Zürcher Hochschule
für Angewandte Wissenschaften

zh
aw
School of
Management and Law

Applied Data Science in Fintech

{'Summer School 2025': Agent-Based Credit Risk Modeling}

mario.gellrich@zhaw.ch
Dr. Mario Gellrich

Program for today

Program: Agent-Based Credit Risk Modeling Workshop
- Introduction, organization of groups, installation of software, brainstorming
- Introduction to cellular automata & agent-based modeling
- Working in groups on the tasks; expert sessions
- Presentation of results

*breaks are included as needed

Workshop procedure and philosophy

Image Credit: https://revistaempresarial.com

- No continuous presentations by the lecturer
- Group work (2 students per group)
- The groups are mixed (BSc/MSc OR beginners/professionals)
- Each "expert group" is responsible for one "topic“
- Methods are explained in detail in "technical sessions“
- Students ask the members of the "expert groups" for help
- The more experienced students help the others
- At the end of the day, the groups present their results
- The presentations are graded pass/fail.

Prerequisites

Software:

- GitHub Codespaces (https://github.com/mario-gellrich-zhaw/summerschool)
  - Python 3.11
  - Jupyter Notebook
  - Visual Studio Code

Material for exercises

- Jupyter Notebooks (will be used to guide the exercises)

Mandatory reading

- https://mesa.readthedocs.io/en/stable/overview.html

Definition

“Credit risk, counterparty risk or default risk is a term used in the banking industry to refer to the risk that a borrower is unable or unwilling to repay the loans granted to it in full or in accordance with the contract. In general, credit risk is the most significant type of risk for credit institutions.”

Source: Wikipedia

Keyword pinboard (basis to define group tasks)

(Topic 1) Introduction credit risk modeling (terms & concepts)

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(Topic 2) Loan calculation example (use-case)

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(Topic 3) Integration of Foundation Models (FM)

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(Topic 4) Pythons mesa library for agent-based modeling

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Keyword pinboard (basis to define group tasks)

(Topic 5) Scheduling agents in an agent-based model

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(Topic 6) Lender & Borrower classes (sketch)

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(Topic 7) CreditModel class (sketch)

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(Topic 8) Agent-based simulations (input & expected output)

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Keyword pinboard (basis to define group tasks)

MG What is credit risk modeling?

Credit risk modeling is a process used by financial institutions and lenders to assess the likelihood of borrowers defaulting on their loan obligations. It involves the use of statistical techniques and models to estimate the probability of credit losses and to evaluate the overall creditworthiness of borrowers or counterparties.

Credit risk modeling typically involves analyzing a variety of factors and variables that may influence the likelihood of default. These factors can include the borrower's financial statements, credit history

MG Write Python code representing a borrower class in an agent based credit-risk model.

Certainly! Here's an example of a `Borrower` class in Python that can be used in an agent-based credit-risk model:

python Copy code

```python
class Borrower:
    def __init__(self, borrower_id, credit_score, income):
        self.borrower_id = borrower_id
        self.credit_score = credit_score
        self.income = income
        self.loan_amount = 0
        self.defaulted = False

    def apply_loan(self, loan_amount):
        self.loan_amount = loan_amount

    def check_default(self):
        # Implement your own credit risk modeling logic here
        if self.credit_score < 600 or self.income < 20000:
            self.defaulted = True

    def __str__(self):
```

To solve the tasks, you are encouraged to use ChatGPT. This includes explanations and Python programming. It is expected that the explanations of ChatGPT are cross-checked with independent sources, and that the Python code is tested.

Minimal structure of the final presentation (Jupyter Notebook / HTML)

The presentation (provided by every group at the end of the day) must have the following structure.

1. Introduction

1.1 Background

1.2 Problem

1.3 Objectives

1.4 Research Question

2. Materials and Methods

2.1 Credit risk modeling – terms and concepts

2.2 Integration of a Foundation Model (FM)

2.3 Loan calculation example

2.4 Pythons mesa library for agent-based modeling

2.5 Agent-based credit risk model classes, methods, parameters

2.6 Agent-based credit risk model simulations

3. Results & Discussion

4. Conclusions