Guided Project

Demand Planning in RStudio: Create Demand Forecast

Estimated Time
2 hours

Instructor:

Moses Gummadi

I am an independent consultant and educator helping companies in the areas of Operational Excellence, Business Improvement and Advanced Data Analytics.

I am excited to teach you how to create a Demand Forecast using RStudio.

This Guided Project is for Operations & Supply Chain Analysts, Data Scientists, and Analytics Professionals.

Familiarity with R language, RStudio interface, and an overview of Supply Chain / Operations is expected to complete this guided project.

By the end of this project, you will learn how to perform Time Series Forecasting, specifically using ARIMA method.

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Tasks In The Guided Project

You will learn to

- Import data, create time series objects.

- Analyse demand trend and seasonality + **Practice Task**

- Determine parameters using Auto-ARIMA

- Create and evaluate ARIMA demand model

- Forecast the demand, evaluate & extract output

- **Capstone Task**

How Guided Projects work

Your workspace is a cloud desktop right in your browser, no download required

In a split-screen video, your instructor guides you step-by-step

You are looking at RStudio from within the Rhyme platform. The instructor video appears on the right-side of your screen, and your virtual machine can be seen on the left side. RStudio is already installed on your Cloud Desktop.

Every task you perform in this Guided Project
can be done later in your own computer
if you have the R script file.

R script file is in Your Learning Journey,
just before the Quiz.

A link to the script will be emailed to you by
Coursera, after you complete the Guided Project.

Project Goal

Demand Forecasting, specifically using ARIMA method

Scenario

Operations / Supply Chain Analyst

A home improvement and DIY distributor with demand history for multiple product lines needs a demand forecast for the next forecasting period.

As an internal Operations / Supply Chain Analyst, you will use ARIMA forecasting method in RStudio to create demand forecast models, evalue the model accuracy and goodness of fit, predict future demand, and evalue forecast statistics.

Task 1

Import data, create time series objects.

Key Takeaways

- Loaded R libraries & imported demand data

- Updated date format & added columns (W, M, Y etc)

- Created summary tables **dtw** and **dtm**

- Learnt how to create Time Series Objects

- Created Time Series Objects **ts_dtw** and **ts_dtm**

Task 2

Analyse demand trend and seasonality (Understanding Autocorrelation)

Data	Y5	Y6	Y7	Y8	Y9	Y10	Y12	Y13	Y14	Y15	Y16	Y17	Y18	Y19	Y20
Lag 1	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y12	Y13	Y14	Y15	Y16	Y17	Y18	Y19
Lag 2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y12	Y13	Y14	Y15	Y16	Y17	Y18
Lag 3	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y12	Y13	Y14	Y15	Y16	Y17
Lag 4	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y12	Y13	Y14	Y15	Y16

Task 2

Analyse demand trend and seasonality (Understanding Autocorrelation)

Series ts_dtm

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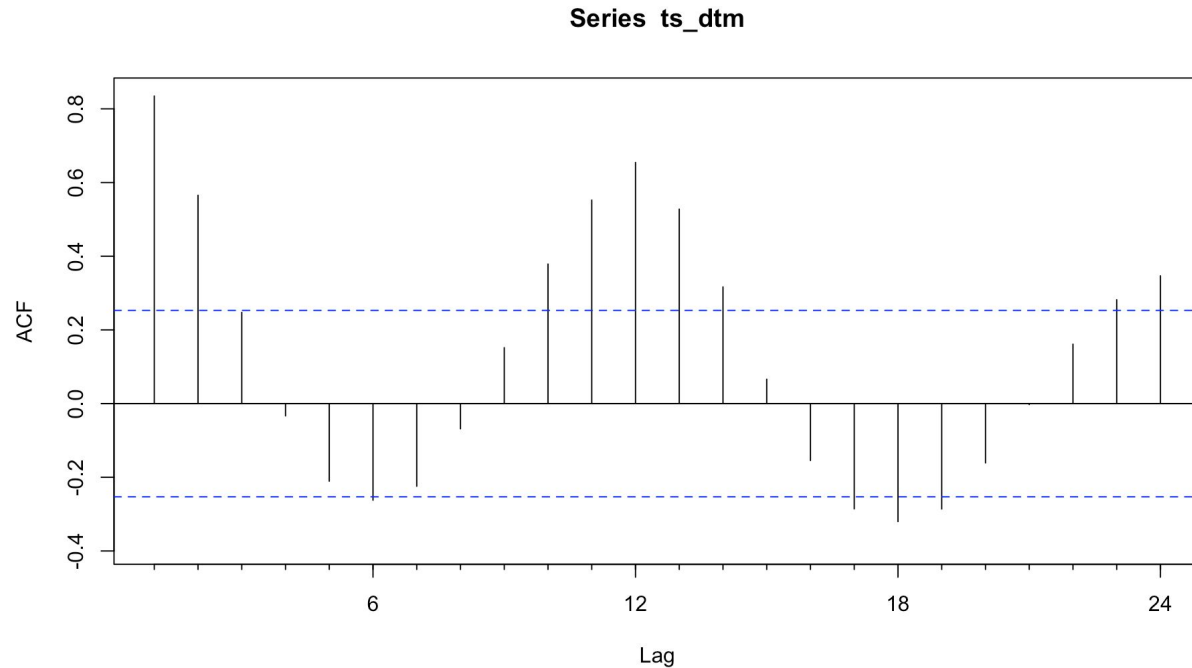
Task 2

Analyse demand trend and seasonality

Key Takeaways

- Learnt to use **ACF** and **PACF** to detect seasonality

- Decomposed the Time Series Objects

- Analysed their trend and seasonality

- Extracted components of decomposed data

- Evaluated data without seasonality using **PACF**

Practice Activity

This task is optional and ungraded. The goal is to check your understanding.

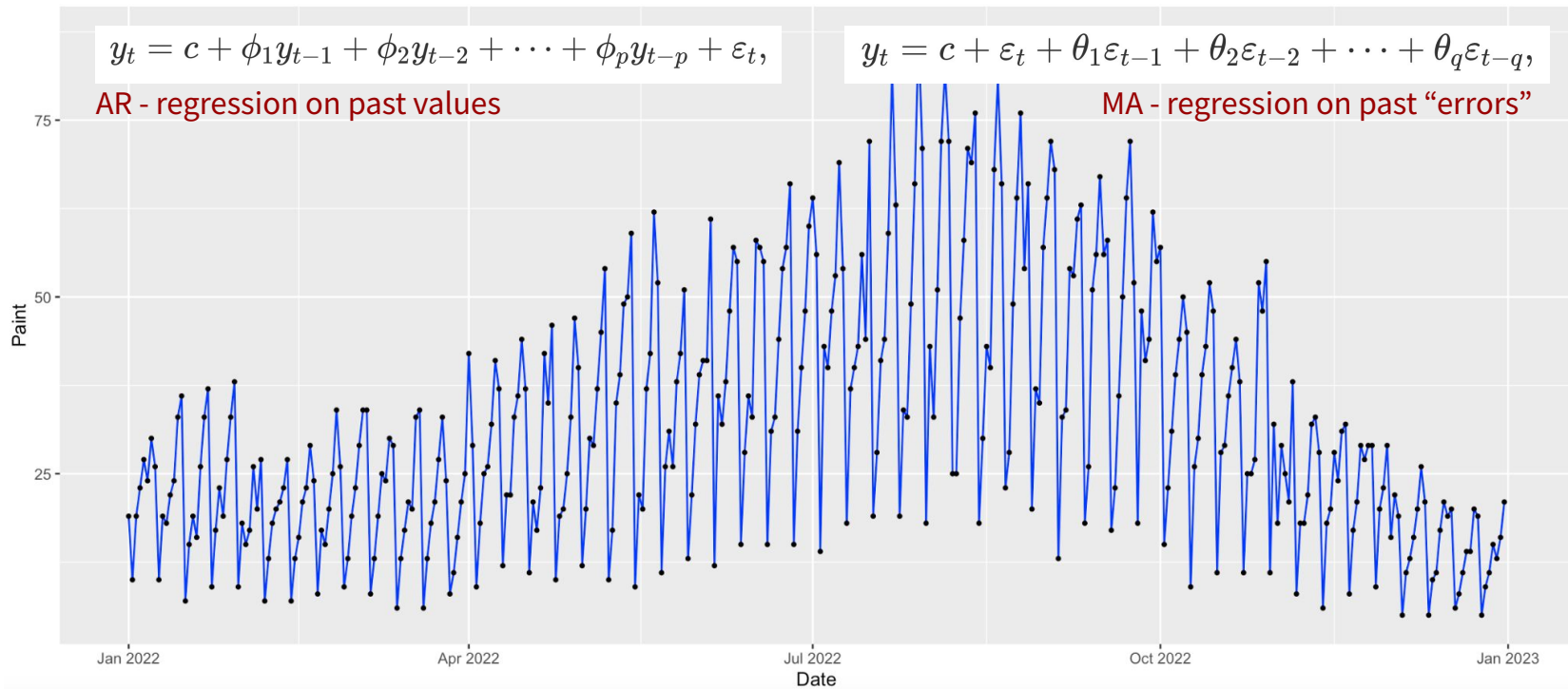# Practice Task

Analyse quarterly trend and seasonality

Task Goals

- Analyse **quarterly** trend and seasonality for **GardEquip**

- Use demand from 2019 onwards, exclude 2018 data

- You will need a new table **dtq** and new time series object

- Don't use the variable names **ts_dtw** and **ts_dtm**

- Use **quarter()** to create an additional column in dt

Task 3

Auto Regression & Moving Average

$$y_t = c + \phi_1 y_{t-1} + \phi_2 y_{t-2} + \cdots + \phi_p y_{t-p} + \varepsilon_t,$$

AR - regression on past values

$$y_t = c + \varepsilon_t + \theta_1 \varepsilon_{t-1} + \theta_2 \varepsilon_{t-2} + \cdots + \theta_q \varepsilon_{t-q},$$

MA - regression on past "errors"

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Task 3

Use Auto-ARIMA to determine parameters

Key Takeaways

- Reviewed Auto-Regression (**AR**) & Moving Average (**MA**) models

- Learnt the how to interpret information criteria (**AIC**, **BIC**)

- Used **auto.arima()** function to determine parameters

- Traced the Auto-ARIMA iterations using **trace = TRUE**

- Conducted a wider model search using **stepwise = FALSE**

- Determined (**p,d,q**) and (**P,D,Q**) parameters

Task 4

Create and evaluate ARIMA demand model

Key Takeaways

- Used previously determine (**p,d,q**) and (**P,D,Q**) values

- Created demand model using **Arima()** function

- Reviewed the model using **summary()** function

- Evaluated model residuals using **checkresiduals()**

Task 5

Forecast the demand, evaluate & extract output

Key Takeaways

- Created & plotted demand forecast for a specified period

- Filtered past data in the forecast using **include** option

- Performed forecast diagnosis using **QQnorm** and **PACF**

- Reviewed forecast data output and confidence intervals

- Extracted forecast into a CSV file for further use

Capstone Task

Capstone Task

Produce a 52-week forecast for Garden Equipment

Task Goals

- Use column **GardEquip** of the data table **dt**

- Create a Time Series Object for the entire range (2018-2022)

- Decompose data and identify seasonality and trend

- Determine (**p,d,q**) and (**P,D,Q**) parameters

- Use stepwise = FALSE, trace = TRUE, in **Arima()**

- Plot the 52-week forecast; include only past 2 years

We have reached the end
of this Guided Project.

Thank You.