

# Applied Data Science in Fintech

{ 'Summer School 2024': Agent-Based Credit Risk Modeling }



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# 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 permanent presentations by the lecturer
- Group work (2 students per group)
- Groups are mixed (beginners/professionals)
- Each «expert» group is responsible for one «topic»
- Methods are explained in detail in «technical sessions»
- Students ask members of «expert groups» for help.
- The more experienced students help the others.
- At the end of the day, groups present their results.

# Prerequisites

## Software:

- GitHub Codespaces ([https://github.com/mario-gellrich-zhaw/Summerschool\\_FS2024](https://github.com/mario-gellrich-zhaw/Summerschool_FS2024))
  - Python 3.10
  - 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 to credit risk modeling

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## (Topic 2) Loan calculation examples (use-cases)

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## (Topic 3) Object Oriented Programming (OOP) with Python

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## (Topic 4) Python's 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



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.

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

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):
```



# Expert groups and definition of tasks

## Expert Group (X): Working with Python, Jupyter Notebooks, Visual Studio Code

- Installation (Anaconda and Visual Studio Code)
- Creating a conda environment
- Working with Jupyter notebooks
- HTML formatting (markdowns)
- Python code formatting (PEP8)
- Getting help for functions
- Working with magic commands
- Installing additional Python libraries
- ...

Example!

# Recommended structure of the «expert» sessions

Questions which help to explain the software, functions, methods, etc. by each expert group

Q1: What is ...?

Q2: What problem is solved with ...?

Q3: How does ... work?

Q4: What are typical applications for ...?

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

## 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 Loan calculation example
- 2.3 Python's mesa library for agent-based modeling
- 2.4 Agent-based credit risk model classes, methods, parameters
- 2.5 Agent-based credit risk model simulations

## 3. Results & Discussion

## 4. Conclusions