

Kaggle客戶流失率預測

Group 3

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統計三 沈冠宇

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1 資料簡介

Raw data


raw data 包含 7043 個觀測值以及 20 個變數

 Dataset


 1371




Telco Customer Churn

Focused customer retention programs

 BlastChar • updated 3 years ago (Version 1)

[Data](#) [Tasks](#) [Notebooks \(506\)](#) [Discussion \(10\)](#) [Activity](#) [Metadata](#)

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 Usability 8.8  License Data files © Original Authors  Tags business

Description

Context

"Predict behavior to retain customers. You can analyze all relevant customer data and develop focused customer retention programs." [IBM Sample Data Sets]

Input format

Input	Format
customerID	string
gender	binary
SeniorCitizen	binary
Partner	binary
Dependents	binary
tenure	integer
PhoneService	binary
MultipleLines	multinomial
InternetService	multinomial
OnlineSecurity	multinomial

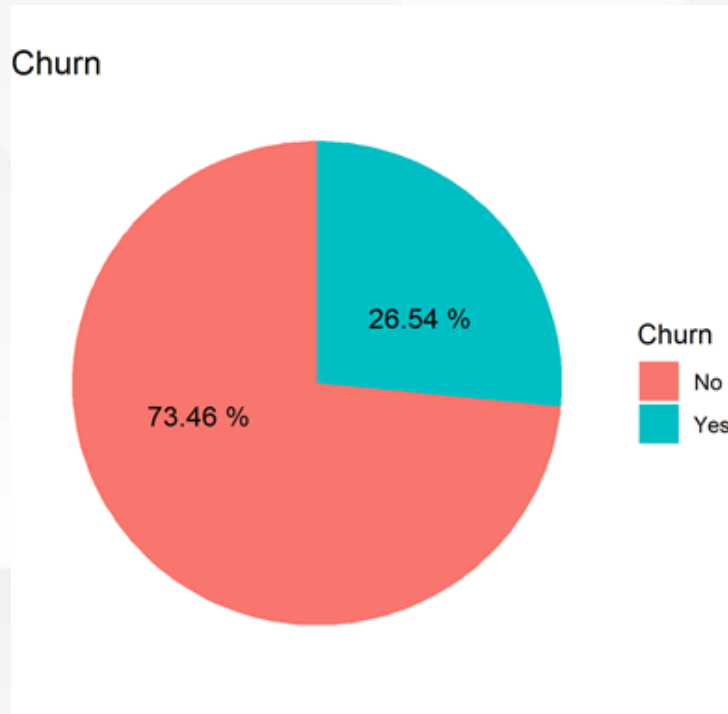
Input	Format
OnlineBackup	multinomial
DeviceProtection	multinomial
TechSupport	multinomial
StreamingTV	multinomial
StreamingMovies	multinomial
Contract	multinomial
PaperlessBilling	binary
PaymentMethod	multinomial
MonthlyCharges	numeric
TotalCharges	numeric

Data-preprocessing

- NA值處理：使用mice套件填補
- 原資料的SeniorCitizen欄位值為1、0，將其改為Yes、No

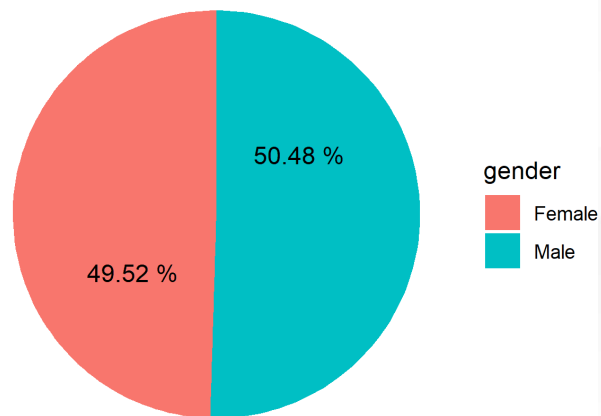
2 EDA

Churn

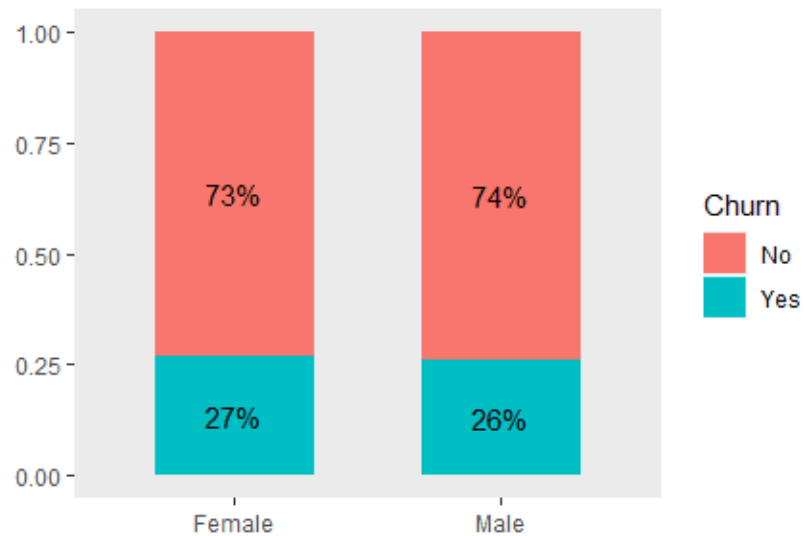


Gender & Churn-gender

Gender

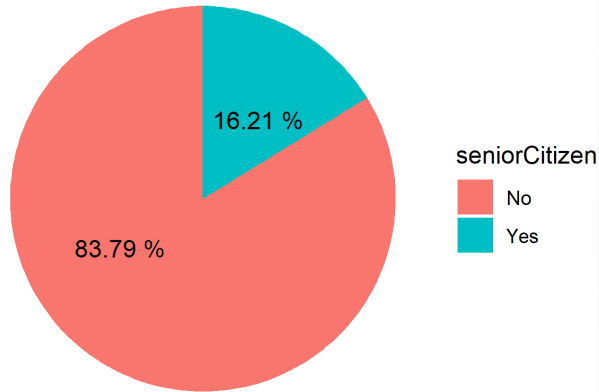


Gender

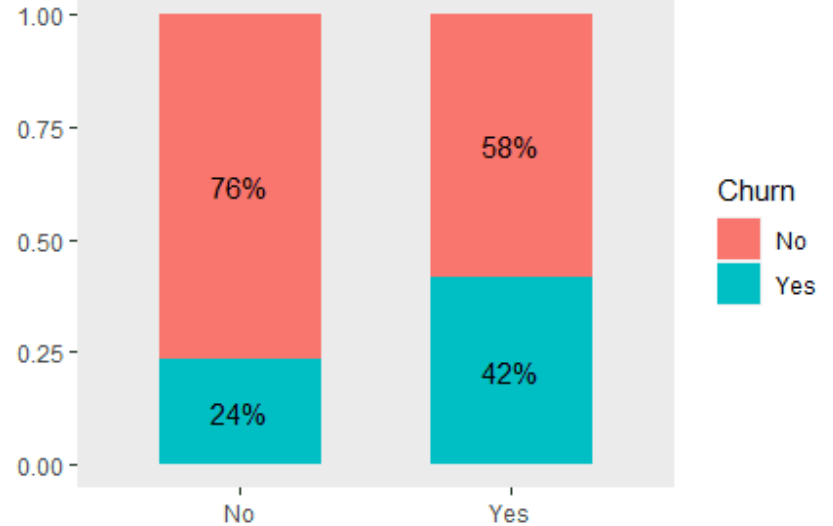


SeniorCitizen & Churn-SeniorCitizen

SeniorCitizen

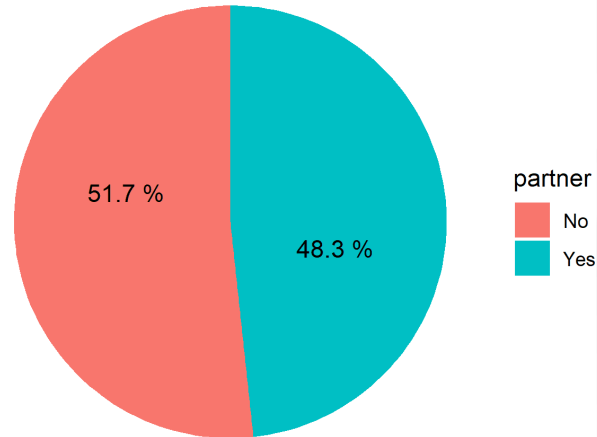


SeniorCitizen

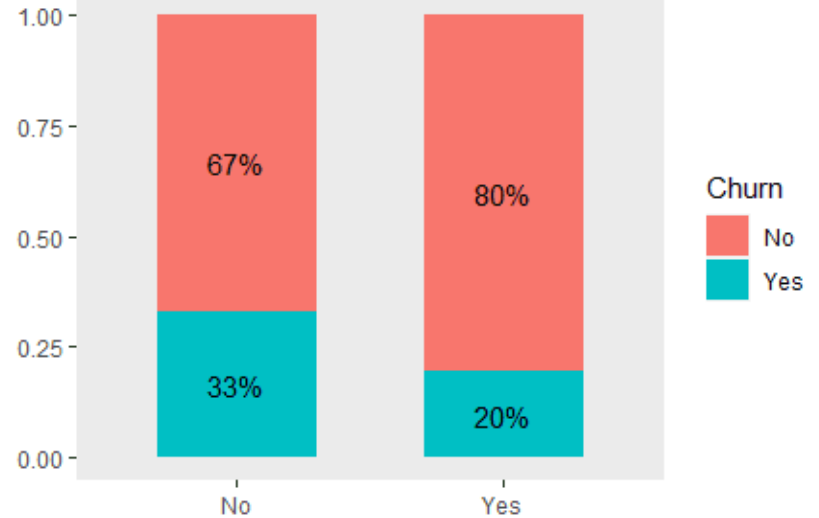


Partner & Churn-Partner

Partner

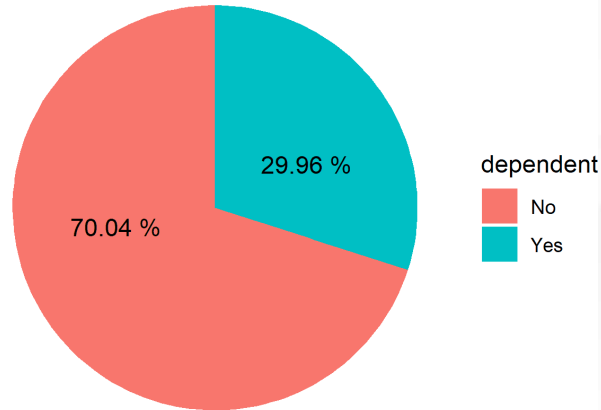


Partner

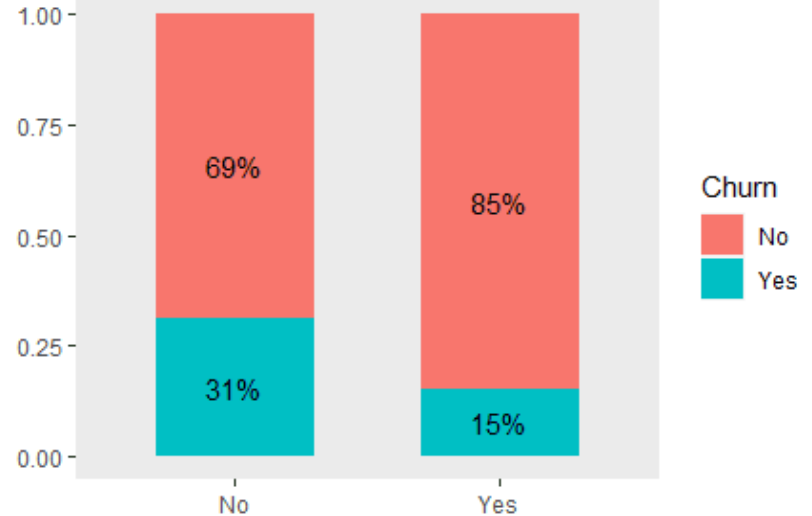


Dependents & Churn-Dependents

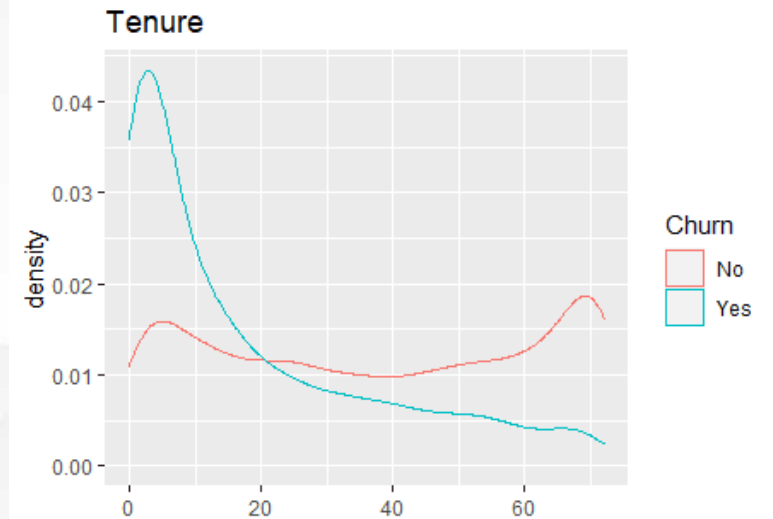
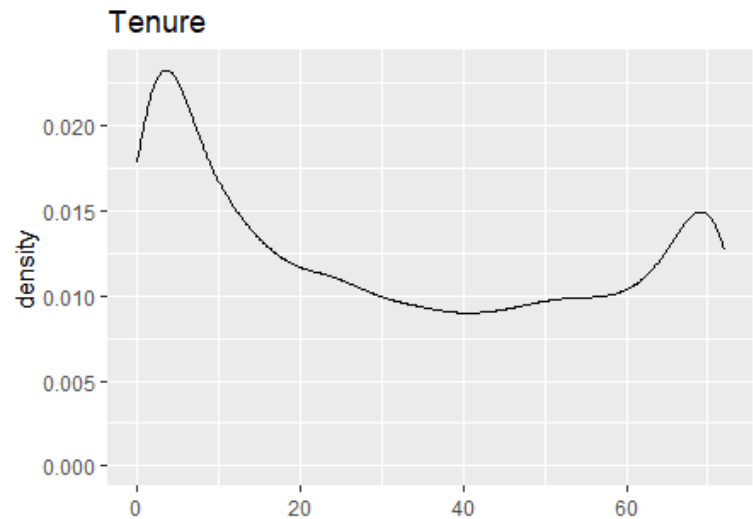
Dependent



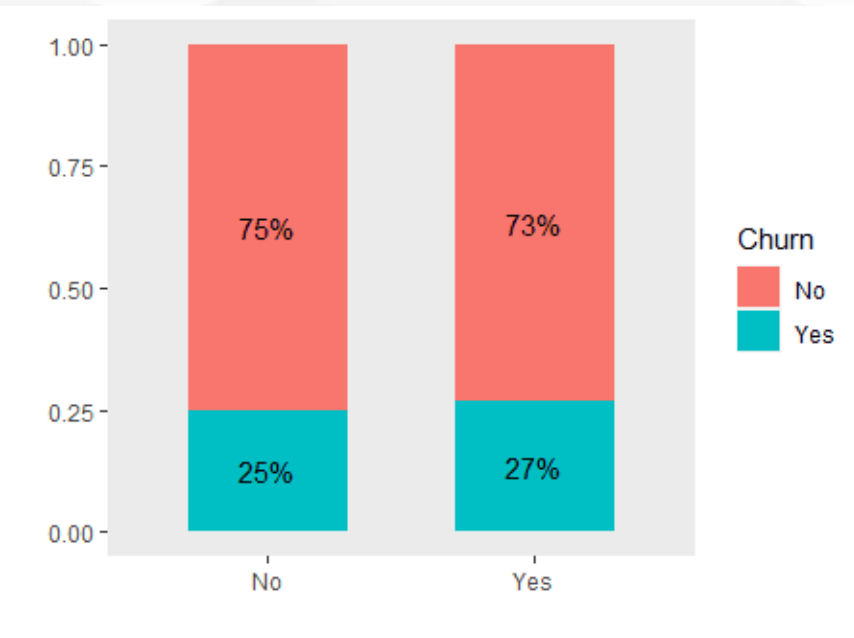
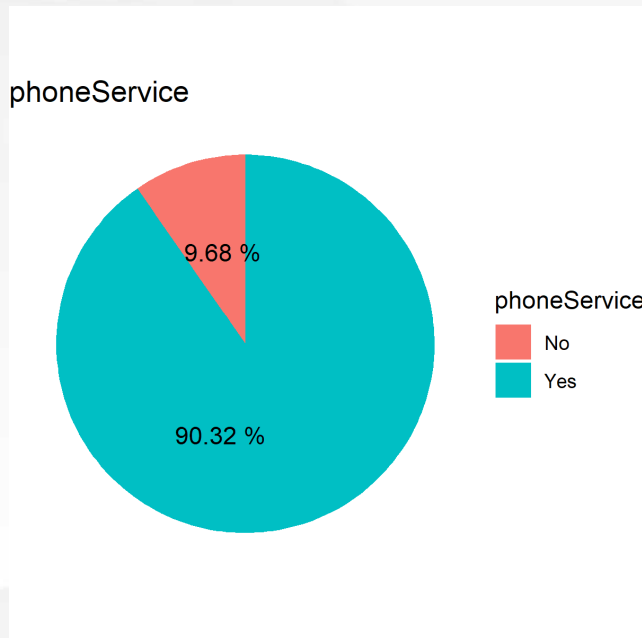
Dependents



tenure & Churn-tenure

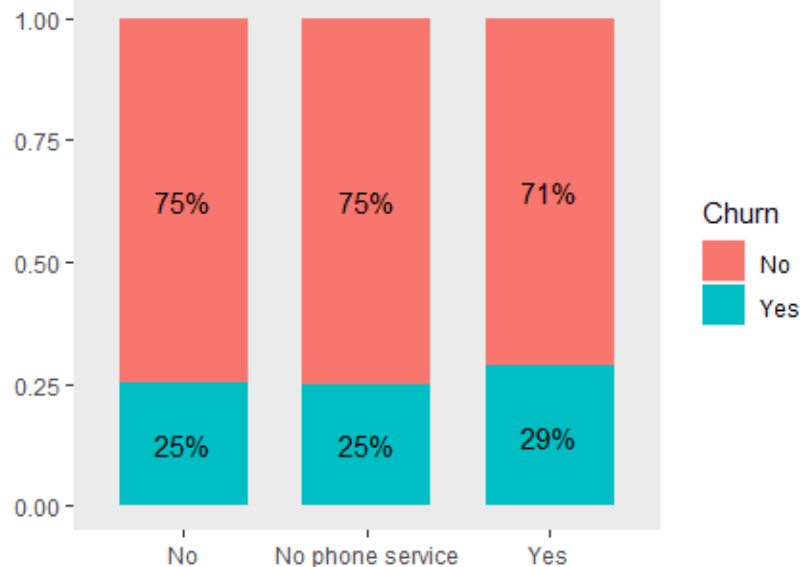
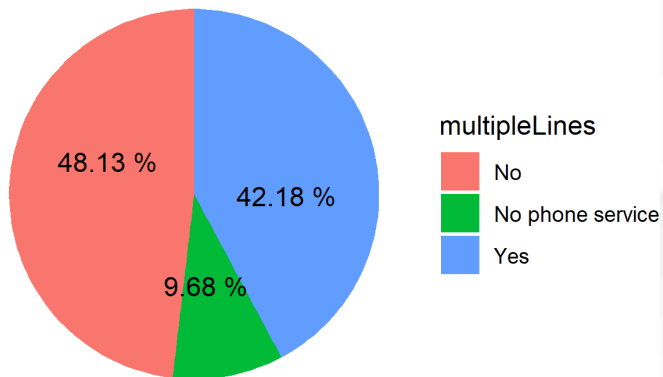


PhoneService & Churn-PhoneService

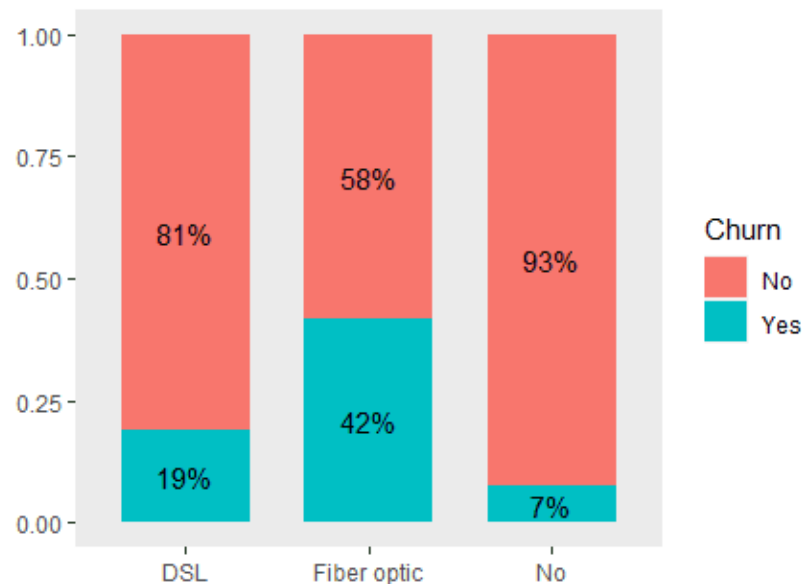
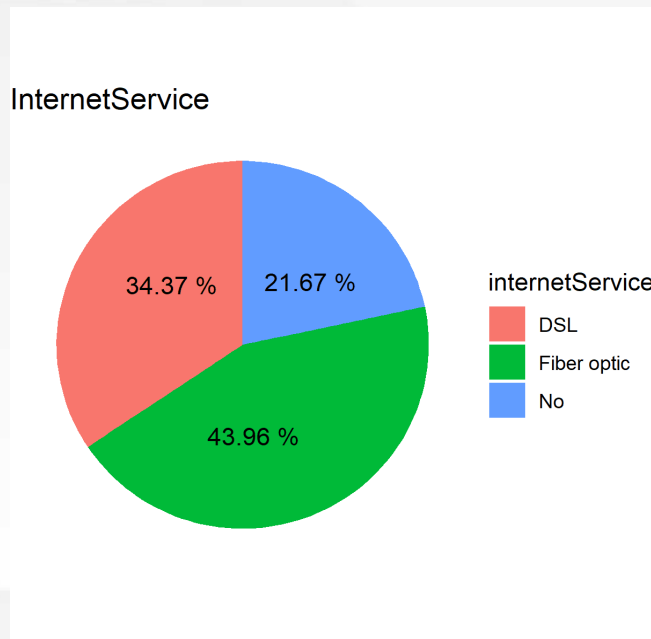


MultipleLines & Churn-MultipleLines

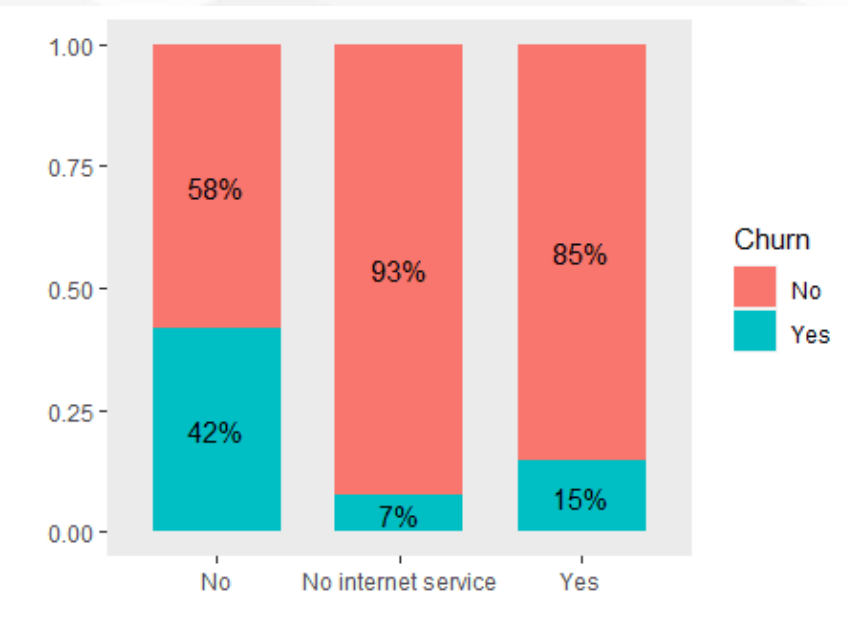
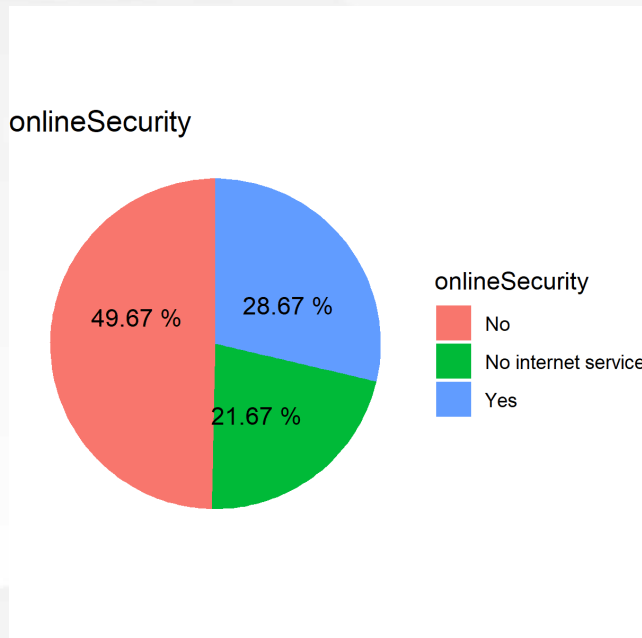
multipleLines



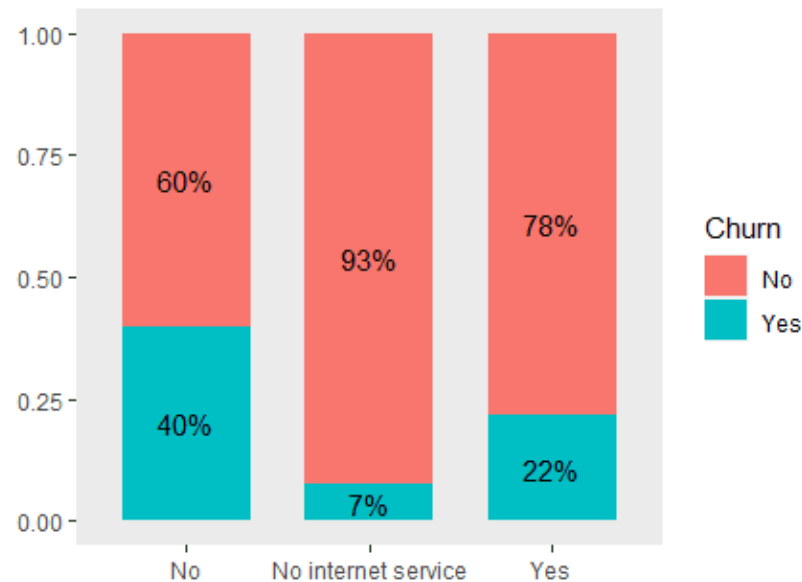
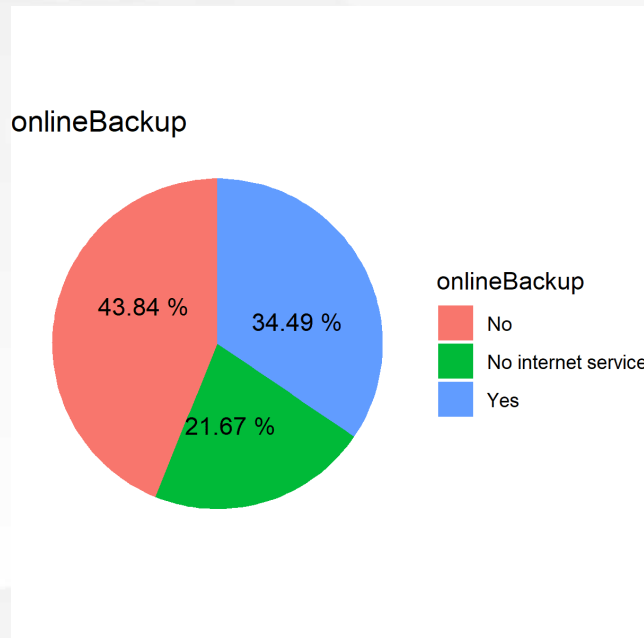
InternetService & Churn-InternetService



OnlineSecurity & Churn-OnlineSecurity

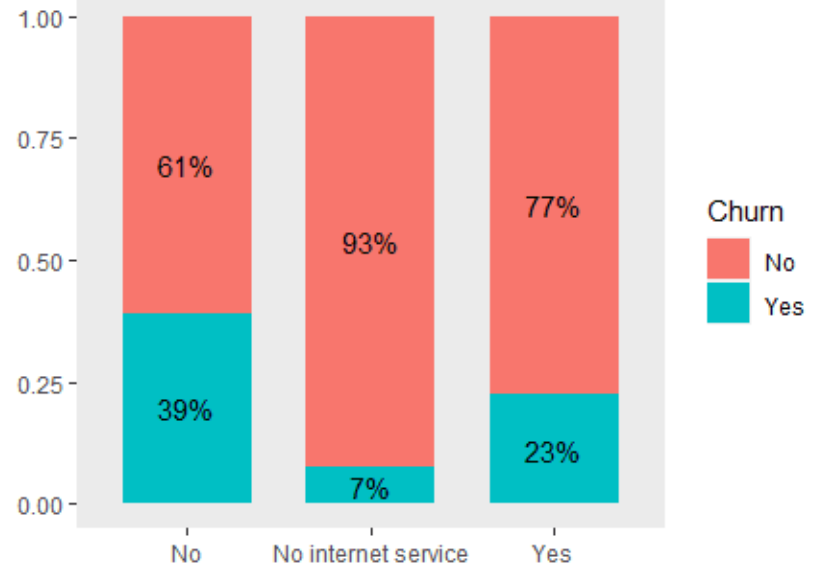
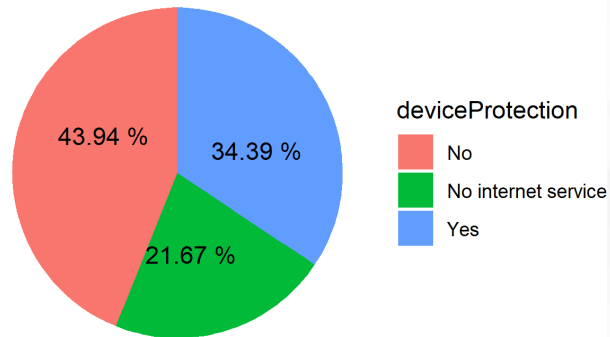


OnlineBackup & Churn-OnlineBackup



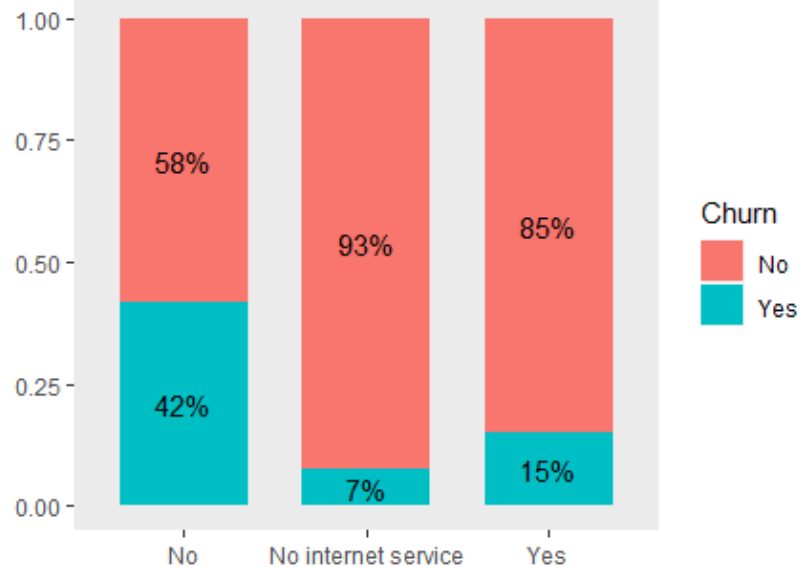
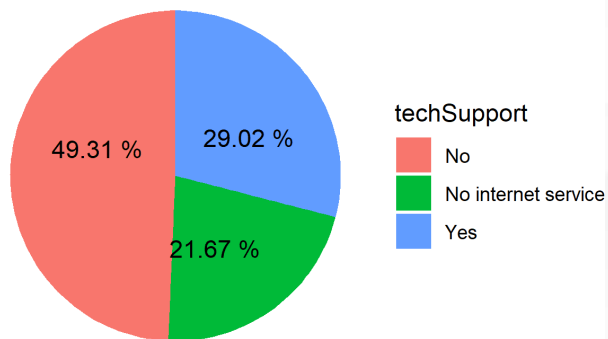
DeviceProtection & Churn-DeviceProtection

DeviceProtection



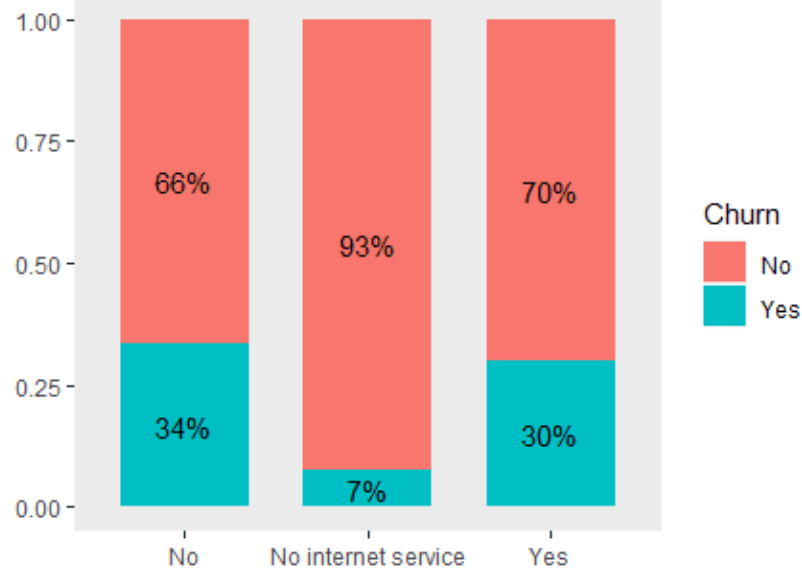
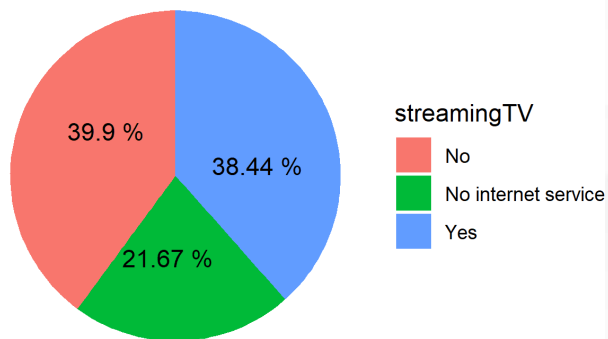
TechSupport & Churn-TechSupport

techSupport



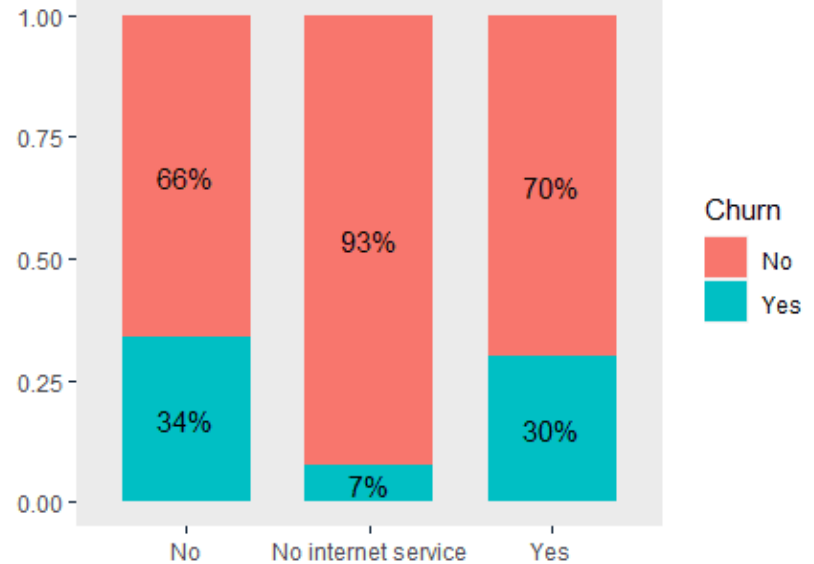
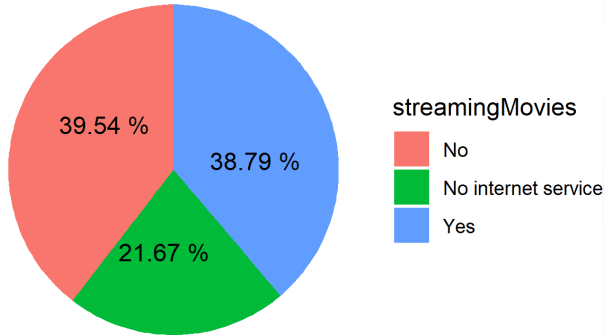
StreamingTV & Churn-StreamingTV

streamingTV



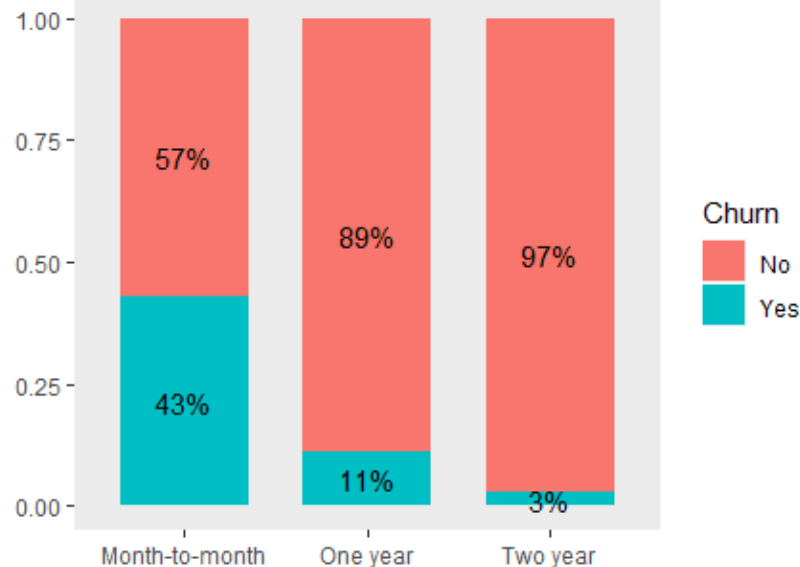
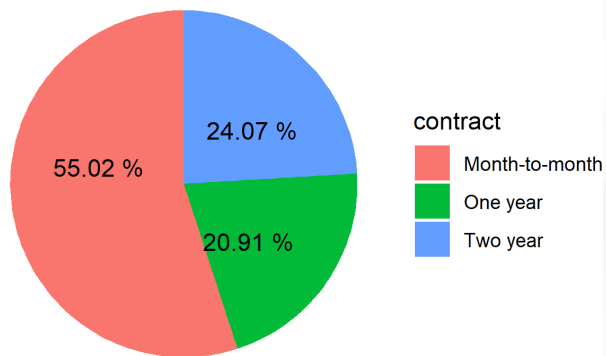
StreamingMovies & Churn-StreamingMovies

streamingMovies

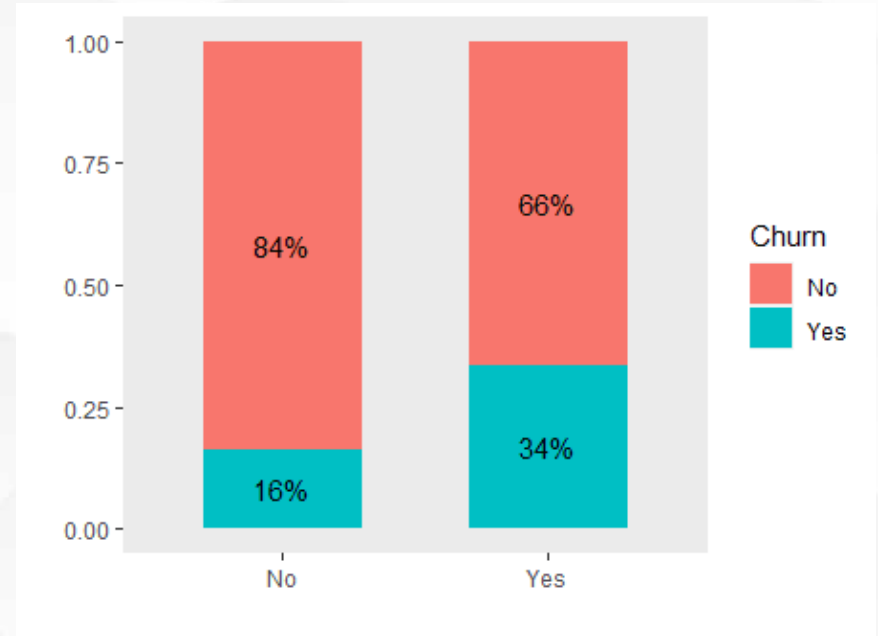
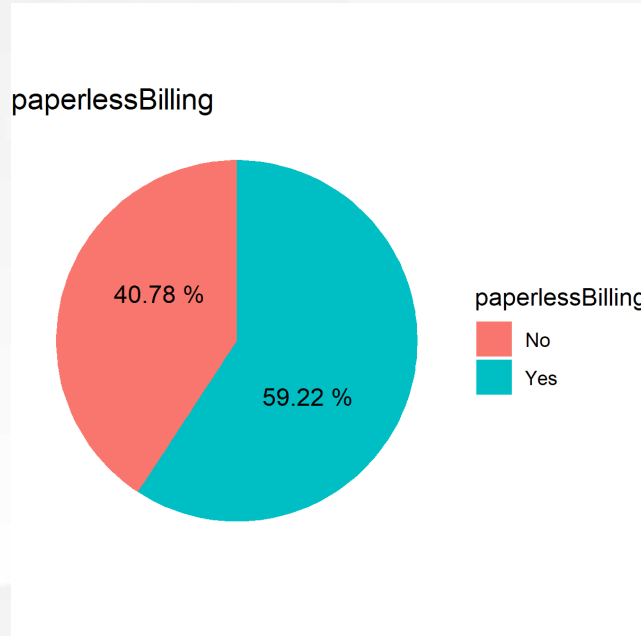


Contract & Churn-Contract

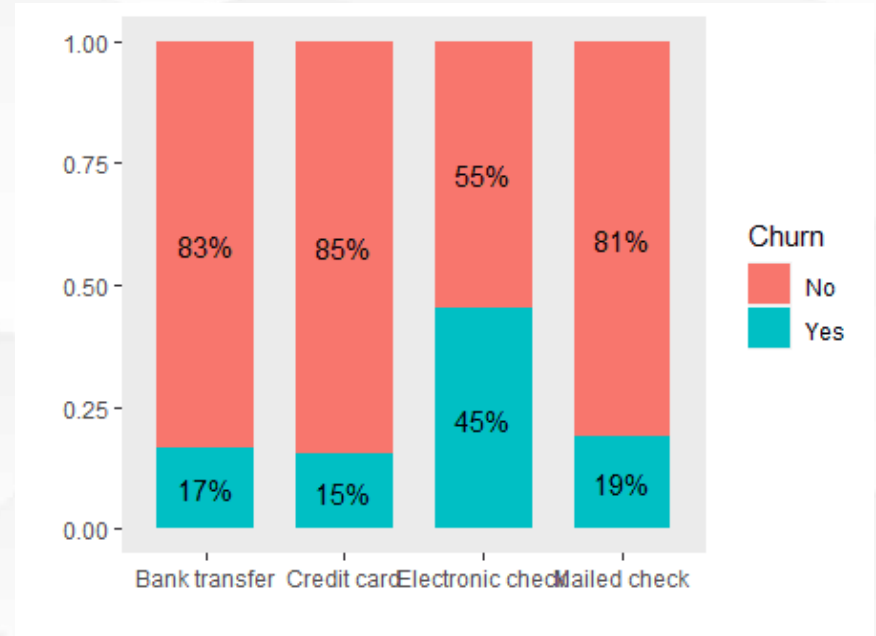
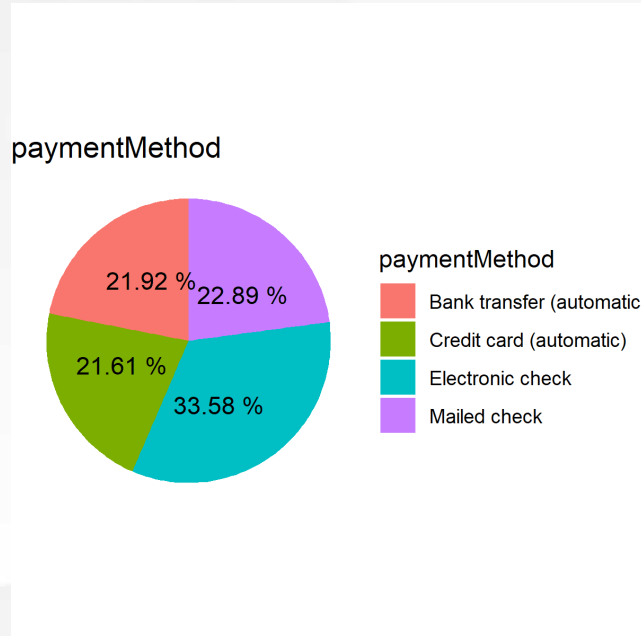
contract



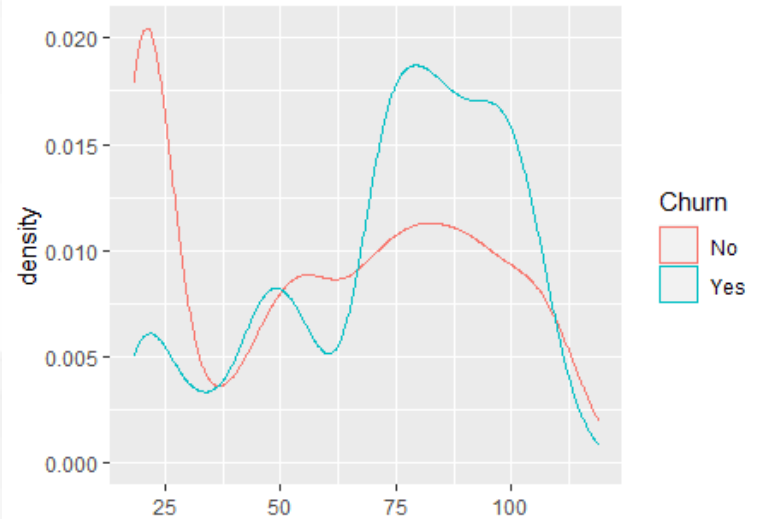
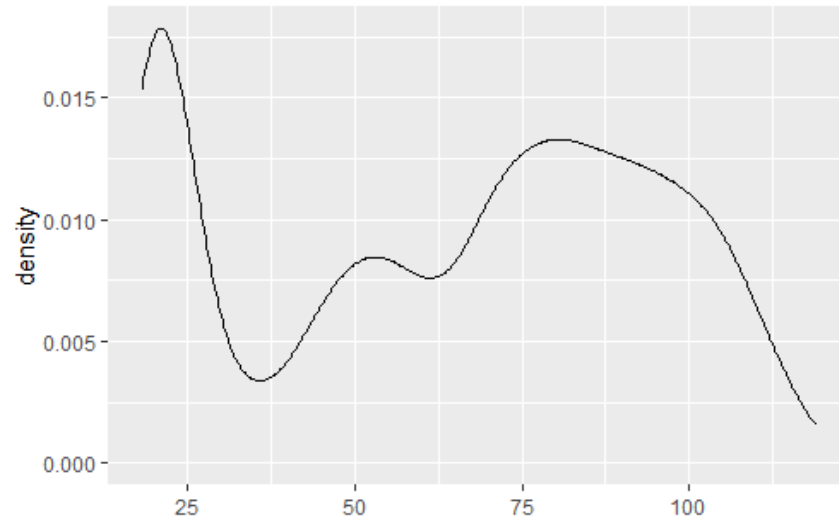
PaperlessBilling & Churn-PaperlessBilling



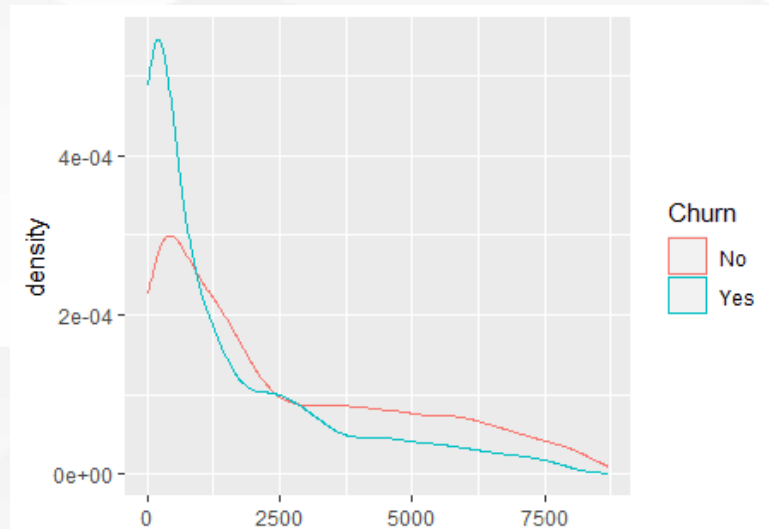
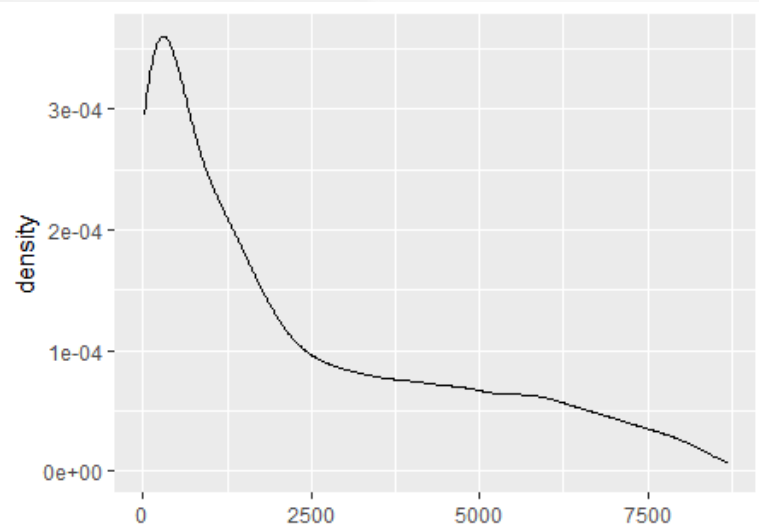
PaymentMethod & Churn-PaymentMethod



MonthlyCharges & Churn-MonthlyCharges



TotalCharges & Churn-TotalCharges



3 Model



原始Model

```
set.seed(1)
'data.frame': 7043 obs. of 20 variables:
 $ gender      : Factor w/ 2 levels "Female","Male": 1 2 2 2 1
 $ SeniorCitizen : int 0 0 0 0 0 0 0 0 0 0 ...
 $ Partner      : Factor w/ 2 levels "No","Yes": 2 1 1 1 1 1 1 1
 $ Dependents   : Factor w/ 2 levels "No","Yes": 1 1 1 1 1 1 1 2
 $ tenure       : int 1 34 2 45 2 8 22 10 28 62 ...
 $ PhoneService : Factor w/ 2 levels "No","Yes": 1 2 2 1 2 2 2 1
 $ MultipleLines : Factor w/ 3 levels "No","No phone service",...:
 $ InternetService : Factor w/ 3 levels "DSL","Fiber optic",...: 1 1
 $ OnlineSecurity : Factor w/ 3 levels "No","No internet service",...:
 $ OnlineBackup   : Factor w/ 3 levels "No","No internet service",...:
 $ DeviceProtection : Factor w/ 3 levels "No","No internet service",...:
 $ TechSupport    : Factor w/ 3 levels "No","No internet service",...:
 $ StreamingTV    : Factor w/ 3 levels "No","No internet service",...:
 $ StreamingMovies : Factor w/ 3 levels "No","No internet service",...:
 $ Contract       : Factor w/ 3 levels "Month-to-month",...: 1 2 1
 $ PaperlessBilling : Factor w/ 2 levels "No","Yes": 2 1 2 1 2 2 2 1
 $ PaymentMethod  : Factor w/ 4 levels "Bank transfer (automatic)",...:
 $ MonthlyCharges : num 29.9 57 53.9 42.3 70.7 ...
 $ TotalCharges   : num 29.9 1889.5 108.2 1840.8 151.7 ...
 $ Churn          : Factor w/ 2 levels "No","Yes": 1 1 2 1 2 2 1 1
```

- 使用mice套件填補NA
- 全變數選用

```
> print(accuracy)
      [,1]      [,2]      [,3]      [,4]
[1,] "set"      "training" "validation" "test"
[2,] "logistic1" "0.79"      "0.79"      "0.81"
[3,] "logistic2" "0.79"      "0.78"      "0.79"
[4,] "logistic3" "0.79"      "0.81"      "0.79"
[5,] "rpart4"    "0.79"      "0.77"      "0.79"
[6,] "rpart5"    "0.79"      "0.8"       "0.77"
[7,] "rpart6"    "0.8"       "0.78"      "0.81"
[8,] "randomforest7" "0.98"    "0.8"       "0.79"
[9,] "randomforest8" "0.98"    "0.8"       "0.8"
[10,] "randomforest9" "0.98"    "0.82"      "0.8"
[11,] "ave."     "0.85"     "0.79"      "0.79"
```

Model 1

➤ 使用EDA挑選變數

```
> str(d)
'data.frame': 7043 obs. of 13 variables:
 $ SeniorCitizen : Factor w/ 2 levels "No","Yes": 1 1 1 1 1 1 2 2 ...
 $ tenure        : int 13 66 11 63 26 62 61 16 55 4 ...
 $ InternetService : Factor w/ 3 levels "DSL","Fiber optic",...: 1 3 1 3 ...
 $ OnlineSecurity : Factor w/ 3 levels "No","No internet service",...: 1 3 ...
 $ OnlineBackup   : Factor w/ 3 levels "No","No internet service",...: 1 3 ...
 $ DeviceProtection: Factor w/ 3 levels "No","No internet service",...: 1 3 ...
 $ TechSupport    : Factor w/ 3 levels "No","No internet service",...: 1 3 ...
 $ Contract       : Factor w/ 3 levels "Month-to-month",...: 1 3 1 ...
 $ PaperlessBilling: Factor w/ 2 levels "No","Yes": 2 1 1 1 2 2 1 2 ...
 $ PaymentMethod  : Factor w/ 4 levels "Bank transfer (automatic)",...: 1 3 ...
 $ MonthlyCharges : num 48.8 25.1 25.2 39.4 69 ...
 $ TotalCharges   : num 633 1698 321 2395 1816 ...
 $ Churn          : Factor w/ 2 levels "No","Yes": 2 1 1 1 1 1 1 1 ...
```

```
> print(accuracy)
      [,1]      [,2]      [,3]      [,4]
[1,] "set"      "training" "validation" "test"
[2,] "logistic1" "0.78"      "0.82"      "0.82"
[3,] "logistic2" "0.79"      "0.77"      "0.81"
[4,] "logistic3" "0.79"      "0.8"       "0.77"
[5,] "rpart4"    "0.8"       "0.79"      "0.8"
[6,] "rpart5"    "0.8"       "0.75"      "0.8"
[7,] "rpart6"    "0.8"       "0.77"      "0.75"
[8,] "randomforest7" "0.96"     "0.81"      "0.78"
[9,] "randomforest8" "0.96"     "0.78"      "0.81"
[10,] "randomforest9" "0.95"     "0.82"      "0.79"
[11,] "ave."      "0.85"      "0.79"      "0.79"
```

Model 2

➤ 挑選羅吉斯顯著之變數

```
Coefficients: (2 not defined because of singularities)
```

	Estimate	Std. Error	z value	Pr(> z)	
(Intercept)	1.589e+00	4.389e-01	3.622	0.000293	***
SeniorCitizenYes	2.783e-01	8.925e-02	3.118	0.001822	**
DependentsYes	-1.474e-01	8.543e-02	-1.725	0.084461	.
tenure	-5.888e-02	6.534e-03	-9.011	< 2e-16	***
MultipleLinesNo phone service	-3.093e-01	2.131e-01	-1.451	0.146672	
MultipleLinesYes	5.124e-01	9.273e-02	5.526	3.28e-08	***
InternetServiceFiber optic	2.013e+00	2.135e-01	9.431	< 2e-16	***
InternetServiceNo	-1.949e+00	2.848e-01	-6.843	7.73e-12	***
StreamingTVNo internet service	NA	NA	NA	NA	
StreamingTVYes	6.933e-01	1.207e-01	5.742	9.34e-09	***
StreamingMoviesNo internet service	NA	NA	NA	NA	
StreamingMoviesYes	7.323e-01	1.199e-01	6.109	1.01e-09	***
ContractOne year	-5.889e-01	1.113e-01	-5.291	1.22e-07	***
ContractTwo year	-1.486e+00	1.880e-01	-7.905	2.68e-15	***
PaperlessBillingYes	3.047e-01	7.875e-02	3.869	0.000109	***
PaymentMethodCredit card (automatic)	-3.036e-02	1.204e-01	-0.252	0.800890	
PaymentMethodElectronic check	3.831e-01	9.974e-02	3.841	0.000123	***
PaymentMethodMailed check	-3.334e-02	1.208e-01	-0.276	0.782509	
MonthlyCharges	-4.888e-02	8.298e-03	-5.891	3.83e-09	***
TotalCharges	3.212e-04	7.445e-05	4.314	1.60e-05	***

```
> print(accuracy)
```

	[,1]	[,2]	[,3]	[,4]
[1,]	"set"	"training"	"validation"	"test"
[2,]	"logistic1"	"0.8"	"0.81"	"0.78"
[3,]	"logistic2"	"0.79"	"0.81"	"0.81"
[4,]	"logistic3"	"0.79"	"0.78"	"0.81"
[5,]	"rpart4"	"0.8"	"0.81"	"0.78"
[6,]	"rpart5"	"0.79"	"0.76"	"0.8"
[7,]	"rpart6"	"0.79"	"0.79"	"0.76"
[8,]	"randomforest7"	"0.96"	"0.82"	"0.77"
[9,]	"randomforest8"	"0.96"	"0.8"	"0.82"
[10,]	"randomforest9"	"0.97"	"0.8"	"0.79"
[11,]	"ave."	"0.85"	"0.8"	"0.79"

Model 3

➤ 挑選stepwise結果

```
> print(accuracy)
```

	[,1]	[,2]	[,3]	[,4]
[1,]	"set"	"training"	"validation"	"test"
[2,]	"logistic1"	"0.8"	"0.79"	"0.8"
[3,]	"logistic2"	"0.8"	"0.8"	"0.78"
[4,]	"logistic3"	"0.79"	"0.8"	"0.8"
[5,]	"rpart4"	"0.79"	"0.81"	"0.8"
[6,]	"rpart5"	"0.79"	"0.78"	"0.81"
[7,]	"rpart6"	"0.79"	"0.78"	"0.78"
[8,]	"randomforest7"	"0.96"	"0.8"	"0.79"
[9,]	"randomforest8"	"0.96"	"0.81"	"0.81"
[10,]	"randomforest9"	"0.96"	"0.8"	"0.81"
[11,]	"ave."	"0.85"	"0.8"	"0.8"

Data processing

```
> str(d)
'data.frame': 7043 obs. of 20 variables:
 $ gender      : Factor w/ 2 levels "Female","Male": 1 2 1 1 2 2 2 1 2 1 ...
 $ SeniorCitizen : Factor w/ 2 levels "No","Yes": 1 2 1 1 1 1 1 1 1 1 ...
 $ Partner      : Factor w/ 2 levels "No","Yes": 2 1 1 1 1 2 1 1 2 2 ...
 $ Dependents   : Factor w/ 2 levels "No","Yes": 1 1 1 2 1 1 2 1 2 2 ...
 $ tenure       : Factor w/ 2 levels "long","short": 2 2 1 2 2 2 2 2 2 1 ...
 $ PhoneService : Factor w/ 2 levels "No","Yes": 2 2 2 2 2 2 2 2 2 2 ...
 $ MultipleLines : Factor w/ 2 levels "No","Yes": 2 1 2 2 1 1 1 1 1 1 ...
 $ InternetService : Factor w/ 3 levels "DSL","Fiber optic",...: 2 2 1 2 1 1 1 1 1 3
 $ OnlineSecurity : Factor w/ 2 levels "No","Yes": 1 1 2 2 1 1 2 1 1 2 ...
 $ OnlineBackup  : Factor w/ 2 levels "No","Yes": 1 1 1 1 1 2 2 2 1 2 ...
 $ DeviceProtection : Factor w/ 2 levels "No","Yes": 1 1 2 1 1 2 2 1 1 2 ...
 $ TechSupport   : Factor w/ 2 levels "No","Yes": 1 1 1 2 2 1 2 1 1 2 ...
 $ StreamingTV    : Factor w/ 2 levels "No","Yes": 1 1 2 1 2 1 1 1 1 1 ...
 $ StreamingMovies : Factor w/ 2 levels "No","Yes": 1 1 2 1 1 1 2 1 1 2 ...
 $ Contract      : Factor w/ 2 levels "long","short": 2 2 1 2 2 2 1 2 1 2 ...
 $ PaperlessBilling : Factor w/ 2 levels "No","Yes": 2 2 2 2 2 2 1 1 1 1 ...
 $ PaymentMethod : Factor w/ 2 levels "No","Yes": 1 2 1 1 2 1 1 2 1 1 ...
 $ MonthlyCharges : Factor w/ 4 levels "<36", ">66", "36~50",...: 2 2 2 2 4 4 2 3 1
 $ TotalCharges   : Factor w/ 3 levels "<800", ">2500",...: 1 1 3 3 1 1 3 1 1 3 ..
 $ Churn          : Factor w/ 2 levels "No","Yes": 2 1 1 1 1 1 1 1 1 1 ...
```

Model

- 雖然經過反覆測試，但test_accuracy仍然無法突破0.8，但經過努力，我們解決了randomForest的overfittting的問題、logistic各個fold之間的accuracy也趨近穩定，0.8的accuracy遠大於null model，但可能已經是極限

```
> print(accuracy)
```

	[,1]	[,2]	[,3]	[,4]
[1,]	"set"	"training"	"validation"	"test"
[2,]	"logistic1"	"0.79"	"0.79"	"0.79"
[3,]	"logistic2"	"0.79"	"0.79"	"0.79"
[4,]	"logistic3"	"0.79"	"0.79"	"0.79"
[5,]	"rpart4"	"0.79"	"0.82"	"0.79"
[6,]	"rpart5"	"0.79"	"0.79"	"0.82"
[7,]	"rpart6"	"0.79"	"0.79"	"0.79"
[8,]	"randomforest7"	"0.84"	"0.76"	"0.79"
[9,]	"randomforest8"	"0.83"	"0.81"	"0.76"
[10,]	"randomforest9"	"0.83"	"0.79"	"0.81"
[11,]	"ave."	"0.8"	"0.79"	"0.79"

4 Demo

Shiny



Challenge

- 無法突破 null model的accuracy
- feature大多都是類別型變數 操作空間不大
- EDA觀察看出的趨勢並不等於model幫我們挑出的顯著變數
- 使用stepwise挑選變數後依然無顯著提升

5 結論

結論

各方面分析重點：

1.客戶基本資料(客戶本身)：

(1)gender(性別)不是影響客戶流失率的主因

(2)老年、單身、無家屬用戶為流失的重點對象

改進建議：

針對高流失率客群ex:老人、單身、無家屬用戶制定專屬方案

2.使用服務內容(服務品質)：

(1)使用Fiber optic(光纖通訊)的用戶流失率極高

改進建議：

因使用Fiber optic的客戶流失率極高，因此建議該公司的技術部門與業務部門可以共同合作，從使用者端取得反饋，並由技術部門進行服務優化，以提升服務品質，降低客戶流失率

結論

3.合約期間與價格(市場定價)：

(1)Contract爲Month-to-month的流失率極高

(2)tenure(使用期數)爲20月是重要的分界點，tenure小於20時流失率極高，高於20的流失率就逐漸下降並趨於穩定

(3)MonthlyCharge在70-100之間時，流失率極高

改進建議：

(1)重新思考合約方案，透過增加誘因ex:價格優惠、提高服務品質、優質行銷，吸引客戶可以長期使用服務(簽訂較長的合約1、2年)，減少月費用戶的流失

(2)調降月費爲70-100的用戶方案、維持月費但提供額外服務來增加合約cp值，或進行更多市場調查，合理估計使用客群的價格接受區間再行定

結論

整體結論：

Tenure、Contract及MonthlyCharge 是影響客戶流失率最大的因素

模型使用：

透過我們所建置的模型可以預測該客戶未來將流失的可能性，若被模型判定為流失的客群，可以提前針對性地實施策略(客製化服務)ex:降低MonthlyCharge、更改合約期數、增加額外服務等，使客戶能接受該方案並穩定使用後(提高tenure)，便能大幅降低客戶的流失率

6 參考資料

參考資料

- Telco Customer Churn
<https://www.kaggle.com/blastchar/telco-customer-churn>
- 我如何分析客戶流失預測？Kaggle比賽思路分享
<https://reurl.cc/3N1MgM>
- Shiny Data-Tables Demo
<https://shiny.rstudio.com/gallery/datatables-demo.html>



Thank you!