Mathematics of Credit Risk

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Course description

Mathematics of Credit Risk course will explore the essence of credit risk in banks and approaches to its assessment. All lectures will be based on regulatory documents such as the Basel Framework, Central Bank regulations, and IFRS standards.

At the end of the course, you will gain knowledge of the basics of credit risk, the ability to assess credit risk using ML models, the ability to assess a company's credit rating, and also get the basics of corporate loan portfolio management.

The acquired knowledge will allow students to prepare for interviews and work with credit risk in the following areas:

- Credit Risk-management (as a business owner of the process)
- Loan portfolio Risk-management (as a portfolio manager)
- Data Science & Machine learning in Credit Risk-management (as a data scientist)
- Model validation (as a model validator)

Course requirements, grading, and attendance policies

The course doesn't have special prerequisites except for the standard calculus and probability courses, ML basics, Excel and Python knowledge.

Your course grade will be determined by results of your home assignments, quizzes & final exam:

(40%) Home Assignments. There will be 4 home assignments:

- Answer questions and solve problems;
- Build a financial/operational model to determine a credit rating for the company;
- Develop a ML-model to estimate the Probability of Default;
- Validate the developed model. Make a calibration;

(20%) Quizzes. You'll have a 5-10-min quiz at the end of each class. Don't be shy, don't panic, it is just a simple check of the lecture materials we discussed the class before.

(40%) Final exam covers core topics from the course. It'll test your ability to think about credit and model risks and Risk-management in general.

Course contents

- Risk overview: sources of risk, risk limits, risk evaluation & mitigation
- How to manage Credit Risk
- Regulatory requirements in credit risk. The Basel, Central Bank regulations, IFRS
- Credit ratings and rating agencies. Migration matrix and rating process
- Modeling of credit ratings for a corporate company in Excel

- VaR and Expected Shortfall estimating
- Expected losses (EL), Unexpected Losses (UL), Risk-weighted assets (RWA)
- Approaches to credit risk assessment
- Modeling of credit risk using ML. Interpreted and non-interpreted models.
- Validation of the model (tests).
- Model risk. Making decisions based on value estimates. Confusion matrix in credit scoring.
- PD, LGD, EAD models. Importance of the model calibration

Course materials

Required textbooks and materials

- Lecture notes and some of the supporting materials will be posted on my.nes after classes
- Risk Management and Financial Institutions by Hull

Additional materials

- A practical guide to Risk-management by Thomas S. Coleman
- The essentials of Risk-management by Crouhy, Galai & Mark
- Some regulatory standards and laws (will be posted on my.nes after classes)

Academic integrity policy

Cheating, plagiarism, and any other violations of academic ethics at NES are not tolerated.