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Data Science for Managerial Decisions (MB 511)

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References/Literature

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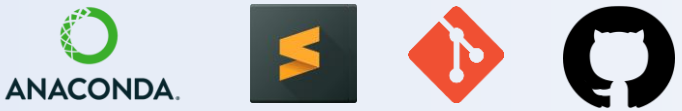
Online Resources

Software Resources



Data Science for Managerial Decisions (MB 511)

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Program Overview

- Introduction to Data Science
- Information Technology An Overview
- Applications of Data Science in various fields
- MIS and Control Systems
- Data Collection and Data Pre-Processing
- Building Information Systems
- Support Systems for Management Decisions

Information Technology An Overview

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- Foundations of Information Technology
- Information Systems and Management
- Project Management in IT
- Cybersecurity and IT Governance
- Future Trends in Information Technology

Information Technology An Overview

Emerging Technologies - Artificial Intelligence and Machine Learning

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Artificial Intelligence (AI) and Machine Learning (ML) are transformative technologies revolutionizing management practices. AI refers to the development of computer systems capable of performing tasks that typically require human intelligence, while ML enables systems to learn and improve from experience without explicit programming. In management, AI and ML streamline decision-making processes, analyze vast datasets to derive insights, and predict future trends. These technologies empower managers to make data-driven decisions, enhance operational efficiency, and optimize resource allocation. As businesses increasingly leverage AI and ML, understanding their applications becomes crucial for effective leadership in the rapidly evolving landscape of modern management.

Future Trends in AI & ML

- Explainable AI (XAI)
- Automated Machine Learning (AutoML)
- Quantum Machine Learning
- Federated Learning
- Neuromorphic Computing
- Edge AI
- Ethical AI
- Generative Models
- Transfer Learning
- Natural Language Processing (NLP) Advancements

Information Technology An Overview

Emerging Technologies - Internet of Things (IoT)

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The Internet of Things (IoT) plays a pivotal role in modern management by interconnecting devices, collecting real-time data, and facilitating informed decision-making. In management, IoT enhances efficiency by enabling remote monitoring, predictive maintenance, and data-driven insights. Through interconnected sensors and devices, organizations gain visibility into operations, optimize resource utilization, and improve overall productivity. IoT-driven data analytics empowers managers to make informed decisions, streamline workflows, and enhance customer experiences. Whether in manufacturing, logistics, or facility management, the integration of IoT fosters a more responsive and adaptive management approach, laying the foundation for a connected and intelligent business ecosystem.

Future Trends in IoT

- Next Generation Wireless Services (6G)
- Edge Computing
- AI and Machine Learning Integration
- Blockchain for Security
- Digital Twins
- IoT in Healthcare
- Smart Cities
- Energy Management
- IoT in Agriculture (AgTech)
- Human Augmentation

Information Technology An Overview

Emerging Technologies - Blockchain technology

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Blockchain technology is of paramount importance in modern management, providing a decentralized and secure framework for data transactions. Its tamper-resistant nature ensures the integrity of information, enhancing trust and transparency in various management processes. Smart contracts enable automated and self-executing agreements, streamlining operations and reducing the risk of fraud. In supply chain management, blockchain enhances traceability and accountability. Additionally, it facilitates efficient and cost-effective cross-border transactions. As a transformative tool, blockchain empowers management with a robust foundation for data governance, offering unprecedented security and efficiency in a wide array of industries.

Future Trends in Blockchain Technology

- Interoperability Protocols
- Scalability Solutions
- Smart Contracts Evolution
- Privacy and Confidentiality
- Sustainability Measures:
- Tokenization of Assets
- Decentralized Identity
- Oracles and Data Feeds
- Governance Models
- Cross-Industry Integration

Information Technology An Overview

Digital Transformation in Business

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Digital transformation in business is a strategic overhaul leveraging technology to reshape operations, enhance customer experiences, and stay competitive. It involves integrating digital technologies into all aspects of a business, fostering agility and efficiency. Cloud computing, data analytics, artificial intelligence, and automation are key drivers. This transformation not only optimizes internal processes but also creates innovative business models, reaching customers through digital channels. It's a paradigm shift that accelerates responsiveness, fosters innovation, and ensures sustained relevance in an increasingly digitalized marketplace, marking a pivotal evolution in how organizations operate and deliver value.

Information Technology An Overview

Digital Transformation – Case studies

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Notable digital transformation case studies across various industries

Amazon: E-Commerce Disruption

Transformation Focus: E-commerce and Cloud Computing

Details: Amazon's evolution from an online bookstore to a global e-commerce giant is a prime example. Its use of data analytics, machine learning, and cloud services has transformed the retail industry, setting new standards in customer experience, supply chain management, and logistics.

Netflix: Streaming Revolution

Transformation Focus: Media and Entertainment

Details: Netflix's transition from a DVD rental service to a global streaming platform is a digital transformation success story. Leveraging big data analytics, recommendation algorithms, and a cloud-based infrastructure, Netflix disrupted traditional television and changed how people consume content worldwide.

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Digital Transformation – Case studies

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Maersk: Blockchain in Supply Chain

Transformation Focus: Logistics and Shipping

Details: Maersk, a global shipping company, implemented blockchain to enhance transparency and efficiency in its supply chain. The solution, developed in collaboration with IBM, streamlined documentation processes, reducing delays, and preventing fraud.

Starbucks: Mobile Payment and Customer Engagement

Transformation Focus: Retail and Customer Experience

Details: Starbucks embraced digital transformation by integrating mobile payment solutions into its app. This not only simplified transactions but also allowed for personalized marketing and loyalty programs, significantly enhancing the overall customer experience.

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Digital Transformation – Case studies

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General Electric (GE): Industrial IoT

Transformation Focus: Industrial Manufacturing

Details: GE's digital transformation involved adopting Industrial Internet of Things (IIoT) technologies. By embedding sensors and connectivity in its industrial equipment, GE could monitor performance in real-time, optimize maintenance schedules, and enhance overall efficiency.

Walmart: Omnichannel Retail

Transformation Focus: Retail and E-commerce

Details: Walmart's digital transformation strategy involved integrating online and offline retail channels. Investments in e-commerce platforms, supply chain optimization, and in-store technology innovations have allowed Walmart to offer a seamless omnichannel experience to customers.

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Digital Transformation – Case studies

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DBS Bank: Digital Banking Transformation

Transformation Focus: Banking and Finance

Details: DBS Bank in Singapore embarked on a digital transformation journey to become a "digital bank." They introduced a cloud-first strategy, revamped their online and mobile banking platforms, and embraced data analytics to provide personalized and efficient financial services.

Airbnb: Peer-to-Peer Hospitality

Transformation Focus: Hospitality and Travel

Details: Airbnb disrupted the traditional hospitality industry by creating a platform that connects hosts with travelers. Leveraging digital technologies, Airbnb transformed the way people find accommodations, fostering a peer-to-peer sharing economy.

Information Technology An Overview

Digital Transformation – Case studies

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Delta Airlines: Predictive Maintenance

Transformation Focus: Aviation and Transportation

Details: Delta Airlines employed predictive maintenance powered by data analytics and IoT sensors. This approach allowed the airline to predict potential equipment failures, optimize maintenance schedules, and improve overall fleet reliability.

AstraZeneca: Data-Driven Drug Discovery

Transformation Focus: Healthcare and Pharmaceuticals

Details: AstraZeneca implemented digital technologies, including artificial intelligence and machine learning, to enhance drug discovery and development processes. This data-driven approach accelerates research, identifies potential drug candidates more efficiently, and reduces time to market.

Information Technology An Overview

Digital Transformation – Frameworks

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- McKinsey 7S Framework
- Prosci ADKAR Model
- Kotter's 8-Step Change Model
- TOGAF (The Open Group Architecture Framework)
- Digital Capability Framework (DCF)
- ITIL (Information Technology Infrastructure Library)
- NIST Cybersecurity Framework
- Six Ds of Exponentials (by Peter Diamandis)
- Gartner's Pace-Layered Application Strategy
- IDC's 3rd Platform Model
- Agile Transformation Framework

MIS and Control Systems

- Introduction to MIS and Control Systems
- Design and Implementation of MIS
- Control Systems in Action
- Challenges and Future Trends

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MIS and Control Systems

Introduction to MIS and Control Systems

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Definition

- MIS, or Management Information System, is a crucial element in contemporary organizational structures. It refers to a system that collects, processes, stores, and disseminates information to support decision-making and control within an organization. MIS integrates people, processes, and technology to provide managers with relevant information for efficient planning, coordination, and control of business operations.

- Key components
  - Key components of MIS include data collection, processing, storage, and retrieval. It often involves the use of specialized software and hardware systems to analyze and present information in a format that aids managerial decision-making. MIS encompasses various sub-systems, such as decision support systems, executive information systems, and transaction processing systems.

MIS and Control Systems

Introduction to MIS and Control Systems

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Objectives

- The primary objectives of MIS are to enhance organizational efficiency, facilitate informed decision-making, support strategic planning, and improve overall communication within an organization. In the modern business landscape, where information is a valuable asset, a well-implemented MIS can provide a competitive advantage by ensuring timely and accurate information is available to the right people at the right time.

Designing an MIS

Building AI Solutions

CRISP DM

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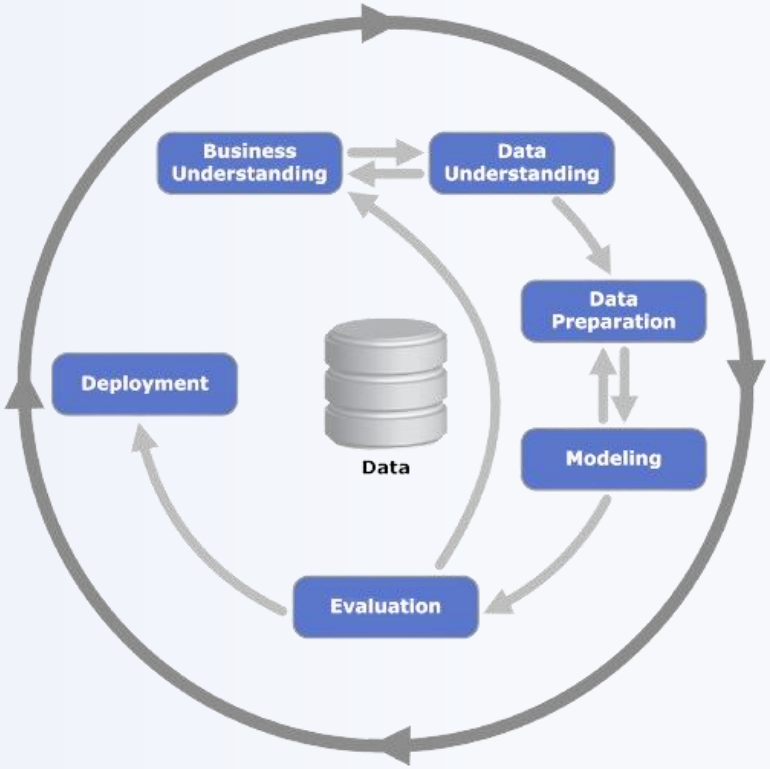
The CRoss Industry Standard Process for Data Mining (CRISP-DM) is a process model that serves as the base for a data science process. It has six sequential phases:

- Business understanding – What does the business need?
- Data understanding – What data do we have / need? Is it clean?
- Data preparation – How do we organize the data for modeling?
- Modeling – What modeling techniques should we apply?
- Evaluation – Which model best meets the business objectives?
- Deployment – How do stakeholders access the results?



Published in 1999 to standardize data mining processes across industries, it has since become the most common methodology for data mining, analytics, and data science projects.

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2. https://exde.files.wordpress.com/2009/03/crisp_visualguide.pdf
3. https://inseaddataanalytics.github.io/INSEADAnalytics/CRISP_DM.pdf

Building AI Solutions

Business Understanding

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Any good project starts with a deep understanding of the customer's needs. Data mining projects are no exception and CRISP-DM recognizes this.

The Business Understanding phase focuses on understanding the objectives and requirements of the project. Aside from the third task, the three other tasks in this phase are foundational project management activities that are universal to most projects:

Determine business objectives: You should first "thoroughly understand, from a business perspective, what the customer really wants to accomplish." (CRISP-DM Guide) and then define business success criteria.

Assess situation: Determine resources availability, project requirements, assess risks and contingencies, and conduct a cost-benefit analysis.

Determine data mining goals: In addition to defining the business objectives, you should also define what success looks like from a technical data mining perspective.

Produce project plan: Select technologies and tools and define detailed plans for each project phase.

While many teams hurry through this phase, establishing a strong business understanding is like building the foundation of a house – absolutely essential.

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Data Understanding

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Next is the Data Understanding phase. Adding to the foundation of Business Understanding, it drives the focus to identify, collect, and analyze the data sets that can help you accomplish the project goals. This phase also has four tasks:

Collect initial data: Acquire the necessary data and (if necessary) load it into your analysis tool.

Describe data: Examine the data and document its surface properties like data format, number of records, or field identities.

Explore data: Dig deeper into the data. Query it, visualize it, and identify relationships among the data.

Verify data quality: How clean/dirty is the data? Document any quality issues.

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Data Preparation

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A common rule of thumb is that 80% of the project is data preparation.

This phase, which is often referred to as “data munging”, prepares the final data set(s) for modeling. It has five tasks:

Select data: Determine which data sets will be used and document reasons for inclusion/exclusion.

Clean data: Often this is the lengthiest task. Without it, you’ll likely fall victim to garbage-in, garbage-out. A common practice during this task is to correct, impute, or remove erroneous values.

Construct data: Derive new attributes that will be helpful. For example, derive someone’s body mass index from height and weight fields.

Integrate data: Create new data sets by combining data from multiple sources.

Format data: Re-format data as necessary. For example, you might convert string values that store numbers to numeric values so that you can perform mathematical operations.

Building AI Solutions

Modeling

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What is widely regarded as data science's most exciting work is also often the shortest phase of the project.

Here you'll likely build and assess various models based on several different modeling techniques. This phase has four tasks:

Select modeling techniques: Determine which algorithms to try (e.g. regression, neural net).

Generate test design: Pending your modeling approach, you might need to split the data into training, test, and validation sets.

Build model: As glamorous as this might sound, this might just be executing a few lines of code like "reg = LinearRegression().fit(X, y)".

Assess model: Generally, multiple models are competing against each other, and the data scientist needs to interpret the model results based on domain knowledge, the pre-defined success criteria, and the test design.

Although the CRISP-DM Guide suggests to "iterate model building and assessment until you strongly believe that you have found the best model(s)", in practice teams should continue iterating until they find a "good enough" model, proceed through the CRISP-DM lifecycle, then further improve the model in future iterations.

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Evaluation

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Whereas the Assess Model task of the Modeling phase focuses on technical model assessment, the Evaluation phase looks more broadly at which model best meets the business and what to do next. This phase has three tasks:

Evaluate results: Do the models meet the business success criteria? Which one(s) should we approve for the business?

Review process: Review the work accomplished. Was anything overlooked? Were all steps properly executed? Summarize findings and correct anything if needed.

Determine next steps: Based on the previous three tasks, determine whether to proceed to deployment, iterate further, or initiate new projects.

Building AI Solutions

Deployment

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"Depending on the requirements, the deployment phase can be as simple as generating a report or as complex as implementing a repeatable data mining process across the enterprise." –CRISP-DM Guide

A model is not particularly useful unless the customer can access its results. The complexity of this phase varies widely. This final phase has four tasks:

Plan deployment: Develop and document a plan for deploying the model.

Plan monitoring and maintenance: Develop a thorough monitoring and maintenance plan to avoid issues during the operational phase (or post-project phase) of a model.

Produce final report: The project team documents a summary of the project which might include a final presentation of data mining results.

Review project: Conduct a project retrospective about what went well, what could have been better, and how to improve in the future.

Your organization's work might not end there. As a project framework, CRISP-DM does not outline what to do after the project (also known as "operations"). But if the model is going to production, be sure you maintain the model in production. Constant monitoring and occasional model tuning is often required.

Building AI Solutions

Deployment

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Quiz and Assignment

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Dear Class your first quiz and assignment will be due as per following schedule.

- Quiz February 25, 2024 (1:30 PM – 02:00 PM) – Link will be shared before the Quiz
- Assignment February 25, 2024 (1200 AM) - March 2, 2024 (1159 PM) - Link

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Have a question?

Feel Free to Reach out at

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