

# Business Analytics Using Forecasting (BAFT)

**Term:** Fall 2025

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**Website:**

**Class Time:** Tuesdays, 14:20-17:20

**Classroom:** Room 406, TSMC Building



## Course Description

Business analytics is the use of data-driven decision making. Companies, governments and other organizations now collect and analyze large amounts of data about suppliers, clients, employees, citizens, transactions, etc. Forecasting is the arm of predictive analytics that provides a powerful toolkit for analyzing time series data. This course focuses on forecasting time series, where past and present values are used to forecast future values of a series of interest. The course covers issues relating to different steps of the forecasting process, from goal definition, through data visualization, modeling, and performance evaluation to model deployment.

Quantitative forecasting uses statistical and machine learning methods to generate numerical forecasts, an important component of decision making across many business functions, including economic forecasting, workload projections, sales forecasts, and transportation demand. Forecasting is now applied to Big Data with many series, often measured at high frequency. Examples include IoT devices and sensor recordings, demand for thousands of products at retail chains, wind turbines, web traffic, etc. Forecasting can be combined with statistical monitoring methods for purposes of anomaly detection – for example, public health organizations collect and monitor clinical and other data for detecting disease outbreaks. Forecasting is also often combined with simulation for purposes of scenario building.

**The focus of this course is on using forecasting for improving service, with a special emphasis on human-oriented and socially-responsible forecasting.**

In the course we'll work with real business problems and real data. We will examine types of applications where forecasting is potentially useful, and learn how to deploy the forecasting process. The emphasis is on understanding the concepts and logic behind a wide set of forecasting techniques and their relation to specific business analytics situations. The course is not about mastering the theoretical underpinnings of the techniques. **The course will be driven by a business forecasting project that will encapsulate the different steps of practical forecasting.**

## Software

An important feature of this course is hands-on learning using forecasting and data visualization software. We will use the open-source [R software](#). For data visualization we will use [Tableau](#).

**To take this course, students are required to have basic familiarity with R.**

## Course Objectives

Upon successful completion of the course, you should possess valuable practical analytical skills that will equip you with a competitive skill in almost any contemporary workplace. More formally, the course will provide participants with the following skills and knowledge:

- Be familiar of business analytics potential and dangers in today's data rich-environment
- Gain experience using forecasting methods
- Know how to decide when to use which technique
- Be able to implement major forecasting techniques using software
- Become a smart and critical user and consumer of forecasting techniques
- Gain the intellectual capital required to provide responsible business analytics services
- Be conscious of humanistic and societal implications of deploying data mining in organizations

## Learning Goals

In addition to the course objectives, students should expect to develop the following by the end of the course:

1. Effective Oral Communication - Each student will be able to communicate verbally in an organized, clear, and persuasive manner, and be a responsive listener. (Assessment: Project presentations)
2. Critical and Integrative Thinking - Each student will be able to identify key issues in a business setting, develop a perspective that is supported with relevant information and integrative thinking, to draw and assess conclusions. (Assessment: Individual Assignments, project proposal, team project report and presentations)
3. Interpersonal Awareness and Working in Teams - Each student will demonstrate an ability to work effectively in a team, exhibiting behavior that reflects an understanding of the importance of individual roles and tasks, and the ability to manage conflict and compromise, so that team goals are achieved. (Assessment: Team project report and team presentations, team meetings with instructor)

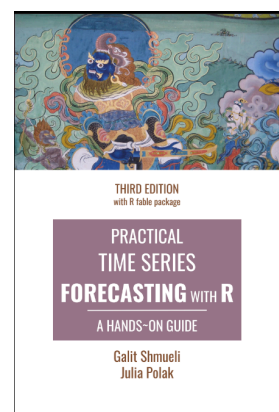
## Flipped Classroom

The course is designed as a “flipped classroom”: students are expected to watch videos, read the textbook, take short quizzes, post on an online forum, and work on an assignment prior to each on-ground session. Face-to-face class time will be devoted to discussions, developing the team projects, gaining hands-on experience, invited lectures, and other forms of interactive learning. We will use Canvas for all the online materials.

## Required Textbook

***Practical Time Series Forecasting with R, 3rd edition (2024), by Shmueli & Polak***

- Kindle eBook available on Amazon.com
- Data and code for book: <https://github.com/gshmueli/ptsf-R-3e>
- Recommended: free online book [Forecasting: Principles and Practice](#)



## Grading

Deliverable	Weight
Individual assignments (8)	40%
Online forum posts and quizzes (on Canvas)	15%
Midterm team proposal presentation & report	7+8 = 15%
Final team project report	15%
Final team presentation	15%

*Final letter grades are determined based on curving the numerical grades (not based on fixed grade intervals).*

*Each student is required to fill a peer evaluation report. If multiple team members indicate insufficient contribution of a member, a deduction of 30% of the presentation/report grade will be applied to that member.*

## Guidelines for Deliverables

### Individual Assignments

- Assignments should be completed independently, without discussing with other students.
- Hardcopy submitted at the start of the class meeting; Files uploaded to course website before class.
- Late assignments accepted, subject to a penalty of 25% on assignment grade per late day.

### On-Ground Attendance

Full attendance is mandatory in all sessions. You can miss a maximum of one class due to an emergency (e.g., illness).

### Online Component

Canvas: Before each class, watch videos, read the book chapters, post online, and take the online short quiz. Complete the individual assignment and submit a hardcopy in class.

## Use of Generative AI: Conditionally Open

Grounded in the principles of transparency and responsibility, this course encourages students to leverage AI for collaboration and mutual learning to enhance the quality of learning and output. In accordance with the published Guidelines for Collaboration, Co-learning, and Cultivation of Artificial Intelligence Competencies in University Education, this course adopts the following policy: **Conditionally open**.

You must briefly explain how you used generative AI for text summarization, topic ideation, writing improvement, translation, coding, image creation, quiz answering, or any other purpose. Mention this in the **footnote of the title/cover page** of your assignments, reports, and presentations. If usage is discovered without proper disclosure, the instructor has the right to reevaluate the deliverable and adjust scores. In turn, the instructor will indicate if course materials or learning resources were derived from generative AI.

## Midterm Team Proposal

Each team should find a real dataset (at least 4 series to analyze) and a business/social idea that can be approached using forecasting with the collected data.

**Written Proposal Format:** 2-pages, 11-point font, 1-inch margins, 1.15 line space, PDF format.

**In class Presentation:** 10 min, maximum 6 slides.

The proposal report and slides should include the following components:

1. Suitable Title - Should reflect the business goal and forecasting goal
2. Business Problem:
  - Who is the stakeholder or client? Choose the one who will make decisions using the forecasts.
  - Describe the business problem/goal. What are the business benefits of implementing this idea? What shortcoming does it address? How can forecasts improve their decisions?
  - What would be considered a success?
3. Forecasting Goal:
  - A description of the forecasting objective (what are you forecasting? Forecasting horizon, etc.).
  - Is the goal retrospective or forward-looking?
  - How will the forecasts be used? For what purpose? (Examples: building scenarios/anomaly detection/optimizing planning/etc.)
4. Data:
  - Brief description of available data (source, what they measure, time period, amount of data).
  - Some guidance on the data subset that will be used and the re-processing or preparation that might be needed based on your past experience.
  - Time plot of each relevant series (at least 4 series).
5. Methods:
  - What are some forecasting methods to consider? (optional: show initial results with smoothing)
  - Which performance measures are appropriate? How do they map to the business goal?
6. Implementation/Production:
  - Operational requirements or constraints (for example, will the forecasting system be run in real-time? will it require collecting new data? will it be a one-time analysis or ongoing?)

## Final Project Presentation (15 minutes)

Each team presents their project to the class on session #16. The project is based on the ideation submission, where the idea is then developed into a forecasting solution with final recommendations.

Create the following 7 slides (no more than 10 slides):

1. Cover: Informative title, team number and member names
2. Business problem (stakeholder, challenge/opportunity, humanistic implications)
3. Forecasting goal (forecast/time series analysis, retrospective/prospective, how to be used?)
4. Data description (source, what is measured, how much, how often)
5. Methods (forecasting methods, relevant outputs)
6. Evaluation (metrics of interest, benchmark, comparison, error magnitude/cost of selected model)
7. Recommendations

## Final Project Report (5 pages)

Written report of the project details, from the business problem through the forecasting problem and solution, to recommendations.

**Format:** 5 pages, 11-point font, 1-inch margins, 1.15 line space, PDF format.

The report should be written clearly and professionally and include the following sections:

1. **Cover page** with informative title, team number, course name, and member names (no student ID)
2. **One-page executive summary:** summarizes the entire report for a non-technical manager (the business problem, data, a relevant chart, the forecasting solution's methods and performance, and recommendations)
3. **Detailed report:**
  - a. Problem description (business goal and forecasting goal)
  - b. Data description (data source, what is measured, how much, how often, sample of 10 rows per series, time plots)
  - c. Brief data preparation details (how your data were created from the raw data)
  - d. Forecasting solution: **methods used** (with sufficient detail and screenshots; use Appendix if needed) and appropriate **performance evaluation** (proper choice of measures, benchmarking, error magnitude/cost of selected model). Charts with training and validation periods
  - e. Time plot of series with future forecasts, for each of the key series
  - f. Conclusions (advantages and limitations) and operational recommendations
4. **Appendix** (not counted in 5-page limit): Your R code (link to github)

## Session-Wise Schedule

<i>Week</i>	<i>Topics</i>	<i>Online Preparation prior to class: watch, read, discuss</i>	<i>In-Class Deliverable</i>
#1 Sept 2	1. Introduction to business analytics 2. Forecasting applications 3. Responsible forecasting 4. Forecasting process, language & notation 5. Goal definition		
#2 Sept 9	1. Goal definition 2. Data collection and characteristics 3. Matching data with goal <b>Case: cab bookings in India</b>	<b>Canvas Session 1</b> Read: Chap 1, Sec 2.1 Watch: video (8 min) Discuss #1: Forecasting goal (Install/update R, RStudio, R packages)	<b>Assignment 1 (Goal):</b> Chp 1 Problems #1-5
#3 Sept 16	1. Data visualization 2. Data Preprocessing <b>Case 11.1: transportation demand, cab bookings</b>	<b>Canvas Session 2</b> Read: Chap 2 Watch: 2 videos (18 min) Install Tableau	<b>Assignment 2</b> (Visualization): Ch 2 Prob #1 + Tableau dashboard
#4 Sept 23	<b>Performance Evaluation</b> 1. Data partitioning 2. Naïve forecasts 3. Predictive charts & measures <b>Case 11.1: transportation demand</b>	<b>Canvas Session 3</b> Read: Chap 3 Watch: 4 videos (21 min) Discuss #2: forecasting harms Quick quiz #1	<b>Assignment 3</b> (Performance): Ch 3 Prob #1 and #2
#5 Sept 30	[Company visits/meeting]	<b>Canvas Session 4</b>	
#6 Oct 7	<b>Smoothing-based methods</b> 1. Moving Average (centered/trailing) 2. Differencing, seasonal indexes 3. Simple Exponential Smoothing	<b>Canvas Session 5</b> Read: Chap 5, until Sec 5.4 Watch: 4 videos (23 min) Discuss #3: MA and differencing	

<b>Week</b>	<b>Topics</b>	<b>Online Preparation prior to class: watch, read, discuss</b>	<b>In-Class Deliverable</b>
#7 Oct 14	<b>Smoothing - cont.</b> 4. Advanced Exponential Smoothing 5. Automated ETS 6. ETS() for many series <b>(Forecasting Australian wines)</b> <b>In-Class: Team Project Proposal Presentations</b>	<b>Canvas Session 6</b> Read: Chap 5, from Sec 5.5 to end Watch: 3 videos (24 min) Quick quiz #2	<b>Assignment 4 (Smoothing):</b> Ch 5 Prob #8  <b>Project Proposal 2-page Report</b>
#8 Oct 21	<b>Regression-based forecasting</b> 1. Linear regression refresher 2. Regression for forecasting vs. inference 3. Trend models 4. Models for seasonality <b>Case 11.1: transportation demand using regression</b>	<b>Canvas Session 7</b> Read: Chap 6 Watch: 4 videos (28 min) Discuss #4: wine forecasting	<b>Assignment 5</b> (Linear Regression): Ch 6 Prob #5
#9 Oct 28	<b>Regression-based forecasting – cont.</b> 1. Autocorrelation 2. AR models (for forecast errors) 3. ARIMA models 4. Evaluating predictability; random walk	<b>Canvas Session 8</b> Read: Chap 7 (7.1-7.3) Watch: 3 videos (30 min) Quick quiz #3	<b>Assignment 6 (ARIMA):</b> Ch 7 Prob #3
#10 Nov 4	<b>Forecasting many series</b> M5 contest dataset (Walmart sales forecasting)	<b>Canvas Session 9</b>	
#11 Nov 11	<b>Regression-based forecasting - cont.</b> Including external information [meetings with teams]	<b>Canvas Session 10</b> Read: Chap 7, Sec 7.4 Watch: 2 videos (22 min) Discuss #5: Sept 11 travel	
#12 Nov 18	Team projects: updates [meetings with teams] <b>Ensembles</b>	<b>Canvas Session 11</b> Read: Chap 4	
#13 Nov 25	<b>Neural networks</b>	<b>Canvas Session 12</b> Read: Chap 8 Watch: 3 videos (30 min)	<b>Assignment 7 (NN):</b> Ch 8 Prob #1-3 (bonus: #4)
#14 Dec 2	<b>Forecasting binary events</b> <b>Logistic regression</b> <b>Case 11.3: forecasting stock price movements</b>	<b>Canvas Session 13</b> Read: Chap 9 Watch: 4 videos (29 min) Quick quiz #4 Discuss #6: mango outbreak	<b>Assignment 8</b> (binary Logistic Regression): Ch 9 Prob #4-10
#15 Dec 9	<b>Communication and maintenance</b>	<b>Canvas Session 14</b> Read: Chap 10	
#16 Dec 16	<b>Team Project Presentations</b>	<b>Canvas Session 15</b>	Upload to Google Slides before class
	<b>Submit Team Project Report by 23:59 on Dec 23, 2026</b>		Upload report to Canvas (PDF)