Assignment time series

2024-09-20

```
library("lubridate")
```

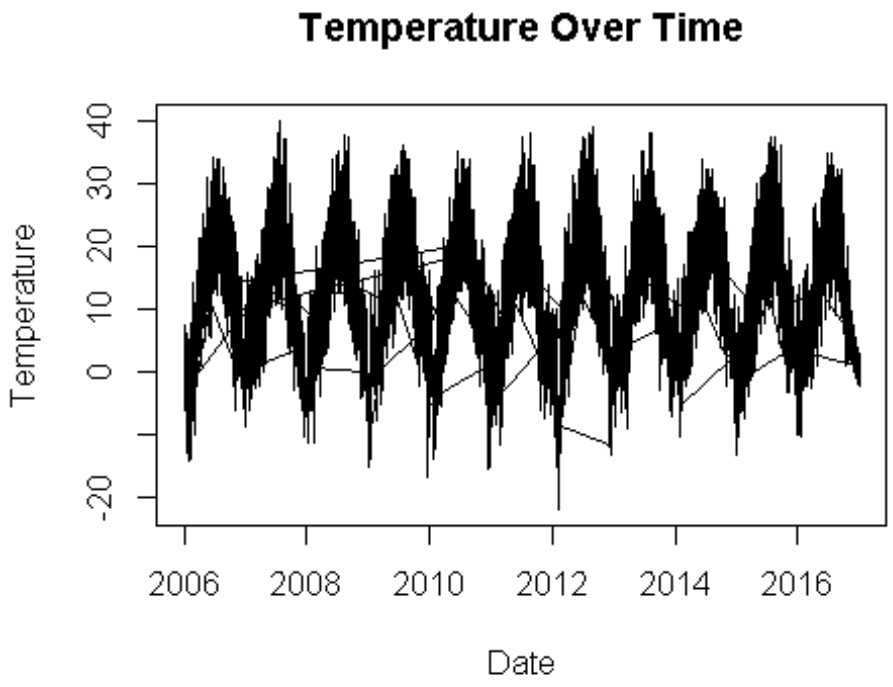
```
##
## Attaching package: 'lubridate'
```

```
## The following objects are masked from 'package:base':
##
##     date, intersect, setdiff, union
```

```
# Import the weather data
weather_data <- read.csv("weather.csv")
head(weather_data)
```

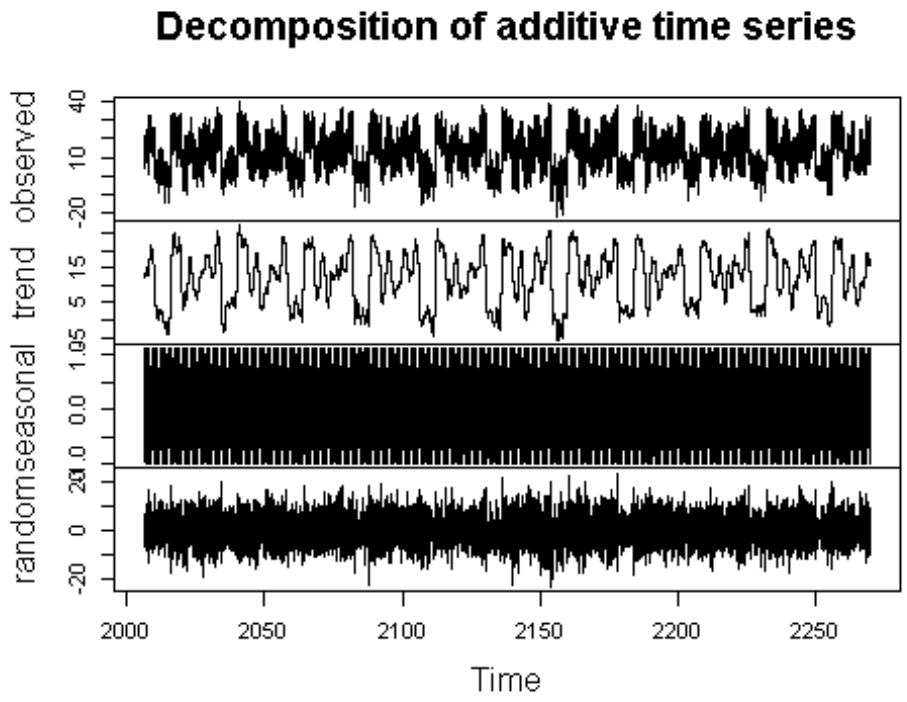
```
##                   Formatted.Date       Summary Precip.Type Temperature..C.
## 1 2006-04-01 00:00:00.000 +0200 Partly Cloudy        rain        9.472222
## 2 2006-04-01 01:00:00.000 +0200 Partly Cloudy        rain        9.355556
## 3 2006-04-01 02:00:00.000 +0200 Mostly Cloudy        rain        9.377778
## 4 2006-04-01 03:00:00.000 +0200 Partly Cloudy        rain        8.288889
## 5 2006-04-01 04:00:00.000 +0200 Mostly Cloudy        rain        8.755556
## 6 2006-04-01 05:00:00.000 +0200 Partly Cloudy        rain        9.222222
##   Apparent.Temperature..C. Humidity Wind.Speed..km.h. Wind.Bearing..degree
s.
## 1                 7.388889     0.89           14.1197                    2
51
## 2                 7.227778     0.86           14.2646                    2
59
## 3                 9.377778     0.89            3.9284                    2
04
## 4                 5.944444     0.83           14.1036                    2
69
## 5                 6.977778     0.83           11.0446                    2
59
## 6                 7.111111     0.85           13.9587                    2
58
##   Visibility..km. Loud.Cover Pressure..millibars.
## 1         15.8263          0              1015.13
## 2         15.8263          0              1015.63
## 3         14.9569          0              1015.94
## 4         15.8263          0              1016.41
## 5         15.8263          0              1016.51
## 6         14.9569          0              1016.66
##                       Daily.Summary
## 1 Partly cloudy throughout the day.
## 2 Partly cloudy throughout the day.
```

```
## 3 Partly cloudy throughout the day.
## 4 Partly cloudy throughout the day.
## 5 Partly cloudy throughout the day.
## 6 Partly cloudy throughout the day.

# Convert to Time Series:
# Convert 'date' column to Date format
weather_data$Formatted.Date <- as.Date(weather_data$Formatted.Date, format="%
Y-%m-%d")

# Assuming daily weather data
ts_weather <- ts(weather_data$Temperature..C., start=c(year(min(weather_data$
Formatted.Date)), month(min(weather_data$Formatted.Date))), frequency=365)

#Plot the Time Series:
plot(weather_data$Formatted.Date, weather_data$Temperature..C., type="l", xla
b="Date", ylab="Temperature", main="Temperature Over Time")
```




```
#Decompose the Time Series:
decomposed_weather <- decompose(ts_weather)
plot(decomposed_weather)

#Check for Stationarity:
library(tseries)
```

```
## Registered S3 method overwritten by 'quantmod':
##   method            from
##   as.zoo.data.frame zoo
```




```
adf_test <- adf.test(ts_weather)

## Warning in adf.test(ts_weather): p-value smaller than printed p-value

print(adf_test)

##
##  Augmented Dickey-Fuller Test
##
## data:  ts_weather
## Dickey-Fuller = -10.099, Lag order = 45, p-value = 0.01
## alternative hypothesis: stationary

## H0 = Data is not stationary
## H0 is rejected as p value is less than 0.05 so data is stationary

#Fit AR, MA, and ARIMA Models:

# AR model

ar_model <- arima(ts_weather, order=c(1,0,0))
summary(ar_model)
```

```
##           Length Class  Mode
## coef          2  -none- numeric
## sigma2        1  -none- numeric
## var.coef      4  -none- numeric
## mask          2  -none- logical
## loglik        1  -none- numeric
## aic           1  -none- numeric
## arma          7  -none- numeric
## residuals 96453  ts     numeric
## call          3  -none- call
## series        1  -none- character
## code          1  -none- numeric
## n.cond        1  -none- numeric
## nobs          1  -none- numeric
## model        10  -none- list
```

```
# MA model
ma_model <- arima(ts_weather, order=c(0,0,1))
summary(ma_model)
```

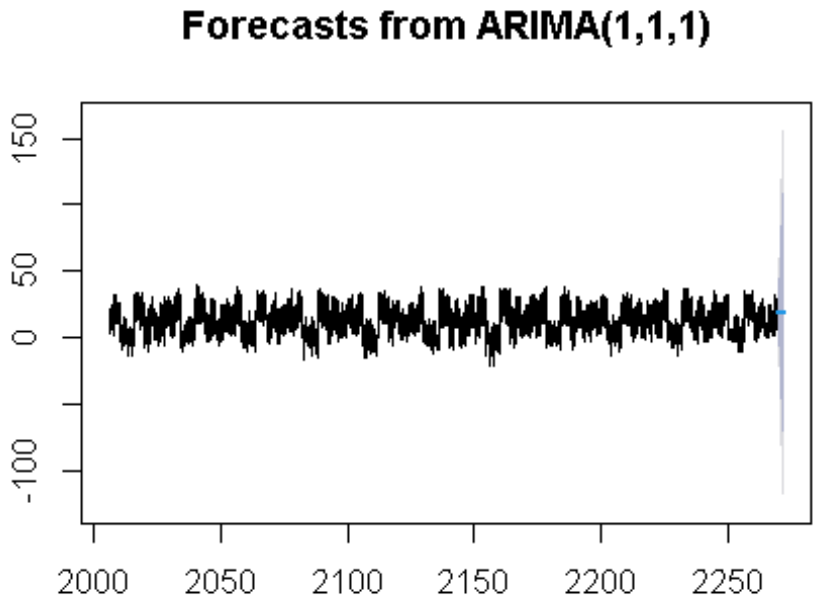
```
##           Length Class  Mode
## coef          2  -none- numeric
## sigma2        1  -none- numeric
## var.coef      4  -none- numeric
## mask          2  -none- logical
## loglik        1  -none- numeric
## aic           1  -none- numeric
## arma          7  -none- numeric
## residuals 96453  ts     numeric
## call          3  -none- call
## series        1  -none- character
## code          1  -none- numeric
## n.cond        1  -none- numeric
## nobs          1  -none- numeric
## model        10  -none- list
```

```
# ARIMA model
arima_model <- arima(ts_weather, order=c(1,1,1))
summary(arima_model)
```

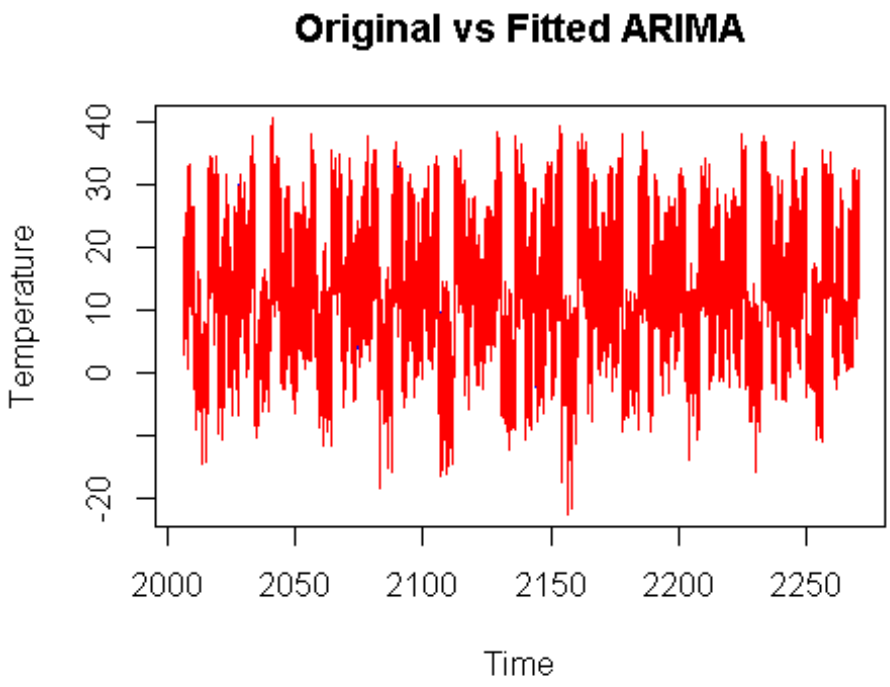
```
##           Length Class  Mode
## coef          2  -none- numeric
## sigma2        1  -none- numeric
## var.coef      4  -none- numeric
## mask          2  -none- logical
## loglik        1  -none- numeric
## aic           1  -none- numeric
## arma          7  -none- numeric
## residuals 96453  ts     numeric
## call          3  -none- call
## series        1  -none- character
```

```
## code          1  -none- numeric
## n.cond        1  -none- numeric
## nobs          1  -none- numeric
## model        10  -none- list
```

```r
#Plot and Interpret Results:
library(forecast)
forecast_arima <- forecast(arima_model)
plot(forecast_arima)
```



```r
# Compare original and fitted values
plot.ts(ts_weather, col='blue', main="Original vs Fitted ARIMA", ylab="Temper
ature")
lines(fitted(arima_model), col='red')
```



Implementation of the analysis :

- Data Import and Preprocessing:
  - The weather data is imported from a CSV file and includes variables like temperature, humidity, wind speed, and visibility.
  - The `Formatted.Date` column is converted to a date format for time series analysis.
- Time Series Conversion:
  - The temperature data is converted into a time series object (`ts_weather`) for analysis, assuming daily frequency.
- Stationarity Check:

- The Augmented Dickey-Fuller (ADF) test is performed to check the stationarity of the data. The null hypothesis (H0) that the data is not stationary is rejected based on the p-value (< 0.05), indicating the data is stationary.

- Modeling:
  - Various models (AR, MA, and ARIMA) are fitted to the time series data:
    - **AR Model**: The autoregressive model is fitted using the `arima` function with specified order.
    - **MA Model**: A moving average model is fitted similarly.
    - **ARIMA Model**: The ARIMA (Auto-Regressive Integrated Moving Average) model is fitted, which combines both AR and MA components.

- Forecasting:
  - The ARIMA model is used to forecast future temperature values, and the results are plotted.

- Plotting Results**:**
  - A plot is generated comparing the original temperature values with the fitted ARIMA model values, providing insights into the model's performance.