Tutorial 1

IM532 3.0 Applied Time Series Forecasting

07/04/2020

Data

Use data in `colmozzie` package in R.

Package installation

```
install.packages("colmozzie")
```

```
library(colmozzie)
head(colmozzie)
```

```
  Cases Year Week    TEM    TMAX    Tm     SLP       H    PP      VV       V
1    44 2009    1 27.300 32.7000 23.60  1010.7 68.0000  0.00 13.0000 11.1000
2    39 2009    2 26.400 29.7667 23.90  1010.7 78.6667  0.00 18.3333  5.8333
3    57 2009    3 27.140 32.0200 23.52 1012.58 67.0000  0.00 20.0000  6.1200
4    53 2009    4 26.800 31.0000 23.35  1009.9 68.0000  0.00 20.0000  7.1500
5    29 2009    5 26.775 30.0750 23.60  1010.1 78.0000 17.21 18.9750  3.2000
6    45 2009    6 26.850 30.5500 23.00 1012.05 72.5000  0.00 20.0000  5.5500
      VM
1 20.600
2  9.200
3 10.460
4 11.100
5  6.825
6 10.300
```

To view the description of variables type,

```
?colmozzie
```

Other packages

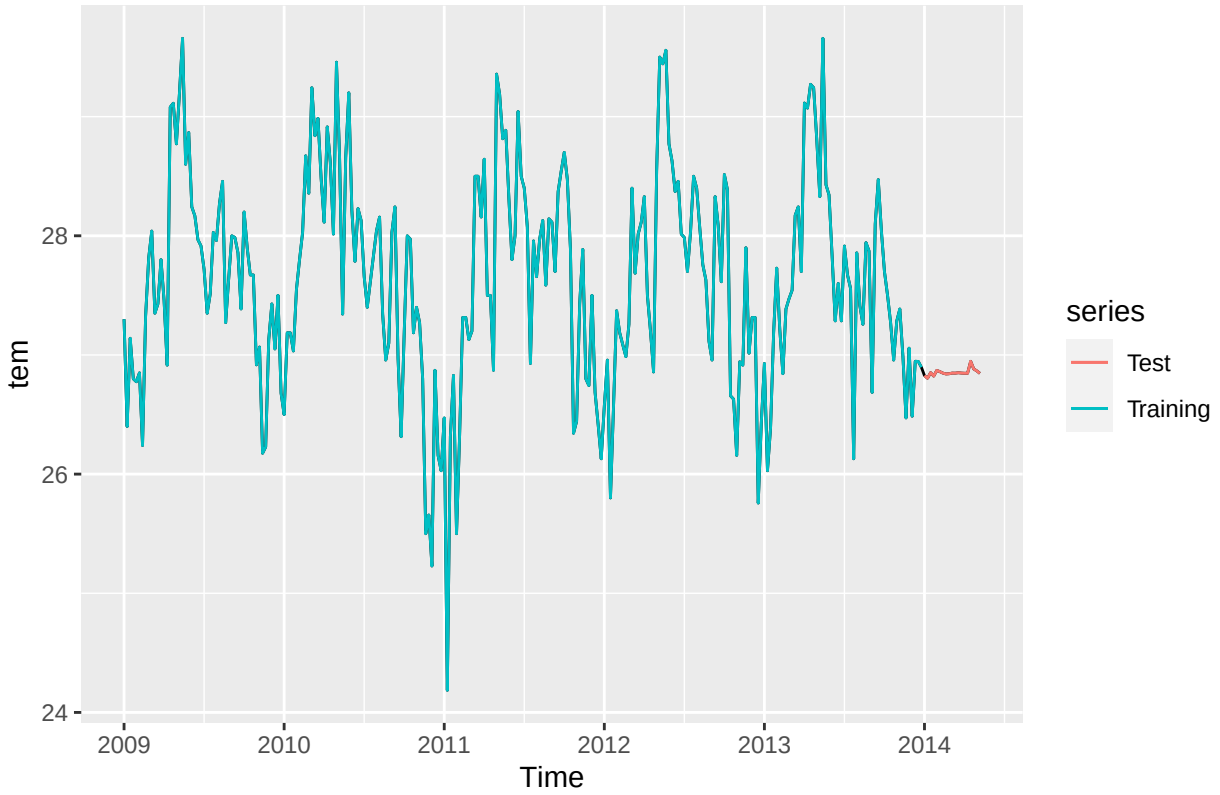
```
install.packages("forecast")
library(forecast)
```

1. Use TEM: average temperature of the week (Celcius) in `colmozzie` data set. Split the data into two parts: i) training set (2009 to 2013 data) and ii) test set (2014 data).

```
tem <- ts(colmozzie$TEM, start=c(2009, 1), frequency = 52)
tem.train <- window(tem, end=c(2013, 52))
tem.test <- window(tem, start=c(2014, 1))
```

2. The following code can be used to check whether time series has been split correctly.

```
library(forecast)
autoplot(tem) +
autolayer(tem.train, series="Training") +
autolayer(tem.test, series="Test")
```



4. Calculate forecasts using `naive` method applied to `tem.train` .

```
forecast.naive <- naive(tem.train, h=length(tem.test))
forecast.naive
```

```
         Point Forecast    Lo 80    Hi 80    Lo 95    Hi 95
2014.000       26.89685 26.01636 27.77735 25.55025 28.24346
2014.019       26.89685 25.65164 28.14207 24.99247 28.80124
2014.038       26.89685 25.37179 28.42192 24.56446 29.22924
2014.058       26.89685 25.13586 28.65785 24.20364 29.59006
2014.077       26.89685 24.92800 28.86571 23.88575 29.90796
2014.096       26.89685 24.74008 29.05362 23.59836 30.19535
2014.115       26.89685 24.56727 29.22643 23.33407 30.45964
2014.135       26.89685 24.40643 29.38728 23.08808 30.70563
2014.154       26.89685 24.25536 29.53835 22.85704 30.93667
2014.173       26.89685 24.11247 29.68123 22.63851 31.15519
2014.192       26.89685 23.97657 29.81714 22.43067 31.36304
2014.212       26.89685 23.84672 29.94699 22.23207 31.56163
2014.231       26.89685 23.72217 30.07153 22.04160 31.75211
2014.250       26.89685 23.60233 30.19138 21.85832 31.93539
2014.269       26.89685 23.48670 30.30701 21.68147 32.11223
2014.288       26.89685 23.37486 30.41885 21.51043 32.28328
```

```
2014.308       26.89685 23.26647 30.52724 21.34466 32.44905
2014.327       26.89685 23.16122 30.63249 21.18369 32.61002
2014.346       26.89685 23.05885 30.73486 21.02714 32.76657
```

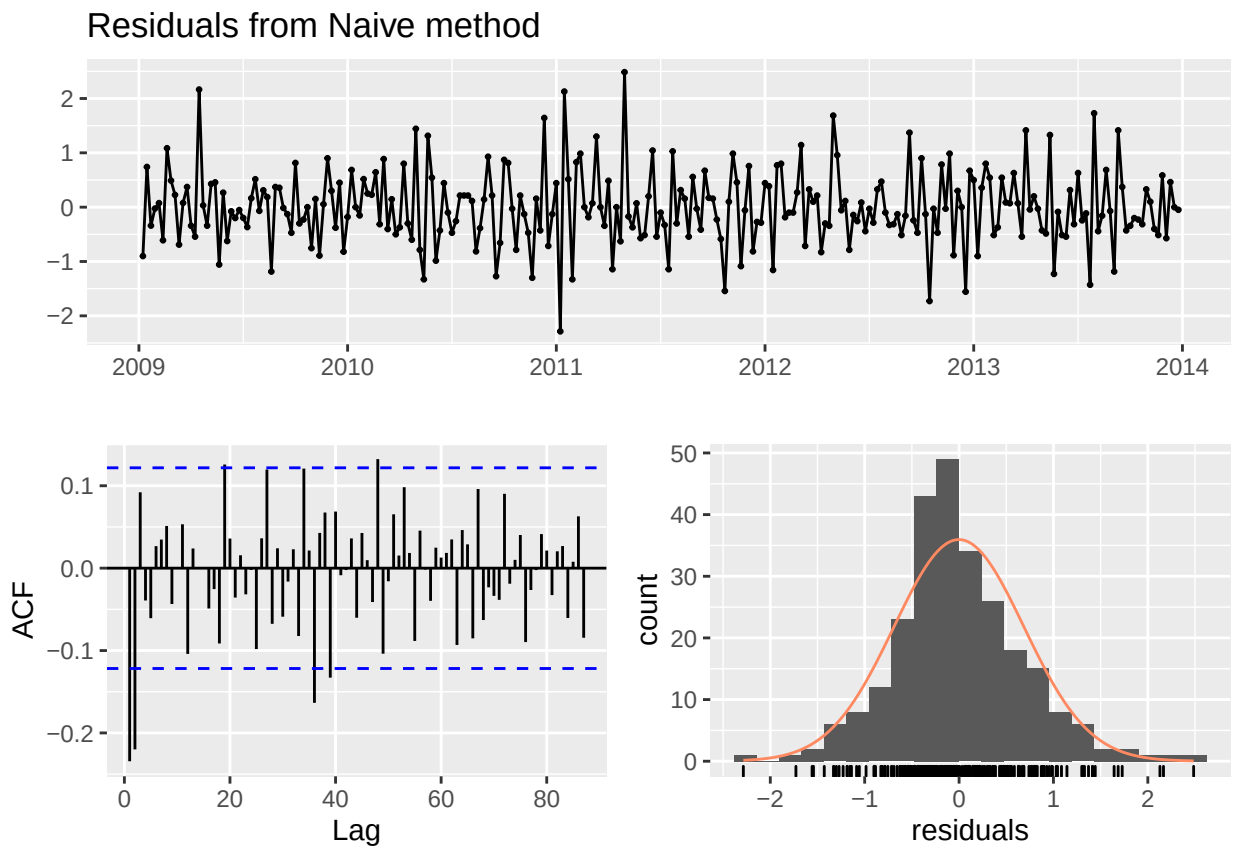
5. Compare the accuracy on the results using the test set.

```
accuracy(forecast.naive, tem.test)
```

```
                      ME       RMSE        MAE         MPE      MAPE
Training set -0.001556551 0.68705633 0.51753041 -0.03729597 1.8815583
Test set     -0.044448907 0.05243908 0.04971848 -0.16563780 0.1851932
                   MASE       ACF1 Theil's U
Training set 0.74948896 -0.2343118        NA
Test set     0.07200244  0.2525745  1.492231
```

6. Check the residuals. Do they resemble white noise?

```
checkresiduals(forecast.naive)
```




```
    Ljung-Box test

data:  Residuals from Naive method
Q* = 92.034, df = 52, p-value = 0.0005217

Model df: 0.   Total lags used: 52
```

7. Use other benchmark methods such as snaive, average method and random walk with drift methods to forecast the training set and compare the results on the test set.

8. Which do you think is best to forecast average temperature in Colombo district? Give reasons for your answer.
9. Repeat the exercise for the other climate variable (TMAX, Tm, SLP, H, PP, VV, V, VM) in `colmozzie` dataset.

Note:

The above exercise is prepared based on Hyndman, R. J., & Athanasopoulos, G. (2018). Forecasting: principles and practice. OTexts. adapting to colmozzie data set avilable on colmozzie package in R written by Thiyanga S. Talagala.