COURSE DESCRIPTION CARD - SYLLABUS

Course name
Machine Learning in Business [S1DSwB1>UMwB]

Course

Field of study
Data Science in Business

Year/Semester
2/3

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
0

Laboratory classes
0

Other
0

Tutorials
30

Projects/seminars
0

Number of credit points

3,00

Coordinators

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Lecturers

Prerequisites

Students should be proficient in Python (including object-oriented programming) and familiar with fundamental machine learning libraries such as scikit-learn, Pandas, NumPy, and Matplotlib. Knowledge of linear algebra, differential calculus, and basic discrete mathematics is required. Additionally, students should have a basic understanding of machine learning algorithms.

Course objective

Celem przedmiotu jest rozwinięcie praktycznych umiejętności stosowania metod uczenia maszynowego w analizie biznesowej. Studenci nauczą się przygotowywać dane, dobierać i optymalizować modele predykcyjne oraz interpretować ich wyniki w kontekście rzeczywistych problemów biznesowych. Kurs obejmuje regresję i klasyfikację w analizie ryzyka i segmentacji klientów, metody klasteryzacji, wykrywanie anomalii oraz wyjaśnialność modeli ML. Studenci poznają również zaawansowane techniki tuningowania hiperparametrów oraz zastosowania modeli w takich obszarach jak predykcja wartości klienta, detekcja oszustw i systemy rekomendacyjne. Zajęcia przygotują ich do efektywnego wykorzystania ML w strategiach biznesowych.

Course-related learning outcomes

Knowledge:
Characterizes machine learning methods used in business analysis, including regression, classification, and clustering [DSB1_W01].
Describes the process of creating ML models, from data preprocessing and feature engineering to validation, hyperparameter tuning, and result interpretation [DSB1_W03].
Describes key machine learning methods, such as linear and logistic regression, decision trees, SVM, ensemble methods, and clustering algorithms [DSB1_W02].

Skills:
Selects appropriate data sources and tools for modeling business problems using ML [DSB1_U01].
Applies linear and logistic regression for price analysis, customer lifetime value (LTV) prediction, and customer classification [DSB1_U02].
Designs and implements classification and regression models in the context of risk analysis, churn prediction, and credit scoring [DSB1_U07].
Creates and validates ML models, applying hyperparameter tuning methods and evaluating prediction quality [DSB1_U08].
Uses clustering techniques (k-means, DBSCAN, hierarchical clustering) for customer segmentation and anomaly detection [DSB1_U09].
Justifies the choice of analytical methods and interprets the results of ML models in the context of business decisions [DSB1_U11].

Social competences:
Uses current scientific and practical advancements in machine learning, considering its application in business [DSB1_K02].
Adheres to code quality and testing principles, considering readability, reusability, and compliance with OOP principles [DSB1_K05].

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Laboratories:
Students will take a test, graded with a maximum of 50 points. The remaining 50 points will be awarded for preparing a case study analyzing a real-world business problem using machine learning. The final grade is determined by the sum of points from both assessments. The passing threshold is 50 points.

Programme content

The course focuses on the practical application of machine learning methods in business analysis. Students will learn how to process and prepare data for ML models, apply regression techniques for price forecasting and customer value prediction, and use classification algorithms for risk analysis and customer segmentation. Decision trees, random forests, XGBoost, and SVM models will be discussed in the context of churn prediction and fraud detection. The course will also cover clustering methods (k-means, DBSCAN, hierarchical clustering) and dimensionality reduction (PCA). Students will explore model evaluation and interpretation techniques and apply their knowledge in a case study based on real-world business data.

Course topics

Introduction to data analysis tools and workflow
Data preparation for ML models
Linear regression in price analysis and forecasting
Polynomial regression and Ridge/Lasso regression in business forecasting
Customer Lifetime Value (LTV) modeling with logistic regression
Using logistic regression for customer classification and churn prediction
Classification models in risk analysis and customer segmentation
Decision trees - theory and implementation on business data
Random Forest - improving model accuracy
XGBoost - hyperparameter tuning for churn prediction
SVM for fraud detection and credit scoring

k-means clustering - customer segmentation and recommendations
Hierarchical clustering - customer behavior analysis
DBSCAN and its application in anomaly detection
Dimensionality reduction and Principal Component Analysis (PCA)
Model optimization and result interpretation
Model interpretability and explainability in business ML
Practical case study - analysis of real-world business data

Teaching methods

Laboratories: Exercises conducted in a selected programming IDE or data analysis environment (e.g., PyCharm or Google Colaboratory).

Bibliography

Basic:
Szpringer, W. (2024). Sztuczna inteligencja w zarządzaniu, MT Biznes
VandePlas, J. (2023). Python Data Science. Niezbędne narzędzia do pracy z danymi, Helion

Additional:
Raschka, S., Mirjalili, V. (2021).Python. Machine learning i deep learning. Biblioteki scikit-learn i TensorFlow 2, Helion
Nowak, M. (2024). Prediction of voluntary employee turnover using machine learning. Scientific Papers of Silesian University of Technology. Organization & Management/Zeszyty Naukowe Politechniki Slaskiej. Seria Organizacji i Zarzadzanie, (201).

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,00
Classes requiring direct contact with the teacher	30	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	45	2,00