8.3 Time Series 1001/1/2019 8/1/2/1/100 (2. "Manger" = 291 · Time Series is a gener of data collected over time. It's data collected at specific time points who have the property and successional applicant and eg. Analysis of website checks. fuel Price you not what Volume of soles at Retail Outlet Island stock Price of the 18 1 miles the police point that of police · Data to be collected consistently and regularly and then only can be stille wed for fore casting.

We sa haves sales data for a particular year and we want to predict sales for next 6 monts Regress ion modelling Time Series Forecasting · Requires explanatory Requires soles figures · To predict the sales of By Plotting the 2017 we need variables like Sales data of previous Price, Location etc. Year Chased on 1 variable
Sales can be predicted & When we have only I variable, the most likely method or choice of forecast would be Time Series Forecasting

Time Series models are built on the premise that I have been to for next complete and planting they not · The future will mimic similar pattern as the past · Information needed to generate the forecast is contained in the Time Series of the data sation went suitables like sale date of previous 1 4 = \$ \$ + \$, 4 t-1 + at salet can be predicted Sylomotry War was a work by cal Y = Bo + B, X we have any I wanter the med they inclind for choice of facult would be time soid township about Total contract of four or makes

Components of a Time Series es delle placer inditioner 1) Trend last 30 years The state of the second hours any to horagener There is a long term pattern 3) Rondom Pluctuo Hope (8 Increase in sales of relectionic items over a period of time

2) Seasonality million and many leg Sales of air conditioner Sales peak in April to June year on year man done concernor of to This is attirbuted to the seasonal component of Time Series Seasonal component of a Time Series -Systematic fluotuations which repeat over periodic time Mardel twee years senot a sale Theoreta long tom poller 3) Random fluctuations There does not also person fund noist fluctuations that cannot be attributed to trend or seasonal though beginn the water wares

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tord of time serial : Amount of Muchalian of we brodust with I'me 4) Cyclic Marie Ma uning a decomposed lundron Occurs when data exhibits fluctuations that are a comment of the later of the · Not in a fixed time period · Usually atleast 2 Years Large Congranded baselie - Scorcoal conforced · Different from seasonal behaviour · Tend to be longer than seasonal · Exhibits more variability with respect to the seasomal patterns Host git List 1. (8 The level of the second state of the second st charge Degreen Machalter moor tost 100 1101 10 1/100

Level of Time Series: Amount of fluctuations as we progress with Time In R, when a Time Series is sliced using a decomposed function Victory of the property of Orignial Time Series Ornally altert 2 Years -> Trend component - Seasonal component -> Random Aluctuations · Tend to be longer then reasonal There are two kinds of Time Series 1) Additive Time Series to the sectional patients 2)-19 ut tip licati · mean does not change over time A. The levels of time Series does not change Progresses, fluctuations remains more or less constant

F

3

3

, T

Seasonality and random fluctuations can be added up to form
Observed Time Series (Additive)

FE + Y+ - 7+ + S+ (T+S+R=0)

- 2) Multiplicatives 7 ime Series
- · As the level of time series changes, the fluctuations change

7 * 3 * R = 0

Yt = Est + Tt + Et.

100000 (Como 100) (com

log yt = log St + log Tt + log Et

De- Seasonalised Series leaver of the and random Plutus hore can be added up to form For the Additive Model Yt - St cobserved - seasonality) Bultiplication Time Series For the Multiplicative Model Carry Collector St Cobserved I seasonality) The British Edder Interview and product a land a series of the series DITTO THE THE PARTY OF THE PART 11 11 11 11 11 Salothone Sone Kate Challet Binging 1160 11 601 115 601 11 603 subjected Convertby level

Steps in Time Series Analysis in R. 1) Read the data Common Contract of the Cold of 2) Store in Time Series object 3) Party save the data into object solg Sales <- scan Chttp://robjbyndman.com/ I tsaldata / data/ sales dat) The land of land burnan 3) Pass this object into 7s function Sales Time Series < - ts (sales) 5 specifical elections period attention we what does that dol borne helps to convert the class of data frame into time series object (1. 18 PI) D (1967) why ? (by) direct 1 boroadin Functionalities within time Series packages requires data to be in Time Series object

4) Pass frequency of Time Series
Salestime Series <- to (sales, frequency=4)
Data Collected Prequency
every month
- annually the sound had not a
5) Specify start of time period along with sub period
Sales time Series X- by (Sales, frequency = 12, Start = c(1987, 1))
Subperiod = 1 (monthly 12.1)
Torred required de la landonio de la force

6) Userplat function to plat Time Senes
plot 15 (515) Decompose function to decompose various components of Time Series decompose Cralestime Series, type="multiplicative") established to of the de Scoteral under Communication alle shop as start (sould start a start a start a start a Plotting of Time Sexies Analysis in R Bondelow object costabilate (1) · Transform the Time Series · Fither by wing a log transformation of Box Cox Transformation the family Appendantal Marida Companies · For better forecast BONDS VININDEN - MORE IN TOTAL IN STANCE Carried and the House of the House of the Miss (" Toologes requests dula decopo to

Plat of Time Serier
aprile stomastral and and and and and
[Additive Fransform [Multiplicative]
1) De compose model month
2) check presense of Trend, Seasonal,
Random Components
3) Select modelling technique
29119 911190981
5) Forecost
Validate
1 Translam the Time Series
The second of th
Forecasting Techniques
1) Exponential Smoothning
The land of the form of the property of the second of the
2) ARIMA - Doesnot take into account
Seasonality
3) X-12 ARTMA 1 - 114/2012/12/1
3) X-12 ARIMA - monthly f quarterly seasonality
4) 574 - 107
4) STL - Seasonal f Trend decomposition using
Lewis

Simple forecosting methods Average Method Marie Method observations observation David Live Oil bewere chieved Problem! Information is lost when overaged or most recent observation is used Solutions I would Halashar of 1000001 Simple Exponential Smoothning Method . Forecash are based on observations · More importance given to most recent observations · No Trend or Seasonality

· cafe data from top package book of such and so the such with on the modern and the late Validation of Forecast action to all of the second of the second Forecast Error = Diff between observed Value of Point forecast whole tot for a par a conson Actual value - Predicted value Hoadra dala Used Measures to calculate forecast accuracy Musical Land Political Survey 1) Mean Abgolute From & MAE = Mean (141) 2) Root Mean Squared From D Imean (e)2 3) Percentage error - Pi = 100 ei Alle these are scale dependent

so it is impossible to compare foreraits on time series on different scales where one woriginal Time series and consignify all of all only other is Leg Transformed Time Series So solnis: 4) Mean Absolute Percentage Error (MAPE) mean (1901) # mart commonly used of water data cure to 5) Mean Absolute Scaled Error (MASE) Aurophor in Peridual Cocompany MASE = MAE 19 10 10 10 Isolal rensamped Handras auto 131 (1) gascoling constant * Ideally THAPE should be less than 7 or 7.3 That water state gay to * Forecast which gives least values is preferred

Residual schecks on time source properties A Residual is the difference between an observation and its fitted value (which is different from fore carted value) Forecast -> Future Time point Fitted Malue - Specific time points within the actual data used for model participation I can Absolute Bratedonner MANIE Assumptions in Residual forecasting 1) Residuals should be uncorrelated Test for PAR Cerrelated

Heteroscodyticity or indicate a patter 1001 -) complete into is not 11 Captured in forecasta) -) components of the forecast are missing

2) Pesiduals mean is close to zero

Residuals have mean - Forecasts are other than trero biosed

- 3) Residuals have a constant variance
- 4) Residuals are normally distributed

+ First 2 assuraptions are to check the accuracy of the model

A Merch este 2 to for testing or computing prediction intervals: Based on sampling distribution, of the data

A Residuals that are normally distributed indicate that they are Identically or Independently Distributed Data (7.701)