Time Series Analysis

Basics of Time Series Analysis: Data Example

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Case Study: Emergency Department Volume

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About This Lesson

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Emergency Department Care

Have you ever experienced long waits in the Emergency Department?

- Good predictions of daily inflow in an emergency department can assist in staffing and diversion
- Time series modeing can be useful in achieving good predictions.

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Case Study Overview

Objective:

- Identify temporal patterns in the Emergency Department (ED) volume of patients
- Develop a model to predict ED volume

Time Series Data:

- Daily number of patients visiting an emergency department of a hospital in the Atlanta area with observations from 2010 until mid 2015
- Other predicting variables were made available by the hospital but we will only focus on the predictability of the time series with respect to temporal factors

Processing Time Data

```
## Read data in R
edvoldata = read.csv("EGDailyVolume.csv",header=T)
## Process Dates
year = edvoldata$Year
month = edvoldata$Month
day = edvoldata$Day
datemat = cbind(as.character(day),as.character(month),as.character(year))
paste.dates = function(date){
    day = date[1]; month=date[2]; year = date[3]
    return(paste(day,month,year,sep="/"))
 }
dates = apply(datemat,1,paste.dates)
dates = as.Date(dates, format="%d/%m/%Y")
```

```
> edvoldata[1:2,]
  Year Month Day Volume
1 2010     1   1    135
2 2010     1   2    163
```

Creating a function in R for translating three strings of characters into a date

R identifies the date strings into dates through the R command as.Date()

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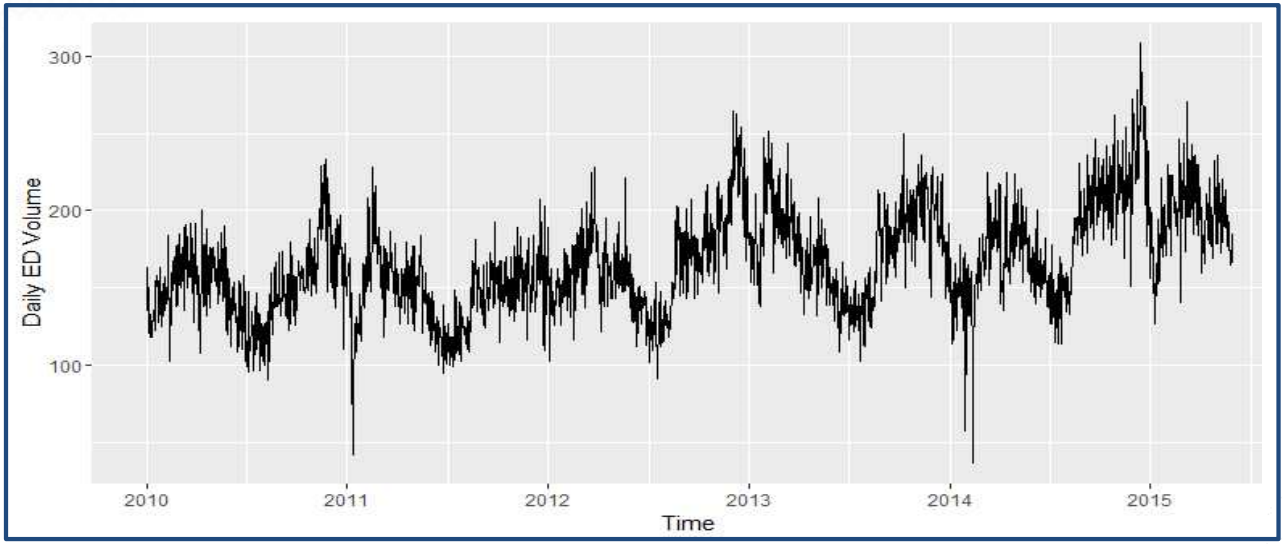
Exploratory Data Analysis

Plot the time series

library(ggplot2)

ggplot(edvoldata, aes(dates, Volume)) + geom_line() + xlab("Time") + ylab("Daily ED Volume")



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Count Data Transformation

ED Volume = Number of patients visiting ED per day ~ Poisson Distribution

- Poisson distribution – mean and variance are equal; if mean varies over time so does the variance
- Standard linear regression model assumes normality with constant variance
- Variance Stabilizing Transformation

```
## Apply Transformation
Volume.tr = sqrt(Volume+3/8)
## Compare Distribution
hist(Volume,nclass=20,xlab="ED Volume", main="",col="brown")
hist(Volume.tr,nclass=20,xlab= "Transformed ED Volume", main="",col="blue")
```

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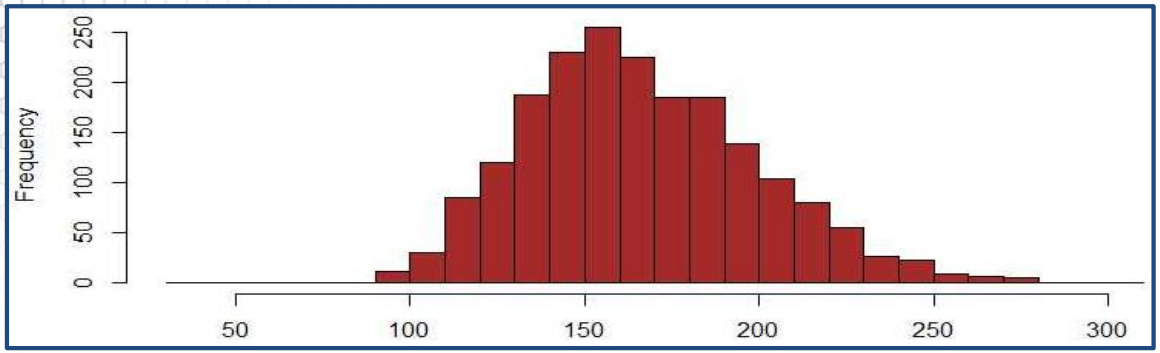
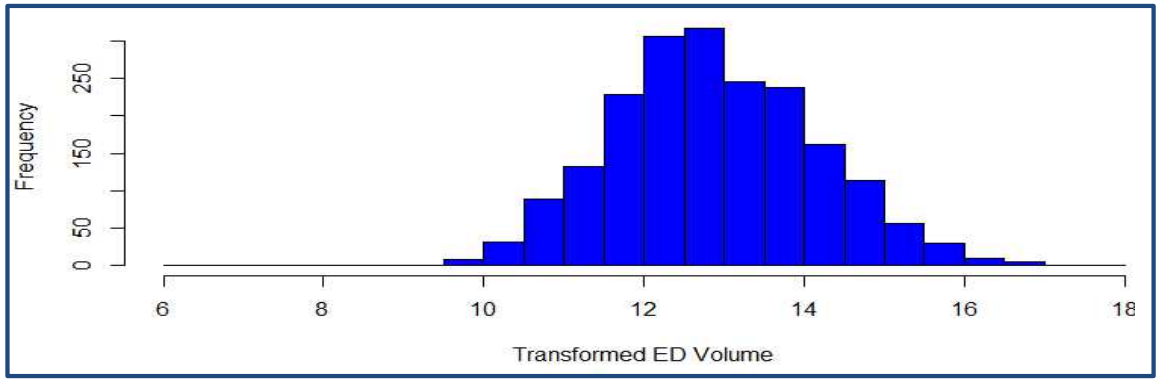
Count Data Transformation





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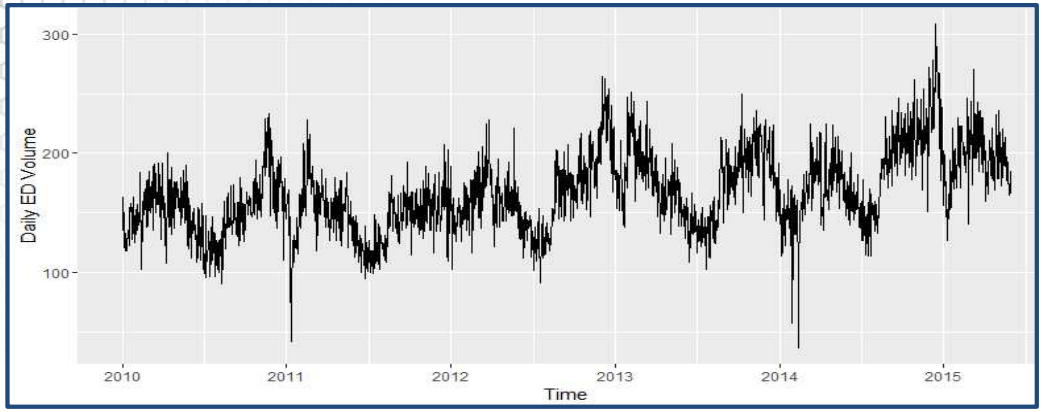
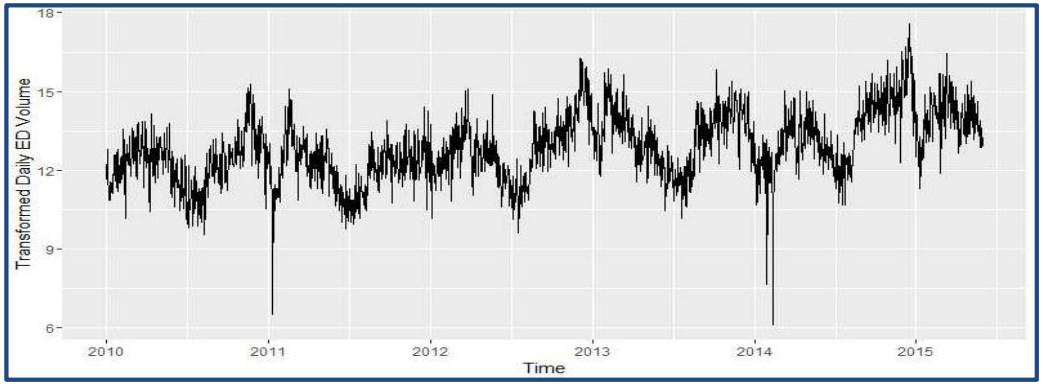
Compare: With/Without Transformation





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Summary

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