Agenda

Great Learning

1. Time Series Analysis
2. Time Series Analysis in Python

Why Forecasting?

Every business operates under risk and uncertainty. Forecasting helps us to assess these risks

Intro to Time Series

$$Y = f(x)$$

Dependent Variable (Future)

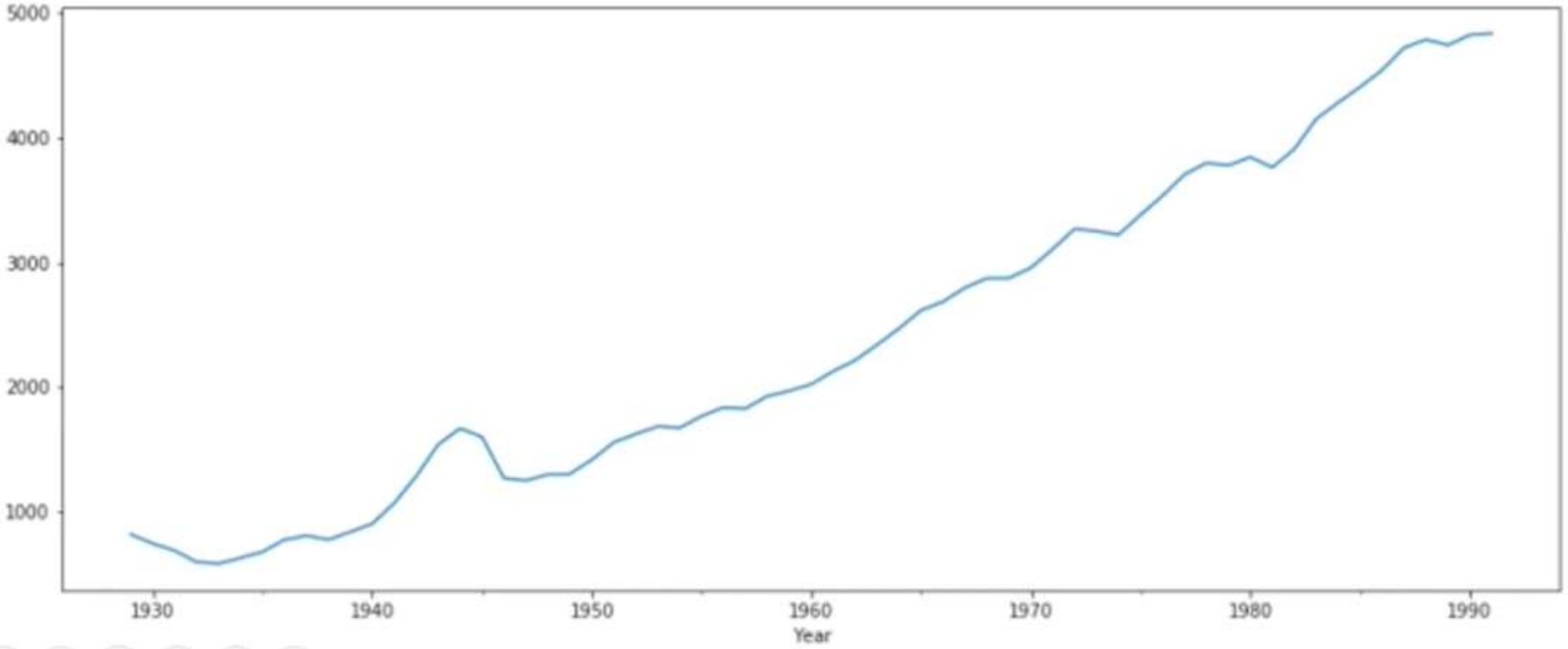
Independent Variable (Past)

Intervals of Time Series

- Yearly
- Quarterly
- Monthly
- Weekly
- Daily
- Hourly

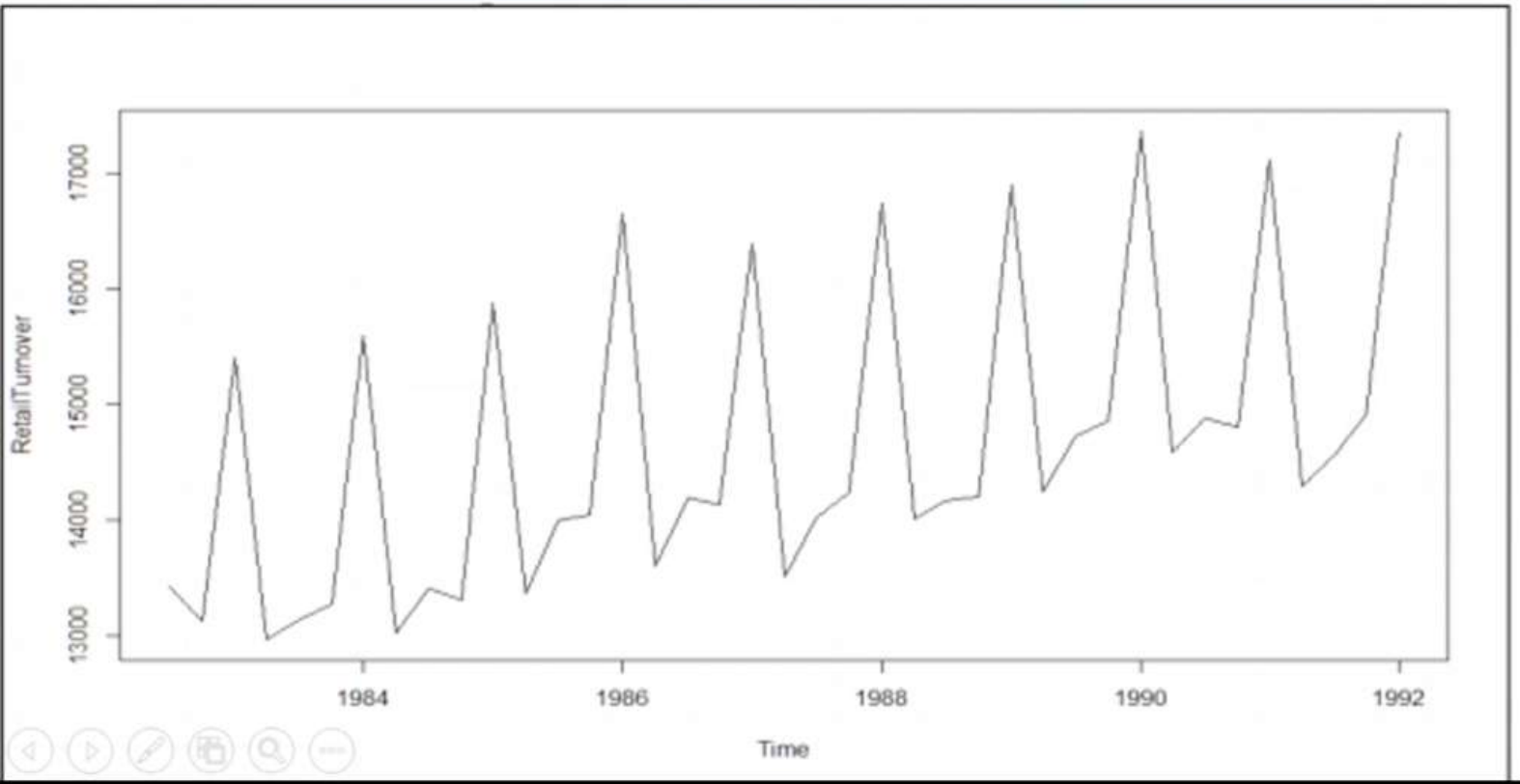
Yearly US GDP

Year	1929	1930	1931	1932	.....	1989	1990	1991
US GDP (b. USD)	821.8	748.9	691.3	599.7	.....	4739.2	4822.3	4835

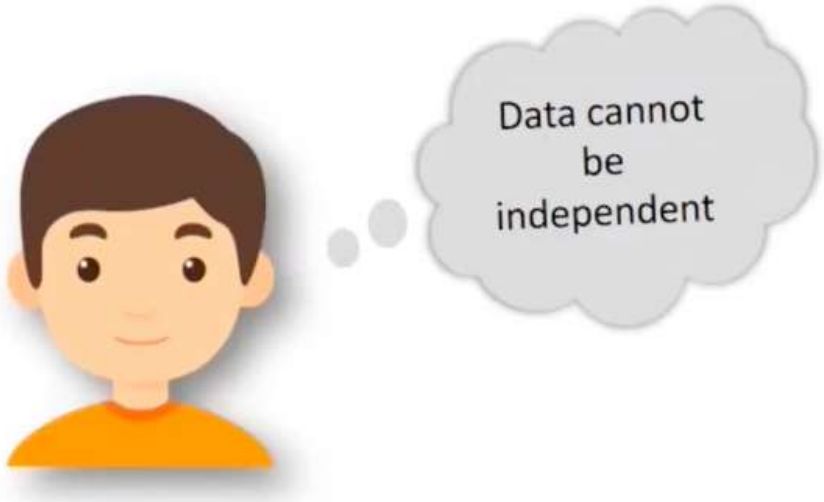


Quarterly Sales Turnover

Year	1982	1982	1983	...	1991	1992
Quarter	Q3	Q4	Q1	...	Q4	Q1
Turnover	13423.2	13128.8	15398.8	...	14914.3	17342.3



Special Features of Time Series Data



GRE Score	CGPA
337	9.65
324	8.87
316	8.00
322	8.67
314	8.21
330	9.34
321	8.20
308	7.90
302	8.00
323	8.60

Special Features of Time Series Data

Time	sales
t1	10
t2	20
t3	30
t4	40

Special Features of Time Series Data

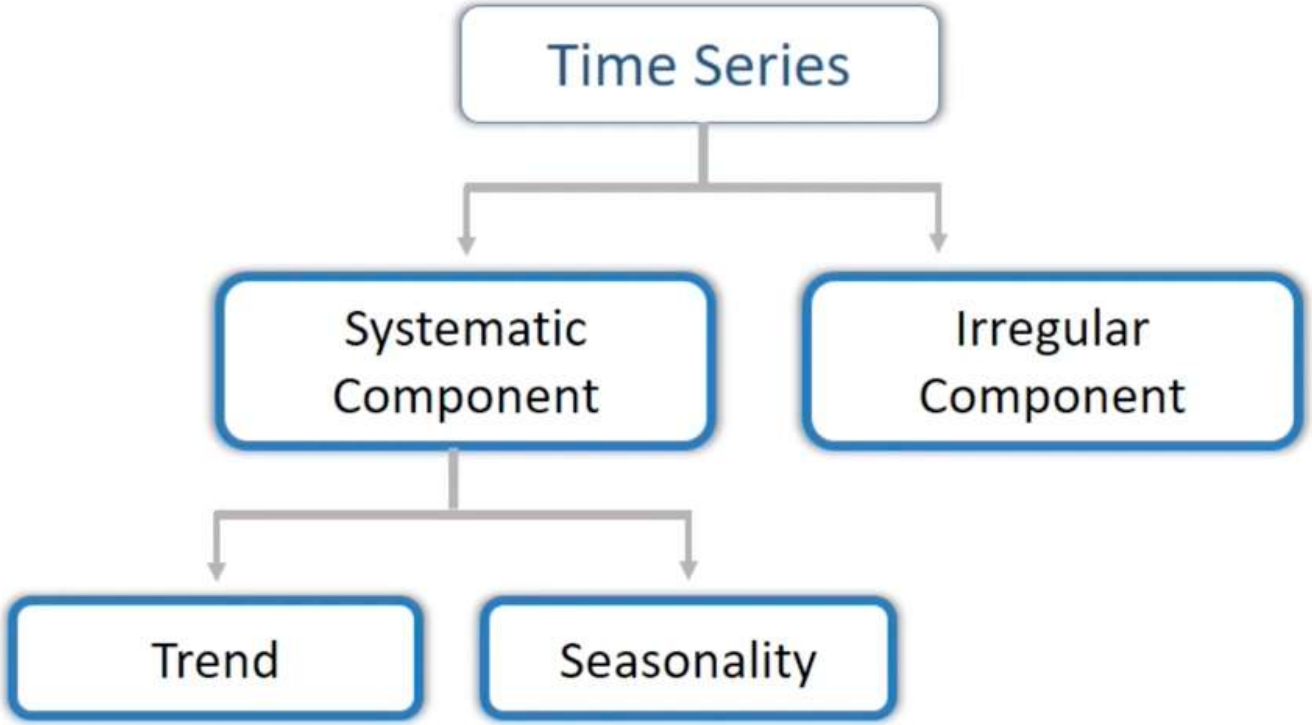
Time	sales
t1	10
t2	20
t3	30
t4	40

Time	sales
t1	90
t4	60
t2	130
t3	40

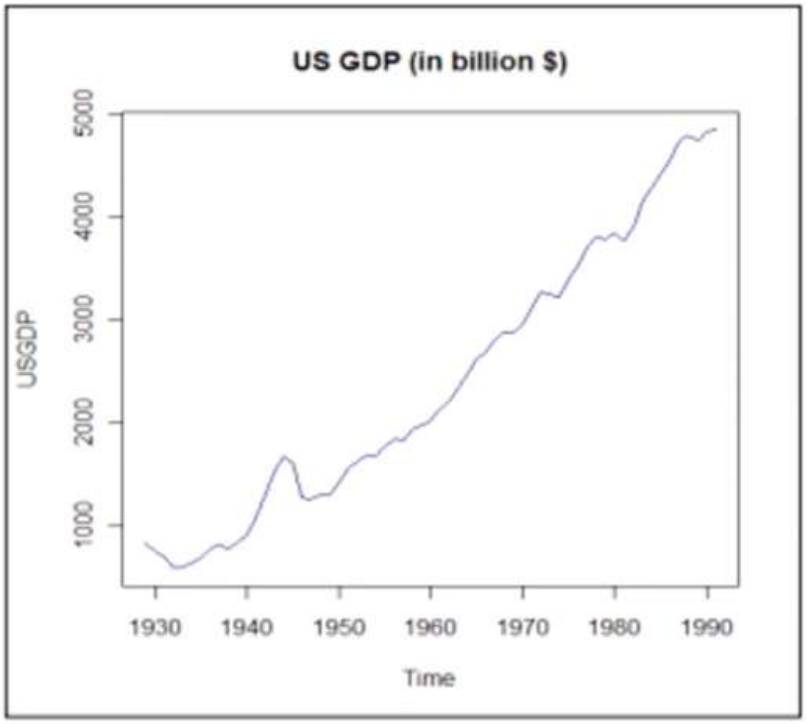
Special Features of Time Series Data

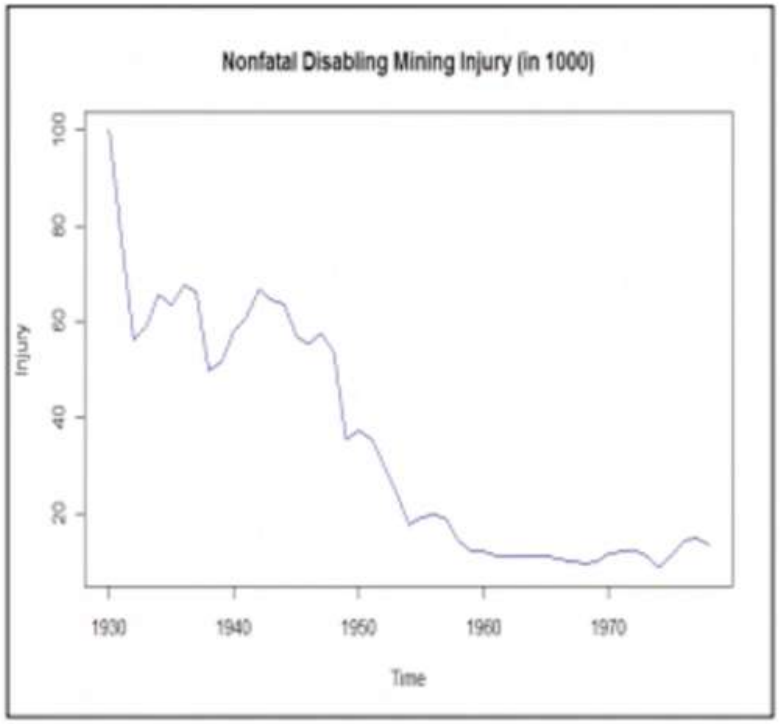
Time	sales
t1	10
t2	?
t3	?
t4	40

Components of Time Series

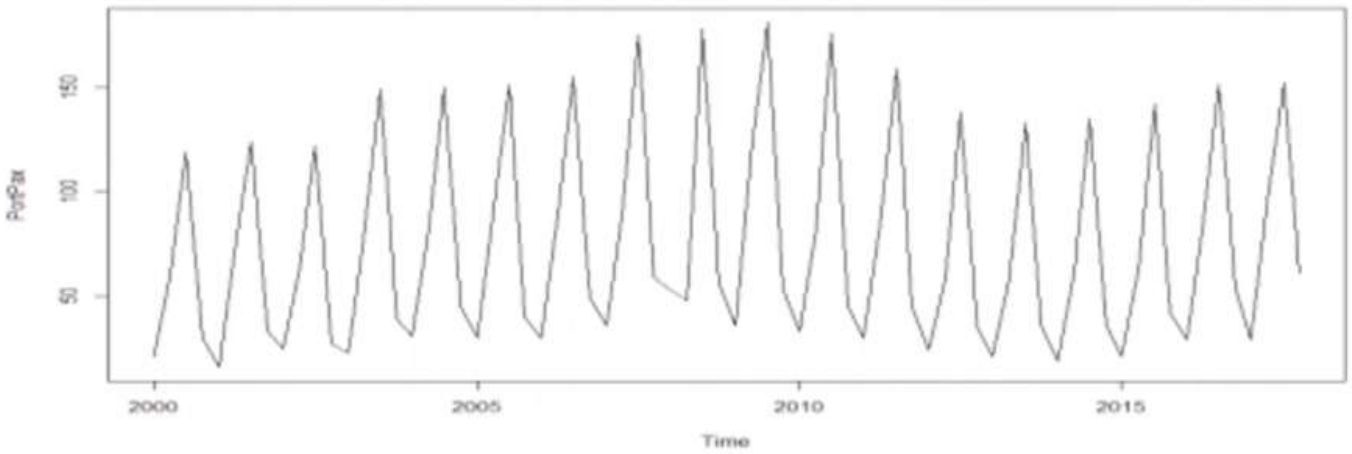


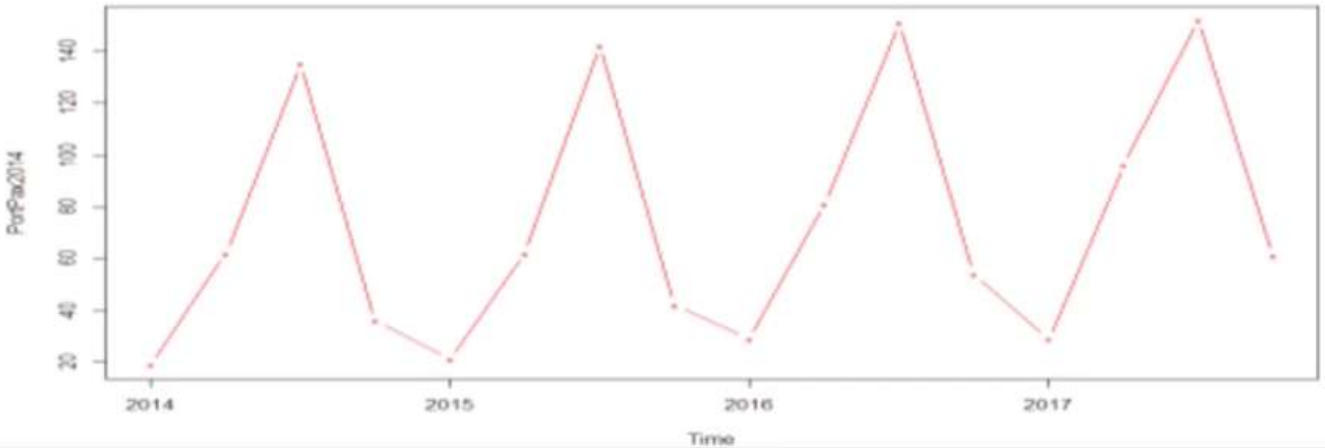
Trend


US GDP (in billion $)
USGDP
1000
2000
3000
4000
5000
1930
1940
1950
1960
1970
1980
1990
Time


Nonfatal Disabling Mining Injury (in 1000)
Injury
20
40
60
80
100
1930
1940
1950
1960
1970
Time

Seasonality



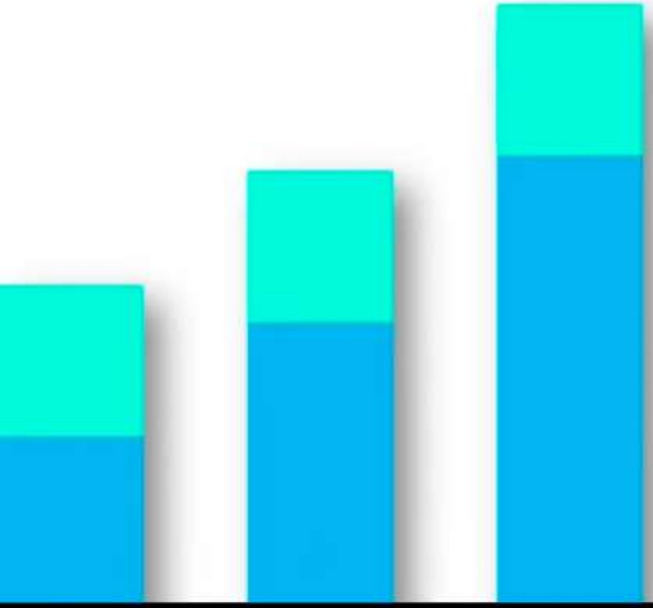


Decomposition of Time Series

Great Learning

Breaking down of Time Series Data into trend, seasonality and Irregular components

Compare the long term movement of series w.r.t the short term movement



Decomposition Model

There are two types of decomposition models: Additive, Multiplicative

Additive Model

$$Observation = \text{Trend} + \text{Seasonality} + \text{Error}$$

$$Y = T + S + I$$

Multiplicative Model

$$Observation = \text{Trend} * \text{Seasonality} * \text{Error}$$

$$Y = T * S * I$$

Understanding Additive Model

Forecasting sales with trend, seasonality and error

$$Sales = \text{Trend} + \text{Seasonality} + \text{Error}$$

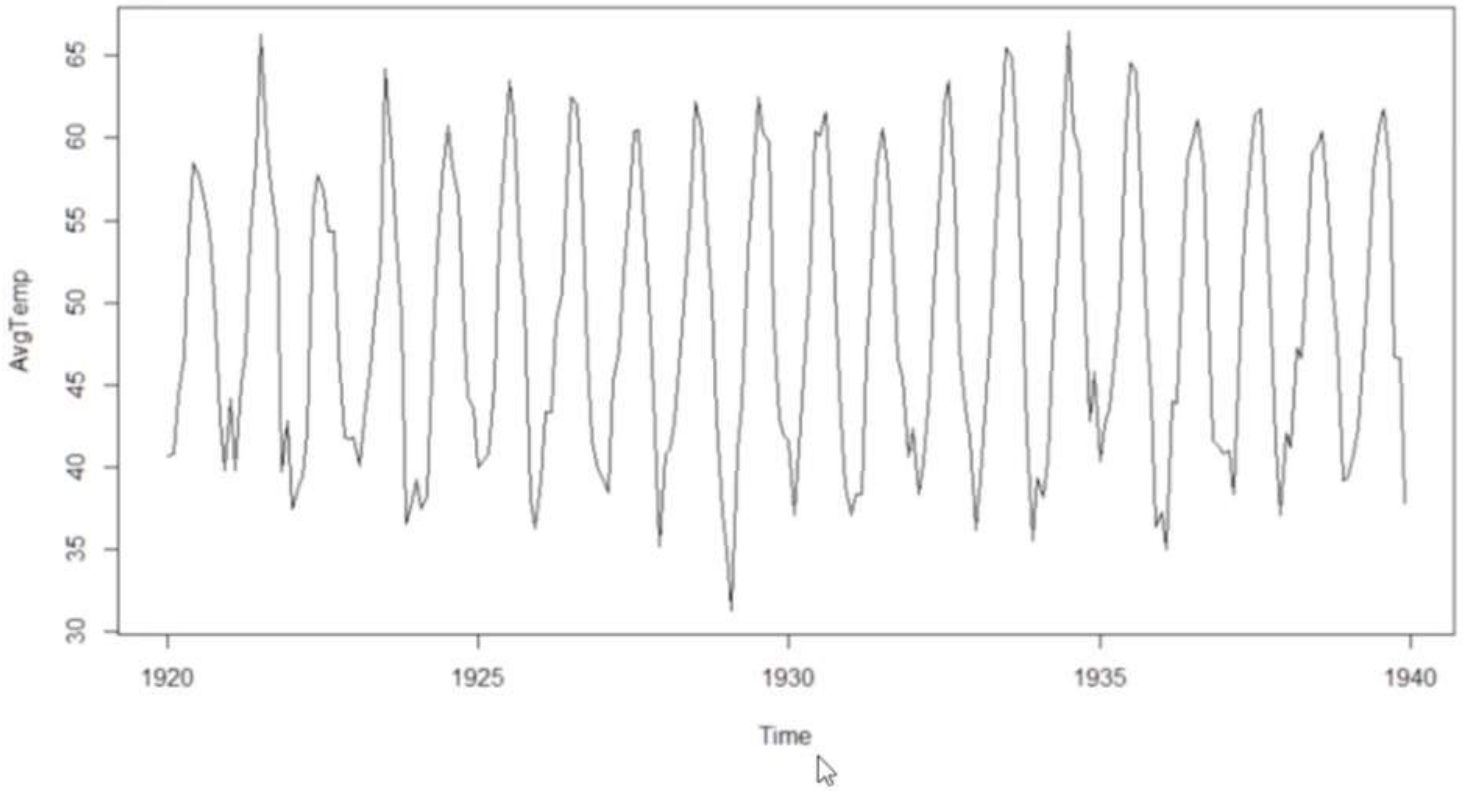
Business Growth

Weather

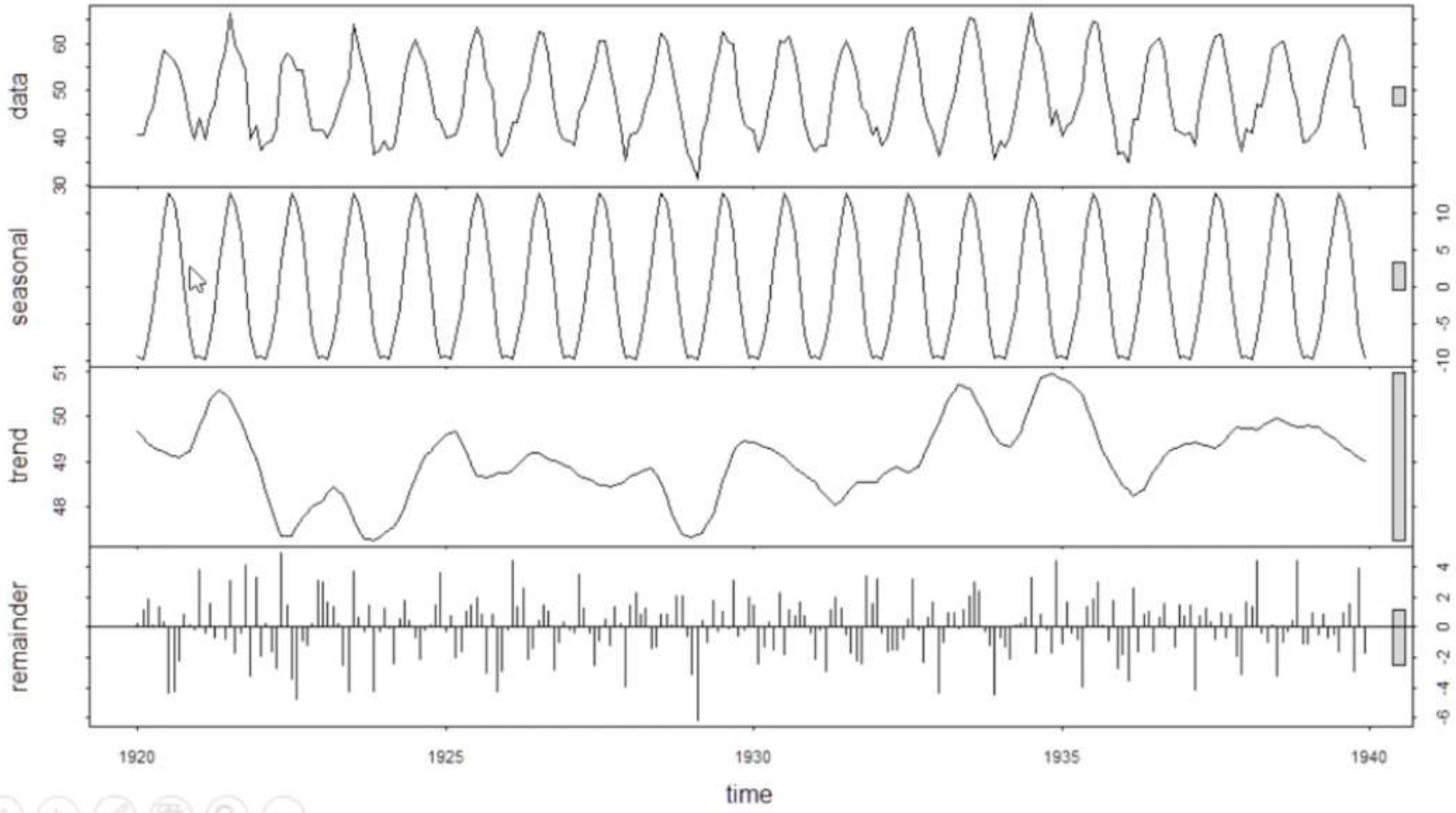
Theft/ Calamity

Understanding Additive Model

Additive Seasonality : If seasonal fluctuations do not change with trend



Decomposition Visualization



Decomposition Visualization