF, p-value: < 2.2e-16

```
> coefficients(fit_attr)
(Intercept)          Age          DailyRate      DistanceFromHome      TotalWorkingYears
1.475108e+00    -4.841883e-03    -4.621800e-05      3.607208e-03      1.189457e+00
MonthlyIncome    MonthlyRate    NumCompaniesWorked    PercentSalaryHike    YearsSinceLastPromotion
-6.435379e-06      6.943688e-07      1.400361e-02      -1.302020e-03      1.211203e-02
TrainingTimesLastYear    YearsAtCompany    YearsInCurrentRole
-1.641803e-02      6.547309e-03    -1.358638e-02
```

```
> #install.packages("GGally")
> #install.packages("FFally")
> library(GGally)
> confint(fit_attr,level=0.95)
```

	2.5 %	97.5 %
(Intercept)	1.330087e+00	1.620129e+00
Age	-7.645349e-03	-2.038416e-03
DailyRate	-9.144038e-05	-9.956195e-07
DistanceFromHome	1.359397e-03	5.855019e-03
HourlyRate	-1.071269e-03	7.188886e-04
MonthlyIncome	-1.256787e-05	-3.028915e-07
MonthlyRate	-1.866389e-06	3.255127e-06
NumCompaniesWorked	5.900450e-03	2.210677e-02
PercentSalaryHike	-6.278083e-03	3.674043e-03
TotalWorkingYears	-7.244350e-03	2.814421e-03
TrainingTimesLastYear	-3.055144e-02	-2.284612e-03
YearsAtCompany	2.164117e-04	1.287821e-02
YearsInCurrentRole	-2.179721e-02	-5.375559e-03
YearsSinceLastPromotion	4.833295e-03	1.939077e-02
YearsWithCurrManager	-2.045105e-02	-3.581037e-03

>

```
> #Predicted values
> fitted(fit_attr)
```

1	2	3	4	5	6	7	8	9	10
1.1925071	1.0383735	1.2114521	1.1756231	1.3404380	1.1029924	1.0752183	1.2906399	1.0986213	1.2309875
13	14	15	16	17	18	19	20	21	22
1.3565093	1.2095810	1.3442734	1.1851934	1.1367118	1.3122560	0.9681044	1.2245651	1.1889457	1.1816301
25	26	27	28	29	30	31	32	33	34
1.2162329	0.8538387	1.1992116	1.1499223	1.0171349	1.0492551	1.2245549	1.0792900	1.2132042	1.1317000
37	38	39	40	41	42	43	44	45	46
1.0986304	1.1779045	1.2903062	1.1263251	1.2338891	1.1899926	1.3186586	1.1194586	1.1183320	1.1071400
49	50	51	52	53	54	55	56	57	58
0.9875015	1.2088953	1.2107472	1.1976104	1.1027696	1.1769008	1.3606416	1.0112144	1.0503242	1.2663000
61	62	63	64	65	66	67	68	69	70
1.1211843	1.3153139	1.2506461	1.0175200	1.1003593	1.0510820	1.1122561	1.0848700	1.2303231	1.2779000
73	74	75	76	77	78	79	80	81	82
1.1892773	1.0753403	1.2749839	1.1142876	1.0191567	1.1368875	1.1631061	1.1776661	1.2154409	1.1126000
85	86	87	88	89	90	91	92	93	94
1.1609122	0.9956106	1.2958829	1.1106158	1.1673794	1.0287419	1.1614188	1.1296730	1.0635080	1.0275000
97	98	99	100	101	102	103	104	105	106
1.1807700	1.1843033	1.0248456	1.2489043	1.2033316	1.2331328	1.2678573	1.0151671	1.2031133	0.9949000
109	110	111	112	113	114	115	116	117	118
1.2695059	1.2958267	1.0488521	1.0757890	1.0982503	1.2722436	1.2531769	1.1033592	0.9705148	0.9627000
121	122	123	124	125	126	127	128	129	130
1.1226320	1.1136118	1.2376346	0.9238711	1.2045781	1.2445552	1.2860723	1.3935309	1.2818995	1.0375000
133	134	135	136	137	138	139	140	141	142
1.3195736	1.0624707	1.2040892	1.2907501	1.0422071	1.0880367	1.2933060	1.0953369	1.2224581	1.2065000
145	146	147	148	149	150	151	152	153	154
1.0986776	1.2878876	1.1557796	1.0801260	1.1889117	1.2779218	1.0974692	1.0334471	1.0270869	1.0828000
157	158	159	160	161	162	163	164	165	166

1.1210851	1.1146537	1.0298291	1.2555301	1.2242867	1.3429739	1.3120264	1.1289271	1.2157031	0.95250
169	170	171	172	173	174	175	176	177	178
1.1004251	1.2256223	1.2551233	1.2292413	1.2153224	1.1496661	1.0947804	1.0976988	1.2138019	1.31990
181	182	183	184	185	186	187	188	189	190
1.3662143	1.2709999	1.1244172	1.1179438	1.1092612	1.0901779	1.0636192	0.8713907	0.9927435	0.96020
193	194	195	196	197	198	199	200	201	202
1.3122680	1.1653183	1.1941978	1.1565519	1.2342299	1.1445573	1.2215024	1.1268367	1.3203772	1.07060
205	206	207	208	209	210	211	212	213	214
1.3031391	1.2172490	1.2678543	1.2283262	1.2111871	1.1105075	1.1633427	1.0933400	1.1020469	0.94460
217	218	219	220	221	222	223	224	225	226
1.3068679	1.1919425	1.2379731	0.9965779	1.1066303	1.2914905	1.0551588	0.9429311	1.1232812	1.08560
229	230	231	232	233	234	235	236	237	238
0.9977769	1.2504511	1.1374029	0.8987928	1.1950058	0.9576079	1.2505982	0.9467761	1.1774490	1.11590
241	242	243	244	245	246	247	248	249	250
1.2315940	1.2584024	1.2108354	1.1298656	1.1069697	1.2103574	1.1970361	1.1504932	1.1470058	1.14160
253	254	255	256	257	258	259	260	261	262
1.2311208	1.2051040	1.2273537	1.1999189	1.1094561	0.9086445	1.1789862	1.2706130	1.1780597	1.18170
265	266	267	268	269	270	271	272	273	274
1.2168443	1.1803276	1.2684178	1.2157573	1.0363435	1.0378193	0.9268986	1.1513654	1.1716387	1.17030
277	278	279	280	281	282	283	284	285	286
1.2010757	1.2398192	1.0586538	0.9287098	0.9339764	1.0766204	1.0798757	1.0431391	1.2696837	1.06230
289	290	291	292	293	294	295	296	297	298
1.2622179	1.1812315	1.1138797	1.3107934	1.1917659	1.2542990	1.1983138	1.2465311	1.3512552	1.06030
301	302	303	304	305	306	307	308	309	310
1.0286514	1.3389128	1.1339686	1.2147086	0.9627429	1.1552994	1.1104839	1.1584355	1.0813643	1.14680
313	314	315	316	317	318	319	320	321	322
1.2289444	1.2295554	1.1216704	1.0387382	1.0400082	1.1450574	1.2198362	1.1790678	1.1194127	1.10290
325	326	327	328	329	330	331	332	333	334
1.1323977	1.1168309	1.2133564	1.1780946	1.1367316	1.0381902	1.1275023	1.2121315	1.0836258	1.23960
337	338	339	340	341	342	343	344	345	346
1.1100736	1.2362541	1.1540241	1.0702784	1.2140869	1.0081543	1.0749396	1.1384309	0.9438025	1.30650
349	350	351	352	353	354	355	356	357	358
1.1657029	1.1775770	1.1432945	1.1345310	1.1751491	1.1377581	1.3759847	1.1624170	1.0574483	1.24130
361	362	363	364	365	366	367	368	369	370
1.0465785	1.0890640	1.2623572	1.2677748	1.1756622	1.1647613	1.0696806	1.0863400	1.1786251	1.19590
373	374	375	376	377	378	379	380	381	382
1.2475162	1.1667711	1.1773788	1.1330966	1.0230550	1.2304282	1.2567775	0.9255460	1.2187198	1.25680
385	386	387	388	389	390	391	392	393	394
1.2377444	1.3337785	1.1672134	1.1613907	1.1619905	1.1849491	1.0162353	1.2047646	0.9695657	1.23960
397	398	399	400	401	402	403	404	405	406
1.1394370	1.1831933	1.2413566	1.2447004	0.9754143	1.0796019	1.1324159	1.0257759	1.2317715	1.21720
409	410	411	412	413	414	415	416	417	418
0.9434221	1.1919258	1.1919812	1.0546437	0.9805107	1.0957466	1.1495476	1.2273134	1.1586543	0.80050
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532	533	534	535	536	537	538	539
-0.071928597	-0.048414295	0.012010680	0.005084608	-0.230962555	-0.187862370	-0.100851067	0.00
541	542	543	544	545	546	547	548
0.814233678	-0.187577125	-0.189301854	-0.177359931	-0.267628087	-0.341103641	-0.179218424	0.710
550	551	552	553	554	555	556	557
-0.247433271	-0.259839010	-0.261270192	-0.097729974	-0.154425950	-0.202010241	-0.248080727	-0.08
559	560	561	562	563	564	565	566
-0.213894767	-0.312613115	-0.254960456	0.065420381	0.856250651	-0.201542451	-0.073642035	-0.26
568	569	570	571	572	573	574	575
-0.091055002	1.007604234	-0.029175254	-0.132402714	-0.279346642	-0.304078418	0.724460282	-0.20
577	578	579	580	581	582	583	584
-0.222893121	-0.212017614	-0.158920679	-0.158542052	-0.240167327	-0.204672358	-0.066674246	-0.23
586	587	588	589	590	591	592	593
0.739461954	-0.269766945	-0.168620928	0.028855723	0.727931201	-0.085388064	0.704045193	-0.050
595	596	597	598	599	600	601	602
-0.142266053	0.901689560	-0.232861677	-0.175618634	0.719631189	-0.243204124	-0.060951781	-0.22
604	605	606	607	608	609	610	611
-0.176544497	-0.160197200	-0.171152895	-0.219728083	0.957665694	0.857010165	-0.146314315	-0.04
613	614	615	616	617	618	619	620
-0.188550768	-0.163415241	0.859467302	-0.227615389	0.045329901	-0.253387850	-0.326458603	-0.01
622	623	624	625	626	627	628	629
0.002893483	-0.243106679	-0.246692181	-0.048775663	-0.099818723	-0.238836703	-0.028024741	-0.287
631	632	633	634	635	636	637	638
-0.291891790	-0.130005529	-0.205099206	-0.100405275	-0.210249849	0.035163132	0.683760263	-0.22
640	641	642	643	644	645	646	647
-0.087691007	-0.219286842	-0.182084751	-0.171169926	-0.115227493	-0.222540353	0.720211697	-0.08
649	650	651	652	653	654	655	656
-0.258379461	-0.090208765	-0.209955283	-0.106014038	-0.154575976	-0.158718707	-0.160491665	-0.16
658	659	660	661	662	663	664	665
-0.202101956	-0.251376947	-0.200260290	0.792216285	-0.257288024	0.738816319	0.705875347	-0.05
667	668	669	670	671	672	673	674
0.789397179	0.818595089	-0.290547625	0.762514140	-0.261475892	-0.261528822	-0.151742254	-0.196
676	677	678	679	680	681	682	683
-0.277184854	-0.133647081	-0.105493365	-0.199522552	-0.201196143	-0.180416416	0.078917462	-0.23
685	686	687	688	689	690	691	692
-0.188902788	-0.081126551	0.073824862	-0.029309406	0.621607890	0.677401612	-0.238312438	-0.28
694	695	696	697	698	699	700	701
0.956863474	-0.141953171	0.682935831	0.024083552	-0.213667554	-0.224279095	0.077557474	0.868
703	704	705	706	707	708	709	710
-0.296704962	-0.217952275	-0.068622912	0.023866663	0.830860599	-0.026687714	-0.073259482	0.73
712	713	714	715	716	717	718	719
0.725571469	-0.231596123	-0.133985973	-0.030121051	-0.154975840	0.168603402	-0.385686489	-0.103
721	722	723	724	725	726	727	728
0.624434046	0.009423860	-0.189115540	-0.047483885	-0.242051717	0.782740076	-0.175896945	-0.344
730	731	732	733	734	735	736	737
-0.289811969	-0.061713126	0.688091130	0.765144812	-0.149788752	-0.281743162	-0.171381743	0.00
739	740	741	742	743	744	745	746
-0.170276445	-0.198111371	-0.174331528	-0.127162779	-0.155044400	0.024385544	0.757625739	-0.10
748	749	750	751	752	753	754	755
-0.250457408	0.628476592	1.045598187	-0.074203224	0.050784796	0.816853202	-0.142819873	-0.20
757	758	759	760	761	762	763	764
-0.356561371	-0.130716221	0.024629139	-0.173887366	-0.025875951	0.698363859	0.671684723	-0.21
766	767	768	769	770	771	772	773
-0.180034381	-0.002847480	-0.206988404	-0.213943814	-0.175211862	-0.156718441	-0.165284850	0.00
775	776	777	778	779	780	781	782
-0.065685838	-0.195835888	0.733342553	0.740612802	-0.070042504	0.789911804	0.879532110	-0.23
784	785	786	787	788	789	790	791
-0.075612064	-0.058723511	-0.183705024	-0.170720415	0.023004884	-0.130077754	0.827902875	-0.23
793	794	795	796	797	798	799	800

```

0.835744188 -0.246306274 -0.160351974 -0.192501807 0.845138792 0.666154442 0.658982009 -0.1609
802 803 804 805 806 807 808 809
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811 812 813 814 815 816 817 818
0.043505743 -0.282449560 -0.224725588 0.732183239 -0.042179442 -0.206345142 -0.244635465 -0.111
820 821 822 823 824 825 826 827
-0.136761436 -0.182936313 -0.074935568 -0.161437420 -0.237860221 -0.290076850 -0.194128722 -0.22
829 830 831 832 833 834 835 836
0.613160196 0.848966678 -0.234941718 0.788457855 -0.351559585 -0.323739141 -0.106021076 -0.157
838 839 840 841 842 843 844 845
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847 848 849 850 851 852 853 854
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-0.061757334 -0.013588517 -0.228481388 -0.206471867 -0.020788788 -0.084384401 -0.179622973 -0.24
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937 938 939 940 941 942 943 944
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955 956 957 958 959 960 961 962
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-0.203332063 -0.191474281 -0.105327831 -0.239442304 -0.099778858 -0.074379317 -0.271144608 0.63
1000
0.066358953

```

```

[ reached getOption("max.print") -- omitted 470 entries ]
> #Anova table
> anova(fit_attr)

```

Analysis of Variance Table

Response: Attrition							
Df	Sum Sq	Mean Sq	F value	Pr(>F)			
Age	1	5.039	5.0386	40.0387	3.307e-10	***	
DailyRate	1	0.600	0.6004	4.7712	0.0290991	*	
DistanceFromHome	1	1.190	1.1904	9.4593	0.0021399	**	
HourlyRate	1	0.003	0.0034	0.0270	0.8695254		
MonthlyIncome	1	1.665	1.6647	13.2284	0.0002854	***	
MonthlyRate	1	0.064	0.0637	0.5066	0.4767412		
NumCompaniesworked	1	1.985	1.9850	15.7739	7.487e-05	***	
PercentsSalaryHike	1	0.055	0.0551	0.4381	0.5081493		
TotalWorkingYears	1	0.298	0.2978	2.3665	0.1241812		
TrainingTimesLastYear	1	0.619	0.6188	4.9174	0.0267408	*	

```

YearsAtCompany      1    0.049  0.0487  0.3872  0.5338555
YearsInCurrentRole  1    1.860  1.8602 14.7818  0.0001259 ***
YearsSinceLastPromotion 1    1.279  1.2795 10.1671  0.0014601 **
YearsWithCurrManager 1    0.983  0.9826  7.8086  0.0052681 **
Residuals          1455 183.101  0.1258

```

```

---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

```
> vcov(fit_attr)
```

```

(Intercept)      Age      DailyRate DistanceFromHome      HourlyRate MonthlyIncome      MonthlyRate
(Intercept)      5.465664e-03 -5.401767e-05 -4.077725e-07 -1.001031e-05 -1.329590e-05
Age              -5.401767e-05  2.042546e-06  4.174337e-10  5.386738e-09 -1.899115e-08
DailyRate        -4.077725e-07  4.174337e-10  5.314811e-10  1.366512e-10 -2.360246e-10
DistanceFromHome -1.001031e-05  5.386738e-09  1.366512e-10  1.313108e-06 -1.691089e-08
HourlyRate        -1.329590e-05 -1.899115e-08 -2.360246e-10 -1.691089e-08  2.082110e-07
MonthlyIncome     -2.253115e-08  2.173753e-10 -5.393647e-14  1.178725e-10  2.497798e-11
MonthlyRate       -2.527187e-08 -8.279939e-12  1.066478e-12 -4.359249e-11  9.431926e-12
NumCompaniesWorked -2.109799e-05 -7.736385e-07 -1.773406e-09  1.538901e-07 -2.299436e-08
PercentSalaryHike -9.596482e-05 -8.172910e-08 -1.172098e-09 -1.147267e-07  1.368832e-08
TotalWorkingYears  5.246665e-05 -1.885600e-06 -1.842474e-09 -7.478390e-08  1.832019e-09
TrainingTimesLastYear -1.500646e-04 -2.084194e-07 -1.130791e-09  3.131160e-07  2.197556e-08
YearsAtCompany    -1.717430e-05  3.245154e-07  3.611569e-09  3.716019e-08 -1.114817e-08
YearsInCurrentRole -7.091218e-06  9.130808e-08 -5.957290e-09 -6.190303e-08  2.078902e-08
YearsSinceLastPromotion 7.009198e-06 -1.115776e-07  2.115227e-09 -2.165622e-08  2.835623e-08
YearsWithCurrManager -2.480019e-05  2.263869e-07  1.708163e-09 -1.238252e-08  6.067393e-09
NumCompaniesWorked PercentSalaryHike TotalWorkingYears TrainingTimesLastYear YearsAtCompany
(Intercept)      -2.109799e-05 -9.596482e-05  5.246665e-05 -1.500646e-04
Age              -7.736385e-07 -8.172910e-08 -1.885600e-06 -2.084194e-07
DailyRate        -1.773406e-09 -1.172098e-09 -1.842474e-09 -1.130791e-09
DistanceFromHome 1.538901e-07 -1.147267e-07 -7.478390e-08  3.131160e-07
HourlyRate        -2.299436e-08  1.368832e-08  1.832019e-09  2.197556e-08
MonthlyIncome     4.319924e-10  9.467275e-11 -4.638835e-09 -8.043639e-10
MonthlyRate       3.410154e-11  2.579984e-11 -6.255431e-11 -4.345587e-11
NumCompaniesWorked 1.706435e-05  2.062118e-07 -2.260527e-06  1.607156e-06
PercentSalaryHike 2.062118e-07  6.435062e-06 -1.525629e-08  7.752798e-09
TotalWorkingYears -2.260527e-06 -1.525629e-08  6.573714e-06  5.188159e-07
TrainingTimesLastYear 1.607156e-06  7.752798e-08  5.188159e-07  5.191289e-08
YearsAtCompany    2.973260e-06  3.611138e-07 -2.523337e-06 -4.985615e-07
YearsInCurrentRole -2.199886e-07 -3.475784e-07  3.788685e-08  2.880460e-08
YearsSinceLastPromotion -5.707867e-07  5.136124e-08  2.107781e-07  5.326433e-08
YearsWithCurrManager -2.757224e-07 -1.350262e-07 -4.741292e-07  2.595454e-08
YearsInCurrentRole YearsSinceLastPromotion YearsWithCurrManager
(Intercept)      -7.091218e-06  7.009198e-06 -2.480019e-05
Age              9.130808e-08 -1.115776e-07  2.263869e-07
DailyRate        -5.957290e-09  2.115227e-09  1.708163e-09
DistanceFromHome -6.190303e-08 -2.165622e-08 -1.238252e-08
HourlyRate        2.078902e-08  2.835623e-08  6.067393e-09
MonthlyIncome     1.864849e-10 -4.541142e-10  1.056369e-09
MonthlyRate       -1.007534e-10 -8.061954e-11  1.696906e-10
NumCompaniesWorked -2.199886e-07 -5.707867e-07  2.757224e-07
PercentSalaryHike -3.475784e-07  5.136124e-08 -1.350262e-07
TotalWorkingYears 3.788685e-08  2.107781e-07 -4.741292e-07
TrainingTimesLastYear 2.880460e-07  5.326433e-09  2.595454e-07
YearsAtCompany    -4.877024e-06 -3.256264e-06 -5.812570e-06
YearsInCurrentRole 1.752082e-05 -2.194322e-06 -5.468174e-06
YearsSinceLastPromotion -2.194322e-06  1.376870e-05 -4.383185e-07
YearsWithCurrManager -5.468174e-06 -4.383185e-07  1.849064e-05

```

```
> temp<-influence.measures(fit_attr)
```

```
> temp
```

```
Influence measures of
```

```

lm(formula = Attrition ~ Age + DailyRate + DistanceFromHome +      HourlyRate + MonthlyIncome + M
+      PercentSalaryHike + TotalWorkingYears + TrainingTimesLastYear +      YearsAtCompany + Year
Promotion +      YearsWithCurrManager) :

```

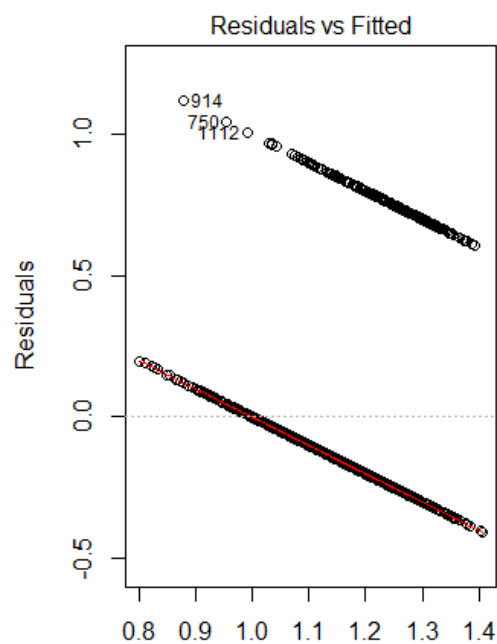
```
dfb.1_    dfb.Age    dfb.DlyR    dfb.DsFH    dfb.HrIR    dfb.MntI    dfb.MntR    dfb.NmCW    dfb.PrSH    dfb.TtWY
```

1	-0.012824	0.049286	0.044617	-0.061209	0.079634	0.031221	0.051700	0.134764	-0.066599	-0.0
2	0.006144	-0.006300	0.003586	0.000856	0.000597	0.000392	-0.004363	0.001719	-0.005996	0.0
3	-0.007932	0.005024	0.075128	-0.048524	0.069570	-0.041534	-0.094111	0.063525	-0.003539	0.0
4	-0.007951	0.001107	-0.019468	0.010194	0.006185	0.012910	-0.016615	0.007261	0.015167	-0.0
5	-0.042692	0.033609	0.013695	0.018529	0.031669	0.005191	-0.007961	-0.073200	0.020158	0.0
6	-0.005141	0.001028	-0.003629	0.007419	-0.005203	0.004969	0.001943	0.008037	0.004920	-0.0
7	0.012454	-0.016242	-0.006821	0.004573	-0.003321	0.006813	0.003282	0.002336	-0.006887	0.0
8	0.019995	-0.004251	-0.030314	-0.037962	0.000695	-0.007840	0.002548	0.009822	-0.037682	0.0
9	0.001215	-0.005125	0.010798	-0.012217	0.007819	-0.010304	0.006206	0.006164	-0.010835	0.0
10	0.007357	0.019847	-0.019869	-0.037016	-0.022667	0.020210	-0.005007	-0.019014	0.012420	-0.0
11	0.005548	-0.004550	-0.000191	-0.008571	-0.008704	0.005324	-0.003181	0.009408	0.006837	0.0
12	-0.020340	0.009146	0.018646	-0.008771	0.009730	0.006439	0.002659	0.008772	0.010837	-0.0
13	-0.027446	0.000244	0.004810	-0.053950	0.046694	0.007098	-0.001573	0.012013	-0.010524	0.0
14	-0.001878	-0.010605	-0.021237	-0.018608	-0.019091	-0.001185	0.011636	0.017614	0.019873	0.0
15	0.052771	-0.045171	-0.084298	0.093910	-0.040170	-0.029502	-0.013099	0.069127	-0.017074	0.0
16	-0.017772	0.009096	-0.020847	-0.020515	0.009947	-0.018581	0.008214	0.005609	0.017464	0.0
17	-0.003794	0.001053	0.011073	0.004907	-0.007441	0.004270	-0.001534	0.008498	0.008382	-0.0
18	-0.020212	0.023752	-0.018201	-0.019461	-0.033241	-0.008525	0.021989	0.008870	0.014548	0.0
19	-0.003120	0.000830	0.002736	-0.002252	0.001423	-0.000879	0.002827	-0.000834	0.000988	0.0
20	-0.025282	-0.010709	0.018106	0.012024	0.017587	-0.000233	0.024029	-0.016204	0.018763	0.0
21	0.003185	0.016470	0.005171	-0.002953	-0.021466	-0.001617	0.011539	0.009957	-0.011006	-0.0
22	-0.090815	-0.023978	0.053247	-0.001236	0.044516	-0.042211	-0.057273	0.116410	0.130150	0.0
23	-0.001066	0.000346	0.001486	0.000363	0.000985	-0.002983	-0.001885	0.001299	0.002041	0.0
24	0.001114	0.026153	0.022245	-0.016472	-0.033573	0.001789	-0.014708	0.004106	0.006702	-0.0
25	0.046807	-0.005346	-0.012603	-0.025191	0.048207	-0.040022	0.024563	-0.022006	-0.066024	0.0
26	-0.002734	0.009227	0.011076	-0.004418	-0.004091	0.021972	-0.006496	-0.000302	-0.013162	-0.0
27	-0.062927	-0.030610	0.053358	0.049792	0.017567	-0.040958	-0.074596	-0.016180	0.111981	0.0
28	-0.007322	-0.013342	0.002181	0.001789	0.009582	-0.001382	-0.009916	0.012970	0.013118	0.0
29	-0.000803	0.000104	0.000785	0.000202	0.001511	0.000788	0.001992	-0.000700	0.000266	-0.0
30	-0.000783	0.000491	0.001218	0.003198	-0.003356	-0.009151	-0.003615	0.003722	0.003065	-0.0
31	-0.018841	0.005785	-0.003678	0.013530	-0.009184	0.011396	0.017701	-0.006000	0.018898	-0.0
32	0.004280	-0.008179	-0.010094	-0.001367	0.007604	-0.002220	-0.004010	0.002686	0.004014	0.0
33	-0.006643	0.012805	0.023776	0.000193	-0.013882	0.020054	-0.005864	0.002912	0.007549	-0.0
34	0.070479	-0.072920	0.004633	-0.028294	-0.035629	-0.177100	-0.106131	-0.048733	-0.023515	0.0
35	0.099020	-0.076502	-0.000240	-0.052213	-0.011202	-0.038428	-0.081657	-0.012731	0.014144	0.0
36	0.004756	-0.011601	-0.008746	0.006235	-0.001778	0.003059	-0.008094	0.005478	0.006296	0.0
37	-0.053245	0.208312	0.011128	-0.051136	0.059579	0.011280	-0.095425	-0.063476	-0.026777	-0.0
38	0.001649	-0.011133	-0.002855	0.011860	-0.020073	0.000519	0.007727	0.008776	0.008069	0.0
39	0.002110	0.001066	-0.000605	0.009008	-0.015722	0.002438	0.003481	-0.056704	0.006040	0.0
40	-0.006578	0.004169	-0.007246	0.009086	0.010942	0.001926	0.014241	0.003006	-0.009634	-0.0
41	-0.011145	-0.016531	0.013738	0.010331	-0.007477	-0.000868	0.008349	0.010765	0.014962	0.0
42	-0.007386	0.003489	-0.016795	0.010257	0.022534	-0.000588	-0.011227	0.004745	0.008416	0.0
43	0.061987	-0.016124	0.074170	0.102505	-0.050297	0.010073	-0.026794	-0.020880	-0.050859	-0.0
44	-0.018059	0.007442	-0.003738	0.001222	0.012389	-0.010071	0.013805	0.003095	0.001011	0.0
45	-0.001190	0.008335	0.002196	0.010227	0.002609	0.009038	0.003377	0.002897	-0.019051	-0.0
46	0.052187	-0.014960	0.099810	0.021881	-0.048390	0.147709	0.012618	-0.039170	-0.057008	-0.0
47	0.008841	0.001689	-0.012622	-0.027178	-0.004999	0.007632	0.009940	0.016802	-0.021053	-0.0
48	0.001178	-0.002224	0.024924	-0.026556	-0.006631	0.013185	0.015511	-0.007186	-0.036694	-0.0
49	-0.002541	0.000907	0.000881	-0.000579	0.001446	-0.000415	0.000942	0.000434	0.001456	-0.0
50	-0.004668	-0.016053	-0.017039	0.001683	0.023858	-0.003421	0.019801	0.009562	-0.014826	0.0
dfb.YICR dfb.YSLP dfb.YWCM dffit cov.r cook.d hat inf										
1	-0.001035	-0.052115	0.044194	0.26249	0.970	4.58e-03	0.01292			
2	-0.001575	0.002920	-0.001613	-0.01173	1.022	9.17e-06	0.01149			
3	-0.023205	0.010303	-0.020357	0.19760	0.967	2.60e-03	0.00776	*		
4	-0.020545	-0.002355	0.032123	-0.05132	1.019	1.76e-04	0.01052			
5	0.002327	-0.011741	-0.000867	-0.09751	1.011	6.34e-04	0.01012			
6	-0.007112	-0.001838	-0.002964	-0.01990	1.014	2.64e-05	0.00466			
7	0.002889	-0.000241	0.002327	-0.02397	1.023	3.83e-05	0.01247			
8	0.014195	-0.001972	0.010258	-0.07713	1.012	3.97e-04	0.00871			
9	-0.004153	0.006889	-0.008391	-0.02960	1.021	5.84e-05	0.01109			
10	-0.008257	-0.030125	-0.014777	-0.07575	1.019	3.83e-04	0.01319			
11	-0.004518	0.005899	0.002187	-0.02892	1.014	5.58e-05	0.00554			
12	0.002714	0.013621	-0.015570	-0.03922	1.015	1.03e-04	0.00721			
13	0.020746	-0.028649	0.001020	-0.09576	1.009	6.11e-04	0.00892			

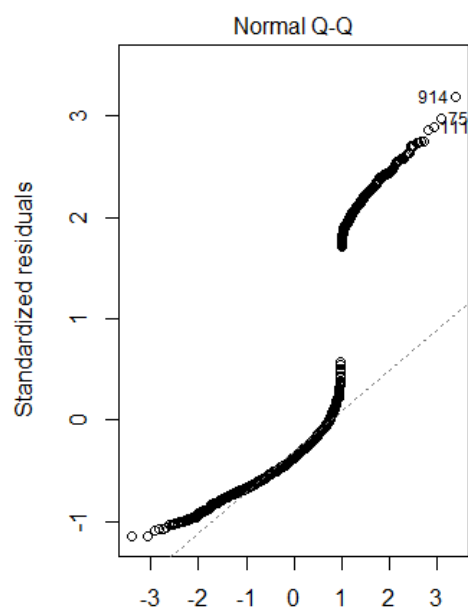
14	0.001047	-0.004329	-0.000552	-0.05196	1.014	1.80e-04	0.00762	
15	-0.015056	-0.023455	0.006151	0.17520	0.984	2.04e-03	0.00881	
16	-0.011431	-0.023603	-0.009648	-0.05895	1.020	2.32e-04	0.01244	
17	0.007765	0.006011	-0.008255	-0.03105	1.015	6.43e-05	0.00641	
18	0.011913	-0.002993	0.011865	-0.07377	1.009	3.63e-04	0.00693	
19	-0.002335	-0.003987	-0.003996	0.01167	1.027	9.09e-06	0.01632	
20	0.000545	-0.000181	0.001847	-0.05104	1.013	1.74e-04	0.00642	
21	0.005551	-0.001140	-0.001831	-0.04537	1.015	1.37e-04	0.00715	
22	-0.009755	-0.034149	-0.006533	0.22448	0.965	3.35e-03	0.00927	*
23	0.001235	0.001505	-0.004351	-0.00716	1.021	3.42e-06	0.01017	
24	0.006518	-0.003807	0.007977	-0.08634	1.014	4.97e-04	0.01054	
25	-0.021552	0.000599	0.010460	0.12753	0.964	1.08e-03	0.00330	*
26	0.027428	-0.007279	-0.001792	0.04737	1.022	1.50e-04	0.01289	
27	-0.125335	0.088043	0.061723	0.25234	0.970	4.23e-03	0.01216	
28	-0.013885	-0.004003	0.017910	-0.03649	1.016	8.88e-05	0.00735	
29	0.003763	0.000749	-0.004440	-0.00705	1.031	3.31e-06	0.02045	*
30	-0.000734	-0.001601	0.000412	-0.01611	1.024	1.73e-05	0.01312	
31	-0.000333	-0.000049	0.010727	-0.04299	1.011	1.23e-04	0.00457	
32	0.002805	0.000318	-0.002145	-0.02009	1.018	2.69e-05	0.00796	
33	0.042149	0.007534	-0.028784	-0.07027	1.020	3.29e-04	0.01331	
34	-0.026740	0.008724	-0.042084	0.33054	0.966	7.26e-03	0.01754	*
35	-0.037184	0.043004	-0.040588	0.16593	0.977	1.83e-03	0.00696	
36	0.001820	0.001116	-0.003219	-0.02124	1.016	3.01e-05	0.00653	
37	-0.001571	-0.019804	-0.003277	0.27143	0.955	4.89e-03	0.01112	*
38	0.000591	-0.008536	-0.000288	-0.03669	1.013	8.98e-05	0.00530	
39	0.000708	0.002619	0.011716	-0.06964	1.011	3.23e-04	0.00714	
40	0.001351	0.001153	0.001250	-0.02650	1.015	4.69e-05	0.00548	
41	0.006445	-0.000692	0.008083	-0.04514	1.011	1.36e-04	0.00465	
42	0.007596	-0.000798	0.005953	-0.05476	1.018	2.00e-04	0.01025	
43	-0.036698	0.003650	-0.001299	0.17670	0.980	2.08e-03	0.00831	
44	-0.009571	0.008090	-0.004413	-0.03530	1.020	8.31e-05	0.01076	
45	-0.004923	0.002839	0.000826	-0.02927	1.017	5.72e-05	0.00759	
46	0.115176	0.195603	-0.119345	0.40341	0.968	1.08e-02	0.02436	*
47	0.012673	-0.037113	-0.013293	-0.06290	1.015	2.64e-04	0.00910	
48	0.011515	-0.000302	0.012966	-0.07646	1.009	3.90e-04	0.00702	
49	0.000039	-0.001118	0.001241	0.00348	1.020	8.09e-07	0.00959	
50	0.011023	-0.000928	0.000388	-0.05180	1.014	1.79e-04	0.00762	

[reached 'max' / getOption("max.print") -- omitted 1420 rows]

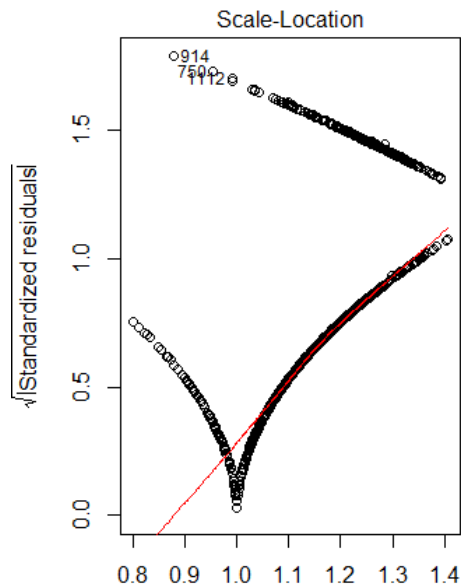
```
> View(temp)
> #Diagnostic Plot
> plot(fit_attr)
Hit <Return> to see next plot:
```



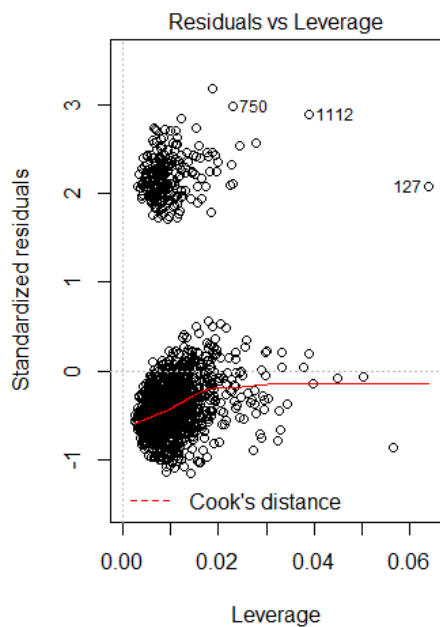
Fitted values
 ~ Age + DailyRate + DistanceFromHome + HourlyRa
 Hit <Return> to see next plot:



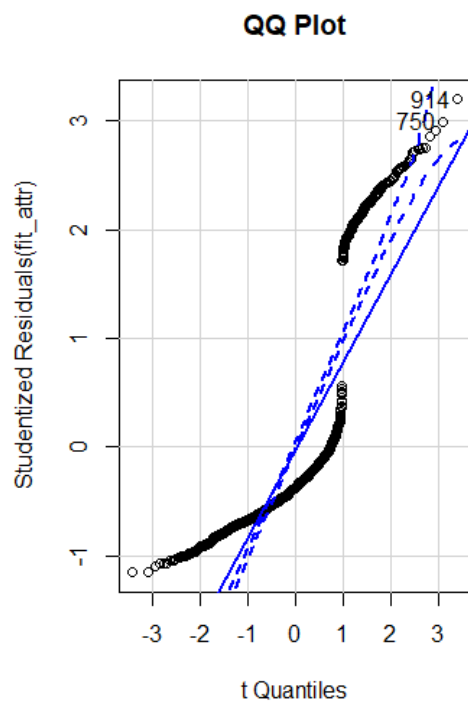
Theoretical Quantiles
 ~ Age + DailyRate + DistanceFromHome + HourlyRa
 Hit <Return> to see next plot:



Hit <Return> to see next plot:



```
~ Age + DailyRate + DistanceFromHome + HourlyRa
> #Assessing Outliers
> outlierTest(fit_attr)
No Studentized residuals with Bonferroni p < 0.05
Largest |rstudent|:
rstudent unadjusted p-value Bonferroni p
914 3.198679 0.0014104 NA
> qqPlot(fit_attr, main="QQ Plot")
[1] 750 914
```

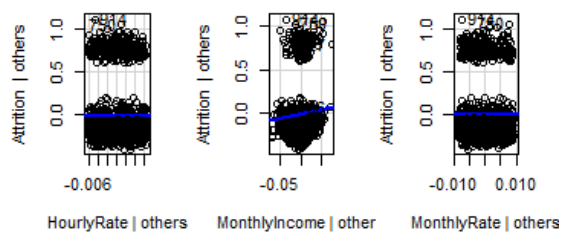
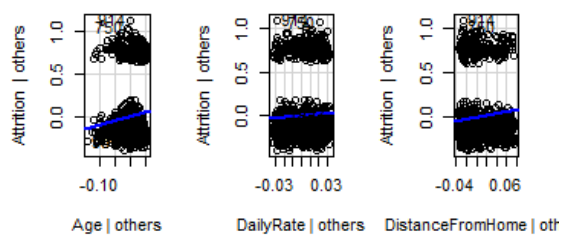


```

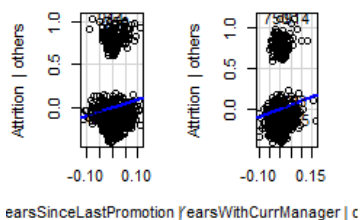
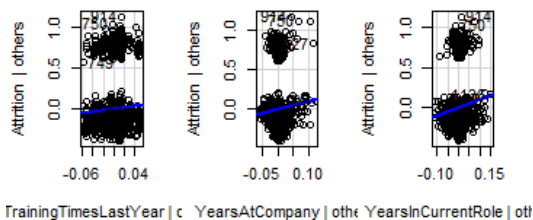
> # graphics.off()
> # par(mfrow = c(1,2))
> plot.new();
> dev.off()
null device
1
> leveragePlots(fit_attr)

```

Hit <Return> to see next plot:



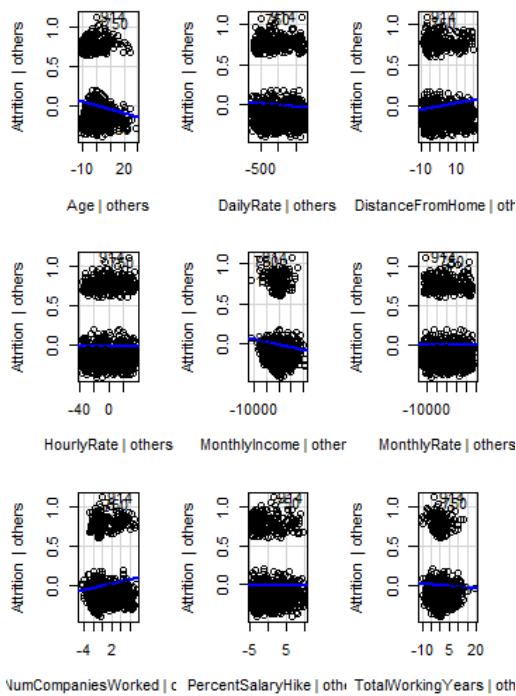
Hit <Return> to see next plot:
Leverage Plots



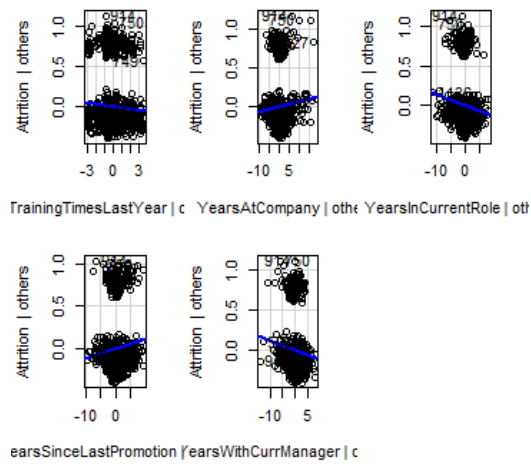
> # Influential observations
> # added variable plots

```
> avPlots(fit_attr)
```

Hit <Return> to see next plot:

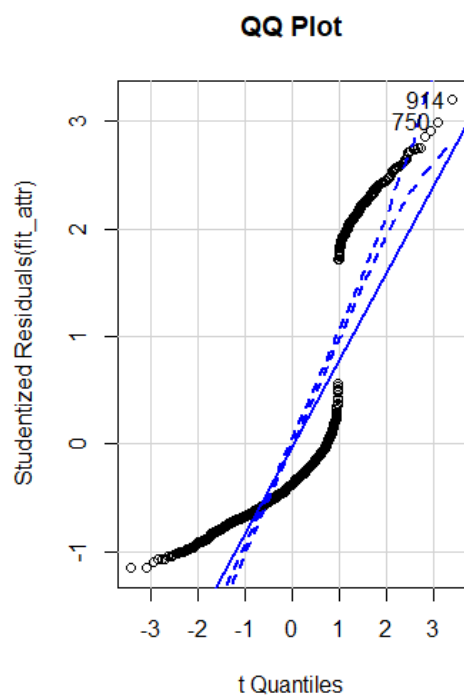


Hit <Return> to see next plot:
Added-Variable Plots



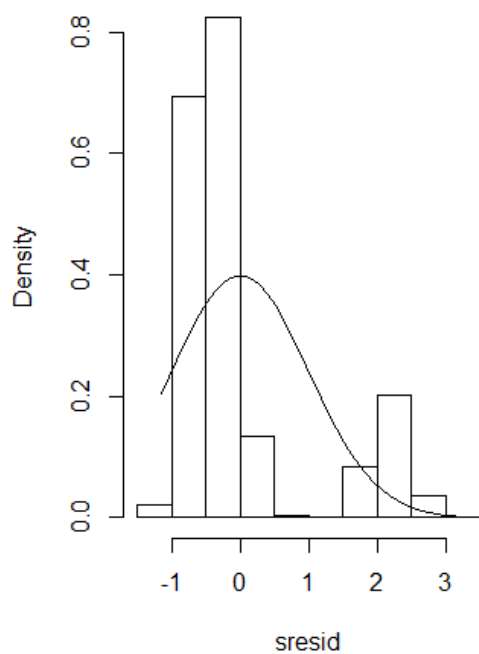
```
> # Normality of Residuals
```

```
> # qq plot for studentized resid
> qqPlot(fit_attr, main="QQ Plot")
[1] 750 914
```



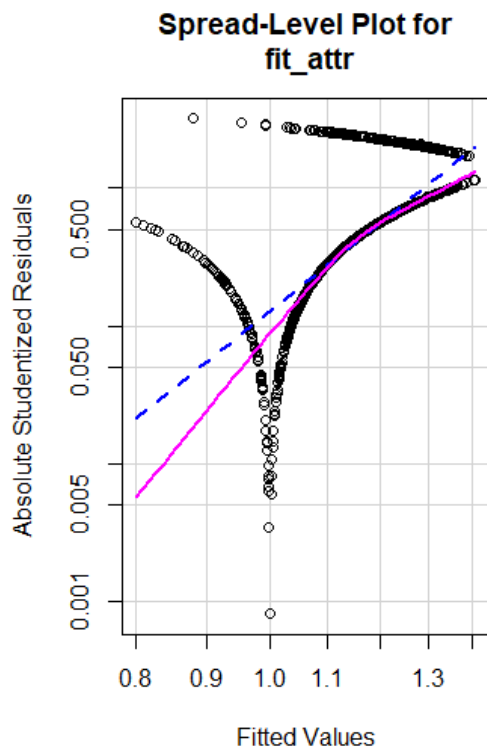
```
> # distribution of studentized residuals
> library(MASS)
> sresid <- studres(fit_attr)
> hist(sresid, freq=FALSE,
+      main="Distribution of Studentized Residuals")
> xfit<-seq(min(sresid),max(sresid),length=40)
> yfit<-dnorm(xfit)
> lines(xfit, yfit)
```

Distribution of Studentized Residual:



```
> #Non-constant Error Variance
> # Evaluate homoscedasticity
> # non-constant error variance test
> ncvTest(fit_attr)
Non-constant Variance Score Test
Variance formula: ~ fitted.values
Chisquare = 174.5721, Df = 1, p = < 2.22e-16
> # plot studentized residuals vs. fitted values
> spreadLevelPlot(fit_attr)
```

Suggested power transformation: -7.081486



```
> #Multi-collinearity
> # Evaluate Collinearity
> vif(fit_attr) # variance inflation factors
```

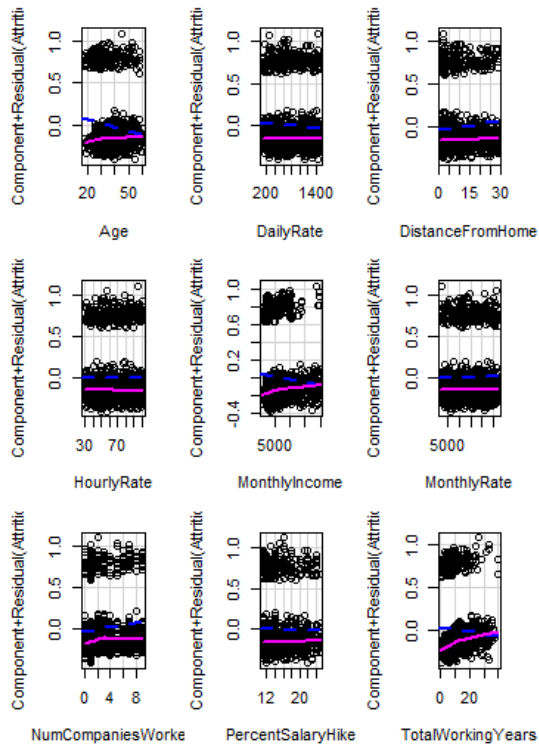
Age	DailyRate	DistanceFromHome	HourlyRate	Month
lyIncome				
1.989844	1.010157	1.007398	1.004497	
2.528796				
MonthlyRate	NumCompaniesWorked	PercentSalaryHike	TotalWorkingYears	Train
ingTimesLastYear				
1.007865	1.243004	1.006224	4.645708	
1.007298				
YearsAtCompany	YearsInCurrentRole	YearsSinceLastPromotion	YearsWithCurrManager	
4.563884	2.684841	1.668993	2.748080	

```
> sqrt(vif(fit_attr)) > 2 # problem?
```

Age	DailyRate	DistanceFromHome	HourlyRate	Month
lyIncome				
FALSE	FALSE	FALSE	FALSE	
FALSE				
MonthlyRate	NumCompaniesWorked	PercentSalaryHike	TotalWorkingYears	Train
ingTimesLastYear				
FALSE	FALSE	FALSE	TRUE	
FALSE				
YearsAtCompany	YearsInCurrentRole	YearsSinceLastPromotion	YearsWithCurrManager	
TRUE	FALSE	FALSE	FALSE	

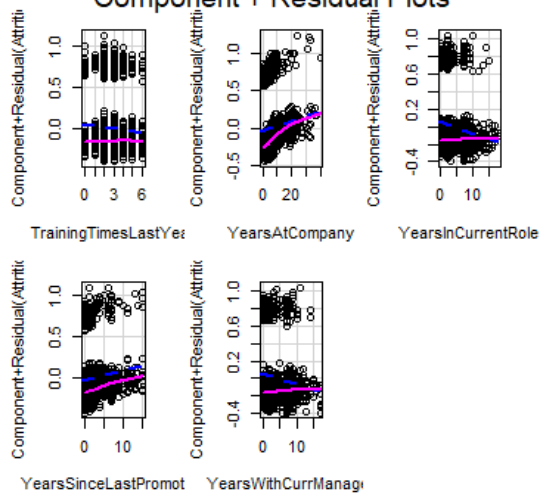
```
> #Nonlinearity
> # component + residual plot
> crPlots(fit_attr)
```

Hit <Return> to see next plot:



Hit <Return> to see next plot:

Component + Residual Plots



```
> library(gvlma)
> gvmodel <- gvlma(fit_attr)
> summary(gvmodel)
```

```

Call:
lm(formula = Attrition ~ Age + DailyRate + DistanceFromHome +
    HourlyRate + MonthlyIncome + MonthlyRate + NumCompaniesWorked +
    PercentSalaryHike + TotalWorkingYears + TrainingTimesLastYear +
    YearsAtCompany + YearsInCurrentRole + YearsSinceLastPromotion +
    YearsWithCurrManager)

Residuals:
    Min       1Q   Median       3Q      Max
-0.40687 -0.20911 -0.13209 -0.01769  1.12055

Coefficients:
(Intercept)          1.475e+00  7.393e-02  19.953  < 2e-16 ***
Age                -4.842e-03  1.429e-03  -3.388  0.000723 ***
DailyRate          -4.622e-05  2.305e-05  -2.005  0.045171 *
DistanceFromHome    3.607e-03  1.146e-03   3.148  0.001678 **
HourlyRate          -1.762e-04  4.563e-04  -0.386  0.699459
MonthlyIncome       -6.435e-06  3.126e-06  -2.058  0.039722 *
MonthlyRate         6.944e-07  1.305e-06   0.532  0.594875
NumCompaniesWorked  1.400e-02  4.131e-03   3.390  0.000718 ***
PercentSalaryHike   -1.302e-03  2.537e-03  -0.513  0.607844
TotalWorkingYears   -2.215e-03  2.564e-03  -0.864  0.387788
TrainingTimesLastYear -1.642e-02  7.205e-03  -2.279  0.022830 *
YearsAtCompany       6.547e-03  3.227e-03   2.029  0.042676 *
YearsInCurrentRole  -1.359e-02  4.186e-03  -3.246  0.001198 **
YearsSinceLastPromotion 1.211e-02  3.711e-03   3.264  0.001123 **
YearsWithCurrManager -1.202e-02  4.300e-03  -2.794  0.005268 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.3547 on 1455 degrees of freedom
Multiple R-squared:  0.07892,    Adjusted R-squared:  0.07006
F-statistic: 8.905 on 14 and 1455 DF,  p-value: < 2.2e-16

```

ASSESSMENT OF THE LINEAR MODEL ASSUMPTIONS
 USING THE GLOBAL TEST ON 4 DEGREES-OF-FREEDOM:
 Level of Significance = 0.05

```

Call:
gvlma(x = fit_attr)

Value    p-value          Decision
Global Stat    748.8633 0.000e+00 Assumptions NOT satisfied!
Skewness       641.8767 0.000e+00 Assumptions NOT satisfied!
Kurtosis        76.5709 0.000e+00 Assumptions NOT satisfied!
Link Function   30.1796 3.938e-08 Assumptions NOT satisfied!
Heteroscedasticity 0.2361 6.270e-01 Assumptions acceptable.
> fit_attr

```

```

Call:
lm(formula = Attrition ~ Age + DailyRate + DistanceFromHome +
    HourlyRate + MonthlyIncome + MonthlyRate + NumCompaniesWorked +
    PercentSalaryHike + TotalWorkingYears + TrainingTimesLastYear +
    YearsAtCompany + YearsInCurrentRole + YearsSinceLastPromotion +
    YearsWithCurrManager)

```

```

Coefficients:
(Intercept)          Age          DailyRate      DistanceFromHome
1.475e+00        -4.842e-03        -4.622e-05           3.607e-03
-1.762e-04

```

MonthlyIncome	MonthlyRate	NumCompaniesWorked	PercentSalaryHike
TotalWorkingYears			
-6.435e-06	6.944e-07	1.400e-02	-1.302e-03
-2.215e-03			
TrainingTimesLastYear	YearsAtCompany	YearsInCurrentRole	YearsSinceLastPromotion
YearsWithCurrManager			
-1.642e-02	6.547e-03	-1.359e-02	1.211e-02
-1.202e-02			

```
> summary(fit_attr)
```

```
Call:
lm(formula = Attrition ~ Age + DailyRate + DistanceFromHome +
    HourlyRate + MonthlyIncome + MonthlyRate + NumCompaniesWorked +
    PercentSalaryHike + TotalWorkingYears + TrainingTimesLastYear +
    YearsAtCompany + YearsInCurrentRole + YearsSinceLastPromotion +
    YearsWithCurrManager)
```

```
Residuals:
    Min       1Q   Median       3Q      Max
-0.40687 -0.20911 -0.13209 -0.01769  1.12055
```

```
Coefficients:
(Intercept)      1.475e+00  7.393e-02  19.953 < 2e-16 ***
Age             -4.842e-03  1.429e-03  -3.388 0.000723 ***
DailyRate       -4.622e-05  2.305e-05  -2.005 0.045171 *
DistanceFromHome 3.607e-03  1.146e-03   3.148 0.001678 **
HourlyRate      -1.762e-04  4.563e-04  -0.386 0.699459
MonthlyIncome   -6.435e-06  3.126e-06  -2.058 0.039722 *
MonthlyRate     6.944e-07  1.305e-06   0.532 0.594875
NumCompaniesWorked 1.400e-02  4.131e-03   3.390 0.000718 ***
PercentSalaryHike -1.302e-03  2.537e-03  -0.513 0.607844
TotalWorkingYears -2.215e-03  2.564e-03  -0.864 0.387788
TrainingTimesLastYear -1.642e-02  7.205e-03  -2.279 0.022830 *
YearsAtCompany    6.547e-03  3.227e-03   2.029 0.042676 *
YearsInCurrentRole -1.359e-02  4.186e-03  -3.246 0.001198 **
YearsSinceLastPromotion 1.211e-02  3.711e-03   3.264 0.001123 **
YearsWithCurrManager -1.202e-02  4.300e-03  -2.794 0.005268 **
```

```
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
Residual standard error: 0.3547 on 1455 degrees of freedom
Multiple R-squared:  0.07892,    Adjusted R-squared:  0.07006
F-statistic: 8.905 on 14 and 1455 DF,  p-value: < 2.2e-16
```

```
> fit1<-fit_attr
> fit2<- lm(Attrition~Age+DailyRate+DistanceFromHome+MonthlyIncome+MonthlyRate+NumCompaniesWorked+PercentSalaryHike+TotalWorkingYears+TrainingTimesLastYear+YearsAtCompany+YearsInCurrentRole+YearsSinceLastPromotion+YearsWithCurrManager,data=attr)
> summary(fit2)
```

```
Call:
lm(formula = Attrition ~ Age + DailyRate + DistanceFromHome +
    MonthlyIncome + MonthlyRate + NumCompaniesWorked + PercentSalaryHike +
    TotalWorkingYears + TrainingTimesLastYear + YearsAtCompany +
    YearsInCurrentRole + YearsSinceLastPromotion + YearsWithCurrManager,
    data = attr)
```

```
Residuals:
    Min       1Q   Median       3Q      Max
-0.40375 -0.20961 -0.13121 -0.01759  1.11560
```

```
Coefficients:
```


	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	1.464e+00	6.793e-02	21.551	< 2e-16 ***
Age	-4.858e-03	1.428e-03	-3.402	0.000688 ***
DailyRate	-4.642e-05	2.304e-05	-2.015	0.044136 *
DistanceFromHome	3.593e-03	1.145e-03	3.138	0.001735 **
MonthlyIncome	-6.414e-06	3.125e-06	-2.053	0.040286 *
MonthlyRate	7.024e-07	1.305e-06	0.538	0.590493
NumCompaniesWorked	1.398e-02	4.129e-03	3.386	0.000727 ***
PercentSalaryHike	-1.290e-03	2.536e-03	-0.509	0.610912
TotalWorkingYears	-2.213e-03	2.563e-03	-0.864	0.387980
TrainingTimesLastYear	-1.640e-02	7.203e-03	-2.277	0.022942 *
YearsAtCompany	6.538e-03	3.226e-03	2.026	0.042908 *
YearsInCurrentRole	-1.357e-02	4.184e-03	-3.243	0.001211 **
YearsSinceLastPromotion	1.214e-02	3.709e-03	3.272	0.001093 **
YearsWithCurrManager	-1.201e-02	4.299e-03	-2.794	0.005274 **

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.3546 on 1456 degrees of freedom
Multiple R-squared: 0.07883, Adjusted R-squared: 0.0706
F-statistic: 9.584 on 13 and 1456 DF, p-value: < 2.2e-16

```
> fit3<- lm(Attrition~Age+DailyRate+DistanceFromHome+MonthlyIncome+NumCompaniesWorked+Perc
entSalaryHike+TotalWorkingYears+TrainingTimesLastYear+YearsAtCompany+YearsInCurrentRole+Yea
rsSinceLastPromotion+YearsWithCurrManager,data=attr)
> summary(fit3)
```

Call:
lm(formula = Attrition ~ Age + DailyRate + DistanceFromHome +
MonthlyIncome + NumCompaniesWorked + PercentSalaryHike +
TotalWorkingYears + TrainingTimesLastYear + YearsAtCompany +
YearsInCurrentRole + YearsSinceLastPromotion + YearsWithCurrManager,
data = attr)

Residuals:

Min	1Q	Median	3Q	Max
-0.40948	-0.20834	-0.13312	-0.01794	1.10809

	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	1.474e+00	6.523e-02	22.598	< 2e-16 ***
Age	-4.855e-03	1.428e-03	-3.400	0.000691 ***
DailyRate	-4.686e-05	2.302e-05	-2.036	0.041970 *
DistanceFromHome	3.611e-03	1.144e-03	3.155	0.001635 **
MonthlyIncome	-6.374e-06	3.123e-06	-2.041	0.041442 *
NumCompaniesWorked	1.397e-02	4.128e-03	3.384	0.000734 ***
PercentSalaryHike	-1.301e-03	2.535e-03	-0.513	0.607948
TotalWorkingYears	-2.188e-03	2.562e-03	-0.854	0.393341
TrainingTimesLastYear	-1.638e-02	7.201e-03	-2.275	0.023060 *
YearsAtCompany	6.480e-03	3.224e-03	2.010	0.044609 *
YearsInCurrentRole	-1.353e-02	4.183e-03	-3.234	0.001248 **
YearsSinceLastPromotion	1.217e-02	3.708e-03	3.282	0.001054 **
YearsWithCurrManager	-1.208e-02	4.296e-03	-2.812	0.004986 **

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.3546 on 1457 degrees of freedom
Multiple R-squared: 0.07864, Adjusted R-squared: 0.07106
F-statistic: 10.36 on 12 and 1457 DF, p-value: < 2.2e-16

```
> fit4<- lm(Attrition~Age+DailyRate+DistanceFromHome+MonthlyIncome+NumCompaniesWorked+Tota
lWorkingYears+TrainingTimesLastYear+YearsAtCompany+YearsInCurrentRole+YearsSinceLastPromoti
on+YearsWithCurrManager,data=attr)
> summary(fit4)
```

```
Call:
lm(formula = Attrition ~ Age + DailyRate + DistanceFromHome +
MonthlyIncome + NumCompaniesWorked + TotalWorkingYears +
TrainingTimesLastYear + YearsAtCompany + YearsInCurrentRole +
YearsSinceLastPromotion + YearsWithCurrManager, data = attr)
```

```
Residuals:
Min      1Q  Median      3Q      Max
-0.41835 -0.20806 -0.13307 -0.01769  1.10641
```

```
Coefficients:
Estimate Std. Error t value Pr(>|t|)
(Intercept)      1.455e+00  5.348e-02  27.204 < 2e-16 ***
Age             -4.871e-03  1.427e-03  -3.413 0.000659 ***
DailyRate       -4.710e-05  2.301e-05  -2.047 0.040853 *
DistanceFromHome  3.588e-03  1.143e-03   3.139 0.001731 **
MonthlyIncome   -6.355e-06  3.122e-06  -2.035 0.041988 *
NumCompaniesWorked  1.401e-02  4.126e-03   3.396 0.000703 ***
TotalWorkingYears -2.191e-03  2.561e-03  -0.855 0.392588
TrainingTimesLastYear -1.637e-02  7.199e-03  -2.273 0.023154 *
YearsAtCompany    6.553e-03  3.220e-03   2.035 0.042021 *
YearsInCurrentRole -1.360e-02  4.179e-03  -3.253 0.001166 **
YearsSinceLastPromotion 1.218e-02  3.707e-03   3.286 0.001040 **
YearsWithCurrManager -1.211e-02  4.294e-03  -2.820 0.004873 **
```

```
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
Residual standard error: 0.3545 on 1458 degrees of freedom
Multiple R-squared:  0.07848,    Adjusted R-squared:  0.07153
F-statistic: 11.29 on 11 and 1458 DF,  p-value: < 2.2e-16
```

```
> fit5<- lm(Attrition~Age+DailyRate+DistanceFromHome+MonthlyIncome+NumCompaniesWorked+TrainingTimesLastYear+YearsAtCompany+YearsInCurrentRole+YearsSinceLastPromotion+YearsWithCurrManager,data=attr)
> summary(fit5)
```

```
Call:
lm(formula = Attrition ~ Age + DailyRate + DistanceFromHome +
MonthlyIncome + NumCompaniesWorked + TrainingTimesLastYear +
YearsAtCompany + YearsInCurrentRole + YearsSinceLastPromotion +
YearsWithCurrManager, data = attr)
```

```
Residuals:
Min      1Q  Median      3Q      Max
-0.41785 -0.20700 -0.13205 -0.01959  1.11348
```

```
Coefficients:
Estimate Std. Error t value Pr(>|t|)
(Intercept)      1.472e+00  4.957e-02  29.695 < 2e-16 ***
Age             -5.500e-03  1.223e-03  -4.497 7.45e-06 ***
DailyRate       -4.770e-05  2.300e-05  -2.074 0.03824 *
DistanceFromHome  3.562e-03  1.143e-03   3.118 0.00186 **
MonthlyIncome   -7.903e-06  2.544e-06  -3.106 0.00193 **
NumCompaniesWorked  1.326e-02  4.031e-03   3.289 0.00103 **
TrainingTimesLastYear -1.619e-02  7.196e-03  -2.250 0.02457 *
YearsAtCompany    5.714e-03  3.066e-03   1.863 0.06262 .
YearsInCurrentRole -1.359e-02  4.179e-03  -3.251 0.00118 **
YearsSinceLastPromotion 1.225e-02  3.705e-03   3.306 0.00097 ***
YearsWithCurrManager -1.226e-02  4.290e-03  -2.859 0.00431 **
```

```
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
Residual standard error: 0.3544 on 1459 degrees of freedom
Multiple R-squared:  0.07802,    Adjusted R-squared:  0.0717
```

F-statistic: 12.35 on 10 and 1459 DF, p-value: < 2.2e-16

```
> fit6<- lm(Attrition~Age+DailyRate+DistanceFromHome+MonthlyIncome+NumCompaniesWorked+TrainingTimesLastYear+YearsInCurrentRole+YearsSinceLastPromotion+YearsWithCurrManager,data=attr)
> summary(fit6)
```

```
Call:
lm(formula = Attrition ~ Age + DailyRate + DistanceFromHome + MonthlyIncome + NumCompaniesWorked + TrainingTimesLastYear + YearsInCurrentRole + YearsSinceLastPromotion + YearsWithCurrManager, data = attr)
```

```
Residuals:
Min       1Q   Median       3Q      Max
-0.40760 -0.20639 -0.13235 -0.02203  1.15117
```

```
Coefficients:
Estimate Std. Error t value Pr(>|t|)
(Intercept)      1.466e+00  4.952e-02  29.611 < 2e-16 ***
Age              -5.261e-03  1.217e-03  -4.322 1.65e-05 ***
DailyRate        -4.945e-05  2.300e-05  -2.150 0.03170 *
DistanceFromHome  3.552e-03  1.144e-03   3.106 0.00193 **
MonthlyIncome    -6.431e-06  2.420e-06  -2.657 0.00797 **
NumCompaniesWorked 1.199e-02  3.976e-03   3.015 0.00261 **
TrainingTimesLastYear -1.601e-02  7.201e-03  -2.223 0.02634 *
YearsInCurrentRole -1.065e-02  3.874e-03  -2.750 0.00604 **
YearsSinceLastPromotion 1.417e-02  3.562e-03   3.979 7.25e-05 ***
YearsWithCurrManager -8.627e-03  3.823e-03  -2.256 0.02420 *
```

```
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
Residual standard error: 0.3547 on 1460 degrees of freedom
Multiple R-squared:  0.07582,    Adjusted R-squared:  0.07013
F-statistic: 13.31 on 9 and 1460 DF, p-value: < 2.2e-16
```

```
> fit7<- lm(Attrition~Age+DistanceFromHome+MonthlyIncome+NumCompaniesWorked+TrainingTimesLastYear+YearsInCurrentRole+YearsSinceLastPromotion+YearsWithCurrManager,data=attr)
> summary(fit7)
```

```
Call:
lm(formula = Attrition ~ Age + DistanceFromHome + MonthlyIncome + NumCompaniesWorked + TrainingTimesLastYear + YearsInCurrentRole + YearsSinceLastPromotion + YearsWithCurrManager, data = attr)
```

```
Residuals:
Min       1Q   Median       3Q      Max
-0.38983 -0.20696 -0.13423 -0.02457  1.14670
```

```
Coefficients:
Estimate Std. Error t value Pr(>|t|)
(Intercept)      1.428e+00  4.621e-02  30.901 < 2e-16 ***
Age              -5.262e-03  1.219e-03  -4.317 1.69e-05 ***
DistanceFromHome  3.561e-03  1.145e-03   3.110 0.00190 **
MonthlyIncome    -6.476e-06  2.423e-06  -2.672 0.00762 **
NumCompaniesWorked 1.170e-02  3.979e-03   2.942 0.00332 **
TrainingTimesLastYear -1.609e-02  7.210e-03  -2.232 0.02580 *
YearsInCurrentRole -1.107e-02  3.874e-03  -2.857 0.00434 **
YearsSinceLastPromotion 1.448e-02  3.563e-03   4.062 5.12e-05 ***
YearsWithCurrManager -8.319e-03  3.825e-03  -2.175 0.02981 *
```

```
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
Residual standard error: 0.3552 on 1461 degrees of freedom
```

Multiple R-squared: 0.0729, Adjusted R-squared: 0.06782
F-statistic: 14.36 on 8 and 1461 DF, p-value: < 2.2e-16

```
> fit8<- lm(Attrition~Age+DistanceFromHome+MonthlyIncome+NumCompaniesWorked+YearsInCurrent  
Role+YearsSinceLastPromotion+YearsWithCurrManager,data=attr)  
> summary(fit8)
```

Call:
lm(formula = Attrition ~ Age + DistanceFromHome + MonthlyIncome +
NumCompaniesWorked + YearsInCurrentRole + YearsSinceLastPromotion +
YearsWithCurrManager, data = attr)

Residuals:
Min 1Q Median 3Q Max
-0.38369 -0.20480 -0.13618 -0.03085 1.14424

Coefficients:
Estimate Std. Error t value Pr(>|t|)
(Intercept) 1.381e+00 4.111e-02 33.584 < 2e-16 ***
Age -5.284e-03 1.220e-03 -4.329 1.60e-05 ***
DistanceFromHome 3.661e-03 1.146e-03 3.196 0.00142 **
MonthlyIncome -6.413e-06 2.427e-06 -2.643 0.00830 **
NumCompaniesWorked 1.228e-02 3.976e-03 3.088 0.00205 **
YearsInCurrentRole -1.103e-02 3.880e-03 -2.843 0.00453 **
YearsSinceLastPromotion 1.444e-02 3.568e-03 4.047 5.46e-05 ***
YearsWithCurrManager -8.283e-03 3.830e-03 -2.162 0.03075 *

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.3557 on 1462 degrees of freedom
Multiple R-squared: 0.06974, Adjusted R-squared: 0.06528
F-statistic: 15.66 on 7 and 1462 DF, p-value: < 2.2e-16

```
> fit9<- lm(Attrition~Age+DistanceFromHome+MonthlyIncome+NumCompaniesWorked+YearsInCurrent  
Role+YearsSinceLastPromotion,data=attr)  
> summary(fit9)
```

Call:
lm(formula = Attrition ~ Age + DistanceFromHome + MonthlyIncome +
NumCompaniesWorked + YearsInCurrentRole + YearsSinceLastPromotion,
data = attr)

Residuals:
Min 1Q Median 3Q Max
-0.39822 -0.20509 -0.13451 -0.03268 1.16520

Coefficients:
Estimate Std. Error t value Pr(>|t|)
(Intercept) 1.374e+00 4.105e-02 33.474 < 2e-16 ***
Age -5.374e-03 1.221e-03 -4.400 1.16e-05 ***
DistanceFromHome 3.658e-03 1.147e-03 3.189 0.001460 **
MonthlyIncome -6.871e-06 2.420e-06 -2.839 0.004592 **
NumCompaniesWorked 1.311e-02 3.963e-03 3.308 0.000962 ***
YearsInCurrentRole -1.586e-02 3.175e-03 -4.995 6.59e-07 ***
YearsSinceLastPromotion 1.305e-02 3.514e-03 3.713 0.000212 ***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.3561 on 1463 degrees of freedom
Multiple R-squared: 0.06676, Adjusted R-squared: 0.06293
F-statistic: 17.44 on 6 and 1463 DF, p-value: < 2.2e-16

```
> #Comparing model  
> anova(fit1,fit9)  
Analysis of Variance Table
```

```

Model 1: Attrition ~ Age + DailyRate + DistanceFromHome + HourlyRate +
MonthlyIncome + MonthlyRate + NumCompaniesWorked + PercentSalaryHike +
TotalWorkingYears + TrainingTimesLastYear + YearsAtCompany +
YearsInCurrentRole + YearsSinceLastPromotion + YearsWithCurrManager
Model 2: Attrition ~ Age + DistanceFromHome + MonthlyIncome + NumCompaniesWorked +
YearsInCurrentRole + YearsSinceLastPromotion
Res.Df    RSS Df Sum of Sq    F Pr(>F)
1    1455 183.10
2    1463 185.52 -8    -2.4177 2.4015 0.0142 *
---

```

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

>
> step <- stepAIC(fit1, direction="both")
Start: AIC=-3031.98
Attrition ~ Age + DailyRate + DistanceFromHome + HourlyRate +
MonthlyIncome + MonthlyRate + NumCompaniesWorked + PercentSalaryHike +
TotalWorkingYears + TrainingTimesLastYear + YearsAtCompany +
YearsInCurrentRole + YearsSinceLastPromotion + YearsWithCurrManager

```

Df	Sum of Sq	RSS	AIC
- HourlyRate	1	0.01876	183.12 -3033.8
- PercentSalaryHike	1	0.03315	183.13 -3033.7
- MonthlyRate	1	0.03560	183.14 -3033.7
- TotalWorkingYears	1	0.09392	183.19 -3033.2
<none>			183.10 -3032.0
- DailyRate	1	0.50578	183.61 -3029.9
- YearsAtCompany	1	0.51789	183.62 -3029.8
- MonthlyIncome	1	0.53324	183.63 -3029.7
- TrainingTimesLastYear	1	0.65342	183.75 -3028.8
- YearsWithCurrManager	1	0.98265	184.08 -3026.1
- DistanceFromHome	1	1.24701	184.35 -3024.0
- YearsInCurrentRole	1	1.32581	184.43 -3023.4
- YearsSinceLastPromotion	1	1.34081	184.44 -3023.3
- Age	1	1.44439	184.54 -3022.4
- NumCompaniesWorked	1	1.44616	184.55 -3022.4

```

Step: AIC=-3033.83
Attrition ~ Age + DailyRate + DistanceFromHome + MonthlyIncome +
MonthlyRate + NumCompaniesWorked + PercentSalaryHike + TotalWorkingYears +
TrainingTimesLastYear + YearsAtCompany + YearsInCurrentRole +
YearsSinceLastPromotion + YearsWithCurrManager

```

Df	Sum of Sq	RSS	AIC
- PercentSalaryHike	1	0.03257	183.15 -3035.6
- MonthlyRate	1	0.03644	183.16 -3035.5
- TotalWorkingYears	1	0.09379	183.21 -3035.1
<none>			183.12 -3033.8
+ HourlyRate	1	0.01876	183.10 -3032.0
- DailyRate	1	0.51042	183.63 -3031.7
- YearsAtCompany	1	0.51643	183.64 -3031.7
- MonthlyIncome	1	0.52990	183.65 -3031.6
- TrainingTimesLastYear	1	0.65197	183.77 -3030.6
- YearsWithCurrManager	1	0.98182	184.10 -3028.0
- DistanceFromHome	1	1.23843	184.36 -3025.9
- YearsInCurrentRole	1	1.32253	184.44 -3025.2
- YearsSinceLastPromotion	1	1.34651	184.47 -3025.1
- NumCompaniesWorked	1	1.44236	184.56 -3024.3
- Age	1	1.45523	184.57 -3024.2

```

Step: AIC=-3035.57
Attrition ~ Age + DailyRate + DistanceFromHome + MonthlyIncome +
MonthlyRate + NumCompaniesWorked + TotalWorkingYears + TrainingTimesLastYear +
YearsAtCompany + YearsInCurrentRole + YearsSinceLastPromotion +

```

YearsWithCurrManager

Df	Sum of Sq	RSS	AIC
- MonthlyRate	1	0.03696	183.19 -3037.3
- TotalWorkingYears	1	0.09405	183.25 -3036.8
<none>			183.15 -3035.6
+ PercentSalaryHike	1	0.03257	183.12 -3033.8
+ HourlyRate	1	0.01818	183.13 -3033.7
- DailyRate	1	0.51573	183.67 -3033.4
- MonthlyIncome	1	0.52690	183.68 -3033.3
- YearsAtCompany	1	0.52900	183.68 -3033.3
- TrainingTimesLastYear	1	0.65077	183.80 -3032.4
- YearsWithCurrManager	1	0.98642	184.14 -3029.7
- DistanceFromHome	1	1.22464	184.38 -3027.8
- YearsInCurrentRole	1	1.33766	184.49 -3026.9
- YearsSinceLastPromotion	1	1.34875	184.50 -3026.8
- NumCompaniesWorked	1	1.45154	184.60 -3026.0
- Age	1	1.46564	184.62 -3025.8

Step: AIC=-3037.27

Attrition ~ Age + DailyRate + DistanceFromHome + MonthlyIncome +
NumCompaniesWorked + TotalWorkingYears + TrainingTimesLastYear +
YearsAtCompany + YearsInCurrentRole + YearsSinceLastPromotion +
YearsWithCurrManager

Df	Sum of Sq	RSS	AIC
- TotalWorkingYears	1	0.09189	183.28 -3038.5
<none>			183.19 -3037.3
+ MonthlyRate	1	0.03696	183.15 -3035.6
+ PercentSalaryHike	1	0.03310	183.16 -3035.5
+ HourlyRate	1	0.01900	183.17 -3035.4
- YearsAtCompany	1	0.52037	183.71 -3035.1
- MonthlyIncome	1	0.52054	183.71 -3035.1
- DailyRate	1	0.52639	183.72 -3035.1
- TrainingTimesLastYear	1	0.64931	183.84 -3034.1
- YearsWithCurrManager	1	0.99893	184.19 -3031.3
- DistanceFromHome	1	1.23774	184.43 -3029.4
- YearsInCurrentRole	1	1.32995	184.52 -3028.6
- YearsSinceLastPromotion	1	1.35672	184.55 -3028.4
- NumCompaniesWorked	1	1.44865	184.64 -3027.7
- Age	1	1.46388	184.65 -3027.6

Step: AIC=-3038.54

Attrition ~ Age + DailyRate + DistanceFromHome + MonthlyIncome +
NumCompaniesWorked + TrainingTimesLastYear + YearsAtCompany +
YearsInCurrentRole + YearsSinceLastPromotion + YearsWithCurrManager

Df	Sum of Sq	RSS	AIC
<none>			183.28 -3038.5
+ TotalWorkingYears	1	0.09189	183.19 -3037.3
- YearsAtCompany	1	0.43614	183.72 -3037.0
+ MonthlyRate	1	0.03480	183.25 -3036.8
+ PercentSalaryHike	1	0.03334	183.25 -3036.8
+ HourlyRate	1	0.01884	183.26 -3036.7
- DailyRate	1	0.54042	183.82 -3036.2
- TrainingTimesLastYear	1	0.63620	183.92 -3035.4
- YearsWithCurrManager	1	1.02671	184.31 -3032.3
- MonthlyIncome	1	1.21206	184.49 -3030.8
- DistanceFromHome	1	1.22105	184.50 -3030.8
- YearsInCurrentRole	1	1.32780	184.61 -3029.9
- NumCompaniesWorked	1	1.35901	184.64 -3029.7
- YearsSinceLastPromotion	1	1.37284	184.65 -3029.6
- Age	1	2.54008	185.82 -3020.3

> step\$anova

Stepwise Model Path
Analysis of Deviance Table

Initial Model:

$$\text{Attrition} \sim \text{Age} + \text{DailyRate} + \text{DistanceFromHome} + \text{HourlyRate} + \text{MonthlyIncome} + \text{MonthlyRate} + \text{NumCompaniesWorked} + \text{PercentSalaryHike} + \text{TotalWorkingYears} + \text{TrainingTimesLastYear} + \text{YearsAtCompany} + \text{YearsInCurrentRole} + \text{YearsSinceLastPromotion} + \text{YearsWithCurrManager}$$

Final Model:

$$\text{Attrition} \sim \text{Age} + \text{DailyRate} + \text{DistanceFromHome} + \text{MonthlyIncome} + \text{NumCompaniesWorked} + \text{TrainingTimesLastYear} + \text{YearsAtCompany} + \text{YearsInCurrentRole} + \text{YearsSinceLastPromotion} + \text{YearsWithCurrManager}$$

```

Step Df    Deviance Resid. Df Resid. Dev      AIC
1              1455    183.1008 -3031.982
2    - HourlyRate 1 0.01876239    1456    183.1195 -3033.831
3    - PercentSalaryHike 1 0.03256930    1457    183.1521 -3035.570
4    - MonthlyRate 1 0.03696356    1458    183.1891 -3037.273
5    - TotalWorkingYears 1 0.09188909    1459    183.2810 -3038.536
> attach(attr)
> predict.lm(fit9, data.frame(Age=27, DistanceFromHome=10, MonthlyIncome=2000, NumCompanieswo
rked=1, YearsInCurrentRole=3, YearsSinceLastPromotion=1))
1
1.230249

```

```

> ##Logistic Regression
> library(ggplot2)
> library(cowplot)
> theme_set(theme_cowplot())
> attr <- as.data.frame(attr)
> summary(attr)

```

Age	Attrition	BusinessTravel	DailyRate	Department
Min.: 18.00	No: 1233	Non-Travel: 150	Min.: 102.0	Human Resources: 9
1st Qu.: 30.00	Yes: 237	Travel_Frequently: 277	1st Qu.: 465.0	Research & Development: 9
Median: 36.00		Travel_Rarely: 1043	Median: 802.0	Sales: 4
Mean: 36.92			Mean: 802.5	
3rd Qu.: 43.00			3rd Qu.: 1157.0	
Max.: 60.00			Max.: 1499.0	

DistanceFromHome	Education	EducationField	EnvironmentSatisfaction	Gender	HourlyRate
Min.: 1.000	1: 170	Human Resources: 27	1: 284	Female: 588	Min.: 30.00
1st Qu.: 2.000	2: 282	Life Sciences: 606	2: 287	Male: 882	1st Qu.: 48.00
Median: 7.000	3: 572	Marketing: 159	3: 453		Median: 66.00
Mean: 9.193	4: 398	Medical: 464	4: 446		Mean: 65.89
3rd Qu.: 14.000	5: 48	Other: 82			3rd Qu.: 83.75
Max.: 29.000		Technical Degree: 132			Max.: 100.00

JobInvolvement	JobLevel	JobRole	JobSatisfaction	MaritalStatus	MonthlyIncome

1: 83	1:543	Sales Executive	:326	1:289	Divorced:327	Min.
: 1009						
2:375	2:534	Research Scientist	:292	2:280	Married :673	1st Qu
.: 2911						
3:868	3:218	Laboratory Technician	:259	3:442	Single :470	Median
: 4919						
4:144	4:106	Manufacturing Director	:145	4:459		Mean
: 6503						
.: 8379	5: 69	Healthcare Representative	:131			3rd Qu
		Manager	:102			Max.
:19999		(Other)	:215			

MonthlyRate	NumCompaniesWorked	OverTime	PercentSalaryHike	PerformanceRating	Relationship
pSatisfaction					
Min. : 2094	Min. :0.000	No :1054	Min. :11.00	3:1244	1:276
1st Qu.: 8047	1st Qu.:1.000	Yes: 416	1st Qu.:12.00	4: 226	2:303
Median :14236	Median :2.000		Median :14.00		3:459
Mean :14313	Mean :2.693		Mean :15.21		4:432
3rd Qu.:20462	3rd Qu.:4.000		3rd Qu.:18.00		
Max. :26999	Max. :9.000		Max. :25.00		

StockOptionLevel	TotalWorkingYears	TrainingTimesLastYear	WorkLifeBalance	YearsAtCompany	YearsInCurrentRole
Min. : 0.000	Min. : 0.00	Min. :0.000	1: 80	Min. : 0.000	Min
1:596	1st Qu.: 6.00	1st Qu.:2.000	2:344	1st Qu.: 3.000	1st
Qu.: 2.000	Median :10.00	Median :3.000	3:893	Median : 5.000	Med
2:158	Mean :11.28	Mean :2.799	4:153	Mean : 7.008	Mea
ian : 3.000	3rd Qu.:15.00	3rd Qu.:3.000		3rd Qu.: 9.000	3rd
3: 85	Max. :40.00	Max. :6.000		Max. :40.000	Max
n : 4.229					
Qu.: 7.000					
:18.000					

YearsSinceLastPromotion	YearsWithCurrManager
Min. : 0.000	Min. : 0.000
1st Qu.: 0.000	1st Qu.: 2.000
Median : 1.000	Median : 3.000
Mean : 2.188	Mean : 4.123
3rd Qu.: 3.000	3rd Qu.: 7.000
Max. :15.000	Max. :17.000

```

> glimpse(attr)
Observations: 1,470
Variables: 31
 $ Age                <int> 41, 49, 37, 33, 27, 32, 59, 30, 38, 36, 35, 29, 31, 34, 28, 2
9, 32, 22, 53...
 $ Attrition          <fct> Yes, No, Yes, No, No, No, No, No, No, No, No, No, No, No, Yes
, No, No, No,...
 $ BusinessTravel     <fct> Travel_Rarely, Travel_Frequently, Travel_Rarely, Travel_Frequ
ently, Travel...
 $ DailyRate          <int> 1102, 279, 1373, 1392, 591, 1005, 1324, 1358, 216, 1299, 809,
153, 670, 13...
 $ Department         <fct> Sales, Research & Development, Research & Development, Resear
ch & Developm...
 $ DistanceFromHome   <int> 1, 8, 2, 3, 2, 2, 3, 24, 23, 27, 16, 15, 26, 19, 24, 21, 5, 1
6, 2, 2, 11, ...
 $ Education          <fct> 2, 1, 2, 4, 1, 2, 3, 1, 3, 3, 3, 2, 1, 2, 3, 4, 2, 2, 4, 3, 2
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 $ EducationField     <fct> Life Sciences, Life Sciences, Other, Life Sciences, Medical,
Life Sciences...

```



```

$ Environmentsatisfaction <fct> 2, 3, 4, 4, 1, 4, 3, 4, 4, 3, 1, 4, 1, 2, 3, 2, 1, 4, 1, 4, 1
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$ Gender <fct> Female, Male, Male, Female, Male, Male, Female, Male, Male, M
ale, Male, Fe...
$ HourlyRate <int> 94, 61, 92, 56, 40, 79, 81, 67, 44, 94, 84, 49, 31, 93, 50, 5
1, 80, 96, 78...
$ JobInvolvement <fct> 3, 2, 2, 3, 3, 3, 4, 3, 2, 3, 4, 2, 3, 3, 2, 4, 4, 4, 2, 3, 4
, 2, 3, 3, 3,...
$ JobLevel <fct> 2, 2, 1, 1, 1, 1, 1, 1, 3, 2, 1, 2, 1, 1, 1, 3, 1, 1, 4, 1, 2
, 1, 3, 1, 1,...
$ JobRole <fct> Sales Executive, Research Scientist, Laboratory Technician, R
esearch Scien...
$ JobSatisfaction <fct> 4, 2, 3, 3, 2, 4, 1, 3, 3, 3, 2, 3, 3, 4, 3, 1, 2, 4, 4, 4, 3
, 1, 2, 4, 1,...
$ MaritalStatus <fct> Single, Married, Single, Married, Married, Single, Married, D
ivorced, Sing...
$ MonthlyIncome <int> 5993, 5130, 2090, 2909, 3468, 3068, 2670, 2693, 9526, 5237, 2
426, 4193, 29...
$ MonthlyRate <int> 19479, 24907, 2396, 23159, 16632, 11864, 9964, 13335, 8787, 1
6577, 16479, ...
$ NumCompaniesWorked <int> 8, 1, 6, 1, 9, 0, 4, 1, 0, 6, 0, 0, 1, 0, 5, 1, 0, 1, 2, 5, 0
, 7, 0, 1, 2,...
$ OverTime <fct> Yes, No, Yes, Yes, No, No, Yes, No, No, No, No, Yes, No, No,
Yes, No, Yes,...
$ PercentSalaryHike <int> 11, 23, 15, 11, 12, 13, 20, 22, 21, 13, 13, 12, 17, 11, 14, 1
1, 12, 13, 16...
$ PerformanceRating <fct> 3, 4, 3, 3, 3, 3, 4, 4, 4, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3
, 4, 3, 3, 3,...
$ RelationshipSatisfaction <fct> 1, 4, 2, 3, 4, 3, 1, 2, 2, 2, 3, 4, 4, 3, 2, 3, 4, 2, 3, 3, 4
, 2, 3, 4, 3,...
$ StockOptionLevel <fct> 0, 1, 0, 0, 1, 0, 3, 1, 0, 2, 1, 0, 1, 1, 0, 1, 2, 2, 0, 0, 1
, 0, 0, 0, 0,...
$ TotalWorkingYears <int> 8, 10, 7, 8, 6, 8, 12, 1, 10, 17, 6, 10, 5, 3, 6, 10, 7, 1, 3
1, 6, 5, 10, ...
$ TrainingTimesLastYear <int> 0, 3, 3, 3, 3, 2, 3, 2, 2, 3, 5, 3, 1, 2, 4, 1, 5, 2, 3, 3, 5
, 4, 4, 6, 2,...
$ WorkLifeBalance <fct> 1, 3, 3, 3, 3, 2, 2, 3, 3, 2, 3, 3, 2, 3, 3, 3, 2, 2, 3, 3, 2
, 3, 3, 3, 3,...
$ YearsAtCompany <int> 6, 10, 0, 8, 2, 7, 1, 1, 9, 7, 5, 9, 5, 2, 4, 10, 6, 1, 25, 3
4, 5, 12, 0...
$ YearsInCurrentRole <int> 4, 7, 0, 7, 2, 7, 0, 0, 7, 7, 4, 5, 2, 2, 2, 9, 2, 0, 8, 2, 2
3, 6, 0, 2,...
$ YearsSinceLastPromotion <int> 0, 1, 0, 3, 2, 3, 0, 0, 1, 7, 0, 0, 4, 1, 0, 8, 0, 0, 3, 1, 1
0, 2, 0, 1,...
$ YearsWithCurrManager <int> 5, 7, 0, 0, 2, 6, 0, 0, 8, 7, 3, 8, 3, 2, 3, 8, 5, 0, 7, 2, 3
3, 11, 0, 3...

```

```

> library(ggplot2)
> library(cowplot)
> theme_set(theme_cowplot())
> attr <- as.data.frame(attr)
> summary(attr)

```

	Age	Attrition	BusinessTravel	DailyRate	Departm
ent					
Min.	:18.00	No :1233	Non-Travel : 150	Min. : 102.0	Human Resources :
63					
1st Qu.:	:30.00	Yes: 237	Travel_Frequently: 277	1st Qu.: 465.0	Research & Development:9
61					
Median	:36.00		Travel_Rarely :1043	Median : 802.0	Sales :4
46					
Mean	:36.92			Mean : 802.5	
3rd Qu.:	:43.00			3rd Qu.:1157.0	
Max.	:60.00			Max. :1499.0	

DistanceFromHome	Education	EducationField	EnvironmentSatisfaction	Gender	HourlyRate
Min. : 1.000	1:170	Human Resources : 27	1:284	Female:588	Min.
1st Qu.: 2.000	2:282	Life Sciences :606	2:287	Male :882	1st Q
Median : 7.000	3:572	Marketing :159	3:453		Media
Mean : 9.193	4:398	Medical :464	4:446		Mean
3rd Qu.:14.000	5: 48	Other : 82			3rd Q
Max. :29.000		Technical Degree:132			Max.

JobInvolvement	JobLevel	JobRole	JobSatisfaction	MaritalStatus	MonthlyIncome
1: 83	1:543	Sales Executive :326	1:289	Divorced:327	Min.
2:375	2:534	Research Scientist :292	2:280	Married :673	1st Qu
3:868	3:218	Laboratory Technician :259	3:442	Single :470	Median
4:144	4:106	Manufacturing Director :145	4:459		Mean
5: 69		Healthcare Representative:131			3rd Qu
		Manager :102			Max.

MonthlyRate	NumCompaniesWorked	OverTime	PercentSalaryHike	PerformanceRating	RelationshipSatisfaction
Min. : 2094	Min. :0.000	No :1054	Min. :11.00	3:1244	1:276
1st Qu.: 8047	1st Qu.:1.000	Yes: 416	1st Qu.:12.00	4: 226	2:303
Median :14236	Median :2.000		Median :14.00		3:459
Mean :14313	Mean :2.693		Mean :15.21		4:432
3rd Qu.:20462	3rd Qu.:4.000		3rd Qu.:18.00		
Max. :26999	Max. :9.000		Max. :25.00		

StockOptionLevel	TotalWorkingYears	TrainingTimesLastYear	WorkLifeBalance	YearsAtCompany	YearsInCurrentRole
Min. : 0.000	Min. : 0.00	Min. :0.000	1: 80	Min. : 0.000	Min
1st Qu.: 2.000	1st Qu.: 6.00	1st Qu.:2.000	2:344	1st Qu.: 3.000	1st
Median : 3.000	Median :10.00	Median :3.000	3:893	Median : 5.000	Med
Mean : 4.229	Mean :11.28	Mean :2.799	4:153	Mean : 7.008	Mea
3rd Qu.: 7.000	3rd Qu.:15.00	3rd Qu.:3.000		3rd Qu.: 9.000	3rd
Max. :18.000	Max. :40.00	Max. :6.000		Max. :40.000	Max

YearsSinceLastPromotion	YearsWithCurrManager
Min. : 0.000	Min. : 0.000
1st Qu.: 0.000	1st Qu.: 2.000
Median : 1.000	Median : 3.000
Mean : 2.188	Mean : 4.123
3rd Qu.: 3.000	3rd Qu.: 7.000
Max. :15.000	Max. :17.000

```
> glimpse(attr)
observations: 1,470
```

Variables: 31

\$ Age	<int> 41, 49, 37, 33, 27, 32, 59, 30, 38, 36, 35, 29, 31, 34, 28, 2
9, 32, 22, 53...	
\$ Attrition	<fct> Yes, No, Yes, No, No, No, No, No, No, No, No, No, No, No, Yes
, No, No, No,...	
\$ BusinessTravel	<fct> Travel_Rarely, Travel_Frequently, Travel_Rarely, Travel_Frequ
ently, Travel...	
\$ DailyRate	<int> 1102, 279, 1373, 1392, 591, 1005, 1324, 1358, 216, 1299, 809,
153, 670, 13...	
\$ Department	<fct> Sales, Research & Development, Research & Development, Resear
ch & Developm...	
\$ DistanceFromHome	<int> 1, 8, 2, 3, 2, 2, 3, 24, 23, 27, 16, 15, 26, 19, 24, 21, 5, 1
6, 2, 2, 11, ...	
\$ Education	<fct> 2, 1, 2, 4, 1, 2, 3, 1, 3, 3, 3, 2, 1, 2, 3, 4, 2, 2, 4, 3, 2
, 4, 4, 2, 1,...	
\$ EducationField	<fct> Life Sciences, Life Sciences, Other, Life Sciences, Medical,
Life Sciences...	
\$ EnvironmentSatisfaction	<fct> 2, 3, 4, 4, 1, 4, 3, 4, 4, 3, 1, 4, 1, 2, 3, 2, 1, 4, 1, 4, 1
, 3, 1, 3, 2,...	
\$ Gender	<fct> Female, Male, Male, Female, Male, Male, Female, Male, Male, M
ale, Male, Fe...	
\$ HourlyRate	<int> 94, 61, 92, 56, 40, 79, 81, 67, 44, 94, 84, 49, 31, 93, 50, 5
1, 80, 96, 78...	
\$ JobInvolvement	<fct> 3, 2, 2, 3, 3, 3, 4, 3, 2, 3, 4, 2, 3, 3, 2, 4, 4, 4, 2, 3, 4
, 2, 3, 3, 3,...	
\$ JobLevel	<fct> 2, 2, 1, 1, 1, 1, 1, 1, 3, 2, 1, 2, 1, 1, 1, 3, 1, 1, 4, 1, 2
, 1, 3, 1, 1,...	
\$ JobRole	<fct> Sales Executive, Research Scientist, Laboratory Technician, R
esearch Scien...	
\$ JobSatisfaction	<fct> 4, 2, 3, 3, 2, 4, 1, 3, 3, 3, 2, 3, 3, 4, 3, 1, 2, 4, 4, 4, 3
, 1, 2, 4, 1,...	
\$ MaritalStatus	<fct> Single, Married, Single, Married, Married, Single, Married, D
ivorced, Sing...	
\$ MonthlyIncome	<int> 5993, 5130, 2090, 2909, 3468, 3068, 2670, 2693, 9526, 5237, 2
426, 4193, 29...	
\$ MonthlyRate	<int> 19479, 24907, 2396, 23159, 16632, 11864, 9964, 13335, 8787, 1
6577, 16479, ...	
\$ NumCompaniesWorked	<int> 8, 1, 6, 1, 9, 0, 4, 1, 0, 6, 0, 0, 1, 0, 5, 1, 0, 1, 2, 5, 0
, 7, 0, 1, 2,...	
\$ OverTime	<fct> Yes, No, Yes, Yes, No, No, Yes, No, No, No, No, Yes, No, No,
Yes, No, Yes,...	
\$ PercentsSalaryHike	<int> 11, 23, 15, 11, 12, 13, 20, 22, 21, 13, 13, 12, 17, 11, 14, 1
1, 12, 13, 16...	
\$ PerformanceRating	<fct> 3, 4, 3, 3, 3, 3, 4, 4, 4, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3
, 4, 3, 3, 3,...	
\$ RelationshipSatisfaction	<fct> 1, 4, 2, 3, 4, 3, 1, 2, 2, 2, 3, 4, 4, 3, 2, 3, 4, 2, 3, 3, 4
, 2, 3, 4, 3,...	
\$ StockOptionLevel	<fct> 0, 1, 0, 0, 1, 0, 3, 1, 0, 2, 1, 0, 1, 1, 0, 1, 2, 2, 0, 0, 1
, 0, 0, 0, 0,...	
\$ TotalWorkingYears	<int> 8, 10, 7, 8, 6, 8, 12, 1, 10, 17, 6, 10, 5, 3, 6, 10, 7, 1, 3
1, 6, 5, 10, ...	
\$ TrainingTimesLastYear	<int> 0, 3, 3, 3, 3, 2, 3, 2, 2, 3, 5, 3, 1, 2, 4, 1, 5, 2, 3, 3, 5
, 4, 4, 6, 2,...	
\$ WorkLifeBalance	<fct> 1, 3, 3, 3, 3, 2, 2, 3, 3, 2, 3, 3, 2, 3, 3, 2, 2, 3, 3, 2
, 3, 3, 3, 3,...	
\$ YearsAtCompany	<int> 6, 10, 0, 8, 2, 7, 1, 1, 9, 7, 5, 9, 5, 2, 4, 10, 6, 1, 25, 3
, 4, 5, 12, 0...	
\$ YearsInCurrentRole	<int> 4, 7, 0, 7, 2, 7, 0, 0, 7, 7, 4, 5, 2, 2, 2, 9, 2, 0, 8, 2, 2
, 3, 6, 0, 2,...	
\$ YearsSinceLastPromotion	<int> 0, 1, 0, 3, 2, 3, 0, 0, 1, 7, 0, 0, 4, 1, 0, 8, 0, 0, 3, 1, 1
, 0, 2, 0, 1,...	
\$ YearsWithCurrManager	<int> 5, 7, 0, 0, 2, 6, 0, 0, 8, 7, 3, 8, 3, 2, 3, 8, 5, 0, 7, 2, 3
, 3, 11, 0, 3...	

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375 -0.8001180158
379 1.7625499052
380 -0.8278680657
381 0.6201774973
392 -1.1330721730
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395 -1.2633832412
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410 -0.5391319547
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746	-0.4529771161
750	-0.9922729694
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783	-1.0585027627
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944	0.2618995747
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1003 0.4436764854
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1024 -0.3381309930
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1060 0.4217148557
1075 0.5457525577
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1092 -0.0418116100
1103 1.6838816228
1104 -0.5603983707
1105 0.4762673573
1111 1.6592743173
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1134 0.7492108511
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1150 0.3315487468
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1160 0.5749177347
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1170 0.8237097327
1172 3.1864271657
1177 -1.2206437180

1178 -1.2215180610
1180 -2.4653933430
1185 -2.1768971925
1187 2.0307067250
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1204 -1.1301592190
1207 -0.6748151676
1208 0.7964700774
1209 -2.1643829553
1210 -1.0792983966
1213 -0.3690588472
1217 -0.7685483698
1218 -1.2676031469
1229 -0.3403187924
1230 -0.2068275496
1234 -1.3030625930
1235 0.0277493744
1236 -0.5432532586
1239 0.8748042944
1245 0.6500129500
1253 0.2760285471
1260 -1.5677920127
1262 0.2386877764
1269 0.0416081884
1274 1.1459698338
1275 0.7935852644
1278 -0.4849496561
1282 0.7966266953
1283 -0.1040357913
1289 -3.2922387448
1292 0.0346052625
1298 0.9332181890
1299 -1.8261694676
1300 -2.8893555057
1305 -1.5253240379
1308 -1.0481353388
1311 0.8220528055
1315 -1.5032247143
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1329 -1.1919838107
1331 0.0394315891
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1345 -0.2737770383
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1351 -0.8475212366
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1366 2.7524830019
1367 0.8732532442
1370 1.3154784797
1372 -0.4950506540
1379 0.1249095167
1383 0.0920420374
1392 2.7519142533
1398 -1.5379828829
1412 1.1327811295
1419 0.2251038432
1420 0.3550654973
1423 1.3255259270
1427 1.5942048248
1429 0.1468891931
1430 0.0973613172
1435 0.2858266984
1447 -0.7113944739

```

1448 0.2284222885
1450 0.5004736099
1454 0.1181467674
1455 0.4324838590
1456 -0.1772018180
1458 -1.2745801306
1459 -0.8732835185
1468 -0.2501786015
> # Get the posteriors as a dataframe.
> attr_mda.lda.predict.posterioriors <- as.data.frame(attr_mda.lda.predict$posterior)#create ROC/AUC c
> pred <- prediction(attr_mda.lda.predict.posterioriors[,2], test_raw.df$Attrition)
> roc.perf = performance(pred, measure = "tpr", x.measure = "fpr")
> auc.train <- performance(pred, measure = "auc")
> auc.train <- auc.train@y.values
> plot(roc.perf)
> abline(a=0, b= 1)
> text(x = .25, y = .65 ,paste("AUC = ", round(auc.train[[1]],3), sep = ""))
>
>
>
> ##Logistic Regression
> library(ggplot2)
> library(cowplot)
> theme_set(theme_cowplot())
> attr <- as.data.frame(attr)
> summary(attr)

```

Age		Attrition		BusinessTravel		DailyRate		Department	
Min.	:18.00	No :1233		Non-Travel	: 150	Min.	: 102.0	Human Resources	: 63
1st Qu.:	:30.00	Yes: 237		Travel_Frequently:	277	1st Qu.:	: 465.0	Research & Development:	961
Median	:36.00			Travel_Rarely	:1043	Median	: 802.0	Sales	:446
Mean	:36.92					Mean	: 802.5		
3rd Qu.:	:43.00					3rd Qu.:	:1157.0		
Max.	:60.00					Max.	:1499.0		

DistanceFromHome		Education		EducationField		Environmentsatisfaction		Gender		HourlyRate	
Min.	: 1.000	1:170		Human Resources	: 27	1:284		Female:588		Min.	: 3
1st Qu.:	: 2.000	2:282		Life Sciences	:606	2:287		Male :882		1st Qu.:	: 4
Median	: 7.000	3:572		Marketing	:159	3:453				Median	: 6
Mean	: 9.193	4:398		Medical	:464	4:446				Mean	: 6
3rd Qu.:	:14.000	5: 48		Other	: 82					3rd Qu.:	: 8
Max.	:29.000			Technical Degree:	132					Max.	:10

JobInvolvement		JobLevel		JobRole		JobSatisfaction		MaritalStatus		MonthlyIncome	
1: 83		1:543		Sales Executive	:326	1:289		Divorced:327		Min.	: 10
2:375		2:534		Research Scientist	:292	2:280		Married :673		1st Qu.:	: 29
3:868		3:218		Laboratory Technician	:259	3:442		Single :470		Median	: 49
4:144		4:106		Manufacturing Director	:145	4:459				Mean	: 65
		5: 69		Healthcare Representative:	131					3rd Qu.:	: 83
				Manager	:102					Max.	:199
				(Other)	:215						

MonthlyRate		NumCompaniesWorked		OverTime		PercentSalaryHike		PerformanceRating		RelationshipSati	
Min.	: 2094	Min.	:0.000	No :1054		Min.	:11.00	3:1244		1:276	
1st Qu.:	: 8047	1st Qu.:	:1.000	Yes: 416		1st Qu.:	:12.00	4: 226		2:303	
Median	:14236	Median	:2.000			Median	:14.00			3:459	
Mean	:14313	Mean	:2.693			Mean	:15.21			4:432	
3rd Qu.:	:20462	3rd Qu.:	:4.000			3rd Qu.:	:18.00				
Max.	:26999	Max.	:9.000			Max.	:25.00				

StockOptionLevel		TotalWorkingYears		TrainingTimesLastYear		workLifeBalance		YearsAtCompany		YearsInC	
0:631		Min.	: 0.00	Min.	:0.000	1: 80		Min.	: 0.000	Min.	:
1:596		1st Qu.:	: 6.00	1st Qu.:	:2.000	2:344		1st Qu.:	: 3.000	1st Qu.:	:
2:158		Median	:10.00	Median	:3.000	3:893		Median	: 5.000	Median	:
3: 85		Mean	:11.28	Mean	:2.799	4:153		Mean	: 7.008	Mean	:

3rd Qu.:15.00 3rd Qu.:3.000
Max. :40.00 Max. :6.000

3rd Qu.: 9.000 3rd Qu.:
Max. :40.000 Max. :

YearsSinceLastPromotion YearswithCurrManager
Min. : 0.000 Min. : 0.000
1st Qu.: 0.000 1st Qu.: 2.000
Median : 1.000 Median : 3.000
Mean : 2.188 Mean : 4.123
3rd Qu.: 3.000 3rd Qu.: 7.000
Max. :15.000 Max. :17.000

> glimpse(attr)

Observations: 1,470

Variables: 31

\$ Age <int> 41, 49, 37, 33, 27, 32, 59, 30, 38, 36, 35, 29, 31, 34, 28, 29, 32
\$ Attrition <fct> Yes, No, Yes, No, No, No, No, No, No, No, No, No, No, No, Yes, No,
\$ BusinessTravel <fct> Travel_Rarely, Travel_Frequently, Travel_Rarely, Travel_Frequently
\$ DailyRate <int> 1102, 279, 1373, 1392, 591, 1005, 1324, 1358, 216, 1299, 809, 153,
\$ Department <fct> Sales, Research & Development, Research & Development, Research &
\$ DistanceFromHome <int> 1, 8, 2, 3, 2, 2, 3, 24, 23, 27, 16, 15, 26, 19, 24, 21, 5, 16, 2,
\$ Education <fct> 2, 1, 2, 4, 1, 2, 3, 1, 3, 3, 3, 2, 1, 2, 3, 4, 2, 2, 4, 3, 2, 4,
\$ EducationField <fct> Life Sciences, Life Sciences, Other, Life Sciences, Medical, Life
\$ EnvironmentSatisfaction <fct> 2, 3, 4, 4, 1, 4, 3, 4, 4, 3, 1, 4, 1, 2, 3, 2, 1, 4, 1, 4, 1, 3,
\$ Gender <fct> Female, Male, Male, Female, Male, Male, Female, Male, Male, Male,
\$ HourlyRate <int> 94, 61, 92, 56, 40, 79, 81, 67, 44, 94, 84, 49, 31, 93, 50, 51, 80,
\$ JobInvolvement <fct> 3, 2, 2, 3, 3, 3, 4, 3, 2, 3, 4, 2, 3, 3, 2, 4, 4, 4, 2, 3, 4, 2,
\$ JobLevel <fct> 2, 2, 1, 1, 1, 1, 1, 1, 3, 2, 1, 2, 1, 1, 1, 3, 1, 1, 4, 1, 2, 1,
\$ JobRole <fct> Sales Executive, Research Scientist, Laboratory Technician, Research
\$ JobSatisfaction <fct> 4, 2, 3, 3, 2, 4, 1, 3, 3, 3, 2, 3, 3, 4, 3, 1, 2, 4, 4, 4, 3, 1,
\$ MaritalStatus <fct> Single, Married, Single, Married, Married, Single, Married, Divorc
\$ MonthlyIncome <int> 5993, 5130, 2090, 2909, 3468, 3068, 2670, 2693, 9526, 5237, 2426,
\$ MonthlyRate <int> 19479, 24907, 2396, 23159, 16632, 11864, 9964, 13335, 8787, 16577,
\$ NumCompaniesWorked <int> 8, 1, 6, 1, 9, 0, 4, 1, 0, 6, 0, 0, 1, 0, 5, 1, 0, 1, 2, 5, 0, 7,
\$ OverTime <fct> Yes, No, Yes, Yes, No, No, Yes, No, No, No, No, No, Yes, No, No, Yes,
\$ PercentSalaryHike <int> 11, 23, 15, 11, 12, 13, 20, 22, 21, 13, 13, 12, 17, 11, 14, 11, 12,
\$ PerformanceRating <fct> 3, 4, 3, 3, 3, 3, 4, 4, 4, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 4,
\$ RelationshipSatisfaction <fct> 1, 4, 2, 3, 4, 3, 1, 2, 2, 2, 3, 4, 4, 3, 2, 3, 4, 2, 3, 3, 4, 2,
\$ StockOptionLevel <fct> 0, 1, 0, 0, 1, 0, 3, 1, 0, 2, 1, 0, 1, 1, 0, 1, 2, 2, 0, 0, 1, 0,
\$ TotalWorkingYears <int> 8, 10, 7, 8, 6, 8, 12, 1, 10, 17, 6, 10, 5, 3, 6, 10, 7, 1, 31, 6,
\$ TrainingTimesLastYear <int> 0, 3, 3, 3, 3, 2, 3, 2, 2, 3, 5, 3, 1, 2, 4, 1, 5, 2, 3, 3, 5, 4,
\$ WorkLifeBalance <fct> 1, 3, 3, 3, 3, 2, 2, 3, 3, 2, 3, 3, 2, 3, 3, 3, 2, 2, 3, 3, 2, 3,
\$ YearsAtCompany <int> 6, 10, 0, 8, 2, 7, 1, 1, 9, 7, 5, 9, 5, 2, 4, 10, 6, 1, 25, 3, 4,
\$ YearsInCurrentRole <int> 4, 7, 0, 7, 2, 7, 0, 0, 7, 7, 4, 5, 2, 2, 2, 9, 2, 0, 8, 2, 2, 3,
\$ YearsSinceLastPromotion <int> 0, 1, 0, 3, 2, 3, 0, 0, 1, 7, 0, 0, 4, 1, 0, 8, 0, 0, 3, 1, 1, 0,
\$ YearswithCurrManager <int> 5, 7, 0, 0, 2, 6, 0, 0, 8, 7, 3, 8, 3, 2, 3, 8, 5, 0, 7, 2, 3, 3,

> library(ggplot2)

> library(cowplot)

> theme_set(theme_cowplot())

> attr <- as.data.frame(attr)

> summary(attr)

Age	Attrition	BusinessTravel	DailyRate	Department
Min. :18.00	No :1233	Non-Travel : 150	Min. : 102.0	Human Resources : 63
1st Qu.:30.00	Yes: 237	Travel_Frequently: 277	1st Qu.: 465.0	Research & Development:961
Median :36.00		Travel_Rarely :1043	Median : 802.0	Sales :446
Mean :36.92			Mean : 802.5	
3rd Qu.:43.00			3rd Qu.:1157.0	
Max. :60.00			Max. :1499.0	

DistanceFromHome	Education	EducationField	EnvironmentSatisfaction	Gender	HourlyRa
Min. : 1.000	1:170	Human Resources : 27	1:284	Female:588	Min. : 3
1st Qu.: 2.000	2:282	Life Sciences :606	2:287	Male :882	1st Qu.: 4
Median : 7.000	3:572	Marketing :159	3:453		Median : 6
Mean : 9.193	4:398	Medical :464	4:446		Mean : 6
3rd Qu.:14.000	5: 48	Other : 82			3rd Qu.: 8

Max. :29.000 Technical Degree:132 Max. :10

JobInvolvement	JobLevel	JobRole	JobSatisfaction	MaritalStatus	MonthlyIncome
1: 83	1:543	Sales Executive :326	1:289	Divorced:327	Min. : 10
2:375	2:534	Research Scientist :292	2:280	Married :673	1st Qu.: 29
3:868	3:218	Laboratory Technician :259	3:442	Single :470	Median : 49
4:144	4:106	Manufacturing Director :145	4:459		Mean : 65
	5: 69	Healthcare Representative:131			3rd Qu.: 83
		Manager :102			Max. :199
		(Other) :215			

MonthlyRate	NumCompaniesWorked	OverTime	PercentSalaryHike	PerformanceRating	RelationshipSatisfaction
Min. : 2094	Min. :0.000	No :1054	Min. :11.00	3:1244	1:276
1st Qu.: 8047	1st Qu.:1.000	Yes: 416	1st Qu.:12.00	4: 226	2:303
Median :14236	Median :2.000		Median :14.00		3:459
Mean :14313	Mean :2.693		Mean :15.21		4:432
3rd Qu.:20462	3rd Qu.:4.000		3rd Qu.:18.00		
Max. :26999	Max. :9.000		Max. :25.00		

StockOptionLevel	TotalWorkingYears	TrainingTimesLastYear	WorkLifeBalance	YearsAtCompany	YearsInCompany
0:631	Min. : 0.00	Min. :0.000	1: 80	Min. : 0.000	Min. : 0.000
1:596	1st Qu.: 6.00	1st Qu.:2.000	2:344	1st Qu.: 3.000	1st Qu.: 3.000
2:158	Median :10.00	Median :3.000	3:893	Median : 5.000	Median : 5.000
3: 85	Mean :11.28	Mean :2.799	4:153	Mean : 7.008	Mean : 7.008
	3rd Qu.:15.00	3rd Qu.:3.000		3rd Qu.: 9.000	3rd Qu.: 9.000
	Max. :40.00	Max. :6.000		Max. :40.000	Max. :40.000

YearsSinceLastPromotion	YearsWithCurrManager
Min. : 0.000	Min. : 0.000
1st Qu.: 0.000	1st Qu.: 2.000
Median : 1.000	Median : 3.000
Mean : 2.188	Mean : 4.123
3rd Qu.: 3.000	3rd Qu.: 7.000
Max. :15.000	Max. :17.000

> glimpse(attr)

Observations: 1,470

Variables: 31

\$ Age	<int> 41, 49, 37, 33, 27, 32, 59, 30, 38, 36, 35, 29, 31, 34, 28, 29, 32
\$ Attrition	<fct> Yes, No, Yes, No, No, No, No, No, No, No, No, No, Yes, No, No
\$ BusinessTravel	<fct> Travel_Rarely, Travel_Frequently, Travel_Rarely, Travel_Frequently
\$ DailyRate	<int> 1102, 279, 1373, 1392, 591, 1005, 1324, 1358, 216, 1299, 809, 153,
\$ Department	<fct> Sales, Research & Development, Research & Development, Research &
\$ DistanceFromHome	<int> 1, 8, 2, 3, 2, 2, 3, 24, 23, 27, 16, 15, 26, 19, 24, 21, 5, 16, 2,
\$ Education	<fct> 2, 1, 2, 4, 1, 2, 3, 1, 3, 3, 3, 2, 1, 2, 3, 4, 2, 2, 4, 3, 2, 4,
\$ EducationField	<fct> Life Sciences, Life Sciences, Other, Life Sciences, Medical, Life
\$ EnvironmentSatisfaction	<fct> 2, 3, 4, 4, 1, 4, 3, 4, 4, 3, 1, 4, 1, 2, 3, 2, 1, 4, 1, 4, 1, 3,
\$ Gender	<fct> Female, Male, Male, Male, Female, Male, Male, Female, Male, Male,
\$ HourlyRate	<int> 94, 61, 92, 56, 40, 79, 81, 67, 44, 94, 84, 49, 31, 93, 50, 51, 80,
\$ JobInvolvement	<fct> 3, 2, 2, 3, 3, 3, 4, 3, 2, 3, 4, 2, 3, 3, 2, 4, 4, 4, 2, 3, 4, 2,
\$ JobLevel	<fct> 2, 2, 1, 1, 1, 1, 1, 1, 3, 2, 1, 2, 1, 1, 1, 3, 1, 1, 4, 1, 2, 1,
\$ JobRole	<fct> Sales Executive, Research Scientist, Laboratory Technician, Research
\$ JobSatisfaction	<fct> 4, 2, 3, 3, 2, 4, 1, 3, 3, 3, 2, 3, 4, 3, 1, 2, 4, 4, 3, 1,
\$ MaritalStatus	<fct> Single, Married, Single, Married, Married, Married, Single, Married, Divorced
\$ MonthlyIncome	<int> 5993, 5130, 2090, 2909, 3468, 3068, 2670, 2693, 9526, 5237, 2426,
\$ MonthlyRate	<int> 19479, 24907, 2396, 23159, 16632, 11864, 9964, 13335, 8787, 16577,
\$ NumCompaniesWorked	<int> 8, 1, 6, 1, 9, 0, 4, 1, 0, 6, 0, 0, 1, 0, 5, 1, 0, 1, 2, 5, 0, 7,
\$ OverTime	<fct> Yes, No, Yes, Yes, No, No, Yes, No, No, No, No, Yes, No, No, Yes,
\$ PercentSalaryHike	<int> 11, 23, 15, 11, 12, 13, 20, 22, 21, 13, 13, 12, 17, 11, 14, 11, 12,
\$ PerformanceRating	<fct> 3, 4, 3, 3, 3, 3, 4, 4, 4, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 4,
\$ RelationshipSatisfaction	<fct> 1, 4, 2, 3, 4, 3, 1, 2, 2, 2, 3, 4, 4, 3, 2, 3, 4, 2, 3, 3, 4, 2,
\$ StockOptionLevel	<fct> 0, 1, 0, 0, 1, 0, 3, 1, 0, 2, 1, 0, 1, 1, 0, 1, 2, 2, 0, 0, 1, 0,
\$ TotalWorkingYears	<int> 8, 10, 7, 8, 6, 8, 12, 1, 10, 17, 6, 10, 5, 3, 6, 10, 7, 1, 31, 6,
\$ TrainingTimesLastYear	<int> 0, 3, 3, 3, 3, 2, 3, 2, 2, 3, 5, 3, 1, 2, 4, 1, 5, 2, 3, 3, 5, 4,
\$ WorkLifeBalance	<fct> 1, 3, 3, 3, 3, 2, 2, 3, 3, 2, 3, 3, 2, 3, 3, 2, 2, 3, 3, 2, 3,

```

$ YearsAtCompany      <int> 6, 10, 0, 8, 2, 7, 1, 1, 9, 7, 5, 9, 5, 2, 4, 10, 6, 1, 25, 3, 4,
$ YearsInCurrentRole  <int> 4, 7, 0, 7, 2, 7, 0, 0, 7, 7, 4, 5, 2, 2, 2, 9, 2, 0, 8, 2, 2, 3,
$ YearsSinceLastPromotion <int> 0, 1, 0, 3, 2, 3, 0, 0, 1, 7, 0, 0, 4, 1, 0, 8, 0, 0, 3, 1, 1, 0,
$ YearsWithCurrManager <int> 5, 7, 0, 0, 2, 6, 0, 0, 8, 7, 3, 8, 3, 2, 3, 8, 5, 0, 7, 2, 3, 3,
> ##Checking relationships between our dependent variable and each of our independent categorical v
> xtabs(~Attrition+Age,data=attr)
      Age
Attrition 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47
      No    4  3  5  7 11 10 19 20 27 45 34 50 51 51 50 46 68 68 63 44 56 36 52 34 44 30 27 39 29 21
      Yes   4  6  6  6  5  4  7  6 12  3 14 18  9 18 11 12  9 10  6  6  2  6  5  6  2  2  6  2  4  3
      Age
Attrition 52 53 54 55 56 57 58 59 60
      No  15 17 18 19 11  4  9 10  5
      Yes   3  2  0  3  3  0  5  0  0
> xtabs(~Attrition+BusinessTravel,data=attr)
      BusinessTravel
Attrition Non-Travel Travel_Frequently Travel_Rarely
      No          138          208          887
      Yes           12           69          156
> xtabs(~Attrition+Department,data=attr)
      Department
Attrition Human Resources Research & Development Sales
      No              51              828       354
      Yes              12              133       92
> xtabs(~Attrition+DistanceFromHome,data=attr)
      DistanceFromHome
Attrition  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22
      No 182 183 70 55 55 52 73 70 67 75 25 14 13 17 21 25 15 22 19 21 15 13
      Yes  26  28 14  9 10  7 11 10 18 11  4  6  6  4  5  7  5  4  3  4  3  6
      DistanceFromHome
Attrition 26 27 28 29
      No  22  9 21 22
      Yes   3  3  2  5
> xtabs(~Attrition+Education,data=attr)
      Education
Attrition  1  2  3  4  5
      No 139 238 473 340 43
      Yes  31  44  99  58  5
> xtabs(~Attrition+EducationField,data=attr)
      EducationField
Attrition Human Resources Life Sciences Marketing Medical Other Technical Degree
      No              20              517       124       401       71       100
      Yes               7               89        35        63        11         32
> xtabs(~Attrition+EnvironmentSatisfaction,data=attr)
      EnvironmentSatisfaction
Attrition  1  2  3  4
      No 212 244 391 386
      Yes  72  43  62  60
> xtabs(~Attrition+Gender,data=attr)
      Gender
Attrition Female Male
      No       501  732
      Yes        87  150
> xtabs(~Attrition+HourlyRate,data=attr)
      HourlyRate
Attrition 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59
      No  19 13 20 16  7 17 13 15  9 13 16 19 28 20 17 19 20 14 23 16 10 17 21 12 21 13 22 21 12 20
      Yes   0  2  4  3  5  1  5  3  4  4  2  2  0  4  1  5  5  2  5  2  6  5  5  2  5  3  4  6  5  1
      HourlyRate
Attrition 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93
      No  15 17 22 16 12 11 10 15 20 19 18 19 18 18 21 21 20 19 20 21 22 12 18 25 18 11 17 16 22 13
      Yes   4  2  7  3  2  4  6  3  5  5  2  1  1  3  2  6  1  3  3  1  6  6  4  1  3  4  2  2  3  3
      HourlyRate
Attrition 98 99 100

```

```

      No 25 16 14
      Yes 3 4 5
> xtabs(~Attrition+JobInvolvement,data=attr)
      JobInvolvement
Attrition 1 2 3 4
      No 55 304 743 131
      Yes 28 71 125 13
> xtabs(~Attrition+JobLevel,data=attr)
      JobLevel
Attrition 1 2 3 4 5
      No 400 482 186 101 64
      Yes 143 52 32 5 5
> xtabs(~Attrition+JobRole,data=attr)
      JobRole
Attrition Healthcare Representative Human Resources Laboratory Technician Manager Manufacturing Dir
      No 122 40 197 97
      Yes 9 12 62 5
      JobRole
Attrition Research Director Research Scientist Sales Executive Sales Representative
      No 78 245 269 50
      Yes 2 47 57 33
> xtabs(~Attrition+JobSatisfaction,data=attr)
      JobSatisfaction
Attrition 1 2 3 4
      No 223 234 369 407
      Yes 66 46 73 52
> xtabs(~Attrition+MaritalStatus,data=attr)
      MaritalStatus
Attrition Divorced Married Single
      No 294 589 350
      Yes 33 84 120
> xtabs(~Attrition+MonthlyIncome,data=attr)
      MonthlyIncome
Attrition 1009 1051 1052 1081 1091 1102 1118 1129 1200 1223 1232 1261 1274 1281 1359 1393 1416 1420
      MonthlyIncome
Attrition 1555 1563 1569 1601 1611 1675 1702 1706 1790 1859 1878 1904 1951 2001 2007 2008 2011 2013
      MonthlyIncome
Attrition 2022 2024 2028 2029 2033 2042 2044 2045 2058 2061 2062 2064 2066 2070 2073 2074 2075 2080
      MonthlyIncome
Attrition 2088 2089 2090 2093 2096 2097 2099 2105 2107 2109 2115 2119 2121 2127 2132 2133 2141 2143
      MonthlyIncome
Attrition 2148 2153 2154 2157 2166 2168 2174 2176 2177 2180 2187 2194 2201 2206 2207 2210 2213 2216
      MonthlyIncome
Attrition 2226 2231 2232 2235 2238 2244 2258 2259 2267 2269 2270 2272 2274 2275 2277 2279 2285 2288
      MonthlyIncome
Attrition 2293 2296 2297 2302 2305 2306 2307 2308 2311 2313 2314 2318 2319 2321 2322 2323 2325 2326
      MonthlyIncome
Attrition 2332 2335 2339 2340 2341 2342 2345 2348 2351 2356 2362 2366 2367 2368 2370 2372 2373 2376
      MonthlyIncome
Attrition 2380 2387 2389 2394 2398 2400 2404 2406 2408 2413 2422 2426 2430 2432 2436 2437 2438 2439
      MonthlyIncome
Attrition 2451 2455 2461 2468 2472 2476 2478 2479 2496 2500 2501 2506 2514 2515 2517 2519 2523 2532
      MonthlyIncome
Attrition 2543 2544 2546 2552 2553 2559 2561 2564 2566 2570 2571 2572 2576 2579 2580 2585 2587 2592
      MonthlyIncome
Attrition 2600 2610 2613 2619 2622 2625 2632 2642 2644 2645 2647 2654 2655 2657 2659 2660 2661 2662
      MonthlyIncome
Attrition 2679 2683 2684 2686 2690 2691 2693 2694 2695 2696 2700 2703 2705 2706 2707 2713 2716 2718
      MonthlyIncome
Attrition 2725 2728 2741 2742 2743 2756 2759 2760 2766 2768 2773 2774 2778 2781 2782 2783 2785 2789
      MonthlyIncome
Attrition 2794 2795 2799 2800 2804 2809 2810 2811 2814 2818 2819 2821 2827 2835 2836 2837 2838 2844
      MonthlyIncome
Attrition 2856 2858 2859 2862 2863 2867 2871 2875 2886 2889 2897 2899 2904 2909 2911 2926 2929 2932

```

Attrition	MonthlyIncome	2936	2942	2950	2956	2960	2966	2972	2973	2974	2976	2977	2979	2983	2991	2994	2996	3022	3033
Attrition	MonthlyIncome	3041	3055	3057	3058	3065	3067	3068	3069	3072	3102	3117	3131	3140	3143	3149	3161	3162	3172
Attrition	MonthlyIncome	3196	3201	3202	3204	3210	3211	3212	3221	3229	3230	3280	3291	3294	3295	3298	3306	3310	3312
Attrition	MonthlyIncome	3346	3348	3375	3376	3377	3388	3407	3408	3419	3420	3423	3424	3433	3441	3445	3447	3448	3452
Attrition	MonthlyIncome	3477	3479	3482	3485	3491	3500	3505	3506	3517	3537	3539	3540	3544	3564	3578	3579	3580	3591
Attrition	MonthlyIncome	3617	3622	3629	3633	3646	3660	3669	3673	3681	3688	3690	3691	3692	3697	3702	3708	3722	3730
Attrition	MonthlyIncome	3748	3755	3760	3761	3780	3785	3812	3815	3816	3833	3838	3867	3875	3886	3894	3902	3904	3907
Attrition	MonthlyIncome	3920	3929	3931	3936	3944	3955	3968	3975	3977	3978	3983	3986	3989	4000	4001	4011	4014	4025
Attrition	MonthlyIncome	4033	4035	4037	4051	4066	4069	4071	4078	4081	4084	4087	4089	4103	4105	4107	4108	4115	4127
Attrition	MonthlyIncome	4157	4162	4163	4171	4187	4189	4193	4194	4197	4198	4200	4213	4221	4227	4230	4233	4240	4244
Attrition	MonthlyIncome	4257	4258	4260	4262	4272	4284	4285	4286	4294	4298	4302	4306	4312	4317	4319	4320	4323	4325
Attrition	MonthlyIncome	4335	4342	4345	4364	4373	4374	4377	4381	4382	4385	4393	4400	4401	4403	4404	4420	4422	4424
Attrition	MonthlyIncome	4440	4444	4447	4448	4449	4450	4465	4477	4478	4485	4487	4490	4502	4505	4507	4508	4522	4523
Attrition	MonthlyIncome	4538	4539	4541	4553	4554	4556	4558	4559	4568	4577	4581	4591	4599	4601	4614	4615	4617	4621
Attrition	MonthlyIncome	4647	4648	4649	4661	4663	4668	4678	4680	4682	4684	4695	4707	4717	4721	4723	4724	4728	4735
Attrition	MonthlyIncome	4741	4759	4765	4766	4768	4771	4774	4775	4777	4779	4787	4788	4789	4805	4809	4810	4821	4834
Attrition	MonthlyIncome	4851	4855	4859	4869	4876	4877	4878	4883	4898	4900	4907	4908	4930	4936	4941	4950	4960	4963
Attrition	MonthlyIncome	4978	4998	4999	5003	5006	5010	5021	5033	5042	5055	5056	5063	5067	5070	5071	5079	5087	5093
Attrition	MonthlyIncome	5121	5126	5130	5131	5147	5151	5154	5155	5160	5163	5171	5175	5204	5206	5207	5208	5209	5210
Attrition	MonthlyIncome	5231	5237	5238	5249	5253	5257	5258	5265	5294	5295	5296	5301	5304	5309	5321	5324	5326	5329
Attrition	MonthlyIncome	5343	5346	5347	5363	5368	5373	5376	5377	5380	5381	5390	5396	5399	5405	5406	5410	5415	5429
Attrition	MonthlyIncome	5441	5454	5460	5467	5468	5470	5472	5473	5476	5482	5484	5485	5486	5487	5488	5505	5507	5538
Attrition	MonthlyIncome	5577	5582	5593	5605	5617	5647	5660	5661	5666	5673	5674	5675	5677	5679	5689	5714	5715	5731
Attrition	MonthlyIncome	5744	5745	5747	5762	5765	5768	5769	5770	5772	5775	5810	5811	5813	5828	5855	5869	5878	5902
Attrition	MonthlyIncome	5915	5916	5933	5940	5957	5968	5974	5980	5985	5993	6029	6032	6062	6074	6077	6091	6118	6120
Attrition	MonthlyIncome	6134	6142	6146	6151	6162	6172	6179	6180	6201	6209	6214	6220	6230	6232	6244	6261	6272	6274
Attrition	MonthlyIncome	6306	6322	6323	6334	6347	6349	6377	6380	6384	6385	6388	6389	6392	6397	6410	6430	6434	6439
Attrition	MonthlyIncome	6472	6474	6499	6500	6502	6513	6516	6524	6538	6540	6545	6549	6553	6567	6577	6578	6582	6583
Attrition	MonthlyIncome	6632	6644	6646	6651	6652	6653	6667	6673	6674	6687	6694	6696	6712	6725	6728	6735	6755	6781
Attrition	MonthlyIncome	6799	6804	6811	6812	6815	6825	6833	6834	6842	6852	6854	6861	6870	6877	6883	6893	6929	6931
Attrition	MonthlyIncome	6962	7005	7082	7083	7094	7104	7119	7140	7143	7260	7264	7295	7314	7336	7351	7379	7403	7406
Attrition	MonthlyIncome	7441	7446	7457	7484	7491	7510	7525	7547	7553	7587	7596	7625	7632	7637	7639	7642	7644	7654

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MonthlyIncome
Attrition 7756 7779 7823 7847 7861 7879 7880 7898 7918 7945 7969 7978 7988 7991 8008 8020 8095 8103
MonthlyIncome
Attrition 8189 8224 8237 8268 8321 8346 8376 8380 8381 8392 8396 8412 8446 8463 8474 8500 8564 8578
MonthlyIncome
Attrition 8621 8628 8633 8639 8686 8722 8726 8740 8789 8793 8823 8834 8837 8847 8853 8858 8865 8926
MonthlyIncome
Attrition 8966 8998 9069 9071 9094 9204 9208 9241 9250 9278 9355 9362 9380 9396 9419 9434 9439 9525
MonthlyIncome
Attrition 9582 9602 9610 9613 9619 9637 9667 9679 9699 9705 9713 9714 9715 9724 9725 9738 9756 9824
MonthlyIncome
Attrition 9884 9888 9907 9924 9936 9950 9957 9980 9981 9985 9991 9998 10008 10048 10096 10124 10169
MonthlyIncome
Attrition 10231 10239 10248 10252 10266 10274 10306 10312 10322 10325 10333 10368 10377 10388 10400
MonthlyIncome
Attrition 10445 10447 10448 10453 10466 10475 10482 10496 10502 10512 10527 10552 10596 10609 10648
MonthlyIncome
Attrition 10685 10686 10725 10739 10748 10761 10793 10798 10820 10845 10851 10854 10855 10880 10883
MonthlyIncome
Attrition 10932 10934 10938 10965 10976 10999 11031 11103 11159 11244 11245 11416 11510 11557 11631
MonthlyIncome
Attrition 11836 11849 11878 11904 11916 11935 11957 11994 11996 12031 12061 12169 12185 12490 12504
MonthlyIncome
Attrition 12936 12965 13116 13120 13142 13191 13194 13206 13212 13225 13237 13245 13247 13269 13320
MonthlyIncome
Attrition 13402 13458 13464 13496 13499 13503 13525 13549 13570 13577 13582 13591 13603 13610 13664
MonthlyIncome
Attrition 13726 13734 13744 13757 13758 13770 13826 13872 13964 13966 13973 14026 14118 14275 14336
MonthlyIncome
Attrition 14756 14814 14852 15202 15379 15402 15427 15787 15972 15992 16015 16032 16064 16124 16184
MonthlyIncome
Attrition 16328 16413 16422 16437 16555 16595 16598 16606 16627 16659 16704 16752 16756 16792 16799
MonthlyIncome
Attrition 16856 16872 16880 16885 16959 17007 17046 17048 17068 17099 17123 17159 17169 17174 17181
MonthlyIncome
Attrition 17426 17444 17465 17567 17584 17603 17639 17650 17665 17779 17856 17861 17875 17924 18041
MonthlyIncome
Attrition 18200 18213 18265 18300 18303 18430 18606 18665 18711 18722 18740 18789 18824 18844 18880
MonthlyIncome
Attrition 19038 19045 19049 19068 19081 19094 19141 19144 19161 19187 19189 19190 19197 19202 19232
MonthlyIncome
Attrition 19272 19328 19331 19392 19406 19419 19431 19436 19502 19513 19517 19537 19545 19566 19586
MonthlyIncome
Attrition 19627 19636 19658 19665 19701 19717 19740 19833 19845 19847 19859 19926 19943 19973 19999
[ reached getOption("max.print") -- omitted 2 rows ]
> xtabs(~Attrition+MonthlyRate,data=attr)
MonthlyRate
Attrition 2094 2097 2104 2112 2122 2125 2137 2227 2243 2253 2261 2288 2302 2323 2326 2338 2354 2373
MonthlyRate
Attrition 2447 2493 2539 2560 2561 2613 2671 2689 2690 2706 2721 2725 2739 2755 2819 2823 2845 2851
MonthlyRate
Attrition 2912 2939 2967 2975 2993 2997 3010 3020 3031 3032 3064 3072 3088 3119 3129 3140 3142 3156
MonthlyRate
Attrition 3173 3193 3208 3297 3300 3334 3335 3339 3356 3372 3376 3395 3415 3423 3425 3427 3445 3449
MonthlyRate
Attrition 3487 3498 3525 3536 3549 3567 3622 3666 3687 3692 3698 3708 3735 3787 3809 3810 3811 3835
MonthlyRate
Attrition 3872 3909 3921 3956 3974 3987 3995 4009 4022 4050 4051 4060 4077 4156 4161 4167 4185 4187
MonthlyRate
Attrition 4235 4244 4257 4258 4267 4279 4284 4297 4303 4306 4317 4344 4345 4349 4381 4386 4488 4510
MonthlyRate
Attrition 4585 4605 4609 4652 4658 4668 4673 4681 4732 4759 4761 4809 4814 4821 4824 4892 4905 4910
MonthlyRate
Attrition 4956 4973 4981 4992 5013 5033 5041 5044 5050 5083 5099 5100 5118 5141 5151 5174 5182 5197

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	MonthlyRate																	
Attrition	5220	5224	5228	5242	5268	5288	5323	5335	5340	5348	5355	5388	5404	5411	5431	5456	5494	5518
	MonthlyRate																	
Attrition	5543	5549	5561	5569	5586	5594	5596	5598	5602	5615	5626	5628	5630	5640	5652	5678	5696	5711
	MonthlyRate																	
Attrition	5771	5829	5843	5855	5860	5868	5869	5915	5949	5970	5972	5982	6004	6009	6020	6039	6054	6060
	MonthlyRate																	
Attrition	6076	6110	6148	6152	6153	6161	6163	6179	6194	6208	6217	6219	6225	6227	6233	6297	6311	6319
	MonthlyRate																	
Attrition	6420	6462	6499	6527	6582	6595	6599	6615	6645	6670	6672	6689	6698	6705	6729	6759	6762	6770
	MonthlyRate																	
Attrition	6865	6881	6889	6896	6927	6950	6961	6975	6984	6986	6992	7003	7018	7060	7100	7102	7103	7108
	MonthlyRate																	
Attrition	7143	7152	7160	7172	7181	7192	7246	7259	7288	7298	7324	7331	7346	7360	7389	7419	7428	7439
	MonthlyRate																	
Attrition	7507	7508	7530	7551	7568	7621	7636	7653	7660	7677	7679	7693	7703	7713	7739	7744	7747	7770
	MonthlyRate																	
Attrition	7815	7824	7858	7909	7914	7950	7973	7975	7999	8007	8018	8039	8040	8045	8053	8059	8191	8192
	MonthlyRate																	
Attrition	8232	8269	8277	8302	8306	8318	8319	8346	8386	8392	8416	8423	8429	8450	8456	8489	8504	8509
	MonthlyRate																	
Attrition	8552	8556	8571	8635	8658	8733	8751	8758	8770	8787	8800	8828	8841	8842	8847	8861	8863	8870
	MonthlyRate																	
Attrition	8931	8935	8952	8978	8984	8989	9051	9060	9068	9075	9096	9100	9125	9128	9129	9148	9150	9192
	MonthlyRate																	
Attrition	9250	9255	9256	9260	9262	9277	9278	9282	9314	9358	9364	9369	9396	9489	9490	9518	9528	9541
	MonthlyRate																	
Attrition	9606	9647	9655	9659	9679	9687	9696	9697	9724	9731	9732	9752	9755	9769	9834	9867	9873	9931
	MonthlyRate																	
Attrition	9947	9953	9961	9964	9973	9977	9983	10007	10022	10034	10036	10056	10074	10077	10084	10092		
	MonthlyRate																	
Attrition	10195	10205	10224	10225	10227	10228	10261	10268	10293	10302	10310	10322	10332	10333	10339			
	MonthlyRate																	
Attrition	10415	10425	10436	10494	10503	10515	10531	10554	10557	10558	10589	10642	10675	10697	10732			
	MonthlyRate																	
Attrition	10778	10781	10826	10842	10846	10849	10877	10893	10901	10910	10919	10942	10950	11005	11012			
	MonthlyRate																	
Attrition	11092	11133	11135	11141	11148	11162	11179	11189	11262	11275	11288	11309	11314	11354	11373			
	MonthlyRate																	
Attrition	11439	11473	11479	11512	11533	11535	11539	11563	11585	11591	11652	11677	11693	11737	11740			
	MonthlyRate																	
Attrition	11781	11806	11825	11827	11864	11866	11868	11873	11879	11882	11912	11924	11925	11929	11934			
	MonthlyRate																	
Attrition	12023	12066	12069	12086	12090	12102	12106	12124	12127	12145	12147	12154	12227	12241	12250			
	MonthlyRate																	
Attrition	12287	12288	12290	12291	12313	12315	12355	12368	12388	12392	12414	12421	12430	12449	12477			
	MonthlyRate																	
Attrition	12549	12682	12695	12719	12740	12761	12826	12828	12832	12853	12858	12862	12888	12916	12930			
	MonthlyRate																	
Attrition	12982	12992	13008	13022	13035	13072	13084	13119	13137	13192	13243	13248	13251	13257	13273			
	MonthlyRate																	
Attrition	13335	13339	13352	13364	13384	13401	13402	13421	13422	13430	13436	13492	13493	13494	13514			
	MonthlyRate																	
Attrition	13547	13551	13554	13556	13583	13586	13588	13596	13624	13637	13672	13684	13693	13738	13755			
	MonthlyRate																	
Attrition	13848	13871	13888	13934	13938	13939	13943	13953	13970	13982	13983	14004	14011	14034	14039			
	MonthlyRate																	
Attrition	14115	14120	14168	14180	14199	14218	14222	14229	14242	14255	14284	14293	14295	14363	14369			
	MonthlyRate																	
Attrition	14394	14399	14408	14460	14470	14506	14511	14561	14590	14618	14630	14669	14674	14720	14753			
	MonthlyRate																	
Attrition	14811	14814	14842	14862	14864	14871	14908	14922	14935	14947	14961	14977	15000	15053	15062			
	MonthlyRate																	
Attrition	15170	15174	15178	15182	15211	15232	15238	15276	15302	15318	15322	15332	15346	15395	15397			

Attrition	MonthlyRate	15428	15434	15471	15480	15497	15530	15587	15589	15596	15624	15669	15678	15682	15696	15701
Attrition	MonthlyRate	15747	15748	15813	15815	15830	15834	15850	15869	15881	15891	15896	15901	15919	15963	15970
Attrition	MonthlyRate	15986	15998	15999	16002	16019	16031	16044	16047	16090	16092	16102	16117	16130	16143	16154
Attrition	MonthlyRate	16193	16213	16225	16280	16290	16292	16321	16340	16346	16374	16375	16376	16379	16392	16439
Attrition	MonthlyRate	16490	16495	16523	16530	16542	16571	16577	16586	16612	16616	16620	16632	16642	16673	16701
Attrition	MonthlyRate	16840	16873	16885	16900	16901	16928	16985	16998	17000	17001	17011	17053	17056	17071	17078
Attrition	MonthlyRate	17119	17171	17181	17198	17205	17218	17231	17235	17241	17251	17258	17285	17312	17323	17334
Attrition	MonthlyRate	17369	17381	17433	17434	17456	17477	17485	17491	17519	17536	17544	17588	17616	17624	17654
Attrition	MonthlyRate	17689	17725	17736	17747	17759	17778	17783	17799	17802	17808	17810	17822	17852	17872	17881
Attrition	MonthlyRate	17970	17997	18016	18024	18079	18089	18092	18103	18115	18154	18168	18203	18235	18256	18264
Attrition	MonthlyRate	18384	18385	18398	18410	18420	18437	18500	18575	18597	18611	18624	18625	18640	18659	18685
Attrition	MonthlyRate	18698	18706	18725	18767	18775	18779	18783	18787	18798	18830	18863	18869	18899	18938	18959
Attrition	MonthlyRate	19028	19100	19106	19121	19124	19146	19170	19188	19191	19196	19225	19239	19246	19255	19271
Attrition	MonthlyRate	19294	19299	19305	19332	19345	19368	19373	19383	19384	19394	19461	19479	19494	19519	19555
Attrition	MonthlyRate	19566	19573	19588	19609	19627	19630	19655	19658	19665	19682	19711	19715	19719	19730	19737
Attrition	MonthlyRate	19764	19783	19788	19805	19826	19863	19877	19899	19905	19911	19920	19921	19944	19948	19982
Attrition	MonthlyRate	20003	20006	20100	20115	20156	20161	20165	20206	20232	20234	20251	20260	20284	20293	20308
Attrition	MonthlyRate	20335	20338	20364	20366	20392	20420	20431	20439	20445	20460	20462	20467	20471	20489	20490
Attrition	MonthlyRate	20586	20619	20623	20652	20682	20689	20715	20739	20750	20763	20794	20898	20925	20933	20938
Attrition	MonthlyRate	20978	20989	20990	21016	21026	21029	21030	21057	21072	21075	21081	21082	21086	21123	21141
Attrition	MonthlyRate	21158	21173	21195	21196	21199	21203	21214	21221	21222	21293	21378	21412	21436	21437	21445
Attrition	MonthlyRate	21495	21509	21519	21526	21530	21534	21602	21624	21630	21632	21643	21653	21698	21703	21708
Attrition	MonthlyRate	21777	21782	21813	21816	21821	21829	21831	21833	21922	21923	21972	21981	22002	22021	22049
Attrition	MonthlyRate	22074	22087	22088	22098	22102	22107	22128	22149	22154	22162	22174	22217	22245	22262	22266
Attrition	MonthlyRate	22376	22384	22422	22455	22456	22474	22477	22478	22482	22490	22495	22534	22539	22553	22573
Attrition	MonthlyRate	22589	22604	22645	22650	22653	22656	22670	22673	22710	22722	22789	22792	22794	22807	22808
Attrition	MonthlyRate	22825	22845	22887	22908	22914	22929	22930	22949	22952	22955	22957	22967	22977	22984	23016
Attrition	MonthlyRate	23070	23099	23159	23163	23177	23213	23231	23238	23258	23281	23288	23293	23300	23333	23343
Attrition	MonthlyRate	23364	23371	23384	23398	23402	23413	23428	23447	23452	23457	23474	23490	23522	23537	23553
Attrition	MonthlyRate	23648	23679	23683	23687	23726	23737	23757	23772	23779	23785	23793	23814	23826	23844	23848
Attrition	MonthlyRate	23910	23914	23965	23978	24001	24008	24017	24032	24052	24097	24117	24118	24152	24162	24164
Attrition	MonthlyRate	24223	24232	24252	24301	24375	24406	24409	24439	24440	24442	24444	24447	24450	24456	24483


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MonthlyRate
Attrition 24539 24558 24594 24608 24609 24619 24624 24666 24668 24737 24785 24788 24793 24795 24812
MonthlyRate
Attrition 24907 24920 24941 24978 25043 25063 25098 25103 25150 25166 25174 25178 25198 25233 25258
MonthlyRate
Attrition 25291 25308 25326 25348 25353 25388 25412 25422 25440 25470 25479 25518 25527 25549 25592
MonthlyRate
Attrition 25657 25681 25713 25725 25751 25755 25761 25796 25800 25811 25812 25846 25927 25949 25952
MonthlyRate
Attrition 26062 26075 26076 26085 26092 26124 26176 26186 26204 26227 26236 26250 26278 26283 26285
MonthlyRate
Attrition 26314 26342 26362 26376 26427 26458 26493 26496 26507 26537 26542 26551 26582 26589 26619
MonthlyRate
Attrition 26767 26820 26841 26849 26862 26894 26897 26914 26933 26956 26959 26968 26997 26999
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> xtabs(~Attrition+OverTime,data=attr)
OverTime
Attrition No Yes
No 944 289
Yes 110 127
> xtabs(~Attrition+PercentSalaryHike,data=attr)
PercentSalaryHike
Attrition 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
No 169 165 175 177 83 64 68 76 67 48 43 44 22 15 17
Yes 41 33 34 24 18 14 14 13 9 7 5 12 6 6 1
> xtabs(~Attrition+PerformanceRating,data=attr)
PerformanceRating
Attrition 3 4
No 1044 189
Yes 200 37
> xtabs(~Attrition+RelationshipSatisfaction,data=attr)
RelationshipSatisfaction
Attrition 1 2 3 4
No 219 258 388 368
Yes 57 45 71 64
> xtabs(~Attrition+StockOptionLevel,data=attr)
StockOptionLevel
Attrition 0 1 2 3
No 477 540 146 70
Yes 154 56 12 15
> xtabs(~Attrition+TotalWorkingYears,data=attr)
TotalWorkingYears
Attrition 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21
No 6 41 22 33 51 72 103 63 87 86 177 29 43 33 27 35 34 30 23 19 28 33
Yes 5 40 9 9 12 16 22 18 16 10 25 7 5 3 4 5 3 3 4 3 2 1
TotalWorkingYears
Attrition 25 26 27 28 29 30 31 32 33 34 35 36 37 38 40
No 13 13 7 13 10 7 8 9 6 4 3 6 4 1 0
Yes 1 1 0 1 0 0 1 0 1 1 0 0 0 0 2
> xtabs(~Attrition+TrainingTimesLastYear,data=attr)
TrainingTimesLastYear
Attrition 0 1 2 3 4 5 6
No 39 62 449 422 97 105 59
Yes 15 9 98 69 26 14 6
> xtabs(~Attrition+YearsAtCompany,data=attr)
YearsAtCompany
Attrition 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21
No 28 112 100 108 91 175 67 79 71 74 102 30 14 22 16 19 11 8 12 10 26 13
Yes 16 59 27 20 19 21 9 11 9 8 18 2 0 2 2 1 1 1 1 1 1
YearsAtCompany
Attrition 25 26 27 29 30 31 32 33 34 36 37 40
No 4 4 2 2 1 2 2 4 1 2 1 0
Yes 0 0 0 0 0 1 1 1 0 0 0 1
> xtabs(~Attrition+YearsInCurrentRole,data=attr)

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YearsInCurrentRole
Attrition 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
No 171 46 304 119 89 35 35 191 82 61 27 22 9 13 10 6 7 4 2
Yes 73 11 68 16 15 1 2 31 7 6 2 0 1 1 1 2 0 0 0

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```
> xtabs(~Attrition+YearsSinceLastPromotion,data=attr)
```

```

YearsSinceLastPromotion
Attrition 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
No 471 308 132 43 56 43 26 60 18 13 5 22 10 8 8 10
Yes 110 49 27 9 5 2 6 16 0 4 1 2 0 2 1 3

```

```
> xtabs(~Attrition+WorkLifeBalance,data=attr)
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WorkLifeBalance
Attrition 1 2 3 4
No 55 286 766 126
Yes 25 58 127 27

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```
> xtabs(~Attrition+YearsWithCurrManager,data=attr)
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```

YearsWithCurrManager
Attrition 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17
No 178 65 294 123 87 27 25 185 97 58 24 21 18 14 3 5 2 7
Yes 85 11 50 19 11 4 4 31 10 6 3 1 0 0 2 0 0 0

```

```
> ##Checking relationships between our dependent variable and each of our independent categorical variables
```

```
> xtabs(~Attrition+BusinessTravel,data=attr)
```

```

BusinessTravel
Attrition Non-Travel Travel_Frequently Travel_Rarely
No 138 208 887
Yes 12 69 156

```

```
> xtabs(~Attrition+Department,data=attr)
```

```

Department
Attrition Human Resources Research & Development Sales
No 51 828 354
Yes 12 133 92

```

```
> xtabs(~Attrition+Education,data=attr)
```

```

Education
Attrition 1 2 3 4 5
No 139 238 473 340 43
Yes 31 44 99 58 5

```

```
> xtabs(~Attrition+EducationField,data=attr)
```

```

EducationField
Attrition Human Resources Life Sciences Marketing Medical Other Technical Degree
No 20 517 124 401 71 100
Yes 7 89 35 63 11 32

```

```
> xtabs(~Attrition+EnvironmentSatisfaction,data=attr)
```

```

EnvironmentSatisfaction
Attrition 1 2 3 4
No 212 244 391 386
Yes 72 43 62 60

```

```
> xtabs(~Attrition+Gender,data=attr)
```

```

Gender
Attrition Female Male
No 501 732
Yes 87 150

```

```
> xtabs(~Attrition+JobInvolvement,data=attr)
```

```

JobInvolvement
Attrition 1 2 3 4
No 55 304 743 131
Yes 28 71 125 13

```

```
> xtabs(~Attrition+JobLevel,data=attr)
```

```

JobLevel
Attrition 1 2 3 4 5
No 400 482 186 101 64
Yes 143 52 32 5 5

```

```
> xtabs(~Attrition+JobRole,data=attr)
```

```

JobRole
Attrition Healthcare Representative Human Resources Laboratory Technician Manager Manufacturing Director
No 122 40 197 97

```

	Yes		9		12		62		5
JobRole									
Attrition	Research	Director	Research	Scientist	Sales	Executive	Sales	Representative	
No			78		245		269		50
Yes			2		47		57		33

```
> xtabs(~Attrition+JobSatisfaction,data=attr)
```

	JobSatisfaction			
Attrition	1	2	3	4
No	223	234	369	407
Yes	66	46	73	52

```
> xtabs(~Attrition+MaritalStatus,data=attr)
```

	MaritalStatus		
Attrition	Divorced	Married	Single
No	294	589	350
Yes	33	84	120

```
> xtabs(~Attrition+OverTime,data=attr)
```

	OverTime	
Attrition	No	Yes
No	944	289
Yes	110	127

```
> xtabs(~Attrition+PerformanceRating,data=attr)
```

	PerformanceRating	
Attrition	3	4
No	1044	189
Yes	200	37

```
> xtabs(~Attrition+RelationshipSatisfaction,data=attr)
```

	RelationshipSatisfaction			
Attrition	1	2	3	4
No	219	258	388	368
Yes	57	45	71	64

```
> xtabs(~Attrition+StockOptionLevel,data=attr)
```

	StockOptionLevel			
Attrition	0	1	2	3
No	477	540	146	70
Yes	154	56	12	15

```
> xtabs(~Attrition+WorkLifeBalance,data=attr)
```

	WorkLifeBalance			
Attrition	1	2	3	4
No	55	286	766	126
Yes	25	58	127	27

```
> #By the above we can see that the independent variables Education and EducationFeild do not have the dependent variable-Attrition.
```

```
> #Hence, we will create 2 logistic models. One simple model, which will not include the independent variables Education and EducationFeild and
```

```
> #The other model, which will include all independent variables
```

```
> attach(attr)
```

```
The following objects are masked from attr (pos = 3):
```

```
Age, Attrition, BusinessTravel, DailyRate, Department, DistanceFromHome, Education, EducationField, EnvironmentSatisfaction, Gender, HourlyRate, JobInvolvement, JobLevel, JobRole, JobSatisfaction, MaritalStatus, MonthlyIncome, MonthlyRate, NumCompaniesWorked, OverTime, PercentSalaryHike, PerformanceRating, RelationshipSatisfaction, StockOptionLevel, TotalWorkingYears, TrainingTimesLastYear, WorkLifeBalance, YearsAtCompany, YearsInCurrentRole, YearsSinceLastPromotion, YearsWithCurrManager
```

```
> logistic_simple <- glm(Attrition~BusinessTravel+Department+Education+EducationField+EnvironmentSatisfaction+JobInvolvement+JobLevel+JobRole+JobSatisfaction+MaritalStatus+OverTime+PerformanceRating+RelationshipSatisfaction+StockOptionLevel+WorkLifeBalance, data=attr, family="binomial")
> summary(logistic_simple)
```

```
Call:
```

```
glm(formula = Attrition ~ BusinessTravel + Department + Education + EducationField + EnvironmentSatisfaction + Gender + JobInvolvement + JobLevel + JobRole + JobSatisfaction + MaritalStatus + OverTime +
```

PerformanceRating + RelationshipsSatisfaction + StockOptionLevel +
WorkLifeBalance, family = "binomial", data = attr)

Deviance Residuals:

Min	1Q	Median	3Q	Max
-2.0543	-0.4857	-0.2643	-0.1006	3.3248

Coefficients:

	Estimate	Std. Error	z value	Pr(> z)	
(Intercept)	-10.18051	396.43314	-0.026	0.979512	
BusinessTravelTravel_Frequently	1.68023	0.40059	4.194	2.74e-05	***
BusinessTravelTravel_Rarely	0.79631	0.37253	2.138	0.032553	*
DepartmentResearch & Development	13.01387	396.43231	0.033	0.973812	
DepartmentSales	12.09486	396.43291	0.031	0.975661	
Education2	0.23495	0.32119	0.731	0.464480	
Education3	0.24902	0.28611	0.870	0.384107	
Education4	0.17917	0.30845	0.581	0.561317	
Education5	0.02805	0.60790	0.046	0.963197	
EducationFieldLife Sciences	-1.38073	0.81317	-1.698	0.089515	.
EducationFieldMarketing	-0.93860	0.85554	-1.097	0.272601	
EducationFieldMedical	-1.42088	0.81631	-1.741	0.081749	.
EducationFieldOther	-1.44764	0.88090	-1.643	0.100306	
EducationFieldTechnical Degree	-0.48734	0.82724	-0.589	0.555781	
EnvironmentsSatisfaction2	-0.89578	0.27248	-3.287	0.001011	**
EnvironmentsSatisfaction3	-1.02358	0.24634	-4.155	3.25e-05	***
EnvironmentsSatisfaction4	-1.20090	0.25132	-4.778	1.77e-06	***
GenderMale	0.35123	0.18329	1.916	0.055333	.
JobInvolvement2	-1.18453	0.34828	-3.401	0.000671	***
JobInvolvement3	-1.52167	0.32887	-4.627	3.71e-06	***
JobInvolvement4	-2.12428	0.45688	-4.650	3.33e-06	***
JobLevel2	-2.10261	0.42564	-4.940	7.82e-07	***
JobLevel3	-1.24154	0.48889	-2.540	0.011101	*
JobLevel4	-2.03631	0.74788	-2.723	0.006474	**
JobLevel5	-0.37731	1.07673	-0.350	0.726025	
JobRoleHuman Resources	12.92989	396.43242	0.033	0.973981	
JobRoleLaboratory Technician	0.34152	0.57103	0.598	0.549785	
JobRoleManager	-0.53701	1.01974	-0.527	0.598461	
JobRoleManufacturing Director	0.16390	0.52217	0.314	0.753604	
JobRoleResearch Director	-2.10097	1.03707	-2.026	0.042779	*
JobRoleResearch Scientist	-0.61304	0.58677	-1.045	0.296133	
JobRolesSales Executive	2.13192	1.22890	1.735	0.082772	.
JobRolesSales Representative	1.71998	1.31031	1.313	0.189302	
JobSatisfaction2	-0.49575	0.26833	-1.848	0.064666	.
JobSatisfaction3	-0.51239	0.23642	-2.167	0.030211	*
JobSatisfaction4	-1.18826	0.25387	-4.681	2.86e-06	***
MaritalStatusMarried	0.24536	0.27093	0.906	0.365129	
MaritalStatusSingle	0.49710	0.38298	1.298	0.194299	
OverTimeYes	1.95894	0.19152	10.228	< 2e-16	***
PerformanceRating4	-0.15678	0.25507	-0.615	0.538778	
RelationshipSatisfaction2	-0.67013	0.27822	-2.409	0.016010	*
RelationshipSatisfaction3	-0.77295	0.24948	-3.098	0.001947	**
RelationshipSatisfaction4	-0.75381	0.24903	-3.027	0.002470	**
StockOptionLevel1	-1.09215	0.30122	-3.626	0.000288	***
StockOptionLevel2	-0.97594	0.43405	-2.248	0.024546	*
StockOptionLevel3	-0.36374	0.43968	-0.827	0.408075	
WorkLifeBalance2	-0.98196	0.36058	-2.723	0.006464	**
WorkLifeBalance3	-1.38617	0.33593	-4.126	3.69e-05	***
WorkLifeBalance4	-0.88866	0.41005	-2.167	0.030217	*

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

(Dispersion parameter for binomial family taken to be 1)

Null deviance: 1298.58 on 1469 degrees of freedom

Residual deviance: 876.06 on 1421 degrees of freedom
AIC: 974.06

Number of Fisher Scoring iterations: 14

```
>  
> logistic <- glm(Attrition~Age+BusinessTravel+DailyRate+Department+DistanceFromHome+Education+EducationField+EnvironmentSatisfaction+Gender+HourlyRate+JobInvolvement+JobLevel+JobRole+JobSatisfaction+MaritalStatus+MonthlyIncome+MonthlyRate+NumCompaniesWorked+OverTime+PercentSalaryHike+PerformanceRating+RelationshipSatisfaction+StockOptionLevel+TotalWorkingYears+TrainingTimesLastYear+WorkLifeBalance+YearsAtCompany+YearsInCurrentRole+YearsSinceLastPromotion+YearsWithCurrManager, data=attr, family="binomial")  
> summary(logistic)
```

```
Call:  
glm(formula = Attrition ~ Age + BusinessTravel + DailyRate +  
    Department + DistanceFromHome + Education + EducationField +  
    EnvironmentSatisfaction + Gender + HourlyRate + JobInvolvement +  
    JobLevel + JobRole + JobSatisfaction + MaritalStatus + MonthlyIncome +  
    MonthlyRate + NumCompaniesWorked + OverTime + PercentSalaryHike +  
    PerformanceRating + RelationshipSatisfaction + StockOptionLevel +  
    TotalWorkingYears + TrainingTimesLastYear + WorkLifeBalance +  
    YearsAtCompany + YearsInCurrentRole + YearsSinceLastPromotion +  
    YearsWithCurrManager, family = "binomial", data = attr)
```

Deviance Residuals:

Min	1Q	Median	3Q	Max
-1.8204	-0.4400	-0.1959	-0.0546	3.5997

Coefficients:

	Estimate	Std. Error	z value	Pr(> z)	
(Intercept)	-1.055e+01	5.865e+02	-0.018	0.985654	
Age	-3.070e-02	1.438e-02	-2.135	0.032798	*
BusinessTravelTravel_Frequently	2.155e+00	4.466e-01	4.826	1.39e-06	***
BusinessTravelTravel_Rarely	1.138e+00	4.118e-01	2.763	0.005736	**
DailyRate	-4.401e-04	2.349e-04	-1.873	0.061004	.
DepartmentResearch & Development	1.439e+01	5.865e+02	0.025	0.980426	
DepartmentSales	1.353e+01	5.865e+02	0.023	0.981599	
DistanceFromHome	5.509e-02	1.160e-02	4.749	2.04e-06	***
Education2	2.637e-01	3.489e-01	0.756	0.449809	
Education3	2.433e-01	3.062e-01	0.795	0.426774	
Education4	2.652e-01	3.344e-01	0.793	0.427686	
Education5	1.776e-01	6.356e-01	0.280	0.779855	
EducationFieldLife Sciences	-1.159e+00	8.860e-01	-1.308	0.190930	
EducationFieldMarketing	-6.167e-01	9.312e-01	-0.662	0.507849	
EducationFieldMedical	-1.154e+00	8.845e-01	-1.304	0.192064	
EducationFieldOther	-1.063e+00	9.563e-01	-1.111	0.266434	
EducationFieldTechnical Degree	1.004e-02	8.993e-01	0.011	0.991089	
EnvironmentSatisfaction2	-1.078e+00	2.939e-01	-3.669	0.000243	***
EnvironmentSatisfaction3	-1.210e+00	2.702e-01	-4.480	7.48e-06	***
EnvironmentSatisfaction4	-1.437e+00	2.739e-01	-5.248	1.54e-07	***
GenderMale	4.455e-01	1.964e-01	2.268	0.023331	*
HourlyRate	4.348e-03	4.763e-03	0.913	0.361358	
JobInvolvement2	-1.261e+00	3.773e-01	-3.344	0.000827	***
JobInvolvement3	-1.563e+00	3.558e-01	-4.394	1.11e-05	***
JobInvolvement4	-2.185e+00	4.914e-01	-4.447	8.72e-06	***
JobLevel2	-1.574e+00	4.815e-01	-3.269	0.001078	**
JobLevel3	1.525e-01	7.397e-01	0.206	0.836709	
JobLevel4	-7.741e-01	1.279e+00	-0.605	0.545064	
JobLevel5	2.324e+00	1.675e+00	1.388	0.165252	
JobRoleHuman Resources	1.470e+01	5.865e+02	0.025	0.979999	
JobRoleLaboratory Technician	6.024e-01	6.078e-01	0.991	0.321687	
JobRoleManager	-2.077e-01	1.117e+00	-0.186	0.852479	
JobRoleManufacturing Director	4.526e-01	5.637e-01	0.803	0.422078	
JobRoleResearch Director	-1.925e+00	1.179e+00	-1.633	0.102438	

JobRoleResearch Scientist	-5.351e-01	6.301e-01	-0.849	0.395796	
JobRoleSales Executive	2.196e+00	1.290e+00	1.702	0.088682	.
JobRoleSales Representative	1.936e+00	1.371e+00	1.412	0.157955	
JobSatisfaction2	-6.562e-01	2.882e-01	-2.277	0.022785	*
JobSatisfaction3	-6.401e-01	2.559e-01	-2.501	0.012370	*
JobSatisfaction4	-1.287e+00	2.734e-01	-4.710	2.48e-06	***
MaritalStatusMarried	3.095e-01	2.903e-01	1.066	0.286405	
MaritalStatusSingle	6.250e-01	4.151e-01	1.506	0.132129	
MonthlyIncome	-1.295e-04	9.565e-05	-1.354	0.175878	
MonthlyRate	1.001e-05	1.325e-05	0.756	0.449743	
NumCompaniesWorked	2.116e-01	4.152e-02	5.097	3.44e-07	***
OverTimeYes	2.192e+00	2.120e-01	10.343	< 2e-16	***
PercentSalaryHike	-2.061e-02	4.133e-02	-0.499	0.618027	
PerformanceRating4	1.099e-01	4.242e-01	0.259	0.795545	
RelationshipSatisfaction2	-9.523e-01	3.048e-01	-3.124	0.001784	**
RelationshipSatisfaction3	-1.008e+00	2.704e-01	-3.729	0.000192	***
RelationshipSatisfaction4	-1.001e+00	2.690e-01	-3.721	0.000198	***
StockOptionLevel1	-1.150e+00	3.275e-01	-3.511	0.000446	***
StockOptionLevel2	-1.107e+00	4.553e-01	-2.433	0.014993	*
StockOptionLevel3	-3.613e-01	4.869e-01	-0.742	0.458012	
TotalWorkingYears	-5.933e-02	3.107e-02	-1.910	0.056155	.
TrainingTimesLastYear	-1.924e-01	7.649e-02	-2.515	0.011901	*
WorkLifeBalance2	-9.456e-01	3.913e-01	-2.416	0.015682	*
WorkLifeBalance3	-1.475e+00	3.678e-01	-4.009	6.11e-05	***
WorkLifeBalance4	-1.064e+00	4.452e-01	-2.391	0.016812	*
YearsAtCompany	1.013e-01	4.301e-02	2.356	0.018469	*
YearsInCurrentRole	-1.429e-01	5.187e-02	-2.755	0.005873	**
YearsSinceLastPromotion	1.726e-01	4.605e-02	3.749	0.000178	***
YearsWithCurrManager	-1.541e-01	5.069e-02	-3.040	0.002369	**

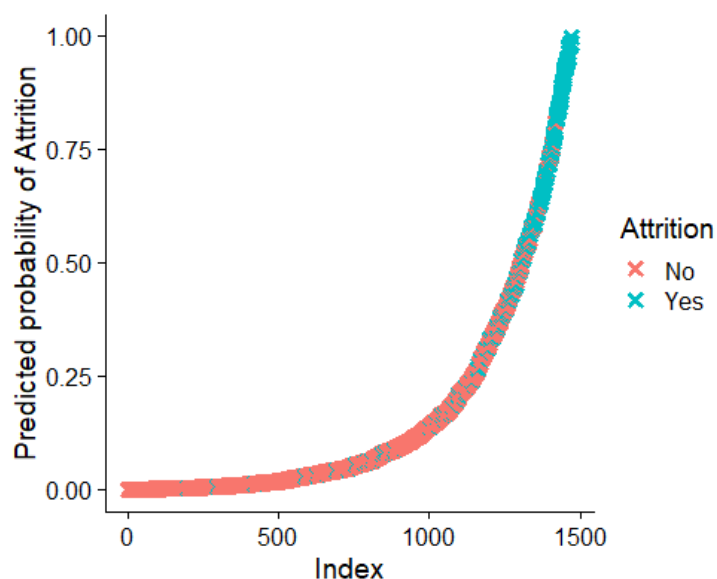
 Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

(Dispersion parameter for binomial family taken to be 1)

Null deviance: 1298.6 on 1469 degrees of freedom
 Residual deviance: 775.3 on 1407 degrees of freedom
 AIC: 901.3

Number of Fisher Scoring iterations: 15

```
> ll.null <- logistic$null.deviance/-2
> ll.proposed <- logistic$deviance/-2
>
>
> ## McFadden's Pseudo R^2 = [ LL(Null) - LL(Proposed) ] / LL(Null)
> (ll.null - ll.proposed) / ll.null
[1] 0.402966
>
> ## The p-value for the R^2
> 1 - pchisq(2*(ll.proposed - ll.null), df=(length(logistic$coefficients)-1))
[1] 0
> ## Now we can plot the data
> predicted.data <- data.frame(probability.of.Attrition=logistic$fitted.values, Attrition=attr$Attrition)
> predicted.data <- predicted.data[order(predicted.data$probability.of.Attrition, decreasing=FALSE),]
> predicted.data$rank <- 1:nrow(predicted.data)
> ## Lastly, we can plot the predicted probabilities for each sample having
> ## Attrition and color by whether or not they would actually leave the company
> #ggplot(data=predicted.data, aes(x=rank, y=probability.of.Attrition)) + geom_point(aes(color=Attrition), alpha=1, shape=4, stroke=2) + xlab("Index") + ylab("Predicted probability of Attrition")
> ggplot(data=predicted.data, aes(x=rank, y=probability.of.Attrition)) +
+   geom_point(aes(color=Attrition), alpha=1, shape=4, stroke=2) +
+   xlab("Index") +
+   ylab("Predicted probability of Attrition")
```



```
> pdata <- predict(logistic,newdata=attr,type="response")
```

```
> pdata
```

	1	2	3	4	5	6	7
8	7.560723e-01	1.092061e-03	6.843401e-01	2.403017e-01	2.556051e-01	7.317852e-02	4.272277e-01
013842e-02							
	9	10	11	12	13	14	15
16	8.287681e-02	1.470678e-02	2.956016e-02	6.482067e-02	1.611716e-01	2.038417e-02	8.998942e-01
164571e-02							
	17	18	19	20	21	22	23
24	7.168260e-02	9.130094e-02	5.736077e-04	1.561319e-01	1.937580e-03	3.877520e-01	1.544354e-03
385729e-02							
	25	26	27	28	29	30	31
32	7.827945e-02	1.180091e-03	8.666864e-01	1.169464e-02	2.130876e-03	6.009201e-02	8.064577e-02
454184e-02							
	33	34	35	36	37	38	39
40	2.787559e-01	5.683170e-03	3.358987e-01	1.260689e-03	8.385769e-01	1.586775e-01	4.952722e-01
604226e-02							
	41	42	43	44	45	46	47
48	1.965579e-02	1.298585e-02	9.316545e-01	1.182723e-01	7.741157e-03	4.220995e-02	6.628048e-02
212409e-01							
	49	50	51	52	53	54	55
56	3.309991e-01	1.559566e-02	8.748411e-01	8.355240e-01	1.153015e-01	7.031555e-02	5.116939e-01
659683e-02							
	57	58	59	60	61	62	63
64	9.741795e-02	4.297881e-01	7.351413e-04	2.861253e-03	2.437402e-02	9.714354e-02	2.638560e-01
370323e-01							
	65	66	67	68	69	70	71
72	2.035034e-02	3.382901e-03	3.803946e-02	1.949061e-03	1.366874e-01	5.136915e-01	1.465905e-01
278483e-03							
	73	74	75	76	77	78	79
80							

3.935983e-02	3.396296e-04	4.103931e-02	2.423433e-03	2.113590e-02	4.070109e-02	3.832791e-02	3.
299772e-02							
81	82	83	84	85	86	87	
88							
3.963934e-02	4.519692e-02	1.414523e-02	5.047391e-03	3.576095e-02	5.665635e-02	2.584617e-01	8.
702935e-03							
89	90	91	92	93	94	95	
96							
1.138010e-02	2.997819e-02	2.143217e-02	5.979635e-01	4.505972e-02	1.489169e-01	1.123394e-01	2.
570398e-02							
97	98	99	100	101	102	103	
104							
5.856404e-02	1.136605e-02	1.411346e-02	7.184111e-03	7.776405e-01	6.121629e-02	6.510143e-01	1.
750094e-03							
105	106	107	108	109	110	111	
112							
7.203139e-04	1.428590e-09	1.985431e-01	5.455631e-01	8.918177e-03	1.003813e-01	3.012435e-01	6.
780033e-01							
113	114	115	116	117	118	119	
120							
2.685964e-09	4.648178e-02	1.637405e-03	1.025160e-01	4.419545e-03	1.364696e-02	9.213427e-02	5.
914592e-03							
121	122	123	124	125	126	127	
128							
3.929817e-01	1.105089e-02	5.967026e-01	1.326147e-02	7.707105e-01	6.029714e-02	4.758793e-02	9.
613626e-01							
129	130	131	132	133	134	135	
136							
7.797648e-02	8.771860e-03	7.520286e-02	1.653754e-01	6.444976e-01	7.293759e-02	1.412470e-02	1.
529240e-02							
137	138	139	140	141	142	143	
144							
2.331515e-01	3.691397e-03	2.570124e-01	1.622492e-01	7.201473e-01	8.309600e-02	5.353754e-02	1.
515598e-01							
145	146	147	148	149	150	151	
152							
3.267031e-02	5.559907e-02	3.267721e-02	6.343559e-03	7.075592e-02	1.239793e-01	2.533282e-03	3.
765186e-02							
153	154	155	156	157	158	159	
160							
1.329830e-01	7.070229e-03	9.585727e-02	1.352181e-03	8.658865e-03	9.548205e-02	4.642671e-02	2.
463004e-01							
161	162	163	164	165	166	167	
168							
1.627756e-02	3.728592e-02	6.238721e-02	9.386985e-02	4.990809e-02	9.300406e-03	3.170853e-02	1.
102244e-02							
169	170	171	172	173	174	175	
176							
2.665204e-02	1.021023e-01	4.147384e-01	9.744047e-01	3.900030e-01	1.497403e-03	1.051302e-01	2.
483959e-02							
177	178	179	180	181	182	183	
184							
8.546057e-02	3.125064e-01	1.408188e-01	4.573657e-02	1.747914e-01	6.137995e-02	7.258392e-01	3.
452449e-02							
185	186	187	188	189	190	191	
192							
1.163673e-03	1.472122e-03	5.153123e-03	7.955166e-04	3.250935e-03	6.816961e-04	7.696850e-03	2.
693851e-02							
193	194	195	196	197	198	199	
200							
6.591865e-01	1.444635e-03	4.779835e-03	2.461774e-01	5.492721e-02	4.055755e-04	1.728142e-02	3.
940780e-02							
201	202	203	204	205	206	207	
208							

2.207592e-01 182500e-01	4.920542e-03	1.749833e-01	1.703833e-01	3.534543e-01	1.239975e-01	1.672530e-01	3.
209	210	211	212	213	214	215	
216							
4.154582e-03 019710e-02	6.492968e-03	2.406388e-01	9.992051e-03	1.908966e-02	1.162202e-03	4.899446e-01	1.
217	218	219	220	221	222	223	
224							
6.982782e-01 713884e-03	1.502846e-01	6.751851e-02	1.742002e-03	1.266987e-02	6.883681e-02	7.442834e-03	9.
225	226	227	228	229	230	231	
232							
2.904592e-03 199557e-02	7.519917e-03	1.429014e-01	9.791768e-03	2.159600e-01	4.294479e-01	9.668164e-02	1.
233	234	235	236	237	238	239	
240							
2.274788e-01 845072e-01	2.819874e-04	5.523517e-01	4.436005e-04	5.335080e-01	5.846656e-01	3.559419e-02	7.
241	242	243	244	245	246	247	
248							
7.020575e-02 356254e-03	7.811716e-02	1.123631e-02	1.624990e-02	4.918922e-03	1.325012e-02	6.625866e-03	7.
249	250	251	252	253	254	255	
256							
2.672801e-02 878741e-03	1.474369e-02	1.149939e-01	2.192539e-01	7.323097e-02	4.584999e-02	5.796699e-03	6.
257	258	259	260	261	262	263	
264							
8.831443e-02 684395e-02	6.905270e-04	3.821313e-02	6.564150e-01	4.039317e-01	1.725190e-03	1.253591e-01	1.
265	266	267	268	269	270	271	
272							
6.335010e-01 832849e-01	2.635938e-02	6.734413e-03	9.346041e-04	1.500453e-02	2.130095e-03	1.478876e-01	1.
273	274	275	276	277	278	279	
280							
5.368182e-03 804487e-03	8.567724e-03	1.873421e-01	2.317468e-03	9.457926e-03	2.102337e-01	1.265193e-02	3.
281	282	283	284	285	286	287	
288							
6.764292e-04 493146e-03	1.563392e-02	5.658557e-02	2.160206e-02	4.885778e-01	2.461525e-03	7.927394e-01	7.
289	290	291	292	293	294	295	
296							
5.369793e-01 700146e-01	8.086849e-03	3.357083e-01	7.608127e-02	1.159375e-01	4.193416e-01	3.550316e-01	1.
297	298	299	300	301	302	303	
304							
3.136650e-01 042937e-02	4.448564e-02	9.409837e-02	6.256080e-03	6.869066e-04	6.030551e-01	5.586544e-03	3.
305	306	307	308	309	310	311	
312							
1.512102e-03 865713e-01	1.013132e-03	8.205465e-03	3.899798e-03	6.641213e-03	5.905678e-02	3.690235e-01	3.
313	314	315	316	317	318	319	
320							
1.181144e-01 772187e-01	2.810461e-02	7.047569e-02	4.296906e-02	6.897793e-02	3.350906e-02	3.480359e-01	4.
321	322	323	324	325	326	327	
328							
2.447347e-01 076879e-01	3.281887e-03	5.619594e-03	8.761327e-01	2.468798e-04	5.351371e-02	3.399344e-01	3.
329	330	331	332	333	334	335	
336							

1.234228e-01	1.027652e-03	9.606608e-03	3.219986e-02	4.914457e-03	1.140452e-01	7.341597e-03	2.
446619e-01							
337	338	339	340	341	342	343	
344							
8.399603e-01	9.230731e-02	8.483058e-03	5.972456e-03	3.522408e-03	1.179079e-03	9.609566e-02	5.
321676e-02							
345	346	347	348	349	350	351	
352							
1.194627e-02	1.909634e-02	2.113041e-01	1.873222e-01	1.431219e-03	8.231074e-03	1.626147e-01	7.
186520e-03							
353	354	355	356	357	358	359	
360							
3.443437e-02	1.701970e-02	5.322405e-01	6.371617e-03	7.005001e-03	9.807391e-01	1.782205e-03	8.
840017e-02							
361	362	363	364	365	366	367	
368							
1.557769e-03	2.282060e-02	2.205279e-01	7.331532e-01	3.399168e-02	2.939710e-03	1.330026e-01	3.
666526e-02							
369	370	371	372	373	374	375	
376							
4.157331e-01	2.641691e-01	3.597191e-01	1.317044e-01	3.728015e-02	1.030366e-02	2.051517e-02	3.
512441e-02							
377	378	379	380	381	382	383	
384							
1.310184e-03	8.923063e-03	5.239329e-01	1.487313e-03	1.016349e-01	3.403405e-01	2.076743e-01	7.
712699e-02							
385	386	387	388	389	390	391	
392							
1.567972e-01	8.946226e-01	3.878402e-02	5.588512e-03	2.628663e-02	1.474686e-01	2.678839e-04	5.
385230e-03							
393	394	395	396	397	398	399	
400							
8.097355e-03	2.256627e-02	2.916705e-03	4.385393e-01	3.116080e-02	1.676113e-01	3.199874e-02	1.
044617e-01							
401	402	403	404	405	406	407	
408							
5.510256e-02	3.520108e-02	5.481617e-02	1.245053e-02	1.098208e-02	1.647339e-01	3.189905e-02	2.
682206e-02							
409	410	411	412	413	414	415	
416							
3.010504e-04	9.451748e-03	1.791935e-02	5.086472e-01	4.108879e-04	1.720425e-02	7.993836e-01	4.
178086e-01							
417	418	419	420	421	422	423	
424							
1.703770e-01	5.283007e-04	6.704946e-02	1.601617e-02	2.574051e-03	5.478596e-01	6.980864e-01	4.
105049e-02							
425	426	427	428	429	430	431	
432							
2.380817e-03	1.231315e-02	1.080898e-02	4.196913e-01	3.399736e-03	2.561486e-03	5.527036e-01	1.
740165e-02							
433	434	435	436	437	438	439	
440							
4.323183e-03	8.669575e-02	8.607010e-04	3.302686e-01	7.035054e-01	3.741397e-01	3.073880e-01	7.
037712e-01							
441	442	443	444	445	446	447	
448							
9.232080e-01	9.495599e-02	8.434524e-02	6.778386e-01	8.529831e-03	6.925400e-04	7.031699e-03	1.
084486e-01							
449	450	451	452	453	454	455	
456							
1.352612e-02	4.314613e-02	1.118095e-01	1.771413e-01	2.209853e-03	5.386058e-01	3.377769e-02	1.
507284e-04							
457	458	459	460	461	462	463	
464							

6.710764e-03 958845e-01 472	9.437483e-01 465	8.307583e-02 466	3.181128e-02 467	2.738711e-01 468	4.472112e-02 469	1.719107e-02 470	9. 471
7.788169e-02 412133e-04 480	9.597212e-02 473	5.560476e-04 474	2.473608e-02 475	1.120197e-02 476	2.602471e-02 477	1.656766e-01 478	4. 479
1.146812e-02 620015e-01 488	3.576328e-03 481	6.764574e-02 482	1.151845e-01 483	1.379453e-01 484	2.586414e-07 485	1.575490e-01 486	5. 487
6.492509e-01 045198e-01 496	4.229417e-02 489	2.242750e-01 490	1.649818e-01 491	6.051342e-03 492	1.552595e-02 493	1.113833e-01 494	1. 495
9.118700e-04 297998e-02 504	8.981951e-04 497	5.459242e-02 498	3.230125e-02 499	7.437110e-03 500	4.329427e-02 501	3.453929e-01 502	4. 503
6.298420e-01 421922e-03 512	5.391778e-02 505	9.257265e-02 506	2.885281e-02 507	1.824917e-02 508	2.971194e-02 509	3.206475e-02 510	2. 511
2.512797e-01 664835e-02 520	1.003136e-01 513	8.475116e-03 514	2.194487e-02 515	1.679629e-02 516	2.523990e-03 517	4.214415e-02 518	1. 519
1.353026e-01 009304e-02 528	2.971844e-01 521	9.251802e-01 522	1.539950e-02 523	1.109398e-01 524	3.319744e-03 525	2.187333e-02 526	1. 527
8.098613e-03 610926e-02 536	8.133884e-03 529	3.811018e-02 530	1.272893e-01 531	2.429888e-02 532	7.148273e-01 533	8.390402e-02 534	1. 535
3.776380e-01 349189e-07 544	2.560692e-04 537	1.497615e-02 538	5.382110e-04 539	1.925844e-02 540	1.891622e-01 541	5.835871e-05 542	5. 543
5.743698e-01 676140e-01 552	2.474037e-02 545	9.544495e-09 546	1.518209e-01 547	7.662188e-01 548	3.843794e-03 549	4.035221e-01 550	3. 551
4.393569e-01 933504e-02 560	1.205090e-01 553	1.608848e-01 554	5.739719e-01 555	1.150040e-02 556	1.932733e-02 557	8.491380e-02 558	3. 559
5.944762e-03 750853e-01 568	1.218138e-01 561	1.542918e-01 562	8.987823e-02 563	3.168393e-03 564	1.199388e-03 565	4.248264e-02 566	5. 567
5.487353e-03 432499e-03 576	2.571645e-03 569	1.332089e-01 570	1.939273e-02 571	3.102660e-01 572	8.399187e-02 573	5.063867e-01 574	5. 575
6.599518e-02 894887e-02 584	9.596389e-02 577	2.210850e-03 578	6.276929e-01 579	4.382117e-02 580	5.192473e-01 581	6.998835e-03 582	9. 583
2.719155e-02 796361e-02 592	1.129240e-01 585	4.457966e-01 586	3.840483e-02 587	1.387418e-01 588	7.717338e-02 589	6.319999e-04 590	2. 591

1.038372e-01 413124e-01	3.216039e-01	3.620859e-02	5.818487e-03	7.176867e-05	4.486112e-01	1.742276e-03	5.
593	594	595	596	597	598	599	
600							
3.134969e-03 089783e-01	1.518921e-03	3.321289e-03	1.427955e-01	1.403672e-02	1.357742e-02	1.275765e-01	1.
601	602	603	604	605	606	607	
608							
1.017148e-03 339423e-02	3.071208e-01	8.417206e-02	4.256365e-02	1.326902e-02	4.347275e-02	7.945248e-02	3.
609	610	611	612	613	614	615	
616							
2.838206e-02 892116e-03	7.005817e-04	1.963684e-03	2.912377e-02	5.260206e-01	8.801560e-02	2.108611e-01	4.
617	618	619	620	621	622	623	
624							
5.966264e-04 082878e-02	4.082202e-02	4.125815e-01	7.129326e-03	1.628808e-01	8.662412e-03	1.320461e-02	5.
625	626	627	628	629	630	631	
632							
1.303265e-01 741070e-01	2.139255e-01	1.957472e-03	4.690247e-03	4.144159e-02	5.069449e-03	7.175240e-02	1.
633	634	635	636	637	638	639	
640							
3.439794e-01 087194e-02	1.823059e-01	3.366980e-01	9.378834e-03	7.173223e-01	3.128365e-03	4.458860e-01	1.
641	642	643	644	645	646	647	
648							
6.926860e-02 908686e-01	2.409506e-02	9.767176e-02	6.063849e-03	4.380086e-02	5.801453e-01	1.280846e-02	2.
649	650	651	652	653	654	655	
656							
1.099801e-01 524804e-01	2.390978e-04	3.736147e-03	6.203480e-02	5.393857e-01	5.243630e-03	9.667961e-04	2.
657	658	659	660	661	662	663	
664							
9.791984e-01 991470e-02	5.296084e-02	6.407209e-01	8.736016e-02	5.049482e-01	2.683675e-02	2.714344e-01	9.
665	666	667	668	669	670	671	
672							
9.011132e-03 177121e-02	5.074259e-01	5.404621e-02	3.840014e-01	1.434284e-02	9.274272e-01	4.994612e-02	6.
673	674	675	676	677	678	679	
680							
8.243587e-02 412801e-03	5.507804e-01	1.469691e-02	4.288763e-01	1.329731e-02	4.234935e-02	4.418275e-02	5.
681	682	683	684	685	686	687	
688							
1.811471e-02 033240e-02	2.482237e-04	4.366117e-02	8.913870e-01	2.913640e-01	6.234345e-02	5.569974e-02	2.
689	690	691	692	693	694	695	
696							
9.483421e-01 291633e-01	8.864904e-01	4.501143e-02	3.290442e-01	1.002026e-02	8.176517e-02	5.676339e-03	9.
697	698	699	700	701	702	703	
704							
8.587043e-04 858497e-01	1.786936e-01	4.403219e-02	8.955376e-05	1.678932e-01	1.678579e-03	3.907138e-01	1.
705	706	707	708	709	710	711	
712							
5.029396e-03 130942e-01	2.199554e-02	9.177140e-02	4.148499e-02	4.375782e-03	6.074784e-01	1.776491e-03	6.
713	714	715	716	717	718	719	
720							

4.202081e-02 407101e-02	4.226640e-03	3.319116e-05	4.517429e-02	1.527447e-03	3.969429e-01	1.035899e-02	6.
721	722	723	724	725	726	727	
728							
8.274825e-01 960941e-02	7.142526e-03	3.423423e-02	3.013987e-03	2.832265e-03	5.771797e-01	9.880836e-03	2.
729	730	731	732	733	734	735	
736							
8.989176e-03 339033e-02	3.020627e-01	7.110506e-03	8.207566e-01	4.435332e-01	1.255087e-03	7.149682e-01	4.
737	738	739	740	741	742	743	
744							
1.077789e-02 140724e-02	1.264415e-02	1.568562e-03	3.802149e-03	4.467993e-02	5.890316e-02	1.262451e-01	2.
745	746	747	748	749	750	751	
752							
6.236534e-01 030002e-04	3.977828e-02	3.080970e-04	2.338835e-01	6.313167e-01	1.222050e-02	7.618069e-03	3.
753	754	755	756	757	758	759	
760							
8.767936e-02 259733e-01	5.797730e-01	5.086734e-02	7.448554e-05	2.231052e-01	1.876336e-03	3.111850e-02	2.
761	762	763	764	765	766	767	
768							
5.964845e-02 768733e-02	1.000888e-01	8.554454e-01	3.002099e-01	1.332994e-01	5.296028e-02	1.460479e-02	2.
769	770	771	772	773	774	775	
776							
1.042792e-01 521962e-02	2.723009e-02	1.518091e-03	5.221460e-02	6.665434e-03	3.042898e-02	2.704361e-03	2.
777	778	779	780	781	782	783	
784							
7.836561e-01 016413e-03	5.855427e-01	4.043204e-02	5.873392e-01	2.708001e-01	3.925557e-01	1.552859e-02	8.
785	786	787	788	789	790	791	
792							
8.058183e-03 207948e-01	1.289547e-01	1.661928e-01	2.331191e-03	3.281318e-03	6.126173e-02	6.430417e-03	8.
793	794	795	796	797	798	799	
800							
5.077833e-02 752883e-03	1.684829e-01	3.060546e-02	4.958742e-02	1.503472e-01	3.637892e-01	9.270578e-01	2.
801	802	803	804	805	806	807	
808							
4.699476e-01 499463e-01	3.541319e-01	7.119882e-03	6.343568e-03	2.741714e-04	5.033725e-04	4.586924e-02	1.
809	810	811	812	813	814	815	
816							
2.040064e-02 451695e-01	4.616591e-03	2.805621e-04	4.015781e-01	1.444641e-01	1.200553e-01	3.844795e-02	4.
817	818	819	820	821	822	823	
824							
2.693697e-02 119157e-02	1.019826e-02	1.563978e-01	3.066235e-01	1.406204e-02	1.555243e-02	5.589843e-02	2.
825	826	827	828	829	830	831	
832							
3.477318e-01 537239e-01	4.011594e-02	7.259144e-02	2.376224e-01	1.757575e-01	7.885174e-01	3.706554e-01	1.
833	834	835	836	837	838	839	
840							
8.421070e-03 811298e-01	3.173293e-02	3.569681e-02	4.919052e-01	2.664246e-01	1.060416e-02	6.944836e-01	1.
841	842	843	844	845	846	847	
848							

5.498071e-02	5.618371e-01	3.611349e-01	5.586276e-03	4.484309e-02	1.465141e-01	1.056947e-02	1.
383967e-02							
849	850	851	852	853	854	855	
856							
1.023866e-01	7.524107e-01	2.744647e-02	1.930245e-02	2.811749e-03	1.097536e-01	1.738208e-01	3.
494507e-04							
857	858	859	860	861	862	863	
864							
8.092852e-01	1.638749e-01	3.683352e-04	4.188273e-01	9.560268e-02	2.224862e-02	9.434149e-02	5.
849968e-02							
865	866	867	868	869	870	871	
872							
4.375170e-01	1.674448e-01	1.135716e-01	1.514301e-04	2.312321e-01	3.080279e-03	9.623186e-02	3.
861287e-01							
873	874	875	876	877	878	879	
880							
1.313960e-01	1.782805e-02	2.642220e-02	3.472050e-03	3.087118e-01	2.338807e-03	3.771688e-03	2.
564587e-03							
881	882	883	884	885	886	887	
888							
1.718123e-01	1.980568e-02	3.954107e-01	3.263935e-03	1.430960e-01	1.928499e-02	3.876612e-02	1.
793307e-01							
889	890	891	892	893	894	895	
896							
4.868221e-02	4.705756e-01	2.062344e-02	2.101259e-03	6.425087e-01	2.190647e-02	1.728520e-05	1.
693678e-01							
897	898	899	900	901	902	903	
904							
9.411277e-03	9.731136e-03	7.797829e-04	3.381233e-02	5.909731e-02	2.349590e-01	4.067767e-02	1.
818374e-02							
905	906	907	908	909	910	911	
912							
5.825426e-03	3.682293e-05	7.201077e-02	6.121822e-03	3.519537e-02	3.868402e-01	1.494601e-02	9.
839442e-01							
913	914	915	916	917	918	919	
920							
3.020351e-01	5.702854e-01	4.157934e-02	9.362631e-01	1.189214e-03	3.635496e-01	3.919394e-01	1.
419253e-02							
921	922	923	924	925	926	927	
928							
1.628793e-02	7.527202e-01	1.635541e-02	6.246538e-03	1.328659e-01	3.223799e-02	1.172707e-01	5.
256600e-02							
929	930	931	932	933	934	935	
936							
6.268066e-03	3.820037e-01	1.928830e-01	4.966561e-02	6.093904e-01	3.378154e-01	5.079834e-02	7.
401946e-04							
937	938	939	940	941	942	943	
944							
1.486845e-01	1.421494e-01	4.247824e-02	1.211941e-02	2.974575e-01	3.707554e-02	1.107299e-01	8.
516623e-02							
945	946	947	948	949	950	951	
952							
3.173874e-03	5.105321e-03	8.972647e-01	8.409169e-01	8.680154e-02	3.219864e-02	8.461240e-02	3.
588872e-01							
953	954	955	956	957	958	959	
960							
9.158644e-01	3.864958e-01	1.666931e-03	1.311956e-02	3.352789e-08	3.253578e-02	2.435338e-03	1.
909339e-03							
961	962	963	964	965	966	967	
968							
9.782947e-03	1.364557e-01	1.356620e-09	1.378822e-03	8.647160e-02	5.222990e-02	2.199899e-01	2.
400776e-02							
969	970	971	972	973	974	975	
976							

7.325119e-02	2.968295e-03	4.768604e-02	1.446383e-02	2.084245e-02	1.127181e-03	2.295463e-01	6.443280e-01																
977	978	979	980	981	982	983																	
984																							
8.181158e-02	1.173166e-01	2.008876e-03	1.190410e-01	6.196633e-01	5.937740e-01	1.624967e-02	3.348141e-03																
985	986	987	988	989	990	991																	
992																							
9.237850e-02	1.966929e-01	2.364639e-01	1.407116e-01	6.019448e-02	2.236580e-01	1.469210e-01	4.694133e-01																
993	994	995	996	997	998	999																	
1000																							
1.914947e-03	1.304819e-01	2.627655e-02	3.998809e-01	3.182463e-01	5.524004e-01	5.256448e-02	2.245625e-10																
[reached getOption("max.print") -- omitted 470 entries]																							
> attr\$Attrition																							
[1]	Yes	No	Yes	No	No	No	No	No	No	No	No	No	No	No	Yes	No	No	No	No	No	No	No	Yes
s	No	No	Yes	No	No	No	No	Yes	Yes	No	Yes	No	No	No	No	No	Yes	No	No	Yes	No	No	No
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No	No	Yes	Yes																				
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No	No	No	No																				
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Yes	No	Yes	No																				
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Yes	Yes	No	No																				
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No	No	No	No																				
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s	No	No	No	No																			
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Yes	Yes	No	No																				
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s	No	No	No	No																			
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No	No	No	Yes																				
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```

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No Yes No No
[989] No No No No No No No No No Yes No No
[ reached getOption("max.print") -- omitted 470 entries ]
Levels: No Yes

```

```

> pdataF <- as.factor(ifelse(test=as.numeric(pdata>0.5) == 0, yes="Employee will Leave", no=
"Employee will not Leave"))
> roc(attr$Attrition,logistic$fitted.values,plot=TRUE)
Setting levels: control = No, case = Yes
Setting direction: controls < cases

```

```

Call:
roc.default(response = attr$Attrition, predictor = logistic$fitted.values, plot = TRUE)

Data: logistic$fitted.values in 1233 controls (attr$Attrition No) < 237 cases (attr$Attritio
n Yes).
Area under the curve: 0.896
> par(pty='s')
> roc(attr$Attrition,logistic$fitted.values,plot=TRUE)
Setting levels: control = No, case = Yes
Setting direction: controls < cases

```

```

Call:
roc.default(response = attr$Attrition, predictor = logistic$fitted.values, plot = TRUE)

Data: logistic$fitted.values in 1233 controls (attr$Attrition No) < 237 cases (attr$Attritio
n Yes).
Area under the curve: 0.896
> roc(attr$Attrition,logistic$fitted.values,plot=TRUE, legacy.axes=TRUE)
Setting levels: control = No, case = Yes
Setting direction: controls < cases

```

```

Call:
roc.default(response = attr$Attrition, predictor = logistic$fitted.values, plot = TRUE,
legacy.axes = TRUE)

Data: logistic$fitted.values in 1233 controls (attr$Attrition No) < 237 cases (attr$Attritio
n Yes).

```


Area under the curve: 0.896

```
> roc(attr$Attrition, logistic$fitted.values, plot=TRUE, legacy.axes=TRUE, xlab="False Positive Percentage", ylab="True Postive Percentage")
Setting levels: control = No, case = Yes
Setting direction: controls < cases
```

Call:

```
roc.default(response = attr$Attrition, predictor = logistic$fitted.values, plot = TRUE, legacy.axes = TRUE, xlab = "False Positive Percentage", ylab = "True Postive Percentage")
```

Data: logistic\$fitted.values in 1233 controls (attr\$Attrition No) < 237 cases (attr\$Attrition Yes).

Area under the curve: 0.896

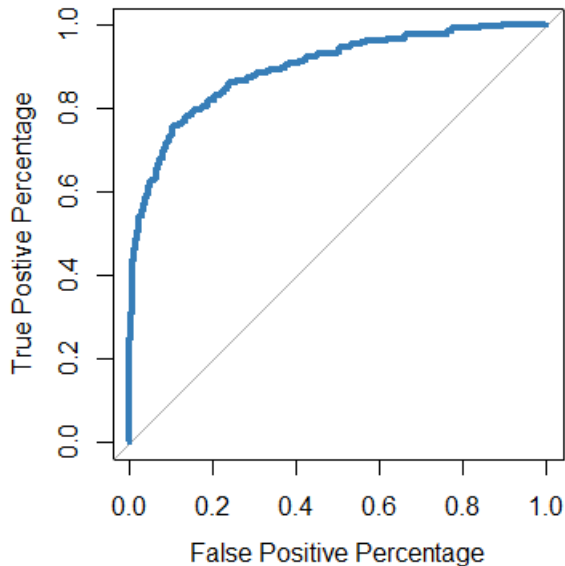
```
> roc(attr$Attrition, logistic$fitted.values, plot=TRUE, legacy.axes=TRUE, xlab="False Positive Percentage", ylab="True Postive Percentage", col="#377eb8", lwd=4)
Setting levels: control = No, case = Yes
Setting direction: controls < cases
```

Call:

```
roc.default(response = attr$Attrition, predictor = logistic$fitted.values, plot = TRUE, legacy.axes = TRUE, xlab = "False Positive Percentage", ylab = "True Postive Percentage", col = "#377eb8", lwd = 4)
```

Data: logistic\$fitted.values in 1233 controls (attr\$Attrition No) < 237 cases (attr\$Attrition Yes).

Area under the curve: 0.896



```
> ## If we want to find out the optimal threshold we can store the
> ## data used to make the ROC graph in a variable...
> roc.info <- roc(attr$Attrition, logistic$fitted.values, legacy.axes=TRUE)
Setting levels: control = No, case = Yes
Setting direction: controls < cases
> str(roc.info)
List of 15
 $ percent      : logi FALSE
 $ sensitivities : num [1:1471] 1 1 1 1 1 1 1 1 1 1 ...
 $ specificities : num [1:1471] 0 0.000811 0.001622 0.002433 0.003244 ...
 $ thresholds    : num [1:1471] -Inf 7.91e-10 1.39e-09 2.06e-09 4.35e-09 ...
 $ direction     : chr "<"
```

```

$ cases      : Named num [1:237] 0.7561 0.6843 0.8999 0.3878 0.0783 ...
..- attr(*, "names")= chr [1:237] "1" "3" "15" "22" ...
$ controls   : Named num [1:1233] 0.00109 0.2403 0.25561 0.07318 0.42723 ...
..- attr(*, "names")= chr [1:1233] "2" "4" "5" "6" ...
$ fun.sesp    : function (thresholds, controls, cases, direction)
$ auc         : 'auc' num 0.896
..- attr(*, "partial.auc")= logi FALSE
..- attr(*, "percent")= logi FALSE
..- attr(*, "roc")=List of 15
.. ..$ percent      : logi FALSE
.. ..$ sensitivities : num [1:1471] 1 1 1 1 1 1 1 1 1 1 ...
.. ..$ specificities : num [1:1471] 0 0.000811 0.001622 0.002433 0.003244 ...
.. ..$ thresholds    : num [1:1471] -Inf 7.91e-10 1.39e-09 2.06e-09 4.35e-09 ...
.. ..$ direction     : chr "<"
.. ..$ cases         : Named num [1:237] 0.7561 0.6843 0.8999 0.3878 0.0783 ...
.. ..- attr(*, "names")= chr [1:237] "1" "3" "15" "22" ...
.. ..$ controls       : Named num [1:1233] 0.00109 0.2403 0.25561 0.07318 0.42723 ...
.. ..- attr(*, "names")= chr [1:1233] "2" "4" "5" "6" ...
.. ..$ fun.sesp        : function (thresholds, controls, cases, direction)
.. ..$ auc             : 'auc' num 0.896
.. ..- attr(*, "partial.auc")= logi FALSE
.. ..- attr(*, "percent")= logi FALSE
.. ..- attr(*, "roc")=List of 8
.. .. ..$ percent      : logi FALSE
.. .. ..$ sensitivities: num [1:1471] 1 1 1 1 1 1 1 1 1 1 ...
.. .. ..$ specificities: num [1:1471] 0 0.000811 0.001622 0.002433 0.003244 ...
.. .. ..$ thresholds    : num [1:1471] -Inf 7.91e-10 1.39e-09 2.06e-09 4.35e-09 ...
.. .. ..$ direction     : chr "<"
.. .. ..$ cases         : Named num [1:237] 0.7561 0.6843 0.8999 0.3878 0.0783 ...
.. .. ..- attr(*, "names")= chr [1:237] "1" "3" "15" "22" ...
.. .. ..$ controls       : Named num [1:1233] 0.00109 0.2403 0.25561 0.07318 0.42723 ...
.. .. ..- attr(*, "names")= chr [1:1233] "2" "4" "5" "6" ...
.. .. ..$ fun.sesp        : function (thresholds, controls, cases, direction)
.. .. ..- attr(*, "class")= chr "roc"
.. ..$ call            : language roc.default(response = attr$Attrition, predictor = logis
tic$fitted.values, legacy.axes = TRUE)
.. ..$ original.predictor: Named num [1:1470] 0.75607 0.00109 0.68434 0.2403 0.25561 ...
.. ..- attr(*, "names")= chr [1:1470] "1" "2" "3" "4" ...
.. ..$ original.response : Factor w/ 2 levels "No","Yes": 2 1 2 1 1 1 1 1 1 1 ...
.. ..$ predictor         : Named num [1:1470] 0.75607 0.00109 0.68434 0.2403 0.25561 ...
.. ..- attr(*, "names")= chr [1:1470] "1" "2" "3" "4" ...
.. ..$ response          : Factor w/ 2 levels "No","Yes": 2 1 2 1 1 1 1 1 1 1 ...
.. ..$ levels            : chr [1:2] "No" "Yes"
.. ..- attr(*, "class")= chr "roc"
$ call          : language roc.default(response = attr$Attrition, predictor = logistic$f
itted.values, legacy.axes = TRUE)
$ original.predictor: Named num [1:1470] 0.75607 0.00109 0.68434 0.2403 0.25561 ...
..- attr(*, "names")= chr [1:1470] "1" "2" "3" "4" ...
$ original.response : Factor w/ 2 levels "No","Yes": 2 1 2 1 1 1 1 1 1 1 ...
$ predictor         : Named num [1:1470] 0.75607 0.00109 0.68434 0.2403 0.25561 ...
..- attr(*, "names")= chr [1:1470] "1" "2" "3" "4" ...
$ response          : Factor w/ 2 levels "No","Yes": 2 1 2 1 1 1 1 1 1 1 ...
$ levels            : chr [1:2] "No" "Yes"
- attr(*, "class")= chr "roc"
> roc.df <- data.frame(tpp=roc.info$sensitivities*100, ## tpp = true positive percentage
+                      fpp=(1 - roc.info$specificities)*100, ## fpp = false positive percentage
+                      thresholds=roc.info$thresholds)
> roc.df
  tpp      fpp thresholds
1 100.00000 100.00000    -Inf
2 100.00000  99.91890 7.905912e-10
3 100.00000  99.83779 1.392605e-09
4 100.00000  99.75669 2.057277e-09
5 100.00000  99.67559 4.350971e-09

```

6	100.00000	99.59448	7.780236e-09
7	100.00000	99.51338	1.152875e-08
8	100.00000	99.43228	2.352045e-08
9	100.00000	99.35118	1.205983e-07
10	100.00000	99.27007	2.331550e-07
11	100.00000	99.18897	3.967801e-07
12	100.00000	99.10787	2.799592e-06
13	100.00000	99.02676	1.117474e-05
14	100.00000	98.94566	2.523818e-05
15	100.00000	98.86456	3.365773e-05
16	100.00000	98.78345	3.547361e-05
17	100.00000	98.70235	4.147835e-05
18	100.00000	98.62125	5.224624e-05
19	100.00000	98.54015	6.506369e-05
20	100.00000	98.45904	7.198707e-05
21	100.00000	98.37794	7.334551e-05
22	100.00000	98.29684	7.702497e-05
23	100.00000	98.21573	8.330191e-05
24	100.00000	98.13463	8.829659e-05
25	100.00000	98.05353	9.113424e-05
26	100.00000	97.97242	9.819423e-05
27	100.00000	97.89132	1.223061e-04
28	100.00000	97.81022	1.413161e-04
29	100.00000	97.72912	1.439960e-04
30	100.00000	97.64801	1.485133e-04
31	100.00000	97.56691	1.510793e-04
32	100.00000	97.48581	1.550036e-04
33	100.00000	97.40470	1.716543e-04
34	100.00000	97.32360	1.911095e-04
35	100.00000	97.24250	2.182926e-04
36	100.00000	97.16139	2.429888e-04
37	100.00000	97.08029	2.475518e-04
38	100.00000	96.99919	2.521465e-04
39	100.00000	96.91809	2.566904e-04
40	100.00000	96.83698	2.606396e-04
41	100.00000	96.75588	2.659258e-04
42	100.00000	96.67478	2.697490e-04
43	100.00000	96.59367	2.728928e-04
44	100.00000	96.51257	2.745488e-04
45	100.00000	96.43147	2.772071e-04
46	100.00000	96.35036	2.800250e-04
47	100.00000	96.26926	2.812748e-04
48	100.00000	96.18816	2.915189e-04
49	100.00000	96.10706	3.020253e-04
50	100.00000	96.02595	3.055486e-04
51	100.00000	95.94485	3.128038e-04
52	100.00000	95.86375	3.178895e-04
53	100.00000	95.78264	3.257990e-04
54	100.00000	95.70154	3.364796e-04
55	100.00000	95.62044	3.445401e-04
56	100.00000	95.53933	3.498530e-04
57	100.00000	95.45823	3.584757e-04
58	100.00000	95.37713	3.675157e-04
59	100.00000	95.29603	3.698468e-04
60	100.00000	95.21492	3.788592e-04
61	100.00000	95.13382	3.897698e-04
62	100.00000	95.05272	3.993776e-04
63	100.00000	94.97161	4.082317e-04
64	100.00000	94.89051	4.260506e-04
65	100.00000	94.80941	4.424069e-04
66	100.00000	94.72830	4.669517e-04
67	100.00000	94.64720	4.968377e-04
68	100.00000	94.56610	5.158366e-04
69	100.00000	94.48500	5.332559e-04

70	100.00000	94.40389	5.429095e-04
71	100.00000	94.32279	5.518278e-04
72	100.00000	94.24169	5.648276e-04
73	100.00000	94.16058	5.777931e-04
74	100.00000	94.07948	5.893025e-04
75	100.00000	93.99838	6.143131e-04
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78	100.00000	93.75507	6.843014e-04
79	100.00000	93.67397	6.887168e-04
80	100.00000	93.59286	6.915335e-04
81	100.00000	93.51176	6.949271e-04
82	100.00000	93.43066	6.989480e-04
83	100.00000	93.34955	7.104478e-04
84	100.00000	93.26845	7.277276e-04
85	100.00000	93.18735	7.375238e-04
86	100.00000	93.10624	7.400504e-04
87	100.00000	93.02514	7.529045e-04
88	100.00000	92.94404	7.683453e-04
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92	100.00000	92.61963	8.560094e-04
93	100.00000	92.53852	8.597026e-04
94	100.00000	92.45742	8.610982e-04
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96	100.00000	92.29521	8.844515e-04
97	100.00000	92.21411	9.050325e-04
98	100.00000	92.13301	9.160711e-04
99	100.00000	92.05191	9.259486e-04
100	100.00000	91.97080	9.331145e-04
101	100.00000	91.88970	9.349385e-04
102	100.00000	91.80860	9.497385e-04
103	100.00000	91.72749	9.655001e-04
104	100.00000	91.64639	9.739829e-04
105	100.00000	91.56529	9.971507e-04
106	100.00000	91.48418	1.015140e-03
107	100.00000	91.40308	1.022400e-03
108	100.00000	91.32198	1.033967e-03
109	100.00000	91.24088	1.055043e-03
110	100.00000	91.15977	1.080932e-03
111	100.00000	91.07867	1.109621e-03
112	100.00000	90.99757	1.131840e-03
113	100.00000	90.91646	1.144877e-03
114	100.00000	90.83536	1.157728e-03
115	100.00000	90.75426	1.162937e-03
116	100.00000	90.67315	1.171376e-03
117	100.00000	90.59205	1.179585e-03
118	100.00000	90.51095	1.180377e-03
119	100.00000	90.42985	1.184939e-03
120	100.00000	90.34874	1.194301e-03
121	100.00000	90.26764	1.227238e-03
122	100.00000	90.18654	1.257888e-03
123	100.00000	90.10543	1.285436e-03
124	100.00000	90.02433	1.325288e-03
125	100.00000	89.94323	1.346286e-03
126	100.00000	89.86212	1.365502e-03
127	100.00000	89.78102	1.405021e-03
128	100.00000	89.69992	1.437927e-03
129	100.00000	89.61882	1.450511e-03
130	100.00000	89.53771	1.464254e-03
131	100.00000	89.45661	1.479717e-03
132	100.00000	89.37551	1.492358e-03
133	100.00000	89.29440	1.504752e-03

134	100.00000	89.21330	1.515097e-03
135	100.00000	89.13220	1.518506e-03
136	100.00000	89.05109	1.523184e-03
137	100.00000	88.96999	1.531379e-03
138	99.57806	88.96999	1.539832e-03
139	99.57806	88.88889	1.551062e-03
140	99.57806	88.80779	1.563165e-03
141	99.57806	88.72668	1.602983e-03
142	99.57806	88.64558	1.639329e-03
143	99.57806	88.56448	1.654093e-03
144	99.57806	88.48337	1.672755e-03
145	99.57806	88.40227	1.701885e-03
146	99.57806	88.32117	1.733596e-03
147	99.57806	88.24006	1.742139e-03
148	99.57806	88.15896	1.746185e-03
149	99.57806	88.07786	1.763293e-03
150	99.57806	87.99676	1.779348e-03
151	99.57806	87.91565	1.807402e-03
152	99.57806	87.83455	1.846736e-03
153	99.57806	87.75345	1.868604e-03
154	99.57806	87.67234	1.892838e-03
155	99.57806	87.59124	1.912143e-03
156	99.57806	87.51014	1.926264e-03
157	99.57806	87.42903	1.943320e-03
158	99.57806	87.34793	1.953266e-03
159	99.57806	87.26683	1.960578e-03
160	99.57806	87.18573	1.986280e-03
161	99.57806	87.10462	2.028702e-03
162	99.57806	87.02352	2.054863e-03
163	99.57806	86.94242	2.068178e-03
164	99.57806	86.86131	2.086303e-03
165	99.57806	86.78021	2.099354e-03
166	99.57806	86.69911	2.115677e-03
167	99.57806	86.61800	2.130486e-03
168	99.57806	86.53690	2.151529e-03
169	99.57806	86.45580	2.191018e-03
170	99.57806	86.37470	2.210351e-03
171	99.57806	86.29359	2.244667e-03
172	99.57806	86.21249	2.297976e-03
173	99.57806	86.13139	2.324330e-03
174	99.57806	86.05028	2.334999e-03
175	99.57806	85.96918	2.359812e-03
176	99.57806	85.88808	2.392968e-03
177	99.57806	85.80697	2.408961e-03
178	99.57806	85.72587	2.417362e-03
179	99.57806	85.64477	2.422677e-03
180	99.57806	85.56367	2.429385e-03
181	99.57806	85.48256	2.447290e-03
182	99.57806	85.40146	2.460383e-03
183	99.57806	85.32036	2.469052e-03
184	99.57806	85.23925	2.479390e-03
185	99.57806	85.15815	2.503097e-03
186	99.57806	85.07705	2.528636e-03
187	99.57806	84.99594	2.542116e-03
188	99.57806	84.91484	2.556218e-03
189	99.57806	84.83374	2.563037e-03
190	99.57806	84.75264	2.567613e-03
191	99.57806	84.67153	2.571142e-03
192	99.57806	84.59043	2.572848e-03
193	99.57806	84.50933	2.638522e-03
194	99.57806	84.42822	2.703677e-03
195	99.57806	84.34712	2.712348e-03
196	99.57806	84.26602	2.736609e-03
197	99.57806	84.18491	2.782316e-03

198	99.57806	84.10381	2.817359e-03
199	99.57806	84.02271	2.827618e-03
200	99.57806	83.94161	2.841301e-03
201	99.57806	83.86050	2.855046e-03
202	99.15612	83.86050	2.860504e-03
203	99.15612	83.77940	2.882923e-03
204	99.15612	83.69830	2.910649e-03
205	99.15612	83.61719	2.928208e-03
206	99.15612	83.53609	2.954002e-03
207	99.15612	83.45499	2.991141e-03
208	99.15612	83.37388	3.047133e-03
209	99.15612	83.29278	3.104322e-03
210	99.15612	83.21168	3.131667e-03
211	99.15612	83.13058	3.149631e-03
212	99.15612	83.04947	3.166343e-03
213	99.15612	82.96837	3.171134e-03
214	99.15612	82.88727	3.206132e-03
215	99.15612	82.80616	3.244662e-03
216	99.15612	82.72506	3.257435e-03
217	99.15612	82.64396	3.272626e-03
218	99.15612	82.56285	3.281603e-03
219	99.15612	82.48175	3.300816e-03
220	99.15612	82.40065	3.320516e-03
221	99.15612	82.31955	3.334715e-03
222	99.15612	82.23844	3.365521e-03
223	99.15612	82.15734	3.391319e-03
224	99.15612	82.07624	3.435893e-03
225	99.15612	81.99513	3.472701e-03
226	99.15612	81.91403	3.497880e-03
227	99.15612	81.83293	3.525753e-03
228	99.15612	81.75182	3.552713e-03
229	99.15612	81.67072	3.584095e-03
230	99.15612	81.58962	3.641630e-03
231	99.15612	81.50852	3.710945e-03
232	99.15612	81.42741	3.733320e-03
233	99.15612	81.34631	3.737560e-03
234	99.15612	81.26521	3.755331e-03
235	99.15612	81.18410	3.786918e-03
236	99.15612	81.10300	3.803318e-03
237	99.15612	81.02190	3.824141e-03
238	99.15612	80.94079	3.871796e-03
239	99.15612	80.85969	3.902618e-03
240	99.15612	80.77859	3.927966e-03
241	99.15612	80.69749	3.969478e-03
242	99.15612	80.61638	4.023006e-03
243	99.15612	80.53528	4.090847e-03
244	99.15612	80.45418	4.139364e-03
245	99.15612	80.37307	4.190611e-03
246	99.15612	80.29197	4.274911e-03
247	99.15612	80.21087	4.349482e-03
248	99.15612	80.12976	4.397663e-03
249	99.15612	80.04866	4.518068e-03
250	99.15612	79.96756	4.653419e-03
251	99.15612	79.88646	4.703749e-03
252	99.15612	79.80535	4.748544e-03
253	99.15612	79.72425	4.812971e-03
254	99.15612	79.64315	4.869112e-03
255	99.15612	79.56204	4.903287e-03
256	99.15612	79.48094	4.916689e-03
257	99.15612	79.39984	4.919732e-03
258	99.15612	79.31873	4.958591e-03
259	99.15612	79.23763	5.004640e-03
260	99.15612	79.15653	5.018580e-03
261	99.15612	79.07543	5.026958e-03

262	99.15612	78.99432	5.038393e-03
263	99.15612	78.91322	5.056171e-03
264	99.15612	78.83212	5.067200e-03
265	99.15612	78.75101	5.079632e-03
266	99.15612	78.66991	5.097568e-03
267	99.15612	78.58881	5.129222e-03
268	99.15612	78.50770	5.198376e-03
269	99.15612	78.42660	5.305906e-03
270	99.15612	78.34550	5.376706e-03
271	99.15612	78.26440	5.385718e-03
272	99.15612	78.18329	5.392000e-03
273	99.15612	78.10219	5.405297e-03
274	99.15612	78.02109	5.422650e-03
275	99.15612	77.93998	5.459926e-03
276	99.15612	77.85888	5.491800e-03
277	99.15612	77.77778	5.541261e-03
278	99.15612	77.69667	5.586410e-03
279	99.15612	77.61557	5.587528e-03
280	99.15612	77.53447	5.592716e-03
281	99.15612	77.45337	5.608257e-03
282	99.15612	77.37226	5.647966e-03
283	99.15612	77.29116	5.679754e-03
284	98.73418	77.29116	5.739934e-03
285	98.73418	77.21006	5.807593e-03
286	98.73418	77.12895	5.821957e-03
287	98.73418	77.04785	5.836028e-03
288	98.73418	76.96675	5.852966e-03
289	98.73418	76.88564	5.886948e-03
290	98.73418	76.80454	5.921446e-03
291	98.73418	76.72344	5.936531e-03
292	98.73418	76.64234	5.958609e-03
293	98.73418	76.56123	6.010829e-03
294	98.73418	76.48013	6.050271e-03
295	98.73418	76.39903	6.057595e-03
296	98.73418	76.31792	6.092836e-03
297	98.73418	76.23682	6.184180e-03
298	98.73418	76.15572	6.251309e-03
299	98.73418	76.07461	6.262073e-03
300	98.31224	76.07461	6.305813e-03
301	98.31224	75.99351	6.343564e-03
302	98.31224	75.91241	6.347443e-03
303	97.89030	75.91241	6.361468e-03
304	97.89030	75.83131	6.401017e-03
305	97.89030	75.75020	6.432594e-03
306	97.89030	75.66910	6.463869e-03
307	97.89030	75.58800	6.495059e-03
308	97.89030	75.50689	6.551912e-03
309	97.89030	75.42579	6.607841e-03
310	97.89030	75.34469	6.617436e-03
311	97.89030	75.26358	6.633539e-03
312	97.89030	75.18248	6.653323e-03
313	97.89030	75.10138	6.688099e-03
314	97.89030	75.02028	6.722589e-03
315	97.89030	74.93917	6.762112e-03
316	97.89030	74.85807	6.834276e-03
317	97.89030	74.77697	6.884614e-03
318	97.89030	74.69586	6.944661e-03
319	97.89030	74.61476	7.001918e-03
320	97.89030	74.53366	7.018350e-03
321	97.89030	74.45255	7.039169e-03
322	97.89030	74.37145	7.058434e-03
323	97.89030	74.29035	7.090367e-03
324	97.89030	74.20925	7.115194e-03
325	97.89030	74.12814	7.124604e-03

```

326 97.89030 74.04704 7.135926e-03
327 97.89030 73.96594 7.163319e-03
328 97.89030 73.88483 7.185315e-03
329 97.89030 73.80373 7.264058e-03
330 97.89030 73.72263 7.348925e-03
331 97.89030 73.64152 7.396682e-03
332 97.89030 73.56042 7.439972e-03
333 97.89030 73.47932 7.467990e-03

```

```
[ reached 'max' / getOption("max.print") -- omitted 1138 rows ]
```

```
> roc(attr$Attrition,logistic$fitted.values,plot=TRUE, legacy.axes=TRUE, xlab="False Positive
Percentage", ylab="True Postive Percentage", col="#377eb8", lwd=4, percent=TRUE)
```

```
Setting levels: control = No, case = Yes
```

```
Setting direction: controls < cases
```

```
Call:
```

```
roc.default(response = attr$Attrition, predictor = logistic$fitted.values, percent = TRUE,
plot = TRUE, legacy.axes = TRUE, xlab = "False Positive Percentage", ylab = "True Postive
Percentage", col = "#377eb8", lwd = 4)
```

```
Data: logistic$fitted.values in 1233 controls (attr$Attrition No) < 237 cases (attr$Attrition
Yes).
```

```
Area under the curve: 89.6%
```

```
> roc(attr$Attrition,logistic$fitted.values,plot=TRUE, legacy.axes=TRUE, xlab="False Positive
Percentage", ylab="True Postive Percentage", col="#377eb8", lwd=4, percent=TRUE, print.auc=TRU
E)
```

```
Setting levels: control = No, case = Yes
```

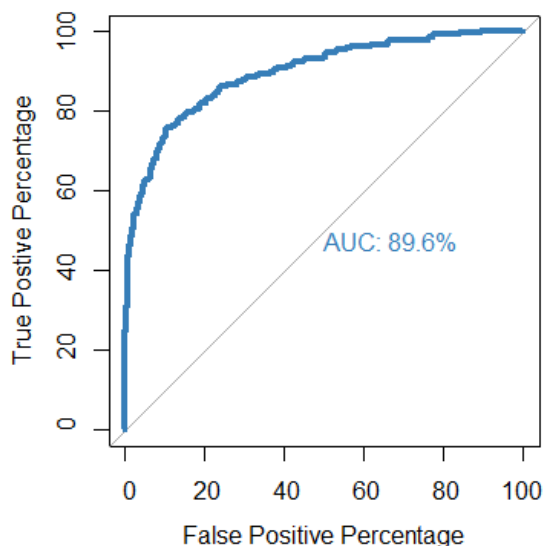
```
Setting direction: controls < cases
```

```
Call:
```

```
roc.default(response = attr$Attrition, predictor = logistic$fitted.values, percent = TRUE,
plot = TRUE, legacy.axes = TRUE, xlab = "False Positive Percentage", ylab = "True Postive
Percentage", col = "#377eb8", lwd = 4, print.auc = TRUE)
```

```
Data: logistic$fitted.values in 1233 controls (attr$Attrition No) < 237 cases (attr$Attrition
Yes).
```

```
Area under the curve: 89.6%
```



```
> roc(attr$Attrition,logistic$fitted.values,plot=TRUE, legacy.axes=TRUE, xlab="False Positive
Percentage", ylab="True Postive Percentage", col="#377eb8", lwd=4, percent=TRUE, print.auc=TRU
E, partial.auc=c(100, 90), auc.polygon = TRUE, auc.polygon.col = "#377eb822", print.auc.x=45)
```

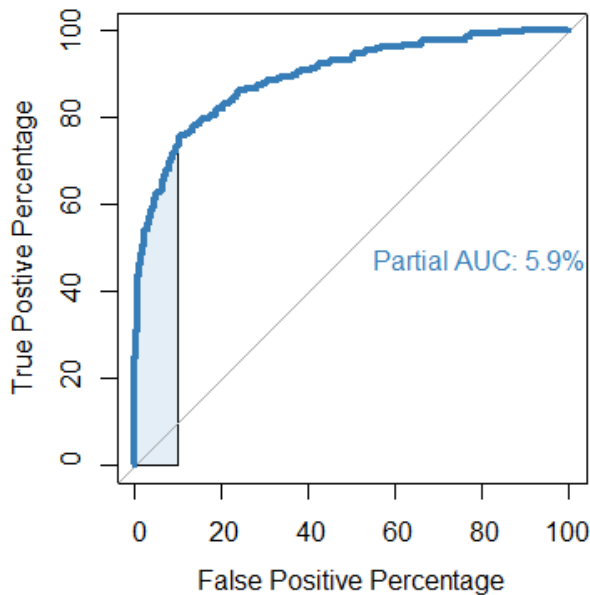
```
Setting levels: control = No, case = Yes
```

```
Setting direction: controls < cases
```



```
Call:
roc.default(response = attr$Attrition, predictor = logistic$fitted.values, percent = TRUE,
plot = TRUE, legacy.axes = TRUE, xlab = "False Positive Percentage", ylab = "True Postive
Percentage", col = "#377eb8", lwd = 4, print.auc = TRUE, partial.auc = c(100, 90), auc.poly
gon = TRUE, auc.polygon.col = "#377eb822", print.auc.x = 45)
```

Data: logistic\$fitted.values in 1233 controls (attr\$Attrition No) < 237 cases (attr\$Attrition Yes).
Partial area under the curve (specificity 100%-90%): 5.921%



```
> # Lets do two roc plots to understand which model is better
> roc(attr$Attrition, logistic_simple$fitted.values, plot=TRUE, legacy.axes=TRUE, percent=TRUE
, xlab="False Positive Percentage", ylab="True Postive Percentage", col="#377eb8", lwd=4, prin
t.auc=TRUE)
Setting levels: control = No, case = Yes
Setting direction: controls < cases
```

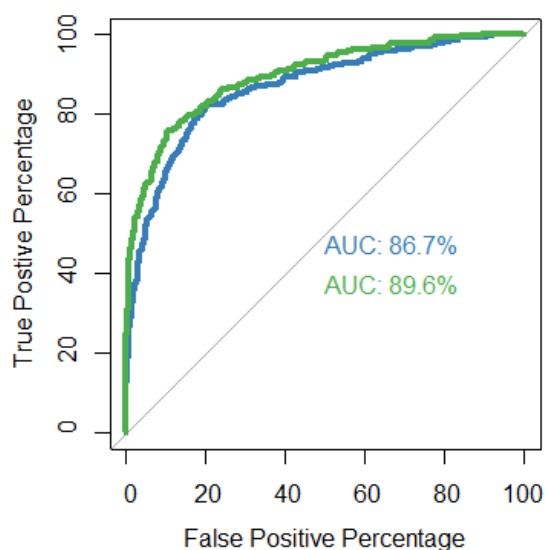
```
Call:
roc.default(response = attr$Attrition, predictor = logistic_simple$fitted.values, percent
= TRUE, plot = TRUE, legacy.axes = TRUE, xlab = "False Positive Percentage", ylab = "True
Postive Percentage", col = "#377eb8", lwd = 4, print.auc = TRUE)
```

Data: logistic_simple\$fitted.values in 1233 controls (attr\$Attrition No) < 237 cases (attr\$Attrition Yes).

Area under the curve: 86.7%

There were 18 warnings (use warnings() to see them)

```
> # Lets add the other graph
> plot.roc(attr$Attrition, logistic$fitted.values, percent=TRUE, col="#4daf4a", lwd=4, print.a
uc=TRUE, add=TRUE, print.auc.y=40)
Setting levels: control = No, case = Yes
Setting direction: controls < cases
```



```
> # reset the par area back to the default setting
> par(pty='m')
```

```
> ##Multiple Discriminant Analysis
```

```
> library(ROCR)
```

```
> library(MASS)
```

```
> attr_mda <- attr
```

```
> dim(attr_mda)
```

```
[1] 1470 31
```

```
> # Lets cut the data into two parts
```

```
> smp_size_raw <- floor(0.75 * nrow(attr_mda))
```

```
> train_ind_raw <- sample(nrow(attr_mda), size = smp_size_raw)
```

```
> train_raw.df <- as.data.frame(attr_mda[train_ind_raw, ])
```

```
> test_raw.df <- as.data.frame(attr_mda[-train_ind_raw, ])
```

```
> # We now have a training and a test set. Training is 75% and test is 25%
```

```
> attr_mda.lda <- lda(formula = train_raw.df$Attrition ~ ., data = train_raw.df)
```

```
> attr_mda.lda
```

```
Call:
```

```
lda(train_raw.df$Attrition ~ ., data = train_raw.df)
```

```
Prior probabilities of groups:
```

```
      No      Yes
0.8475499 0.1524501
```

```
Group means:
```

	Age	BusinessTravel	Travel_Frequently	BusinessTravel	Travel_Rarely	DailyRate
No	37.62313		0.1638116		0.7194861	812.6724
Yes	34.27381		0.2797619		0.6666667	740.3571

	DepartmentResearch & Development	DepartmentSales	DistanceFromHome	Education2	Education3	Education4
No	0.6670236	0.2880086	8.765525	0.1991435	0.3886510	0
Yes	0.5595238	0.3928571	11.083333	0.1726190	0.4047619	0

	Education5	EducationFieldLife Sciences	EducationFieldMarketing	EducationFieldMedical	EducationFieldOther
No	0.03426124	0.4218415	0.09957173		0.3244111
Yes	0.01190476	0.3750000	0.15476190		0.2797619

EducationFieldTechnical Degree	EnvironmentSatisfaction2	EnvironmentSatisfaction3	EnvironmentSatisfaction4
No	0.07922912	0.1916488	0.3115632
0.3244111			
Yes	0.11904762	0.1547619	0.2559524
0.2916667			
GenderMale	HourlyRate	JobInvolvement2	JobInvolvement3
JobLevel4	JobInvolvement4	JobLevel2	JobLevel3
No	0.6027837	65.69486	0.2548180
0.08565310			0.5985011
Yes	0.6428571	65.28571	0.10278373
0.01785714			0.3822270
JobLevel5	JobRoleHuman Resources	JobRoleLaboratory Technician	JobRoleManager
acturing Director	JobRoleManuf		
No	0.05781585	0.03319058	0.1563169
0.1167024			0.08779443
Yes	0.02976190	0.04761905	0.2678571
0.0297619			0.02976190
JobRoleResearch Director	JobRoleResearch Scientist	JobRolesSales Executive	JobRolesSales Rep
representative			
No	0.06316916	0.1937901	0.2173448
0.03961456			
Yes	0.01190476	0.1904762	0.2380952
0.14285714			
JobSatisfaction2	JobSatisfaction3	JobSatisfaction4	MaritalStatusMarried
e MonthlyIncome	MaritalStatusSingl		
No	0.2023555	0.3008565	0.3276231
3	6936.455		0.4828694
Yes	0.1964286	0.2976190	0.2261905
0	4855.577		0.3809524
MonthlyRate	NumCompaniesWorked	OverTimeYes	PercentsSalaryHike
ipSatisfaction2	PerformanceRating4	Relationships	
No	14309.85	2.662741	0.2280514
0.2184154			15.20236
Yes	14121.93	2.928571	0.5714286
0.2083333			15.32143
RelationshipsSatisfaction3	RelationshipsSatisfaction4	StockOptionLevel1	StockOptionLevel2
StockOptionLevel3	StockOptionLevel3		
No	0.3169165	0.2944325	0.4293362
0.06531049			0.12633833
Yes	0.2738095	0.2857143	0.2440476
0.05357143			0.05357143
TotalWorkingYears	TrainingTimesLastYear	WorkLifeBalance2	WorkLifeBalance3
YearsAtCompany	WorkLifeBalance4		
No	11.866167	2.860814	0.2291221
7.323340			0.6327623
Yes	8.214286	2.702381	0.2321429
5.119048			0.5416667
YearsInCurrentRole	YearsSinceLastPromotion	YearsWithCurrManager	
No	4.431478	2.252677	4.349036
Yes	2.857143	1.839286	2.755952

Coefficients of linear discriminants:

	LD1
Age	-1.152523e-02
BusinessTravelTravel_Frequently	9.781898e-01
BusinessTravelTravel_Rarely	4.661039e-01
DailyRate	-2.809728e-04
DepartmentResearch & Development	5.384509e-01
DepartmentsSales	3.273765e-01
DistanceFromHome	2.731846e-02
Education2	-1.277977e-02
Education3	3.800546e-02
Education4	7.653387e-02

Education5	-2.173898e-01
EducationFieldLife Sciences	-4.781895e-01
EducationFieldMarketing	-1.198532e-01
EducationFieldMedical	-4.648028e-01
EducationFieldOther	-5.407323e-01
EducationFieldTechnical Degree	2.568835e-02
EnvironmentSatisfaction2	-7.524387e-01
EnvironmentSatisfaction3	-7.448215e-01
EnvironmentSatisfaction4	-6.917045e-01
GenderMale	1.448186e-01
HourlyRate	-4.865589e-05
JobInvolvement2	-1.030019e+00
JobInvolvement3	-1.149826e+00
JobInvolvement4	-1.533953e+00
JobLevel2	-5.456699e-01
JobLevel3	-7.738463e-02
JobLevel4	9.779248e-02
JobLevel5	7.670219e-01
JobRoleHuman Resources	7.370635e-01
JobRoleLaboratory Technician	3.377002e-01
JobRoleManager	-5.868232e-02
JobRoleManufacturing Director	-2.065769e-01
JobRoleResearch Director	-3.884694e-01
JobRoleResearch Scientist	-3.396420e-01
JobRoleSales Executive	4.930880e-01
JobRoleSales Representative	1.134055e+00
JobSatisfaction2	-5.227940e-01
JobSatisfaction3	-4.860490e-01
JobSatisfaction4	-7.661890e-01
MaritalStatusMarried	4.211232e-02
MaritalStatusSingle	2.330454e-01
MonthlyIncome	-3.785043e-05
MonthlyRate	2.812677e-06
NumCompaniesWorked	9.206791e-02
OverTimeYes	1.342059e+00
PercentsSalaryHike	9.271971e-03
PerformanceRating4	2.297203e-02
RelationshipSatisfaction2	-3.956695e-01
RelationshipSatisfaction3	-5.078096e-01
RelationshipSatisfaction4	-5.020019e-01
StockOptionLevel1	-6.293360e-01
StockOptionLevel2	-6.382947e-01
StockOptionLevel3	-3.390076e-01
TotalWorkingYears	-3.165715e-02
TrainingTimesLastYear	-5.281399e-02
WorkLifeBalance2	-8.466847e-01
WorkLifeBalance3	-1.056643e+00
WorkLifeBalance4	-6.795946e-01
YearsAtCompany	2.920513e-02
YearsInCurrentRole	-3.586132e-02
YearsSinceLastPromotion	4.905133e-02
YearsWithCurrManager	-4.406472e-02

> summary(attr_mda.lda)

	Length	Class	Mode
prior	2	-none-	numeric
counts	2	-none-	numeric
means	124	-none-	numeric
scaling	62	-none-	numeric
lev	2	-none-	character
svd	1	-none-	numeric
N	1	-none-	numeric
call	3	-none-	call
terms	3	terms	call
xlevels	16	-none-	list

```
> print(attr_mda.llda)
```

```
Call:
```

```
lda(train_raw.df$Attrition ~ ., data = train_raw.df)
```

```
Prior probabilities of groups:
```

```
      No      Yes  
0.8475499 0.1524501
```

```
Group means:
```

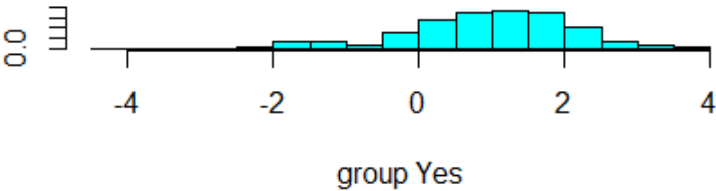
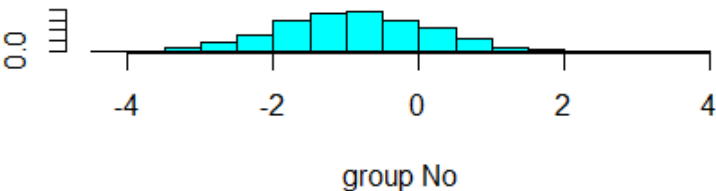
```
      Age BusinessTravelTravel_Frequently BusinessTravelTravel_Rarely DailyRate  
No 37.62313 0.1638116 0.7194861 812.6724  
Yes 34.27381 0.2797619 0.6666667 740.3571  
DepartmentResearch & Development DepartmentSales DistanceFromHome Education2 Education3 Edu  
cation4  
No 0.6670236 0.2880086 8.765525 0.1991435 0.3886510 0.  
2698073  
Yes 0.5595238 0.3928571 11.083333 0.1726190 0.4047619 0.  
2559524  
Education5 EducationFieldLife Sciences EducationFieldMarketing EducationFieldMedical Educat  
ionFieldOther  
No 0.03426124 0.4218415 0.09957173 0.3244111  
0.05674518  
Yes 0.01190476 0.3750000 0.15476190 0.2797619  
0.04761905  
EducationFieldTechnical Degree EnvironmentsSatisfaction2 EnvironmentsSatisfaction3 Environmen  
tSatisfaction4  
No 0.07922912 0.1916488 0.3115632  
0.3244111  
Yes 0.11904762 0.1547619 0.2559524  
0.2916667  
GenderMale HourlyRate JobInvolvement2 JobInvolvement3 JobInvolvement4 JobLevel2 JobLevel3  
JobLevel4  
No 0.6027837 65.69486 0.2548180 0.5985011 0.10278373 0.3822270 0.1477516 0  
.08565310  
Yes 0.6428571 65.28571 0.2797619 0.5476190 0.05357143 0.2261905 0.1250000 0  
.01785714  
JobLevel5 JobRoleHuman Resources JobRoleLaboratory Technician JobRoleManager JobRoleManufa  
cturing Director  
No 0.05781585 0.03319058 0.1563169 0.08779443  
0.1167024  
Yes 0.02976190 0.04761905 0.2678571 0.02976190  
0.0297619  
JobRoleResearch Director JobRoleResearch Scientist JobRolesSales Executive JobRolesSales Repr  
esentative  
No 0.06316916 0.1937901 0.2173448  
0.03961456  
Yes 0.01190476 0.1904762 0.2380952  
0.14285714  
JobSatisfaction2 JobSatisfaction3 JobSatisfaction4 MaritalStatusMarried MaritalStatusSingle  
MonthlyIncome  
No 0.2023555 0.3008565 0.3276231 0.4828694 0.2762313  
6936.455  
Yes 0.1964286 0.2976190 0.2261905 0.3809524 0.5000000  
4855.577  
MonthlyRate NumCompaniesWorked OverTimeYes PercentSalaryHike PerformanceRating4 Relationshi  
pSatisfaction2  
No 14309.85 2.662741 0.2280514 15.20236 0.1498929  
0.2184154  
Yes 14121.93 2.928571 0.5714286 15.32143 0.1726190  
0.2083333  
RelationshipsSatisfaction3 RelationshipsSatisfaction4 StockOptionLevel1 StockOptionLevel2 Sto  
ckOptionLevel3  
No 0.3169165 0.2944325 0.4293362 0.12633833  
0.06531049
```

Yes	0.2738095	0.2857143	0.2440476	0.05357143
0.05357143				
TotalWorkingYears	TrainingTimesLastYear	workLifeBalance2	workLifeBalance3	workLifeBalance4
YearsAtCompany				
No	11.866167	2.860814	0.2291221	0.6327623
7.323340				0.09743041
Yes	8.214286	2.702381	0.2321429	0.5416667
5.119048				0.11904762
YearsInCurrentRole	YearsSinceLastPromotion	YearsWithCurrManager		
No	4.431478	2.252677	4.349036	
Yes	2.857143	1.839286	2.755952	

Coefficients of linear discriminants:

	LD1
Age	-1.152523e-02
BusinessTravelTravel_Frequently	9.781898e-01
BusinessTravelTravel_Rarely	4.661039e-01
DailyRate	-2.809728e-04
DepartmentResearch & Development	5.384509e-01
DepartmentSales	3.273765e-01
DistanceFromHome	2.731846e-02
Education2	-1.277977e-02
Education3	3.800546e-02
Education4	7.653387e-02
Education5	-2.173898e-01
EducationFieldLife Sciences	-4.781895e-01
EducationFieldMarketing	-1.198532e-01
EducationFieldMedical	-4.648028e-01
EducationFieldOther	-5.407323e-01
EducationFieldTechnical Degree	2.568835e-02
EnvironmentSatisfaction2	-7.524387e-01
EnvironmentSatisfaction3	-7.448215e-01
EnvironmentSatisfaction4	-6.917045e-01
GenderMale	1.448186e-01
HourlyRate	-4.865589e-05
JobInvolvement2	-1.030019e+00
JobInvolvement3	-1.149826e+00
JobInvolvement4	-1.533953e+00
JobLevel2	-5.456699e-01
JobLevel3	-7.738463e-02
JobLevel4	9.779248e-02
JobLevel5	7.670219e-01
JobRoleHuman Resources	7.370635e-01
JobRoleLaboratory Technician	3.377002e-01
JobRoleManager	-5.868232e-02
JobRoleManufacturing Director	-2.065769e-01
JobRoleResearch Director	-3.884694e-01
JobRoleResearch Scientist	-3.396420e-01
JobRoleSales Executive	4.930880e-01
JobRoleSales Representative	1.134055e+00
JobSatisfaction2	-5.227940e-01
JobSatisfaction3	-4.860490e-01
JobSatisfaction4	-7.661890e-01
MaritalStatusMarried	4.211232e-02
MaritalStatusSingle	2.330454e-01
MonthlyIncome	-3.785043e-05
MonthlyRate	2.812677e-06
NumCompaniesWorked	9.206791e-02
OverTimeYes	1.342059e+00
PercentSalaryHike	9.271971e-03
PerformanceRating4	2.297203e-02
RelationshipSatisfaction2	-3.956695e-01
RelationshipSatisfaction3	-5.078096e-01
RelationshipSatisfaction4	-5.020019e-01

```
StockOptionLevel1      -6.293360e-01
StockOptionLevel2      -6.382947e-01
StockOptionLevel3      -3.390076e-01
TotalWorkingYears      -3.165715e-02
TrainingTimesLastYear  -5.281399e-02
WorkLifeBalance2       -8.466847e-01
WorkLifeBalance3       -1.056643e+00
WorkLifeBalance4       -6.795946e-01
YearsAtCompany          2.920513e-02
YearsInCurrentRole     -3.586132e-02
YearsSinceLastPromotion 4.905133e-02
YearsWithCurrManager   -4.406472e-02
> plot(attr_mda.lda)
```



```
> attr_mda.lda.predict <- predict(attr_mda.lda, newdata = test_raw.df)
> attr_mda.lda.predict$class
[1] Yes No No No No No No No No No No No Yes No No No No No No No No No No
No Yes No No
[27] No No No No No No Yes No No No No No No No No No Yes No No No No No Yes
No No No No
[53] No No No No No No No No No No No No No No No No No No No No No No Yes No
No No No Yes
[79] No No No No No No No No No No No No No No No No No No No No No No Yes Yes
No Yes Yes Yes
[105] No No No No No No No No No No Yes No No No Yes No No No No No No No No Yes
No No No No
[131] No No No No No No No No No No No No No No No No No No No No No No No No
No Yes No No
[157] No No No No No No No No No No No Yes Yes No No No No No No No No No Yes No
No No No No
[183] No No No No No No No Yes No No No No No No No No Yes No No Yes No Yes No
No No No No
[209] No No No No No No No No No No No Yes Yes No No No No No Yes No No Yes No No
No No No Yes
[235] No No No Yes No No No No No No No No No No No Yes Yes No No Yes No No
Yes No No No
[261] Yes No No No No No No Yes No Yes No No No No No No No No No No No No Yes
No No No No
```

```
[287] Yes Yes No No No No No No No Yes No No No No Yes No Yes No No No No No No
No No Yes No
[313] No No Yes No No No No No No No No No No No Yes Yes No No No Yes No No No No
No No No No
[339] No No No No No No No No Yes No No No No No No No No No No No No No No No
No No No Yes
[365] No No No No
```

```
Levels: No Yes
```

```
> view(attr_mda.lda.predict)
```

```
> attr_mda.lda.predict$x
```

```
LD1
```

```
3      1.76121943
7      1.29131476
25     -0.05625620
30      0.17170342
31     -0.07180830
32      0.05083115
39      1.47868844
42     -0.39974653
44      0.17548651
45     -0.62002040
47     -0.16505869
49      1.61182804
50     -0.55182038
54      0.12612796
63      0.62333773
64      0.93958831
68     -1.91608816
72     -1.78878323
74     -2.40080564
76     -1.51956078
78      1.05334070
79      0.66410499
104    -1.22487177
112     3.06671605
114    -0.45220867
116    -0.34577530
117    -0.89477900
118    -1.23168732
126    -0.39249716
129    -0.27024214
131    -0.26851536
133     1.76132505
135    -0.61662434
136    -1.25066208
140     1.42263281
144     0.56855913
146    -0.02268665
154    -0.33635149
158     0.20227417
159    -0.41210564
163     0.02038132
167    -0.18510386
172     4.23686608
176    -0.06652022
177     0.12617154
181     0.67091584
182    -0.11733258
183     2.51299682
185    -2.03642979
186    -1.72805140
187    -1.22385828
188    -1.53127837
191    -1.27500283
```


193	1.36255050
200	0.21709917
206	0.04150286
211	0.61147423
218	-0.01177307
228	-1.38499464
229	0.73029011
242	0.02436315
249	-0.73672789
250	-1.00394759
251	-0.07346678
252	0.43058030
253	0.03183453
261	1.09817447
263	0.84138072
269	0.06923796
274	-0.93259819
277	-1.05510434
284	0.17673519
285	1.80667700
286	-1.47901342
292	-0.22620524
293	0.86446593
297	0.70184622
302	1.81883502
309	0.04785827
312	0.98673925
317	0.69845229
320	1.03925408
323	-0.89924005
341	-1.68693961
348	1.08807333
359	-1.63675596
370	1.04105563
374	-0.96742728
377	-2.16283010
391	-1.50315559
399	-0.43739146
405	-0.77533408
406	0.68974502
414	-0.23545660
420	-0.45629240
422	1.06857276
424	-0.55989816
430	0.03748954
431	1.93233030
438	1.68723739
444	1.48420970
454	1.57947234
458	3.10345137
464	4.95002956
465	-0.29563800
466	0.22639165
469	-0.20805147
470	-0.87523612
482	-0.33401072
483	0.97112721
485	-0.85760171
492	0.23760413
493	0.21218667
495	1.77840469
502	-0.52361290
508	-1.00567617
514	1.09812963

515	2.82116090
526	1.48814915
528	-0.51676477
529	0.99789875
530	-2.25883399
535	-2.34284804
546	-0.06216472
553	-0.92736842
555	1.59343824
561	-1.48159036
563	0.55340609
564	-0.21271415
571	-1.40982387
574	1.32854175
575	-1.31809263
578	0.74982894
579	1.54782112
581	0.89985583
583	-1.98161967
585	-0.27413856
588	-0.82078560
595	-1.66394504
601	-2.36377945
605	-1.35739184
606	0.35013602
608	-0.41942057
610	-1.09562846
613	1.42686490
615	0.71118671
617	-1.09894699
618	-0.09538875
623	-1.10680667
625	0.39039826
628	-0.90902902
641	0.16736646
644	-0.96490620
646	2.00116913
650	-1.19248841
651	-1.12103190
652	0.29305243
658	0.12535960
662	-0.30154438
665	-0.45772058
668	1.55687008
675	-0.59608748
680	-1.22833232
681	-0.76959745
683	-0.25947668
686	0.16703561
690	2.53993439
696	1.99229968
703	0.36969295
705	-1.34786621
707	0.39748387
719	0.17277682
720	0.16939861
727	-1.12317320
729	-1.52033552
730	0.77569044
732	2.30352487
737	-0.90802474
744	-0.08089126
753	0.22382614
758	-2.01955357

766	-0.45872785
776	-0.92278399
779	0.67266146
780	1.49570592
781	0.78317327
788	-1.84832324
798	1.00140406
799	2.73865532
805	-1.67319789
806	-2.45872230
807	-0.43433303
808	0.54855830
811	-1.34233552
813	-0.10691430
814	0.52685526
818	-0.56701457
825	1.63449353
827	-0.21700362
828	0.77726434
830	2.68596193
833	-0.94977381
836	1.69030147
840	0.86181320
844	-0.91107375
851	0.03815281
861	0.30058346
872	1.21950343
873	-0.01651217
876	-0.88078780
882	0.14650838
885	0.23715792
891	-0.40250428
903	-0.45617649
904	-0.44674830
908	-1.23909986
909	-0.35385419
911	-0.89580276
916	3.06661445
922	2.15251394
925	0.51761516
927	0.16521156
940	-0.75582856
944	0.61822967
948	1.73072494
967	0.64579594
971	-0.07787481
981	1.91319232
989	0.42942463
990	0.76236293
998	1.53272885
1005	-0.15268651
1006	0.87724024
1007	1.89920243
1011	-3.35337568
1015	0.03562049
1019	0.20896557
1022	2.81318196
1024	-0.17356214
1027	-1.22269921
1032	0.30136029
1034	-0.98523285
1041	-2.67117734
1042	-0.27524801
1043	-0.45543174

1048 0.22622513
1049 0.51735503
1053 -0.77780051
1054 -2.42177685
1057 1.96840335
1061 3.16581656
1065 0.03025533
1066 0.15613636
1069 2.01548684
1072 -0.21664437
1074 -0.20793688
1078 2.52239787
1081 -1.30494220
1083 0.99764251
1086 1.54416392
1087 2.13428321
1092 -0.23521561
1094 1.30969353
1100 0.38866273
1101 0.91345835
1102 -1.52172927
1103 2.02152853
1106 0.68666316
1111 2.05222918
1112 -2.46443356
1114 -1.08931092
1115 -0.08156361
1116 1.27783036
1121 -0.01692074
1123 1.37944526
1124 1.13424391
1125 -1.14193963
1129 1.25502732
1130 -0.19894274
1133 -0.63663596
1142 -0.71513971
1143 2.16224557
1144 0.92203511
1152 0.56208496
1153 -0.46507334
1166 1.41926887
1168 2.42967037
1169 2.15774470
1170 0.15509663
1179 1.20916104
1183 -1.98678255
1193 1.56000969
1194 1.00522880
1197 1.18952077
1198 2.00001567
1200 0.08139102
1203 -0.43271563
1209 -1.83293099
1212 -0.24648601
1216 2.12933896
1222 -1.66670504
1225 1.76026197
1227 1.09272064
1231 1.35414283
1236 -0.30704764
1239 1.26507729
1245 0.31976237
1246 0.44331960
1247 0.78033989

1248 -0.25848711
1250 2.38769616
1262 0.87247305
1267 0.02038309
1268 -1.17417898
1272 1.60899332
1275 0.57846678
1278 -0.39646980
1280 0.76047788
1282 1.21237617
1285 -0.63864438
1287 -0.22240054
1288 -1.06359129
1296 0.55528650
1300 -2.49343095
1309 1.83291626
1314 3.38340218
1318 1.53187464
1319 0.70022527
1320 1.28046070
1327 1.83752708
1331 0.16058137
1335 0.19594292
1342 -0.45767239
1353 -1.67916103
1358 -0.75839321
1359 -0.51753839
1360 0.41824121
1362 -0.53625406
1367 0.57228150
1368 -0.88032481
1369 0.44908663
1374 -0.76978824
1375 -0.79679883
1377 -1.42291531
1379 0.01977661
1380 2.57475513
1381 0.38424883
1388 0.08764078
1393 -0.39751981
1404 1.36849965
1405 -1.30013186
1406 -1.72434361
1408 -0.39138475
1410 0.69763776
1413 -0.62010094
1414 1.07172381
1415 0.31016371
1417 -1.69130454
1431 -0.93913148
1433 -0.74058048
1434 0.58897711
1452 -1.31597174
1456 -0.67008971
1461 1.73562676
1463 0.05737990
1464 -1.24876603
1468 -0.49987602
1470 -0.03421014

```
> # Get the posteriors as a dataframe.  
> attr_mda.lda.predict.posteriors <- as.data.frame(attr_mda.lda.predict$posterior)#create ROC/AUC c  
> pred <- prediction(attr_mda.lda.predict.posteriors[,2], test_raw.df$Attrition)  
> roc.perf = performance(pred, measure = "tpr", x.measure = "fpr")  
> auc.train <- performance(pred, measure = "auc")
```

```
> auc.train <- auc.train@y.values  
> plot(roc.perf)  
> abline(a=0, b= 1)  
> text(x = .25, y = .65 ,paste("AUC = ", round(auc.train[[1]],3), sep = ""))
```

