**FOUNDATION**

**LEVEL 2**

**Applied statistics for business analytics**

**Introduction to Statistics**

This algebra-based introduction to statistics is designed to provide students from various majors with a foundational understanding of statistical concepts and techniques. The course uses practical application of statistical methods to real-world scenarios across different disciplines. Key topics include data visualization, descriptive statistics, sampling, elementary probability, statistical inference, and simple linear regression. This course uses technology, such as statistical software, to analyze data and draw meaningful conclusions. Students will develop the skills to critically evaluate data-driven studies, make informed decisions, and apply statistical methods in their academic, professional, and everyday life. This course does not count for the Statistics minor nor the Statistics major. Students who have already taken Calculus I should not take this course, instead they should take STAT 301 or STAT 325, both of which use R and count for the Statistics minor and major. (F, W, S).

**Biostatistics**

This course focuses on statistical techniques and applications for biological and life sciences, as well as the relevant mathematical aspects of these statistical techniques. Topics include samples and populations, quantitative vs. categorical data, clinical vs. epidemiological studies, comparative displays and analysis, probability, Bayes' Theorem, point estimation, confidence intervals, hypothesis tests, ANOVA, and linear regression. Study design is emphasized: clinical trials in experimental settings, case-control, cohort studies in epidemiological settings, and review of some case studies from the literature. This course includes learning statistical software in labs with a biological focus. Students will be expected to write short lab reports. Students can receive credit for only one of STAT 301 and STAT 325. (F, W, S). Prerequisite(s): MATH 113 or MATH 115

**Introduction to Data Science for All**

With the growing availability of data, companies, governments, and nonprofits alike are striving to convert this data into insightful knowledge. This course will provide students with the fundamental skills in the statistical software called R needed to handle such data. The course will focus on three broad areas: computation, inferential thinking, and real-world applications. We will also discuss data collection, data cleaning, and exploratory data analysis. Students will connect data to underlying phenomena and think critically about the conclusions of data analyses. Students will also learn how to write short programs that automate data analysis processes. Students will gain an applied understanding of various analytical methods, including data visualization, linear regression, and classification or clustering. Most of the material will be taught using real-world data. (F, W).

**Applied Statistics**

This course studies the principles and applications of statistics. Topics include descriptive statistics, random variables, probability distributions, sampling distributions, the central limit theorem, confidence intervals, hypothesis testing for means and variances, and the use of normal, chisquare, F, and t distributions in statistical problems. Other topics are selected from regression and correlation, the design of experiments, and analysis of variance. A minimum grade of C- is required in the prerequisite. Students can receive credit for only one of STAT 301 and STAT 325. (F). Prerequisite(s): MATH 113 or MATH 115

**Statistical Computing**

This course focuses on computational techniques that are crucial for statistics applications. Using the statistical packages R and SAS, the course teaches students about importing and storing data, manipulating and visualizing data, debugging and re-sampling, as well as simulation methods including bootstrap and Monte Carlo methods. A minimum grade of C- is required in the prerequisite course(s). (YR). Prerequisite(s): STAT 325 or (STAT 301 and STAT 305)

**Introduction to Survey Sampling**

An introduction to survey sampling techniques assuming only a limited knowledge of higher-level mathematics. Topics include: simple and stratified random sampling, estimation, systematic sampling, simple and two stage cluster sampling, and population size estimation. (AY). Prerequisite(s): STAT 325

**Applied Regression Analysis**

Topics include single-variable linear regression, multiple linear regression and polynomial regression. Model checking techniques based on the analysis of residuals will be emphasized. Remedies to model inadequacies, such as transformations, will also be covered along with basic time series analysis and forecasting using moving averages and autoregressive models with prediction errors. Statistical packages will be used. A minimum grade of C- is required in the prerequisite course(s). Students are encouraged to take MATH 227 before STAT 430. Students cannot receive credit for both STAT 430 and STAT 530. (F, W). Prerequisite(s): STAT 325 or MATH 325 or IMSE 317 or ME 364 or (STAT 301 and STAT 305)

**Machine Learning and Computational Statistics**

Computational models trained with high dimensional data are increasingly important in industry and many academic disciplines. We will cover a wide range of topics in machine learning and statistical programming that enhance learning from data. Topics include an introduction to statistical learning, a review of simple and multiple linear regression, logistic regression, classification with linear and quadratic discriminant analysis and naïve Bayes, variable selection, shrinkage methods, dimension reduction methods, decision trees, deep learning (neural networks), and clustering methods. Students cannot receive credit for both STAT 431 and STAT 531. (W). Prerequisite(s): STAT 325 or MATH 325 or IMSE 317 or ME 364 or (STAT 301 and STAT 305)

**Design and Analysis of Experiments**

 An introduction to the basic methods of designed experimentation. Fixed and random effects models together with the analysis of variance techniques will be developed. Specialized designs including randomized blocks, latin squares, nested, full, and fractional factorials will be studied. The statistical computer package R will be used. In addition to the course prerequisite, students are strongly encouraged to complete STAT 305 prior to enrolling in STAT 440 for a more comprehensive understanding. Students cannot receive credit for both STAT 440 and STAT 540. (W, AY). Prerequisite(s): STAT 301 or STAT 325 or MATH 425 or IMSE 317

**Environmental Statistics**

The primary objective of the course is to teach students majoring in the environmental and biological sciences how to make data-driven decisions with statistics. This course aims to nurture the importance of statistical methods to enhance the understanding of issues related to environmental sciences. A one-semester course cannot be exhaustive in depth and width of literature but the aim of this course is to create interest and encourage students to delve more into the subject. This course does not count for the Statistics minor nor the Statistics major. Students who have already taken Calculus I should not take this course, instead they should take STAT 301 or STAT 325, both of which use R and count for the Statistics minor and major. Students cannot receive credit for both STAT 455 and STAT 555. (AY). Restriction(s)

**Time Series Analysis**

An introduction to time series, including trend effects and seasonality, while assuming only a limited knowledge of higher-level mathematics. Topics include: linear Gaussian processes, stationarity, autocovariance, and autocorrelation; autoregressive (AR), moving average (MA), and mixed (ARMA) models for stationary processes; likelihood in a simple case such as AR(1); ARIMA processes, differencing, seasonal ARIMA as models for non-stationary processes; the role of sample autocorrelation, partial autocorrelation, and correlograms in model choice; inference for model parameters; forecasting: dynamic linear models and the Kalman filter. Students cannot receive credit for both STAT 460 and STAT 560. (F, AY)

**Books**

**Quatember, A. (2015). Pseudo-Populations - A Basic Concept in Statistical Surveys. Springer, Heidelberg.**

**Mateu, J. and Müller W.G. (2012) Spatio-temporal Design: Advances in Efficient Data Acquisition. John Wiley & Sons, Inc. Chichester, West Sussex. ISBN: 978-0-470-97429-2**

Peter H. Westfall Kevin S. S. Henning

**Understanding Advanced Statistical Methods**

Advanced Statistics Janette Walde janette.walde@uibk.ac.at Department of Statistics University of Innsbruck

Advanced Statistics Using R Zhiyong Zhang Lijuan Wang

Course Description

This advanced statistics course focuses on essential techniques in data manipulation, variable creation, transformations, multiple regression, nonlinear regression, ANOVA, and nonparametric statistics. Using statistical software like R or other equivalent programs, students will develop the analytical skills required for solving complex business and data challenges.

Credit and Contact Hours

Lecture: 3 hours

Lab: 0 hours

Credit Hours: 3

Prerequisites

Grade of “C” in a foundational statistics or equivalent course.

Books, Supplies, and Supplementary Materials

Textbooks:

Statistics: Informed Decisions (Text/CD/MyStatLab), 6th Ed., 2020, Sullivan, Pearson Education, ISBN: 9780134135366

R for Data Science by Wickham, H. and Grolemund, G. (Free online resource: R for Data Science)

Required Software: R or R-Studio (free downloads available)

Methods of Instruction

Hybrid online format

General Education Student Learning Outcome

Applied Knowledge: Students will apply learned concepts and analytical techniques to solve real-world business problems using statistical tools and methods.

**Fundamentals of Business Intelligence & Analytics**

**Course description**

Gain practical proficiency in the core principles of business intelligence and analytics. This course will guide you through the process of understanding, using, and evaluating diverse techniques and skills for analyzing datasets and deriving appropriate interpretations.

**Learning Outcome**

* Explain the fundamentals of business intelligence and analytics
* Evaluate different techniques and tools that can be used in business intelligence and analytic activities.
* Apply guidelines to business intelligence and analytics practices considering ethics and privacy.
* Analyse and apply strategies and technologies for effective business  management that supports evidence-based decisions
* Discuss the evolution of BI and current industry trends.

**Course Content**

**Introduction to Business Intelligence and Analytics**

* What is Business Intelligence (BI) and Analytics?
* The Business Intelligence lifecycle: data collection, data cleaning, data transformation, analysis, visualization, and action
* Key components of a BI system: data warehouse, data mart, OLAP (Online Analytical Processing)
* Importance of BI in decision-making
* Different types of business analytics: descriptive, diagnostic, predictive, prescriptive

**Data Warehousing and ETL Processes**

* Data warehouse architecture: dimensional modeling, snowflake schema, star schema
* Data extraction, transformation, and loading (ETL) process
* Data quality issues and cleansing techniques
* Data integration challenges and strategies

**Exploratory Data Analysis (EDA)**

* Descriptive statistics: mean, median, mode, standard deviation, variance
* Data visualization techniques: histograms, scatter plots, box plots, heatmaps
* Identifying patterns, trends, and outliers in data
* Techniques for data profiling and data exploration

**Data Mining and Machine Learning Algorithms**

* Supervised learning algorithms: linear regression, decision trees, neural networks, support vector machines
* Unsupervised learning algorithms: clustering analysis, association rule mining
* Feature engineering and data preparation for machine learning
* Model evaluation metrics: accuracy, precision, recall, F1-score

**Advanced Analytics Techniques**

* Time series analysis: forecasting, trend analysis, seasonality
* Text mining: sentiment analysis, topic modeling
* Social network analysis
* Recommendation systems

**Business Intelligence Reporting and Dashboards**

* Key Performance Indicators (KPIs) and metrics selection
* Designing effective dashboards and reports
* Data visualization best practices: color schemes, chart types, interactive elements

**Implementing Business Intelligence Solutions**

* Choosing a BI platform: considerations and factors
* Deployment options: on-premise, cloud-based
* User adoption and change management strategies

**Case Studies and Applications**

* Real-world examples of BI applications across different industries (e.g., retail, healthcare, finance)
* Ethical considerations and data privacy in BI

**Suggested Readings**

* **Business Intelligence: The Savvy Manager's Guide** by David Loshin: A practical, non-technical overview of BI concepts.
* **The Data Warehouse Toolkit: The Complete Guide to Dimensional Modeling** by Ralph Kimball and Margy Ross: A classic text on data warehousing, a core component of BI.
* **Data Smart: Using Data Science to Transform Information into Insight** by James D. Miller: A beginner-friendly introduction to data analysis and interpretation.
* **Learning SQL** by Alan Beaulieu: Essential for anyone working with databases, a fundamental skill in BI.

**Data Management & SQL**

**Course Description**

 This course provides a comprehensive introduction to data management principles and the Structured Query Language (SQL). Students will learn how to design, implement, and manage databases, as well as how to use SQL to retrieve, manipulate, and analyze data. The course covers both theoretical concepts and practical applications, equipping students with the skills needed to work effectively with data in various contexts.

**Learning Outcome**

Upon successful completion of this course, students will be able to:

* Understand fundamental data management concepts, including data modeling, database design, and data integrity.
* Design and implement relational databases using appropriate tools and techniques.
* Master SQL syntax and use it to perform various database operations.
* Retrieve and manipulate data from databases efficiently and accurately.
* Analyze data using SQL queries and aggregate functions.
* Understand database normalization and apply it to design efficient databases.
* Implement data security measures to protect sensitive information.
* Use database management systems (DBMS) for data administration tasks.
* Understand the role of data management in various applications and industries.

**Course Content**

**Introduction to Data Management**

* What is data management?
* Importance of data management in organizations.
* Types of data and data sources.
* Data lifecycle and data governance.
* Introduction to database systems.
* Database management system (DBMS) concepts.
* Different types of databases (relational, NoSQL, etc.).

**Database Design**

* Data modeling concepts (entities, attributes, relationships).
* Entity-relationship diagrams (ERD).
* Relational database model.
* Database normalization (1NF, 2NF, 3NF, BCNF).
* Designing relational databases.
* Choosing appropriate data types.
* Implementing database constraints.

**Introduction to SQL**

* What is SQL?
* History and evolution of SQL.
* SQL syntax and structure.
* Basic SQL commands (SELECT, INSERT, UPDATE, DELETE).
* Retrieving data from tables.
* Filtering data using WHERE clause.
* Sorting and grouping data.

**Advanced SQL**

* Joining tables (INNER JOIN, LEFT JOIN, RIGHT JOIN, FULL JOIN).
* Subqueries and nested queries.
* Aggregate functions (COUNT, SUM, AVG, MIN, MAX).
* Grouping and aggregating data using GROUP BY and HAVING.
* Working with dates and times.
* String manipulation functions.
* Creating and managing tables and views.

**Data Manipulation and Transactions**

* Inserting, updating, and deleting data.
* Transactions and ACID properties.
* Controlling transactions (COMMIT, ROLLBACK).
* Data integrity constraints (primary keys, foreign keys, unique constraints, check constraints).
* Working with large datasets.

**Database Administration**

* User management and security.
* Backup and recovery.
* Performance tuning and optimization.
* Database maintenance tasks.
* Introduction to stored procedures and triggers.

**Data Analysis with SQL**

* Performing data analysis using SQL queries.
* Using aggregate functions and window functions.
* Creating reports and visualizations.
* Introduction to data warehousing and OLAP.

**Data Management in Practice**

* Data management in different industries (e.g., healthcare, finance, e-commerce).
* Case studies of data management challenges and solutions.
* Emerging trends in data management (e.g., big data, cloud databases).

**Suggested Readings**

* **Sams Teach Yourself SQL in 24 Hours** by Ben Forta: A very accessible and popular starting point. It breaks down SQL concepts into bite-sized lessons.
* **SQL for Dummies** by Allen G. Taylor: Another excellent beginner-friendly option, explaining database concepts and SQL in a clear and easy-to-understand way.
* **Head First SQL** by Lynn Beighley: A more visual and engaging approach to learning SQL, using a format that emphasizes practical application.
* **Learning SQL** by Alan Beaulieu: A well-regarded book that covers SQL fundamentals and best practices.
* **Effective SQL** by Peter J. Robison: Focuses on writing efficient and maintainable SQL code.

**Fundamentals of Business Intelligence & Analytics**

**Course description**

Gain practical proficiency in the core principles of business intelligence and analytics. This course will guide you through the process of understanding, using, and evaluating diverse techniques and skills for analyzing datasets and deriving appropriate interpretations.

**Learning Outcome**

* Explain the fundamentals of business intelligence and analytics
* Evaluate different techniques and tools that can be used in business intelligence and analytic activities.
* Apply guidelines to business intelligence and analytics practices considering ethics and privacy.
* Analyse and apply strategies and technologies for effective business  management that supports evidence-based decisions
* Discuss the evolution of BI and current industry trends.

**Course Content**

**Introduction to Business Intelligence and Analytics**

* What is Business Intelligence (BI) and Analytics?
* The Business Intelligence lifecycle: data collection, data cleaning, data transformation, analysis, visualization, and action
* Key components of a BI system: data warehouse, data mart, OLAP (Online Analytical Processing)
* Importance of BI in decision-making
* Different types of business analytics: descriptive, diagnostic, predictive, prescriptive

**Data Warehousing and ETL Processes**

* Data warehouse architecture: dimensional modeling, snowflake schema, star schema
* Data extraction, transformation, and loading (ETL) process
* Data quality issues and cleansing techniques
* Data integration challenges and strategies

**Exploratory Data Analysis (EDA)**

* Descriptive statistics: mean, median, mode, standard deviation, variance
* Data visualization techniques: histograms, scatter plots, box plots, heatmaps
* Identifying patterns, trends, and outliers in data
* Techniques for data profiling and data exploration

**Data Mining and Machine Learning Algorithms**

* Supervised learning algorithms: linear regression, decision trees, neural networks, support vector machines
* Unsupervised learning algorithms: clustering analysis, association rule mining
* Feature engineering and data preparation for machine learning
* Model evaluation metrics: accuracy, precision, recall, F1-score

**Advanced Analytics Techniques**

* Time series analysis: forecasting, trend analysis, seasonality
* Text mining: sentiment analysis, topic modeling
* Social network analysis
* Recommendation systems

**Business Intelligence Reporting and Dashboards**

* Key Performance Indicators (KPIs) and metrics selection
* Designing effective dashboards and reports
* Data visualization best practices: color schemes, chart types, interactive elements

**Implementing Business Intelligence Solutions**

* Choosing a BI platform: considerations and factors
* Deployment options: on-premise, cloud-based
* User adoption and change management strategies

**Case Studies and Applications**

* Real-world examples of BI applications across different industries (e.g., retail, healthcare, finance)
* Ethical considerations and data privacy in BI

**Suggested Readings**

* **Business Intelligence: The Savvy Manager's Guide** by David Loshin: A practical, non-technical overview of BI concepts.
* **The Data Warehouse Toolkit: The Complete Guide to Dimensional Modeling** by Ralph Kimball and Margy Ross: A classic text on data warehousing, a core component of BI.
* **Data Smart: Using Data Science to Transform Information into Insight** by James D. Miller: A beginner-friendly introduction to data analysis and interpretation.
* **Learning SQL** by Alan Beaulieu: Essential for anyone working with databases, a fundamental skill in BI.

**Artificial Intelligence for Business Excellence**

**Course Description**

This course explores the transformative potential of Artificial Intelligence (AI) in driving business excellence. Students will gain a comprehensive understanding of AI concepts, techniques, and applications, focusing on how AI can be leveraged to optimize business processes, enhance decision-making, and create innovative products and services. The course blends theoretical foundations with practical case studies and real-world examples, equipping students with the knowledge and insights needed to navigate the AI landscape and implement AI solutions effectively.

**Learning Outcome**

 Upon successful completion of this course, students will be able to:

* Understand the fundamental concepts of AI, including machine learning, deep learning, and natural language processing.
* Identify opportunities for AI implementation in various business functions.
* Evaluate and select appropriate AI techniques for specific business challenges.
* Develop and implement AI-driven solutions to improve business processes.
* Analyze the ethical and societal implications of AI in business.
* Manage AI projects and teams effectively.
* Understand the future trends and potential of AI in business.

**Course Outline**

**Introduction to Artificial Intelligence**

* What is AI? Definitions, history, and evolution.
* Types of AI: Narrow/Weak AI, General/Strong AI, Super AI.
* Core AI disciplines: Machine Learning, Deep Learning, Natural Language Processing, Computer Vision, Robotics.
* AI applications in business: Examples and use cases.

**Machine Learning Fundamentals**

* Supervised learning: Algorithms (linear regression, classification), model training and evaluation.
* Unsupervised learning: Clustering (k-means), dimensionality reduction (PCA).
* Reinforcement learning: Concepts and applications.
* Feature engineering and selection.
* Model selection and hyperparameter tuning.

**Deep Learning for Business**

* Neural networks: Architectures and training.
* Convolutional Neural Networks (CNNs) for image recognition.
* Recurrent Neural Networks (RNNs) for sequential data.
* Deep learning frameworks (TensorFlow, PyTorch).
* Applications of deep learning in business.

**Natural Language Processing (NLP) for Business**

* Text processing and analysis.
* Sentiment analysis.
* Text summarization.
* Chatbots and conversational AI.
* Language translation.
* Applications of NLP in business.

**AI for Business Functions**

* AI in Marketing: Personalized recommendations, targeted advertising, customer segmentation.
* AI in Sales: Lead scoring, sales forecasting, customer relationship management.
* AI in Operations: Process automation, supply chain optimization, predictive maintenance.
* AI in Finance: Fraud detection, risk management, algorithmic trading.
* AI in Human Resources: Talent acquisition, performance management, employee engagement.

**Ethical and Societal Implications of AI**

* Bias in AI algorithms.
* Fairness and accountability.
* Privacy and data security.
* Job displacement and the future of work.
* Regulation and governance of AI.

**Implementing AI Solutions**

* AI project lifecycle.
* Data acquisition and preparation.
* Model development and deployment.
* AI team building and management.
* Change management and adoption.

**The Future of AI in Business**

* Emerging trends in AI research and development.
* The impact of AI on industries and society.
* The future of work in the age of AI.
* AI strategy and roadmap development.

**Suggested Readings**

**General AI & Business:**

* **Artificial Intelligence: A Modern Approach** by Stuart Russell and Peter Norvig: A comprehensive and foundational textbook on AI. (More technical, but excellent for a deep understanding)
* **AI Superpowers: China, Silicon Valley, and the New World Order** by Kai-Fu Lee: Explores the global AI landscape and its implications for business and society.
* **Prediction Machines: The Simple Economics of Artificial Intelligence** by Ajay Agrawal, Joshua Gans, and Avi Goldfarb: Focuses on the economic impact of AI and how it will change business.

**Machine Learning:**

* **Hands-On Machine Learning with Scikit-Learn, Keras & TensorFlow** by Aurélien Géron: A practical guide to machine learning using Python and popular libraries.
* **The Elements of Statistical Learning** by Trevor Hastie, Robert Tibshirani, and Jerome Friedman: A more theoretical and advanced text on statistical learning.

**Deep Learning:**

* **Deep Learning** by Ian Goodfellow, Yoshua Bengio, and Aaron Courville: A comprehensive textbook on deep learning. (More technical)
* **Hands-On Deep Learning with Python** by Pramod Kaushik: A practical guide to deep learning using Python.

**Natural Language Processing:**

* **Speech and Language Processing** by Dan Jurafsky and James H. Martin: A comprehensive textbook on NLP. (More technical)
* **Natural Language Processing with Python** by Steven Bird, Ewan Klein, and Edward Loper: A practical guide to NLP using Python and the NLTK library.

**AI for Specific Business Functions:**

* (Look for books tailored to your area of interest, e.g., "Marketing Analytics with AI," "AI for Finance," etc.)

**Ethical Considerations of AI:**

* **Weapons of Math Destruction** by Cathy O'Neil: Explores the negative impacts of algorithms on society.
* **Automating Inequality** by Virginia Eubanks: Examines how automated systems perpetuate inequality.

**Marketing Analytics**

**Course Description**

 This course provides a comprehensive introduction to the principles and practices of marketing analytics. Students will learn how to leverage data to understand customer behavior, optimize marketing campaigns, and measure marketing ROI. The course covers a range of topics, including data collection, data analysis, statistical modeling, and marketing measurement. Students will gain hands-on experience using marketing analytics tools and techniques.

**Learning Outcome**

Upon successful completion of this course, students will be able to:

* Understand the role of data in marketing decision-making.
* Collect and prepare marketing data from various sources.
* Apply statistical methods to analyze marketing data.
* Use marketing analytics tools and platforms.
* Develop and implement marketing metrics and KPIs.
* Measure the effectiveness of marketing campaigns.
* Make data-driven recommendations to improve marketing performance.
* Understand ethical considerations in marketing analytics.

**Course Content**

**Introduction to Marketing Analytics**

* What is marketing analytics?
* The importance of data-driven marketing.
* Marketing analytics framework.
* Types of marketing data (e.g., customer demographics, website traffic, sales data).
* Data sources (e.g., CRM systems, web analytics platforms, social media).

**Data Collection and Preparation**

* Data collection methods (e.g., surveys, experiments, web scraping).
* Data cleaning and preprocessing.
* Data integration and transformation.
* Data warehousing and database management for marketing.
* Ethical considerations in data collection.

**Descriptive Analytics for Marketing**

* Descriptive statistics (e.g., mean, median, mode, standard deviation).
* Data visualization techniques (e.g., charts, graphs, dashboards).
* Customer segmentation and profiling.
* Market basket analysis.
* RFM analysis (Recency, Frequency, Monetary).

**Predictive Analytics for Marketing**

* Introduction to statistical modeling.
* Regression analysis (linear, multiple, logistic).
* Classification techniques (e.g., decision trees, support vector machines).
* Churn prediction.
* Customer lifetime value (CLTV) prediction.
* Propensity modeling.

**Marketing Measurement and ROI**

* Marketing metrics and KPIs (e.g., website traffic, conversion rates, customer acquisition cost).
* Attribution modeling.
* Measuring the effectiveness of marketing campaigns (e.g., A/B testing).
* Calculating marketing ROI.
* Reporting and communicating marketing analytics insights.

**Marketing Analytics Tools and Platforms**

* Web analytics platforms (e.g., Google Analytics, Adobe Analytics).
* CRM systems (e.g., Salesforce, HubSpot).
* Marketing automation platforms (e.g., Marketo, Pardot).
* Data visualization tools (e.g., Tableau, Power BI).
* Statistical software (e.g., R, Python).

**Digital Marketing Analytics**

* Search engine marketing (SEM) analytics.
* Social media marketing analytics.
* Email marketing analytics.
* Display advertising analytics.
* Mobile marketing analytics.

**Advanced Topics in Marketing Analytics**

* Big data analytics for marketing.
* Real-time marketing analytics.
* Machine learning for marketing.
* Customer journey analytics.
* Marketing analytics in specific industries.

**Suggested Reading**

**Foundational & Overview Texts:**

* **Marketing Analytics: The Definitive Guide to Measuring Marketing Performance** by Stephan Sorger: This book offers a comprehensive overview of marketing analytics, covering both online and offline channels. It emphasizes the importance of data-driven decision-making and provides a framework for measuring marketing effectiveness.
* **Marketing Metrics: The Definitive Guide to Measuring Marketing Performance** by Paul Farris, Neil Bendle, Phillip Pfeifer, and David Reibstein: A 1 classic resource focusing on key marketing metrics and KPIs. It helps you understand what to measure and how to interpret the data to improve marketing ROI.
* [1. issuu.com](https://issuu.com/thewagmag/docs/west_052112)
* [issuu.com](https://issuu.com/thewagmag/docs/west_052112)
* **Data-Driven Marketing: The 15 Metrics Everyone in Marketing Should Know** by Mark Jeffery: This book focuses on the most important marketing metrics and how to use them to make better decisions. It's a practical guide that avoids overly technical jargon.

**Digital Marketing Analytics:**

* **Web Analytics 2.0: The Art of Online Accountability and Science of Customer Centricity** by Avinash Kaushik: While slightly older, this book remains a valuable resource for understanding web analytics principles. It covers how to measure and analyze website traffic, user behavior, and online marketing campaigns.
* **Digital Marketing Analytics: Understanding Marketing Performance** by Chuck Hemann and Ken Burbary: This book offers a practical guide to using data and analytics to improve digital marketing performance across various channels, including search, social media, email, and mobile.

**Specific Techniques & Tools:**

* **Data Mining for Business Analytics** by Galit Shmueli, Peter C. Bruce, Gedeon O. Data, and Nitin R. Patel: This book delves into data mining techniques and their applications in marketing, such as customer segmentation, market basket analysis, and churn prediction.
* **Predictive Analytics: The Power to Predict Who Will Click, Buy, or Die** by Eric Siegel: This book explores the world of predictive modeling and its applications in marketing, finance, and other areas. It explains how to build predictive models and use them to make better marketing decisions.
* **R for Marketing Analytics** by Marcel Hinz and Manfred Kuhn: If you're interested in using R for marketing analytics, this book provides a practical guide to using this powerful statistical programming language.

**Data Visualization & Communication:**

* **Storytelling with Data: A Data Visualization Guide for Business Professionals** by Cole Nussbaumer Knaflic: This book emphasizes the importance of effective data communication and provides practical tips for creating compelling visualizations that tell a story.
* **The Visual Display of Quantitative Information** by Edward Tufte: A classic text on data visualization principles, focusing on clarity, accuracy, and effectiveness.