unibz
Fakultät für Wirtschaftswissenschaften
Facoltà di Economia
Faculty of Economics and Management

MASTER IN DATA ANALYTICS FOR ECONOMICS AND MANAGEMENT (LM-Data)

Course contents

1st year – both curricula

Programming and Visualisation for Data Science

M1 Introduction to programming for data science

- Languages for programming data and data visualization
- Integrated development environments for data science
- Data wrangling, cleaning, and preprocessing
- Advanced libraries for linear algebra and statistics
- Data science pipelines, from data ingestion to models and analysis
- Model tuning, validation, and testing

M2 – Data visualization and exploration

- Reproducible analysis practices
- Human perception for effective visualization
- Data types and visual encodings
- Visualization idioms
- Exploratory data analytics, data exploration, and feature engineering
- Advanced libraries for data visualization

Econometrics for data science

M1 - Time Series Analysis and Forecasting

- Characteristics of time series data and basic models
- Stationarity and time series regression
- Detrending, de-seasonalizing and smoothing
- Intro to AR, MA and ARMA models
- Estimation and forecasting
- Basics of ARIMA, GARCH models
- Introduction to spectral Analysis
- Filtering, smoothing and forecasting in DLMs
- Maximum likelihood estimation
- Bayesian methods for time series

M2 – Management of economic and business data

- Data management overview
- Introduction to programming with Python
- File handing, extracting, storing, curating data with Python
- Working with different data formats including CSV and JSON
- Managing, analysing and vizualising numeric data with Numpy, Pandas and Python matplotlib
- Creating and relational databases with SQL
- NoSQL Data Management
- Applications to economic and business data

Statistical Methods

M1 - Statistical methods for business analysis

- Principles of statistical inference: confidence intervals and hypothesis tests
- Introduction to statistical learning: basic notions and concepts
- Linear regression and its extensions
- Logistic regression and generalized linear models
- Model selection, model assessment and evaluation of model complexity
- Classification and clustering
- Economics and business applications with the software R

M2 – Advanced statistics

- Sampling distributions
- Estimators
- Finite-sample and asymptotic properties of estimators
- Parameter estimation: maximum likelihood methods
- Parameter estimation: Bayesian inference
- Confidence intervals
- Hypothesis testing
- Missing data
- Elements of statistics for big data

Machine learning

- Data analysis
- Model selection
- Unsupervised learning
- Supervised learning
- Deep learning
- Reinforcement learning

1st year – Curriculum "Data Analytics for Economics"

Financial mathematics

- interest rate markets and conventions
- Pricing of bonds
- Duration and convexity
- Interest rate term structure determination and yield spreads
- Forward and future markets
- Mechanics of option markets
- Trading strategies involving options
- Binomial trees
- Wiener processes
- Black-Scholes-Merton model

Financial Econometrics

- Basics of stochastic processes theory, financial assets and returns
- Analysis of empirical “stylized” facts
- Correlation analysis of the financial series
- Models and methods for predicting the level of future returns
- Models for volatility analysis and prediction specification, inference and forecasting
- Models for macro-finance analysis: (volatility) term structure models and credit risk models.

- Models for asset management, risk management and insurance

Economic Policy

- Size and development of the public sector
- Public policy tools
- Behavioral public policy
- Public goods
- Externalities
- Political economics
- Cost-benefit analysis

Methods for Public Policies Evaluation

- The experimental Ideal: causal effects and the selection problem
- Randomized Control Trials
- Natural experiments (discovering, analyzing, evaluating)
- Panel, difference-in-differences, matching, instrumental variables
- Regression discontinuity designs

1st year – Curriculum "Business Analytics "

Network thinking and agent-based modelling

- Introduction to systems and complexity
- Introduction to networks
- Introduction to agent-based modeling
- Modeling Diffusion dynamics
- Real business data applications

Marketing B2B and sales management

- Significance of B2B marketing
- Organizational buying behavior
- Inter-organization relationships
- Marketing channels and supply chains
- Industrial networks
- Marketing Planning and analysis
- B2B Strategies and Implementation
- Business products
- Business services
- Value and pricing
- Marketing communication

Experiental Tourism Marketing

- Tourist experience and experiential tourism marketing
- Experiential marketing for tourism destinations
- Designing and marketing experiential tourism attractions
- Experiential marketing as driver of sustainable tourism growth
- Implementing experiential tourism marketing through technologies, virtual realities, AI and social media

2nd year – both curricula

Optimization methods for decision making

M1 Optimization methods for economics and business

- Linear optimization techniques
- Nonlinear optimization techniques
- Combinatorial optimization techniques
- Multicriteria optimization and decision making
- Decision making under uncertainty

M2 Data science applications for resource optimization, risk evaluation and sustainability

- Spatio-temporal data and their visualization
- Measuring association and risk: covariance, spatial covariance and autocovariance
- Spatio-temporal statistical models, trend-surface estimation and prediction
- Tail dependence, multivariate models for extremes, extreme risk management
- Real data applications in resource and risk management

Big data methods for economics and business

M1 Statistical methods for high-dimensional data

- High-dimensional data, big data and the curse of dimensionality
- Convex criteria for model selection and shrinkage methods
- Model aggreagation and model combining
- Introduction to data dimension reduction
- High-dimensional regression
- Graphical models
- Multiple testing

M2 – Natural language processing and web analytics

- Basics of natural language Processing (NLP)
- Text classification and prediction using supervised approaches
- Unsupervised methods for NLP and latent models
- Neural networks for NLP and neural language models
- Information Retrieval
- Relation extraction, question answering, dialog systems and chatbots
- Web crawling and link analysis

Cybersecurity and digital privacy

- Challenges to data privacy and security
- The cybercrime ecosystem, vulnerabilities and cyberattacks
- Data privacy and General Data Protection Regulation
- Comparative privacy and data law around the globe
- New directions in privacy and security

2nd year – Curriculum "Data Analytics for Economics"

Financial engineering and quantitative investment strategies

- Quantitative methods
- Structured products
- Credit risk transfer
- Introduction to alternative investments
- Real assets
- Trend-following and momentum strategies
- Mean reversion strategies

- Fixed income strategies
- Relative value and event-driven strategy

Applied resource and energy economics

- Natural resources and energy
- Natural resources and economic development
- The economics of climate change, externalities, discounting, International agreements
- Quantitative analysis of power markets, electricity supply and demand
- Quantitative analysis of commodity markets, sequential markets, convergence and divergence of prices
- Measuring the recent global shocks and their effects on energy and environment

Sustainability Economics

- Economics of the environment and sustainability: an overview of models and theory
- Sustainability issues of climate change and energy policy
- Sustainability in business and within corporate strategy
- Applied methods: data sources and econometric methods
- Case studies of sustainable economic development

2nd year – Curriculum "Business Analytics "

Digital marketing methods and consumer experience

- Designing a marketing analytics program
- Data mining and predicting consumer behavior
- Targeting and optimizing marketing communications through social media analytics and digital platforms
- Mobile marketing data
- Search data
- Web and email analytics
- Marketing automation
- Experiments with A/B testing

Performance analytics for business

- Performance measurement systems and management analytics
- Introduction to information systems, from process to data, business intelligence, data warehousing
- Analytical tools for business analysis
- Analytical tools for performance management
- Prescriptive methods, for business analytics testing and optimization of single/multiple objectives
- Predictive methods for business analytics, assessing quality of outcomes and prediction uncertainty

Introduction to Block Chain

- Blockchain and its foundational concepts
- Intro to cryptography
- Consensus protocols
- Smart contracts
- Introduction to decentralized finance and non-fungible tokens

- Provenance on bockchain
- Blockchain in accounting and auditing
- Other use-cases of blockchain