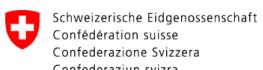


DIGITAL FINANCE

This project has received funding from the Horizon Europe research and innovation programme under the Marie Skłodowska-Curie Grant Agreement No. 101119635



Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

State Secretariat for Education,
Research and Innovation SERI



Funded by
the European Union



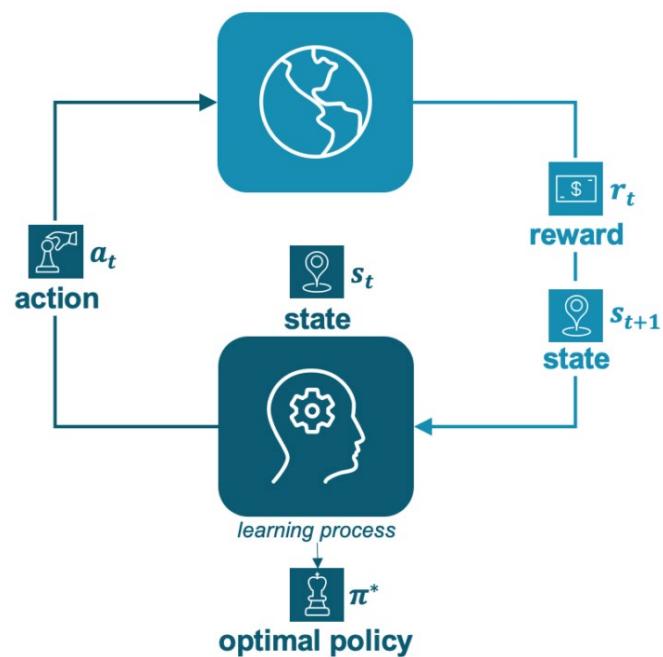
IRP1: Reinforcement Learning for Finance

Mathis Jander



Objective

Advance the applicability of Reinforcement Learning for decision-making in finance.



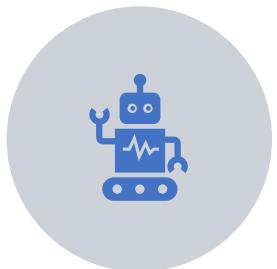
[This Photo](#) by Unknown Author is licensed under [CC BY-NC](#)

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Challenges



FINANCIAL MARKETS ARE
CHARACTERIZED BY HIGH
COMPLEXITY AND UNCERTAINTY



(DEEP) REINFORCEMENT
LEARNING REQUIRES LARGE
AMOUNTS OF DATA



MARKET DYNAMICS ARE
DIFFICULT TO MODEL



EXISTING LITERATURE DOES NOT
OFFER SOLID FOUNDATION TO
BUILD ON (PRELIMINARY
INSIGHTS OF MY RESEARCH)

Approach



Reframe problem to “sequential decision making in low predictability environments”



Define financial use cases as instances of this general problem class



Investigate methods to solve this general problem



Test methods on specific financial use cases for validation

IRP2: Machine Learning for ESG Credit Risk

Manuele Massei



Background



Bachelor's degree in
Economics and
Business

Focus on portfolio
optimization



Master's degree in
Quantitative Finance

Focus on climate
credit risk



ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

Secondments

Potential amendment

- September 2025 – March 2026 →
Swedbank, Lithuania
- March 2026 – August 2027 →
ECB, Frankfurt



Current situation

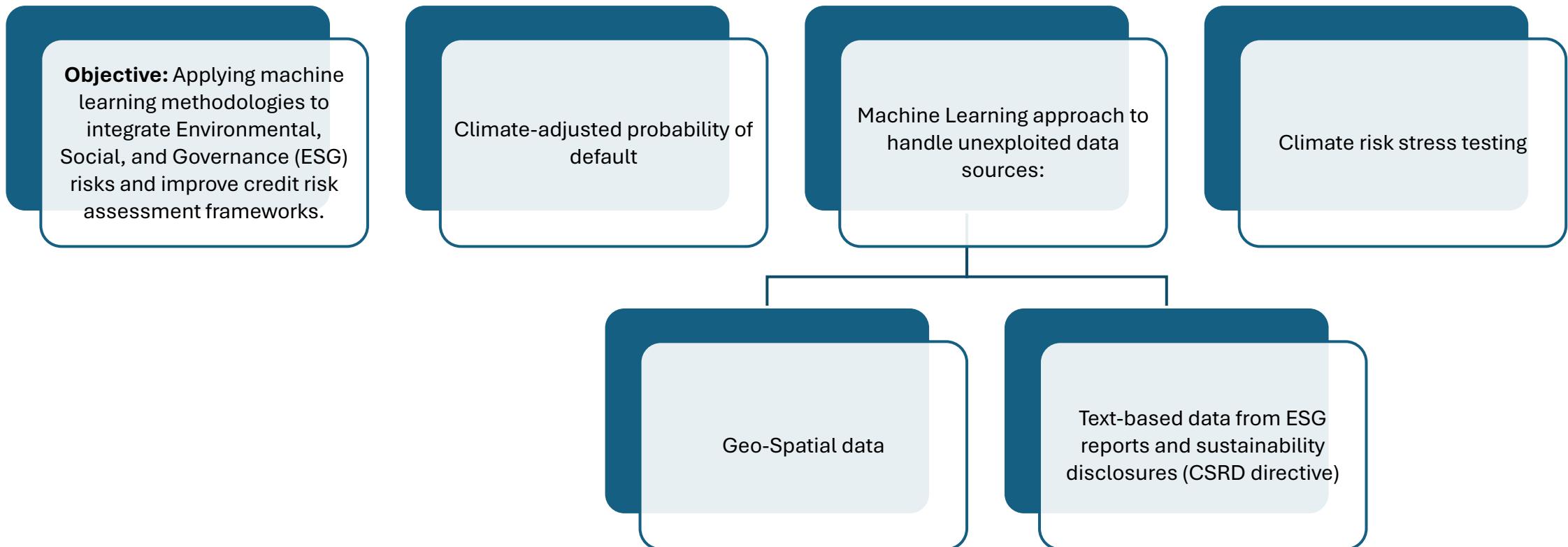
- September 2025 – March 2026 →
Swedbank, Lithuania
- March 2026 – March 2027 →
BIS, Switzerland



Systematic Literature Review

- Research Questions:
 - **RQ1:** How ESG features impact firms credit risk?
 - **RQ2:** How are ESG factors currently integrated and which are the main challenges?
 - **RQ3:** How are machine learning state-of-the-art models employed in credit risk?
 - **RQ4:** How can we bridge the gap between the two fields using machine learning techniques?

Research



IRP3: Machine Learning for Digital Finance

Armin Sadighi



Early Warning Systems for Financial Risk Management

Armin Sadighi





Computer Engineering



Working as FPGA designer
Working in Insurance

Electrical Engineering
Management



Allianz

DIGITAL

Secondments



ECB: 01.09.2025 – 31.08.2026



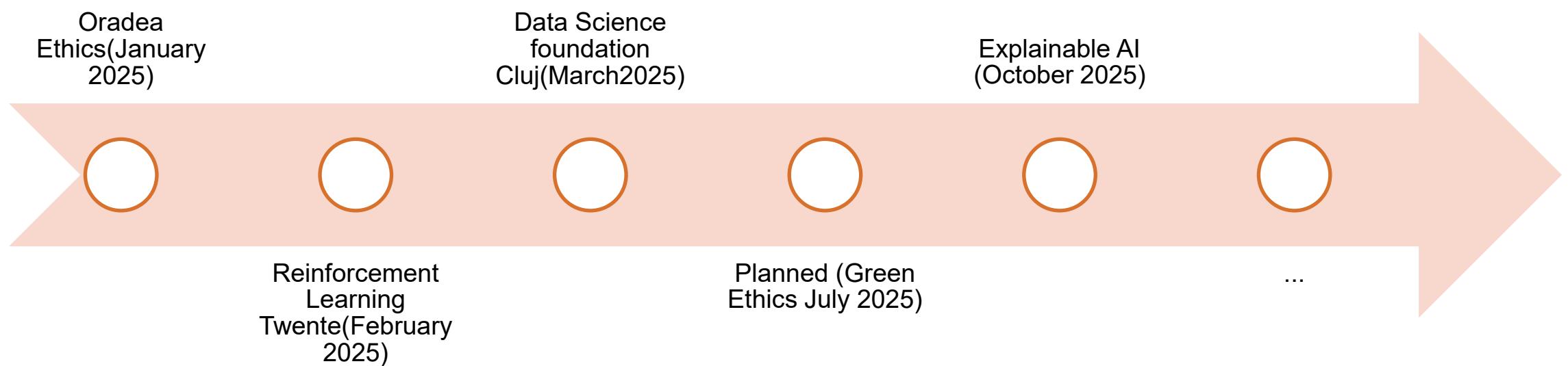
Fraunhofer: 01.09.2026 – 28.02.2027



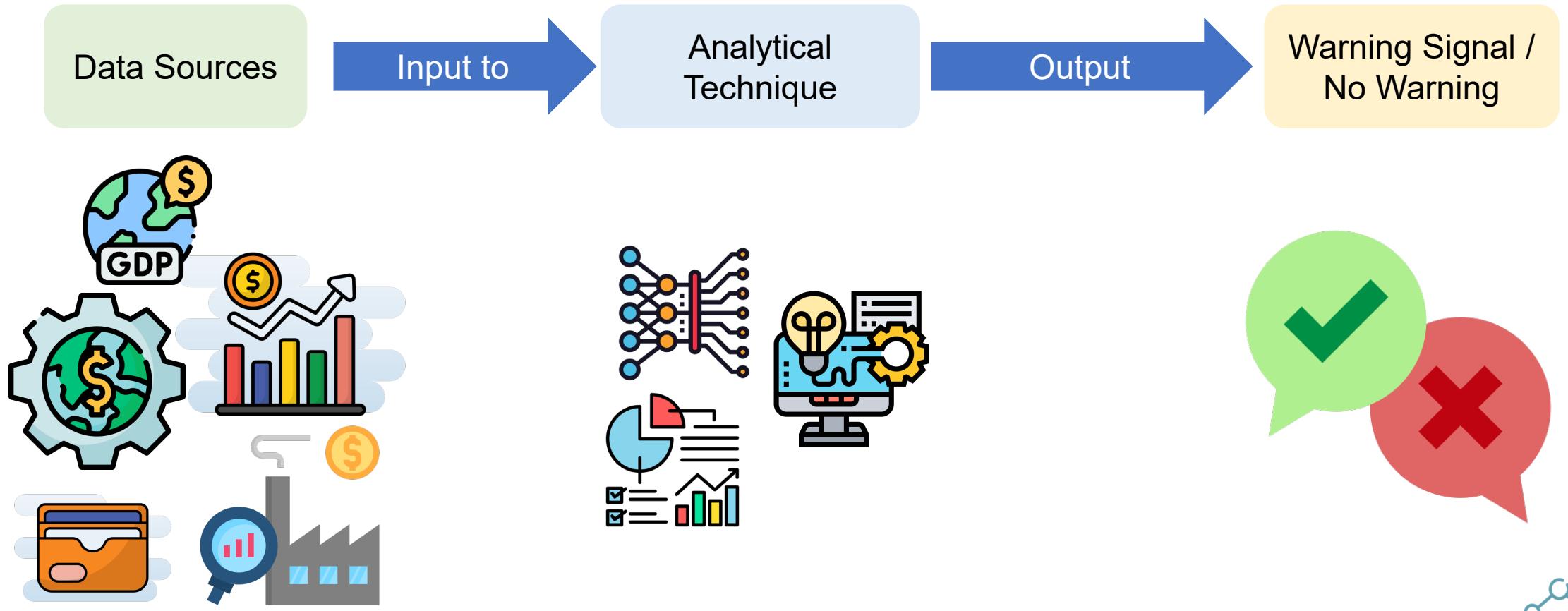
ECB: 01.03.2027 – 31.08.2027



Trainings



How do Early Warning Systems work?



All icons are from: <https://www.flaticon.com/> and are free to use for personal and commercial purpose with attribution.

Current State of my research:

Systematic Literature Review based on the following 3 questions:

1. How are the state-of-the art AI-based EWS systems used for financial risk management?

2. How do different financial risk categories interact, and how can their correlation be modeled within EWS systems?

3. What are the challenges, limitations, and regulatory concerns associated with implementing AI-based EWS in financial risk management?



IRP4 : Recommender System for Sustainable Investment

Mohamed Faid, University of Twente

Email: mohamed.faid@utwente.nl

Background

Education : Master's degree in Computer Science with a minor in Data Science – Strasbourg 2024
Bachelor's degree in Mathematics and Physics – Toulouse 2021

Professional Experience : Software Engineer – Thales 4 months
Computer Vision Research Internship – Thales 4 months
Machine Learning Consultant – CRSI 13 months

Area of interest : Financial Markets, Machine Learning, Software Development.

Joined **UTW 01/11/2024** -> 6 months ago, Secondments : BIS 12 months and ARC 6 months

Motivation

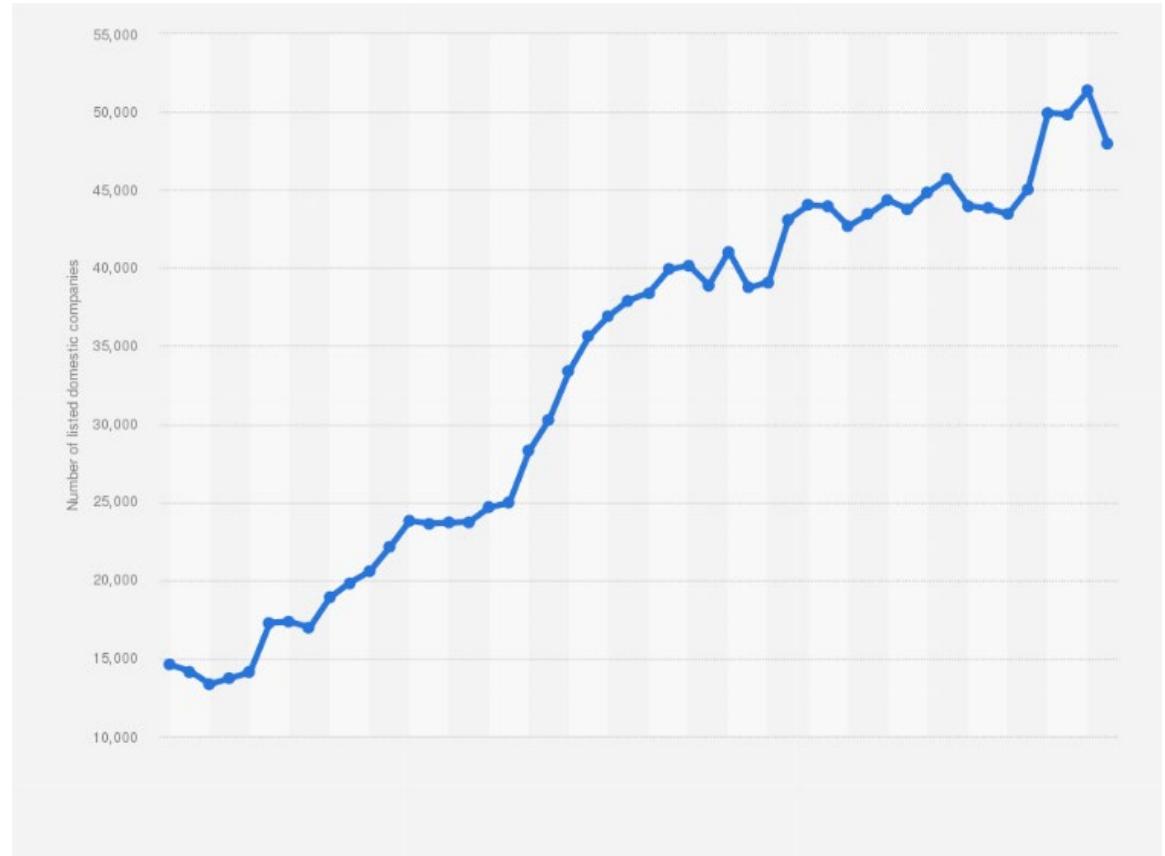
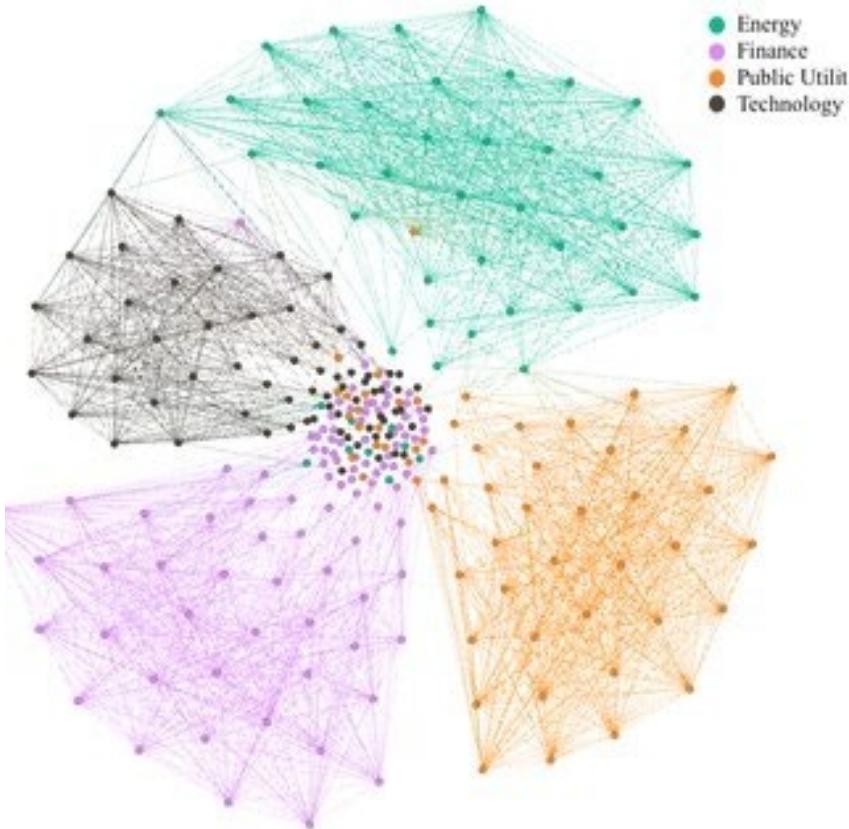
**French poet Paul Valery
wrote in 1895:**

**“Western cultures worship
information as if it were an
omnipotent beast and
place no limits on what
they seek to know.”**



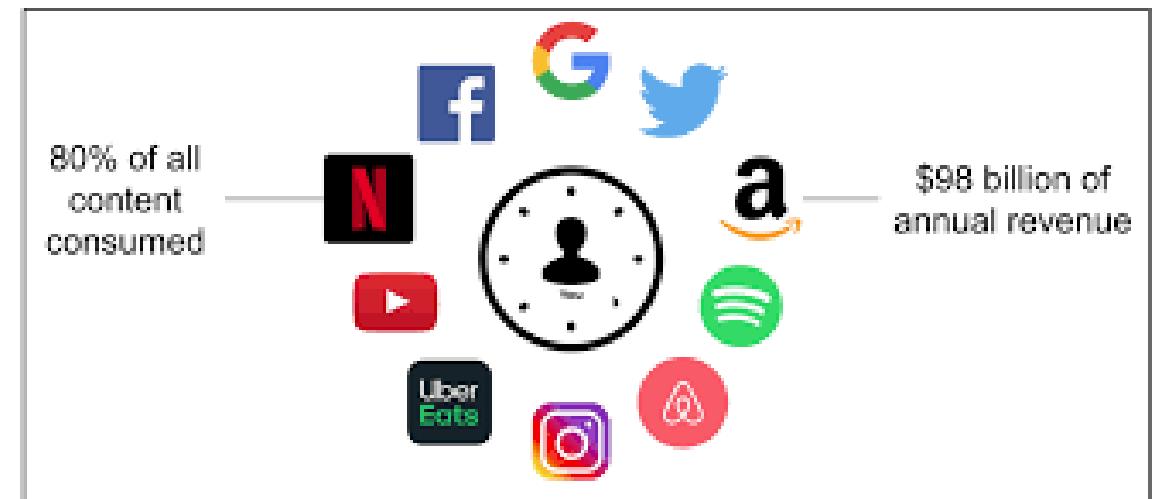
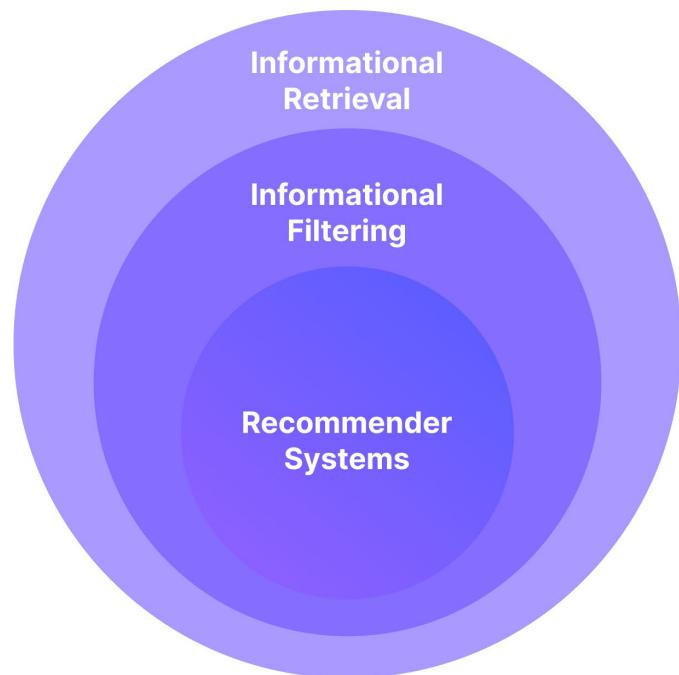
Information Paradox : Drowning in
Information, Starving for Knowledge - IEEE
Technology and Society

Motivation



What is A RecSys.

Definition : Recommender systems (RS) are information filtering and decision supporting systems that present items in which the user is likely to be interested in a specific context [Vidler et al. (2024)]

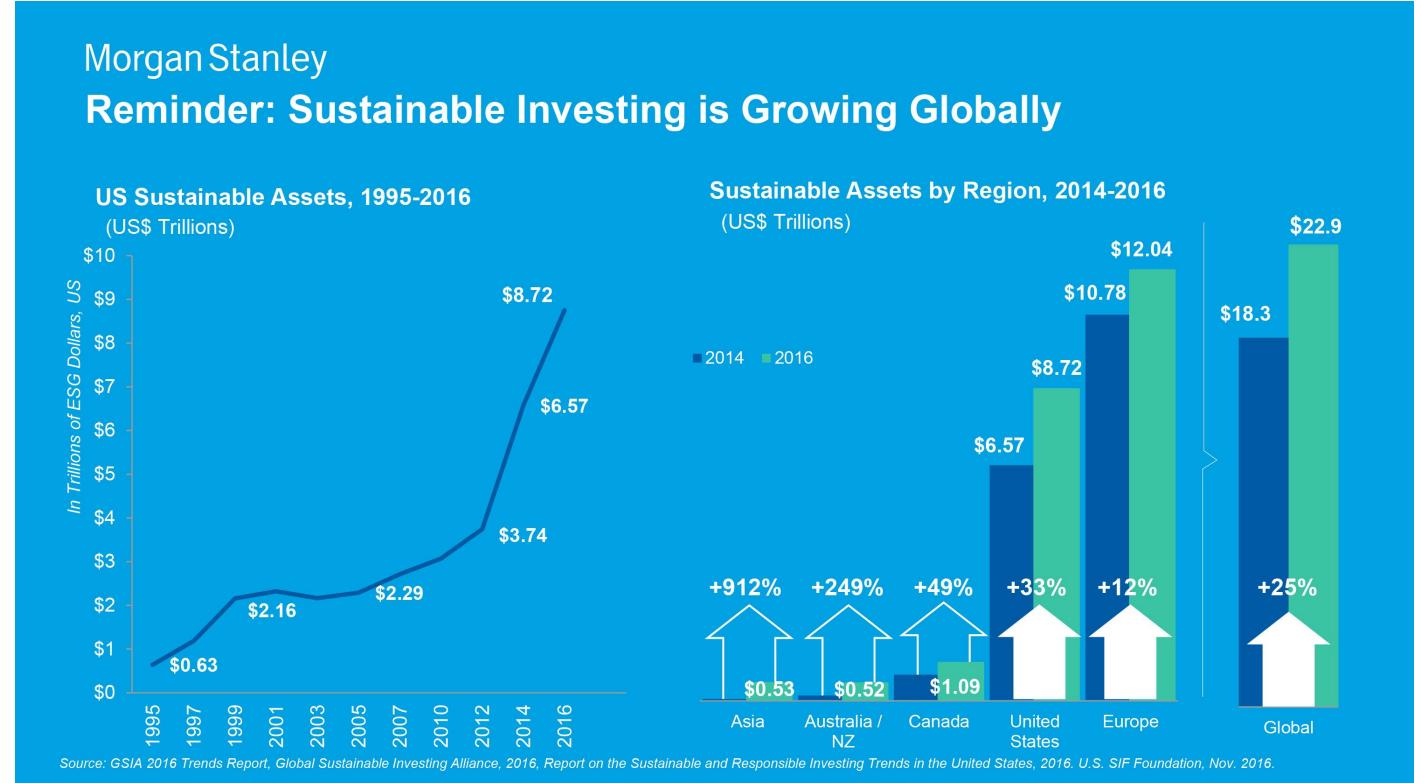


Sustainability

"We don't have plan B because there is no planet B."

-United Nations Secretary-General, Ban Ki-moon

- Environmental (Climate change, renewables)
- Social (Labor practices, human rights, community)
- Governance (Executive pay, ethics)



Sustainability



Summary
News
Chart
Conversations
Statistics
Historical Data
Profile
Financials
Analysis
Options
Holders
Sustainability

Controversy Level ⓘ

ESG data provided by Sustainalytics, Inc. Last Updated on 5/2025

● AAPL ▼ Category Average

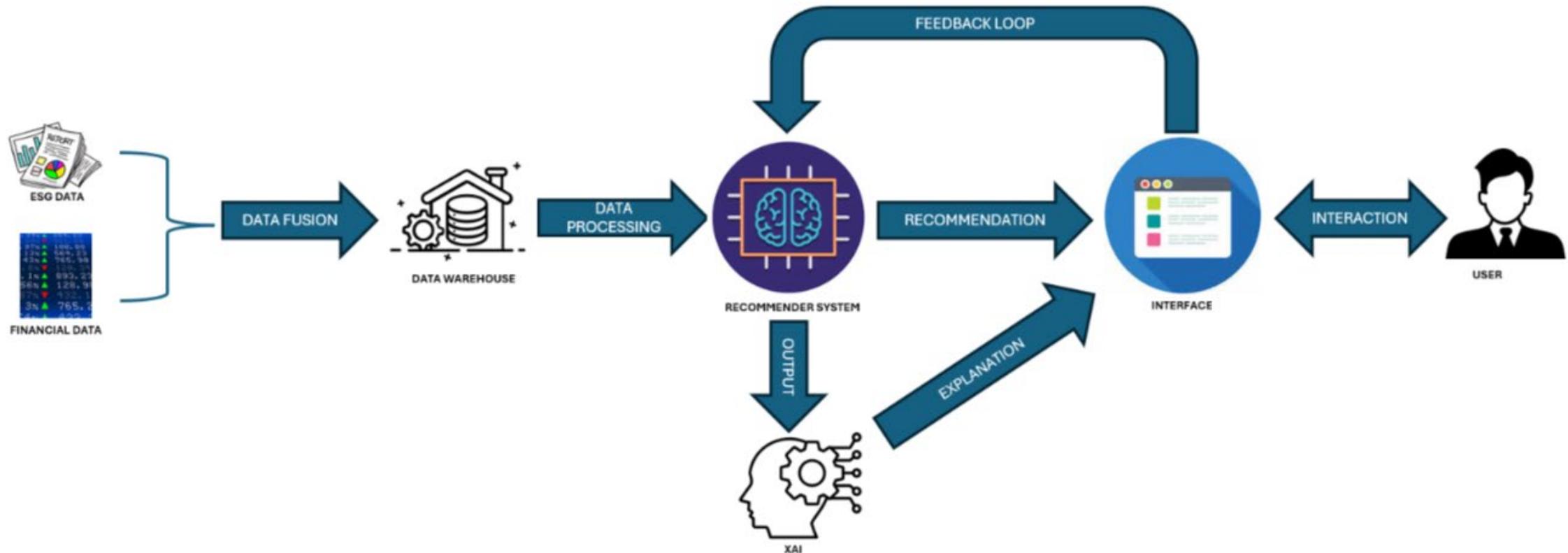
3 | Significant Controversy Level



Product Involvement Areas ⓘ

Products and Activities	Significant Involvement
Alcoholic Beverages	No
Adult Entertainment	No
Gambling	No
Tobacco Products	No
Animal Testing	No
Fur and Specialty Leather	No
Controversial Weapons	No
Small Arms	No
Catholic Values	No
GMO	No
Military Contracting	No
Pesticides	No
Thermal Coal	No
Palm Oil	No

Framework of a Recommender System for Sustainable Investments



User-Centric Design: Focus on usability for Institutions and Retail investors.

Portfolio construction by accounting user profile information

Lack of data->
User Agnostic Models.

Current State of my research:

1. First Draft of my SLR with 72 peer reviewed studies

2. Formulation and development of new Portfolio Optimization techniques under Personalization/ESG constraints

IRP5: Financial Networks

Gabriel Dias



AGENDA



 1. Brief introduction

 2. Research plan

 3. Timetable

1. Brief introduction



Gabriel Pereira

Academic background:

- **Econometrics, MSc (2022-2024)**
 - University of Lisbon, Portugal
 - Master's thesis: Causal Inference in High-Dimensional Panel Models: An Application of the Double Machine Learning Estimator
- **Economics, BSc (2016-2019)**
 - Universidade do Estado de Santa Catarina, Brazil
 - Bachelor's thesis: Stochastic Volatility Models for Option Pricing

Professional background:

- **Data Scientist – Portugal (2022-2025)**
 - Telecom industry: Recommender Systems, Causal Inference, Experimentation
- **Data Scientist - Brazil (2019-2022)**
 - Consultancy industry: Recommender Systems, NLP, Portfolio Management

2. Research Plan



Causal Machine Learning for Finance: Main research plan

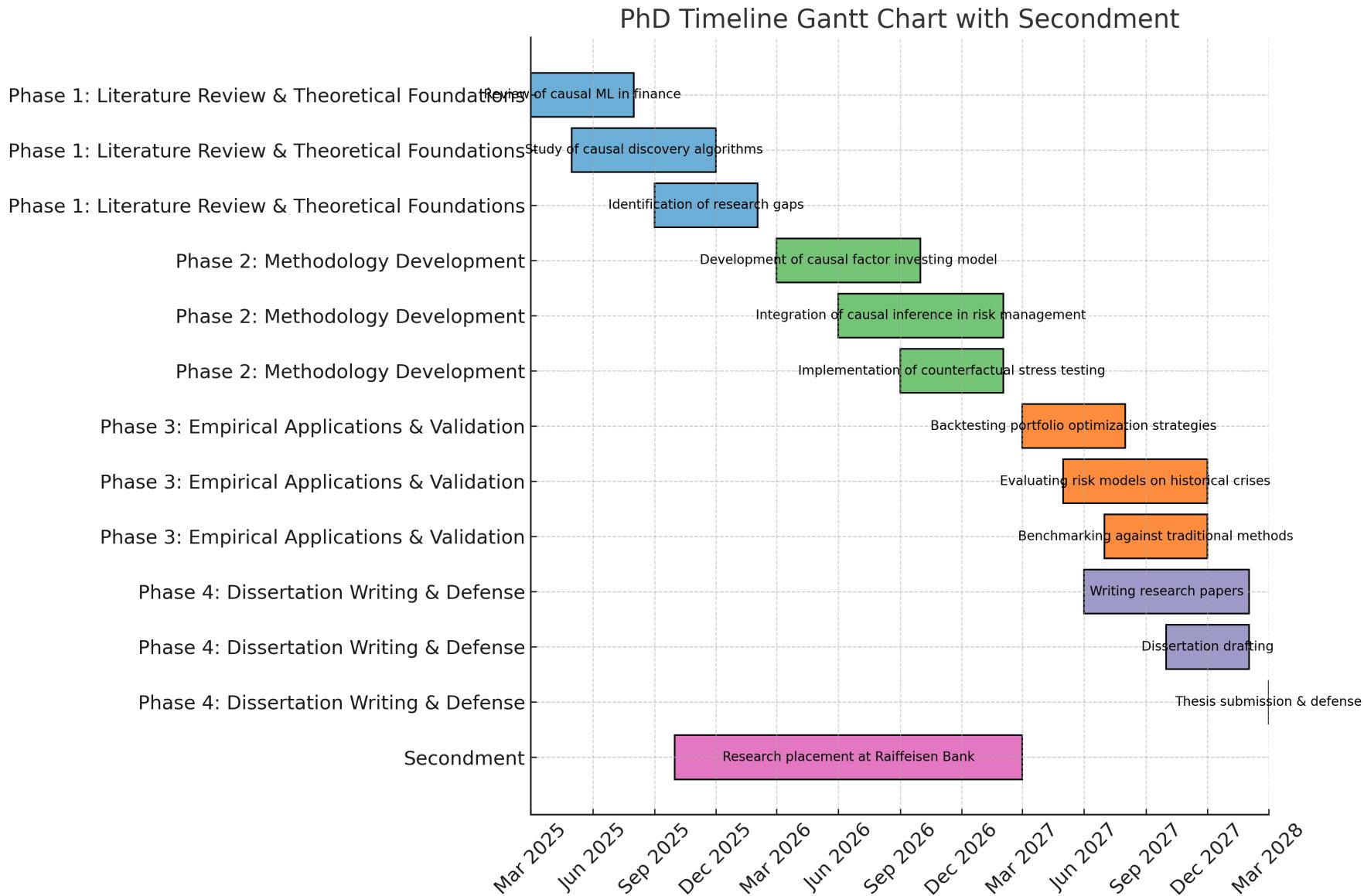
Supervisor: PD Ronald Hochreiter

- **Causal Discovery**
 - Identify economic mechanisms that drive asset returns through causal graphs using observational time series data. Apply methods like LiNGAM, DYNOTEARs, and CD-NOD to handle nonstationarity and dynamic relationships.
 - **Main challenges:** Causal inference with latent confounders and measurement error. Ensuring stability and robustness of causal graphs across economic regimes.
- **Regime-switch models**
 - Adapt causal models to account for structural breaks and shifts in market dynamics over time. Incorporate regime detection to update causal relationships adaptively.
 - **Main challenges:** Detecting and modeling latent regime changes in real-time. Avoiding overfitting and preserving interpretability across multiple regimes.
- **Counterfactual Analysis for stress testing**
 - Simulate “what-if” financial scenarios (e.g., shocks, interventions) using structural causal models. Leverage do-calculus and Bayesian networks to evaluate portfolio sensitivity under different macroeconomic conditions.
 - **Main challenges :** Specifying valid causal models without experimental data. Accurately estimating intervention effects under structural instability (we can evaluate through synthetic time series, i.e. GAN)

3. Timetable



Timetable



IRP6: Governance Framework for Generative AI in European Banking: Ensuring Regulatory Compliance

Karolina Anna Weyna



IRP 6: Governance Framework for Generative AI in European Banking: Ensuring Regulatory Compliance

- DC: Karolina Weyna
 - B.Sc. Business Economics, VUB, Belgium
 - M.Sc. International and Sustainable Finance, KU Leuven, Belgium
 - PHd Social and Economic Sciences, focus on Information Systems and Information Business, WU Vienna University of Economics and Business, Austria
- Host institution: WU Vienna University of Economics and Business, Austria
- Supervisor: PD. Dr. Ronald Hochreiter
- **WP1: Towards a European Financial Data Space.**



Trainings and Secondments

- Planned Secondments:
 - Raiffeisen Bank International
 - Fraunhofer Institute
- Completed Trainings
 - Ethics and AI in Digital Finance
 - Foundation of Data Science (BBU)
- Upcoming Trainings
 - Green Digital Finance (KTU)
 - Introduction to AI for financial applications (WWU)
- Upcoming Conferences
 - International Conference on Large-Scale AI Risks (KU Leuven), 26-28th May 2025



Research Project: **Generative AI in European Banking**

- The rapid advancement of Artificial Intelligence technologies over the last two decades has been transforming the financial sector (Bahoo et al., 2024).
- In the modern banking landscape, it is crucial for institutions to use the potential of these technologies to stay relevant in the competitive market (Fares et al., 2022).
- Generative AI has demonstrated significant potential in enhancing financial analytics, improving decision-making processes, and generating synthetic financial data for various applications (Lee et al., 2024).
- Despite their potential, the lack of interpretability and transparency presents significant challenges (Kong et al., 2024).
- Ensuring that gen AI systems are within the bounds of **inherently complex financial regulatory landscape became a major obstacle for banks and other financial institutions** (Remolina, 2024).

Research Project: “Developing a Governance Framework for Generative AI in European Banking: Ensuring Regulatory Compliance”

Expected results:

- A comprehensive synthesis of the **current regulatory landscape** and knowledge gaps for GenAI in banking.
- A structured, machine-readable **regulatory knowledge base** to enable automated compliance checks.
- **Agentic AI for contestability**, enhancing accountability, and regulatory alignment.
- A practical **governance framework**, validated through real-world case studies.

Thank you!

Questions?

IRP7: Risk Index for Cryptocurrencies

Ştefan Găman

Poznań University of Economics and Business

Bucharest University of Economic Studies



Academic beginnings

- BD in Economic Informatics
- MS in Applied Statistics and Data Science
- PhD in Cybernetics and Economic Statistics



Secondments

- ☐ Royalton - 12 months starting with 2026, January 1st
- ☐ ING - 6 months

IRP 7 : Individual Research Project

Topic	Involvement
Risk index for cryptos	<ul style="list-style-type: none">• IRP belongs to WP4 (Blockchain applications)• WP Leader: ASE (Bucharest)• One supervisor from secondments: ROY
Objectives	Deliverables
<p>The cryptocurrency market is exceptional: it is volatile, with a constantly shifting market structure. As cryptocurrencies evolve from a class of investable assets, the need for an index product arises. We investigate the dependencies of tail risk events within cryptocurrencies, which entails identifying coins with high or low joint tail event risks. Based on this, we intend to develop a risk index for cryptocurrencies to measure joint tail events, which will be an important tool for communicating risks to the public and regulators.</p>	<p>Develop a risk index to understand, measure and forecast upcoming risk flows from all cryptocurrency market participants and risk drivers. The possibility of pinpointing co-tress components in a dynamic network context makes the tool versatile and flexible for Digital Finance. The index will provide a thorough understanding of cryptocurrencies, and measure the dependencies and spillover effects in tail risk events within cryptocurrencies. It helps investors to manage risks and support decision-making.</p>

TIMELINE

The timeline diagram illustrates the project's progress from M9 to M45. It starts at 'DC starts' (M9) and ends at 'DC ends' (M45). The project involved two entities: Poznań University (POZ) and Royalton Partners. The timeline shows a green line connecting M9 and M27, followed by a blue line connecting M27 and M45. Arrows indicate the flow between these points, with one arrow pointing from POZ to Royalton Partners and another from Royalton Partners back to POZ. The text 'Research in innovation-driven business, use-case implementation' is also present near the end of the timeline.



Trainings

- Foundations of Data Science - Cluj, BBU, 2025
- AI in Digital Finance seminars:
 - Predicting The Undead: Using Machine Learning to Forecast Cryptocurrency Zombies
 - Middlemen In Limit-Order Markets
 - On SGX's Voyage To Corporate Sustainability: Exploring Emerging Topics in Multi-IndustryCorpora
 - Data Science and Financial Risk Management
 - Risk Premia In The Bitcoin Market
 - Low-Rank And Sparse Network Regression
 - Toward Modeling News Interactions for Financial Market Predictions with LLMs
- Digital Finance Hybrid Workshop - Bucharest, ASE, 2025
- ICBE International Conference on Business Excellence - Bucharest, ASE, 2025

Scientific Papers

- BitMood: AI Analysis of [Bitcoin Trends](#) via Facebook Emotions



- Market Responses to [Ethereum Development Milestones](#)



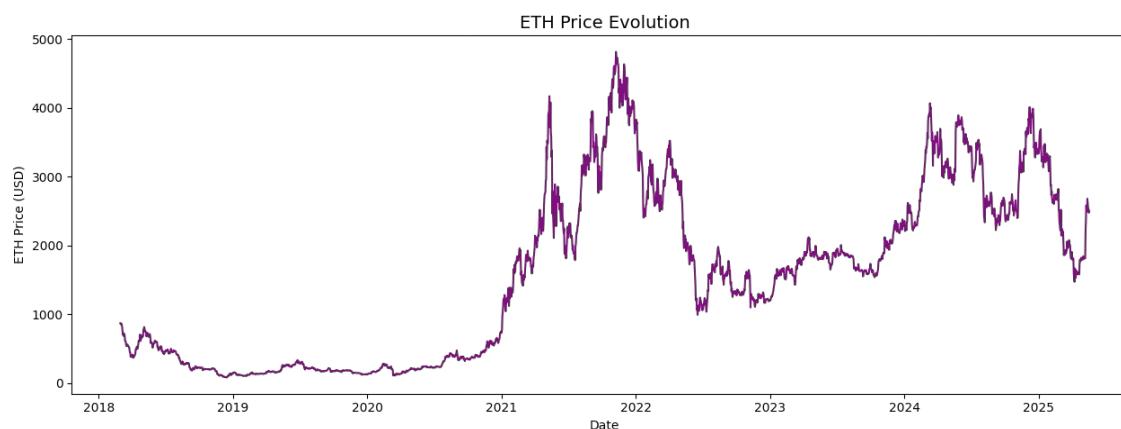
- Quantlet: The Code [Snippet Knowledge](#) Platform



- Whitepaper on Risk Index for Cryptocurrencies

Risk Index for Cryptocurrencies

- **May 2025:** Crypto markets dropped over **\$300 billion** after Donald Trump announced **new tariffs** on Canada, Mexico, and China
- **Extreme sensitivity** of crypto markets to **geopolitical events**
- Capture volatility, market sentiment, and external shocks
- Use quantitative models and alternative data
- Support **investors, regulators, and researchers** in navigating uncertainty



Why is Crypto Down Today? Markets Plunge as Trump Tariffs Trigger \$450M Liquidation Cascade

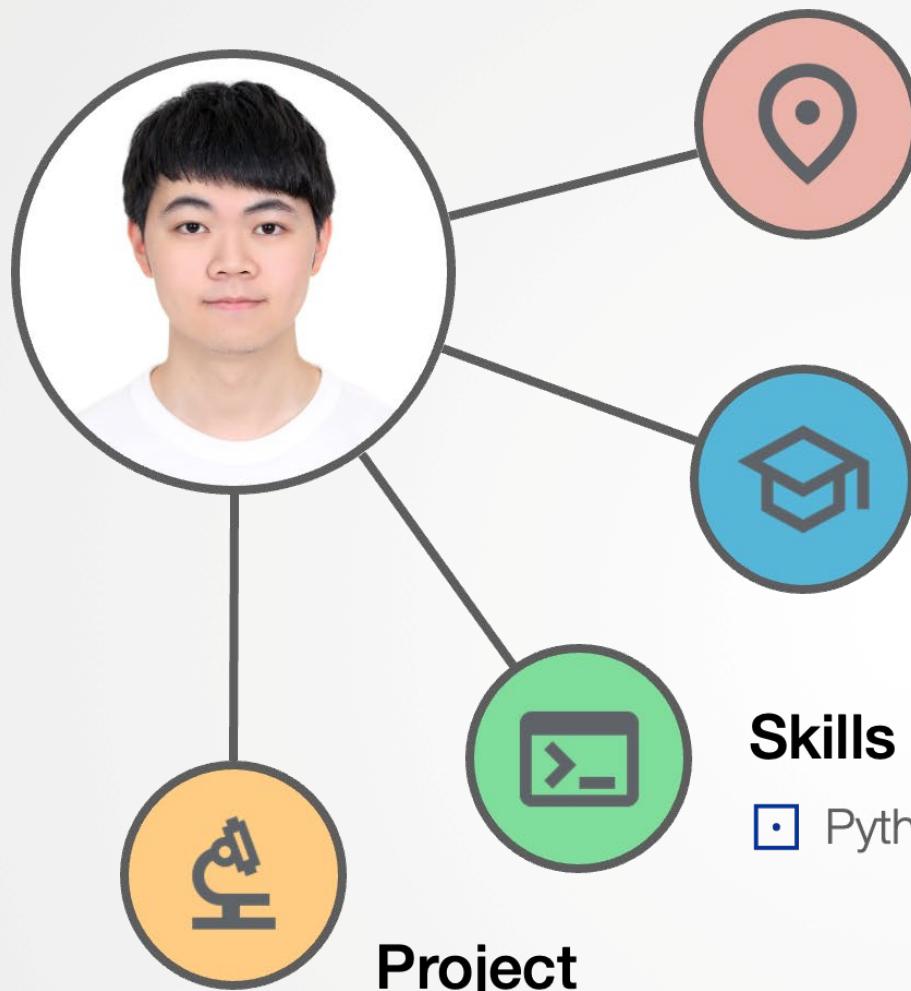
Trump's new tariff policy triggered \$450M in crypto liquidations as Bitcoin fell from \$88,500 to \$83,500

BY OLIVER DALE - APRIL 1, 2018 | 4 MIN READ



IRP8: Detecting Anomalies and Dependence Structures in High Dimensional, High Frequency Financial Data

- | PhD Candidate - David Siang-Li Jheng
- | Supervisors - Daniel Traian Pele, Wolfgang Karl Härdle



Location

- Taipei, Taiwan 🇹🇼 🍹
- Bucharest, Romania 🇷🇴 🥘

Education

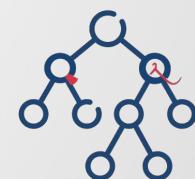
- NYCU, Taiwan - M.S. in Finance
- NTNU, Taiwan - B.S. in Mathematics

Skills

- Python, R, MATLAB, GitHub, LaTeX

Project

- Financial Risk Meter in Taiwan's High-Cap Sectors
- Fraud Detection
- Population Growth Models and COVID-19 Daily Case Predictions



Timeline



M0 **Bucharest University of Economic Studies (ASE)**



M18 **DeutscheBank**

Contribute to the application of AI, anomaly detection, and early warning systems



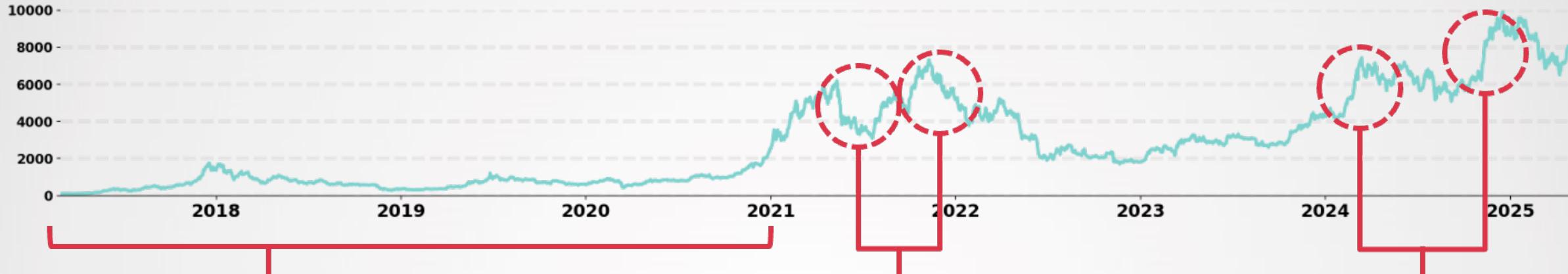
M24 **Royalton Partners**

Training in portfolio optimization of ETFs



M36 **DC ends**





Literature Review

- Write a review paper
- Not only a review paper!
- LLM semi-automatic paper selection
- Replicate previous research result by using the latest data

Bubbles Detection

- Example: South Sea Bubble
- Crypto market:
Highly volatile, heavy-tailed
- Goal:
Establish an early-warning system

Herd Behavior

- Example: Meme coin
- Gather data from various forums
- Analyze sentiment data
- Studies
 - ▶ High-dimensional sentiment networks
 - ▶ High-frequency crypto data



IRP9: Audience-dependent XAI

Patricia Marcella A. Evite





MSCA DIGITAL DOCTORAL
CANDIDATE 9

University of Naples Federico II

patriciamarcella.evite@unina.it

**PATRICIA
MARCELLA
EVITE**

STUDY THE ECONOMY



University of the Philippines
LOS BAÑOS

Major in Development Economics
2014-2018

Best Thesis in Economics

Bitcoin and the Efficient Market Hypothesis (2010-2017)
• Time-series analysis and Event Study

Compliance & Data Science, Coins.ph



COOPERATE

Economist

Department of Finance (2019-2021)
International Finance Group
European Section

DOF inks €60.5-M worth of agreement for Mindanao projects

By JON VIKTOR D. CABUENAS, GMA News

Published July 12, 2020 4:14pm



Duterte order shuns all loans, grants, aid from 18 countries backing probe of PH killings

By: Ben O. de Vera - Reporter / @bendeveraINQ Philippine Daily Inquirer / 03:37 PM September 20, 2019

Philippines inks €24.5M financing agreement for Bangsamoro development, Marawi reha

By JON VIKTOR D. CABUENAS, GMA News

Published August 24, 2020 12:14pm



GIZ provides network for all climate change projects in the Philippines funded by the German Environment Ministry to support



CREATE IMPACT

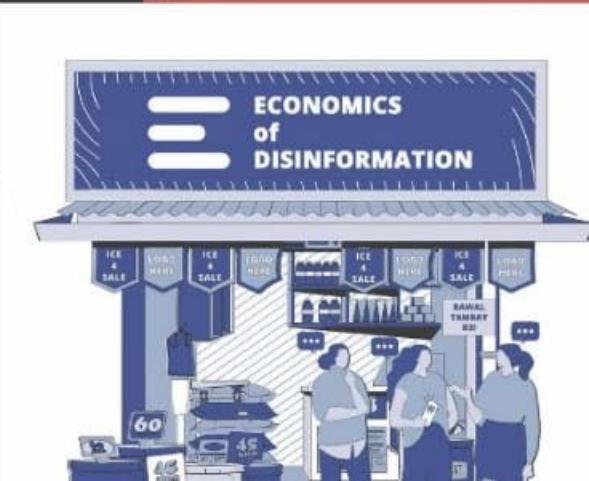
Ekonsepto

Founder
Chief Economist (2020-2025)



Academic Fellowship

University of Connecticut & Brown University
(2020-2022)
Social Entrepreneurship and Economic Development



75 Filipinos awarded with Erasmus+ scholarships

By: Jean Mangaluz - 3 years ago



RETHINK ECONOMICS

ERASMUS MUNDUS JOINT MASTER'S DEGREE
Economics for the Global Transition (EPOG+), 2022-2024

- *Summa Cum Laude "Mention Très Bien"*
- *Partner Country Scholar*
- *Best Graduate Thesis, Socioeconomic and Ecological Economics*

Sorbonne Université, Paris, France
Roma Tre University, Rome, Italy

IMMERSE

BEYOND THE DATA, TECHNOLOGY

Moneywork and Affordances in Blockchain-based Community Currency: The Case of Sarafu Network in Kenya



The Kenyan Sarafu Network Transitioning to Celo Blockchain with About 20,000 Token Holders

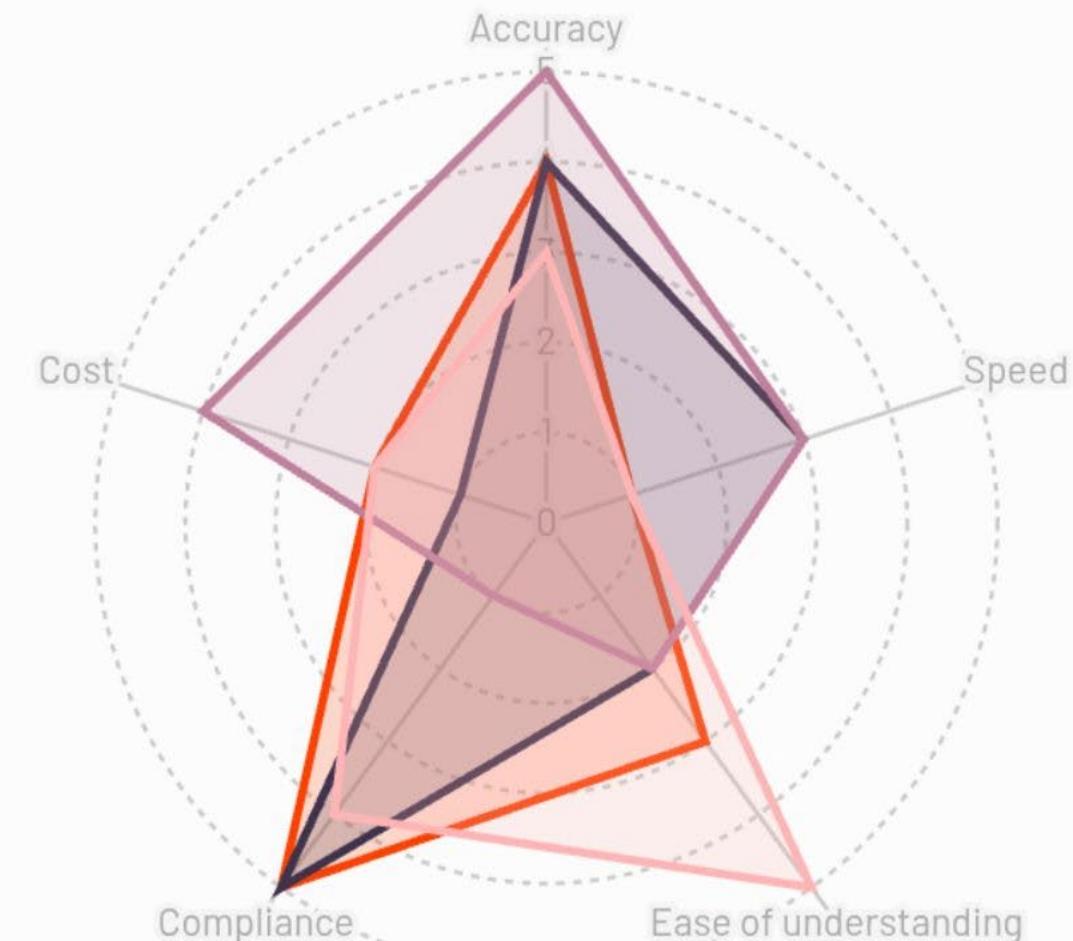
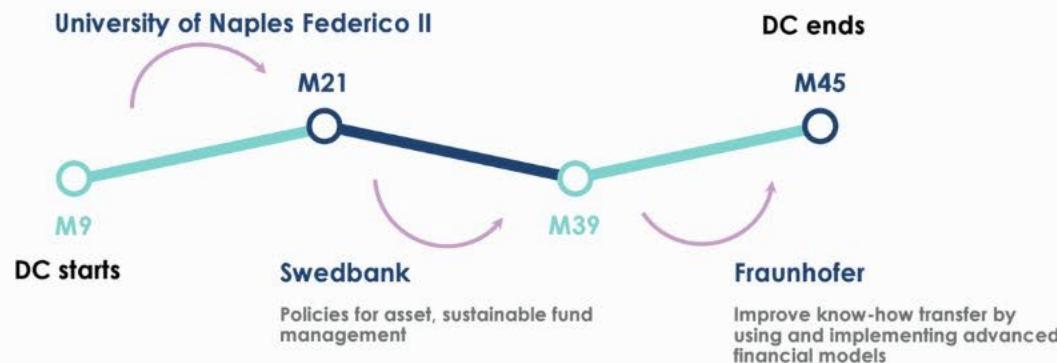
Previously, the Sarafu platform ran on its (Kitabu) blockchain where communities could launch their own community inclusion currencies (CIC's) without needing the internet or users to pay gas fees.

KODZILLA · DECEMBER 15, 2022 · 1 MIN READ



IRP 9

- Credit risk modeller
- Corporate banker
- Product manager
- Branch manager



Audience-dependent XAI

Supervisors: Dr. Maria Iannario, Dr. Ekaterina Svetlova

IRP10: Experimenting with Green AI to reduce processing time and contributes to creating a low-carbon economy

Ismail Elbouknify



Background



Ismail Elbouknify

PhD Candidate, MSCA Digital Finance

University of Naples Federico II

Master, Big Data Analytics & Smart Systems

Sidi Mohamed Ben Abdellah University

September 2020 – July 2022

Fez, Morocco

AI Research Engineer

Mohammed VI Polytechnic University

March 2023 - October 2024

Benguerir, Morocco

PhD candidate

University of Naples Federico II

November 2024

Napoli, Italy

MSCA Industrial Doctoral Network on Digital Finance

IRP 10: Individual Research Project

Topic	Involvement
<p>Experimenting with Green AI to reduce processing time and contributes to creating a low-carbon economy</p> <p>Objectives</p>	<ul style="list-style-type: none"> IRP belongs to WP5 (Sustainability of digital finance) WP Leader: UNA (Naples) Two supervisors from secondments: SWE, and ARC
<p>Green AI supports the use of resources more efficiently and conserves them for future generations. This research objective focuses on experimenting with green AI concepts in multiple applications in finance, analysing economical and practical impact of its deployment in industry. It facilitates the exchange of innovative ideas and cooperation opportunities in the field of Environmental, Social, and Governance (ESG), Sustainable Finance, and ESG Technology.</p>	<p>The project aims at providing reports about pricing and risk management of green financial instruments across all asset classes, with a focus on new products development, model validation, model risk management, funding and counterparty risk, fair and prudent valuation, applications. It aims at focusing on financial inclusion and inequality.</p>
<p>TIMELINE</p> <p>DC starts</p> <p>University of Naples Federico II</p> <p>M9</p> <p>Swedbank Policies for asset, sustainable fund management</p> <p>DC ends</p> <p>Athena Research Center Applied industry-research, using large-scale computing infrastructure to implement the theory</p> <p>10</p>	

Progress: Systematic Review of Green AI in Finance

Submitted paper: Systematic Review of Green AI in Finance: Taxonomies, Barriers, and Proposed Frameworks for Sustainable Integration (**Under review**).

□ This systematic review aims to address the following research questions:

- **RQ1:** What are the key drivers, challenges, and barriers of adopting Green AI in finance applications?
- **RQ2:** What methodologies and frameworks exist (or can be developed) to implement Green AI in finance?
- **RQ3:** How does applying Green AI in finance contribute to ESG goals and Sustainable Finance?
- **RQ4:** What benchmarks or assessment criteria can be used to measure the economic and environmental impact of Green AI in finance?

Progress

Research Directions

- Develop standardized metrics to assess the environmental impact of AI systems and empirically validate the proposed framework in real-world financial settings.
- Energy-Efficient Architectures: pruning, quantization to slash the costs without losing accuracy.
- Integrate Green AI principles within finance applications by developing low-energy AI models for risk assessment, credit scoring, fraud detection, and algorithmic trading.
- Adapt and optimize large language model (LLM) architectures for finance applications to reduce their computational and energy footprints.

Current work

- Financial applications, such as algorithmic trading and price forecasting, require real-time forecasts, which means longer computation times.
- Traditional forecasting models often come with a trade-off between performance, computational cost, and explainability.
- There is a growing demand for accurate and fast forecasting models in the financial sector.

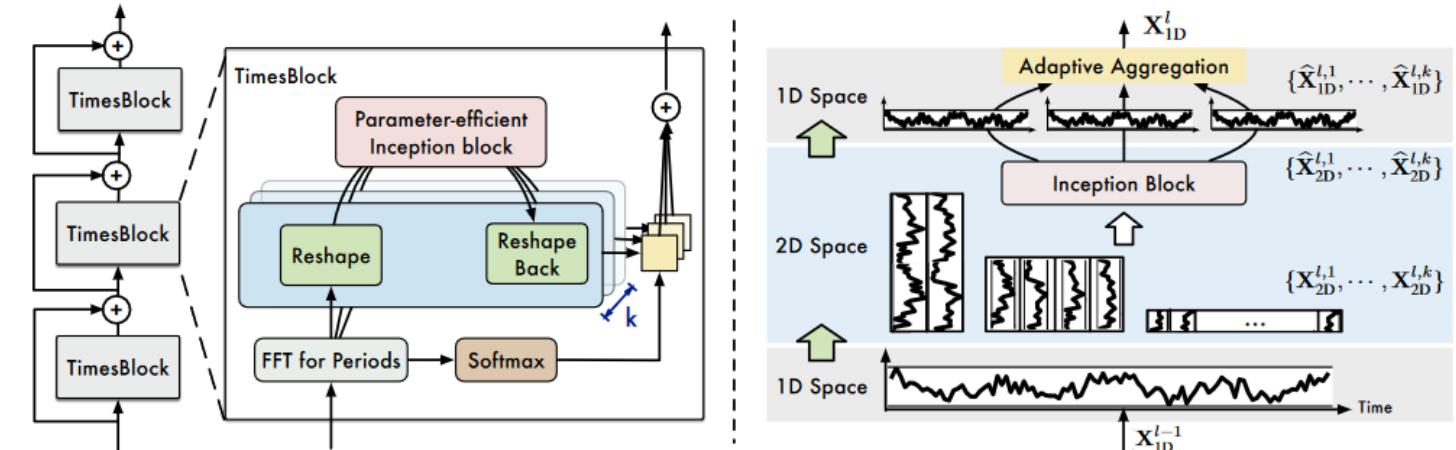
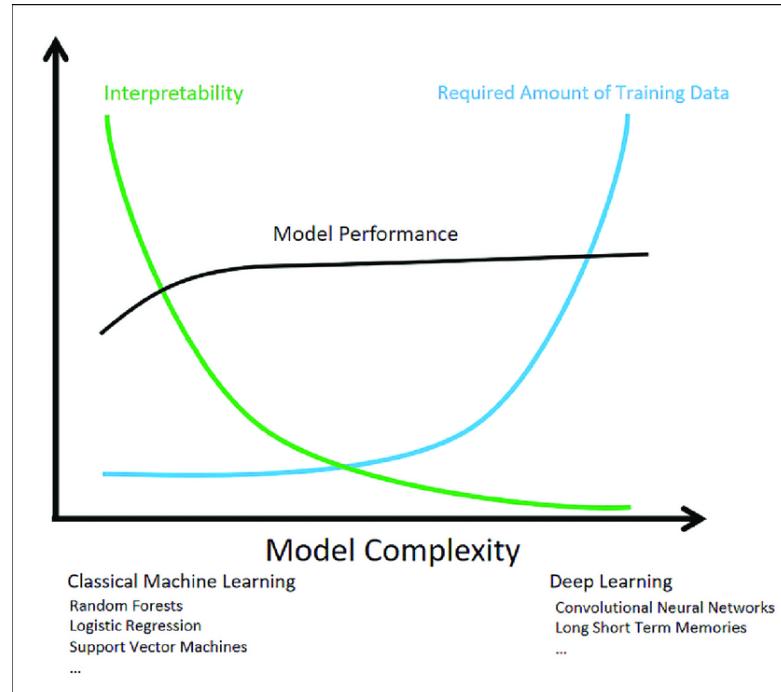


Figure 3: Overall architecture of TimesNet. TimesNet is stacked by TimesBlocks in a residual way. TimesBlocks can capture various temporal 2D-variations from k different reshaped tensors by a parameter-efficient inception block in 2D space and fuse them based on normalized amplitude values.

Current work

- Comparison of Different Architectures: From statistical models to deep learning architectures for long-term forecasting, as the task becomes more complex, it demands more computational resources and energy.
- Optimize energy efficiency of forecasting models based on different indicators to reduce energy consumption and execution time.

IRP11: Applications of Agent-based Models (ABM) in Sustainable Finance Growth

DC: Megang Nkamga Junile Staures

Background:

- B.Sc. in Pure Mathematics, University of Buea, Cameroon
- M.Sc. in Financial Mathematics, PAUSTI, Kenya
- M.Sc. in Data Science for Business, University of Stirling , Scotland
- Ph.D in Mathematics

Host Institution: Kaunas University of Technology (KUT), Lithuania

Supervisor: Prof. Dr. Audrius Kabasinskas

WP5: Sustainability of Digital Finance



RESEARCH QUESTION

How are agent-based models being applied to analyse sustainable finance growth over long-term periods, and what insights do they provide about system stability and sustainability transitions?



OBJECTIVE

To develop and validate agent-based models that accurately simulate the long-term impact of sustainable finance practices on financial growth, stability, and sustainability transitions.

Research Overview



Planned Secondments

Royalton Partners

- Duration: 18 months
- Research focus: Development and implementation of agent-based models to simulate crypto asset markets as a component of sustainable finance frameworks.

Athena Research Center

- Duration: 6 months
- Research focus: Utilizing large-scale computing infrastructure to run complex ABM simulations analyzing long-term sustainable finance scenarios.

RESEARCH APPROACH

- ✓ Develop ABMs that simulates interactions among various financial actors.
- ✓ Analyze how sustainable finance markets evolve over time. This builds upon the work of Poledna et al. (2022), which demonstrates ABM's superior forecasting capabilities, while also addressing the gap in long-term sustainability dynamics identified by researchers such as Jung and Kim (2023)
- ✓ Incorporate ESG scoring systems and regulatory frameworks to enhance the models.
- ✓ Include crypto asset markets as a component during the Royalton Partners secondment.

EXPECTED RESULTS

✓ Predictive Forecasting Tools

- Validated agent-based models projecting sustainable finance growth
- Quantifiable confidence intervals for scenario planning

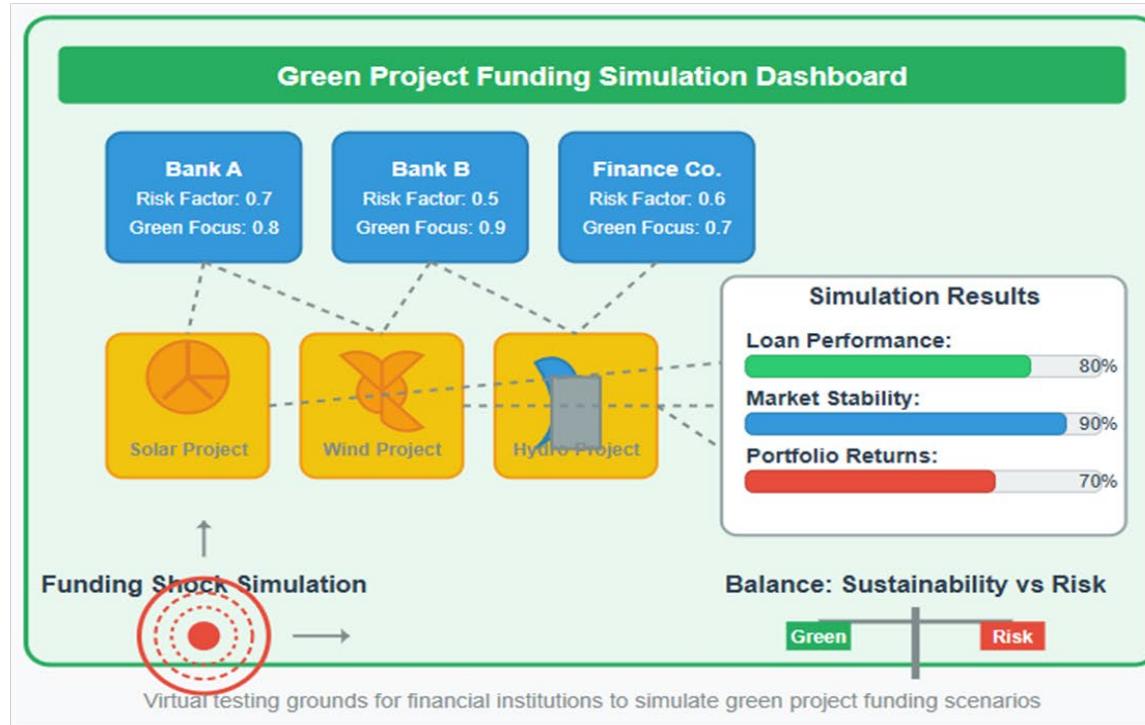
✓ Open Knowledge Platform

- Curated repository of ABM frameworks & datasets

✓ Policy Implementation Toolkit

- Threshold-based recommendations for market stability
- Timeline-driven ESG adoption strategies

INDUSTRIAL APPLICATIONS



CONCLUSION

In a rapidly evolving sustainable finance landscape, my research provides the analytical tools needed to navigate complexity and uncertainty. By modelling the interactions between market participants, we can better understand how sustainable finance will grow and transform in the years ahead, creating more resilient and sustainable financial markets for everyone. Thank you.

PROGRESS TO DATE

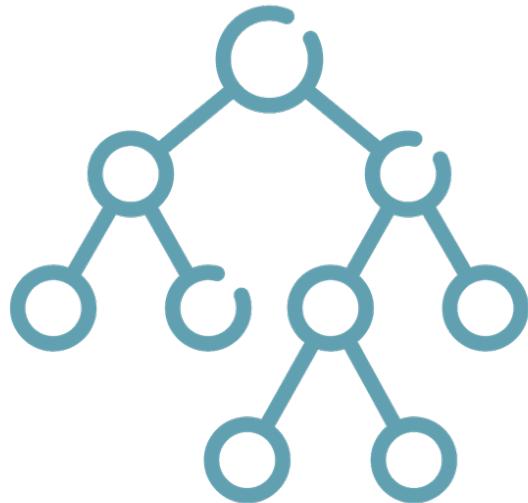
- ✓ Completed 2 modules at KUT and participated in three trainings (Ethics in AI, RL, and FDS)
- ✓ Quantile Regression-PCA Framework in Portfolio Selection Process paper by David Nedela, Audrius Kabasinskas, Megang N. Junile Staures submitted to the Central European Journal of Operations Research for publication

RELATED LITERATURE

Poledna, S., et al. (2022). Economic forecasting with an agent-based model.

Jung, H., & Kim, J. (2023). Sustainability transitions in financial markets.





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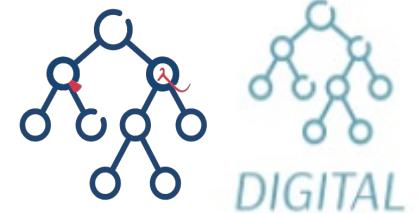
This project has received funding from the European Union's Horizon Europe research and innovation programme under the Marie Skłodowska-Curie grant agreement No. 101119635

IRP 12:

Developing industry-ready automated trading systems to conduct EcoFin analysis using deep learning algorithms

Rahul Tak

Supervisors: Daniel Traian Pele, Wolfgang Karl Härdle



My Background

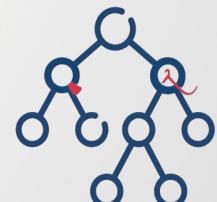
General

- BS-MS Physics
- Indian Institute of Science Education and Research
- Research interests: Complex dynamic systems, AI/ML, Quantitative finance



Professional/Research

- Computational material science
- Geophysical modelling and earthquake forecasting
- Consultant at Deloitte USI
 - Climate risk assessment (US FRB)
 - Credit risk model validation
 - Consumer complaint analytics and Strategy



Objectives and Deliverables

Goals

- Develop a multi-agent algorithm to integrate multimodal market information and RL for decision making
- Use LLM based reasoning and validation framework to improve explainability
- Incorporate ESG awareness, regulatory compliance and reduce algo failure

Deliverables

- RL model use case for trading (Due in M48)
- Industry prototype for automated trading strategies based on ML models (Due in M48)
- Summary report on all results and impacts related to AI in Finance (Due in M48)



IRP12: Individual Research Project

Topic	Involvement
Developing industry-ready automated trading systems to conduct EcoFin analysis using deep learning algorithms	<ul style="list-style-type: none">• IRP belongs to WP2 (AI for financial markets)• WP Leader: WWU (Vienna)• Secondments: Deutsche Börse, ROY, and ARC
Objectives	Deliverables
<p>Addressing the challenges associated with automated trading systems. Maximizing the captured market information, improving the explainability of the underlying AI/ML models used in automated trading systems to better address performance-related issues, and also addressing ESG/CSR and ethical issues. This area will contribute to Green Finance, thereby addressing the European Green Deal.</p>	<p>The project's outcomes will provide financial institutions with new automated trading tools. The primary anticipated outcome of the project is the design of new trading algorithm solutions for capturing unstructured and structured market information, enhancing the explainability of the underlying AI/ML models used in automated trading systems to better address performance-related issues, as well as ESG/CSR and ethical concerns.</p>
<p>Bucharest University (ASE)</p> <p>IRP12 DC starts</p> <p>M12</p> <p>M21</p> <p>M27</p> <p>Deutsche Börse Group High Precision Timestamp (HPT) and its application in automated trading</p>	<p>Royalton Partners Research on crypto assets for prototype and user acceptance</p> <p>Bucharest University (ASE)</p> <p>M39</p> <p>M45</p> <p>M48</p> <p>DC ends</p> <p>Athena Research Center Applied industry-research, exposure to world-leading research centre and infrastructure</p>



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Current work

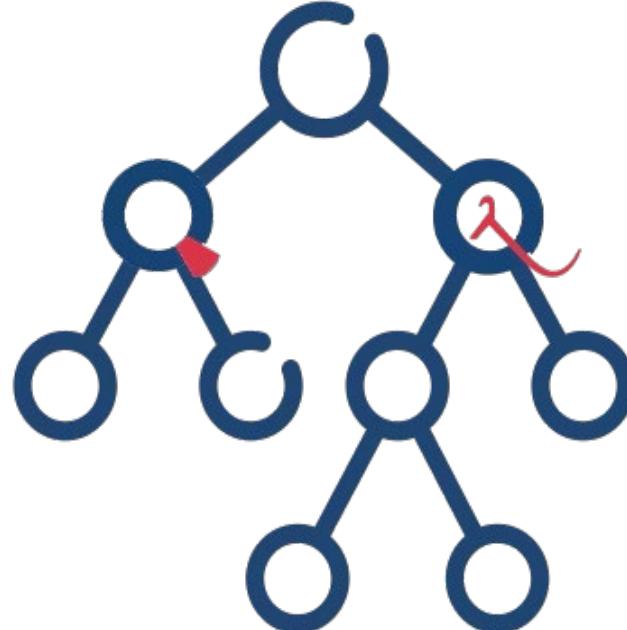
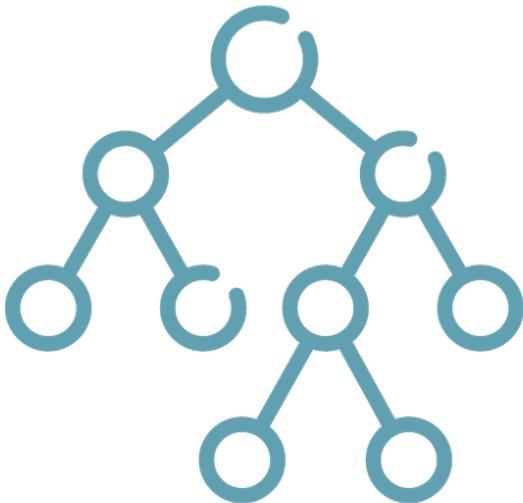
LLM-enhanced deep reinforcement learning for automated trading

- Developing LLM enhanced multi-agent system to capture the sentiments, fundamental, technical and historical information of asset.
- Integrating the information captured with DRL for trading decision making

Varied impact of local central bank and ECB communications on economy and markets across Central Europe

- LLM based sentiment scoring and aspect classification of central bank communications
- Analysing the combined and individual effect of ECB and local central bank on markets and macro-variables across different regions in Europe





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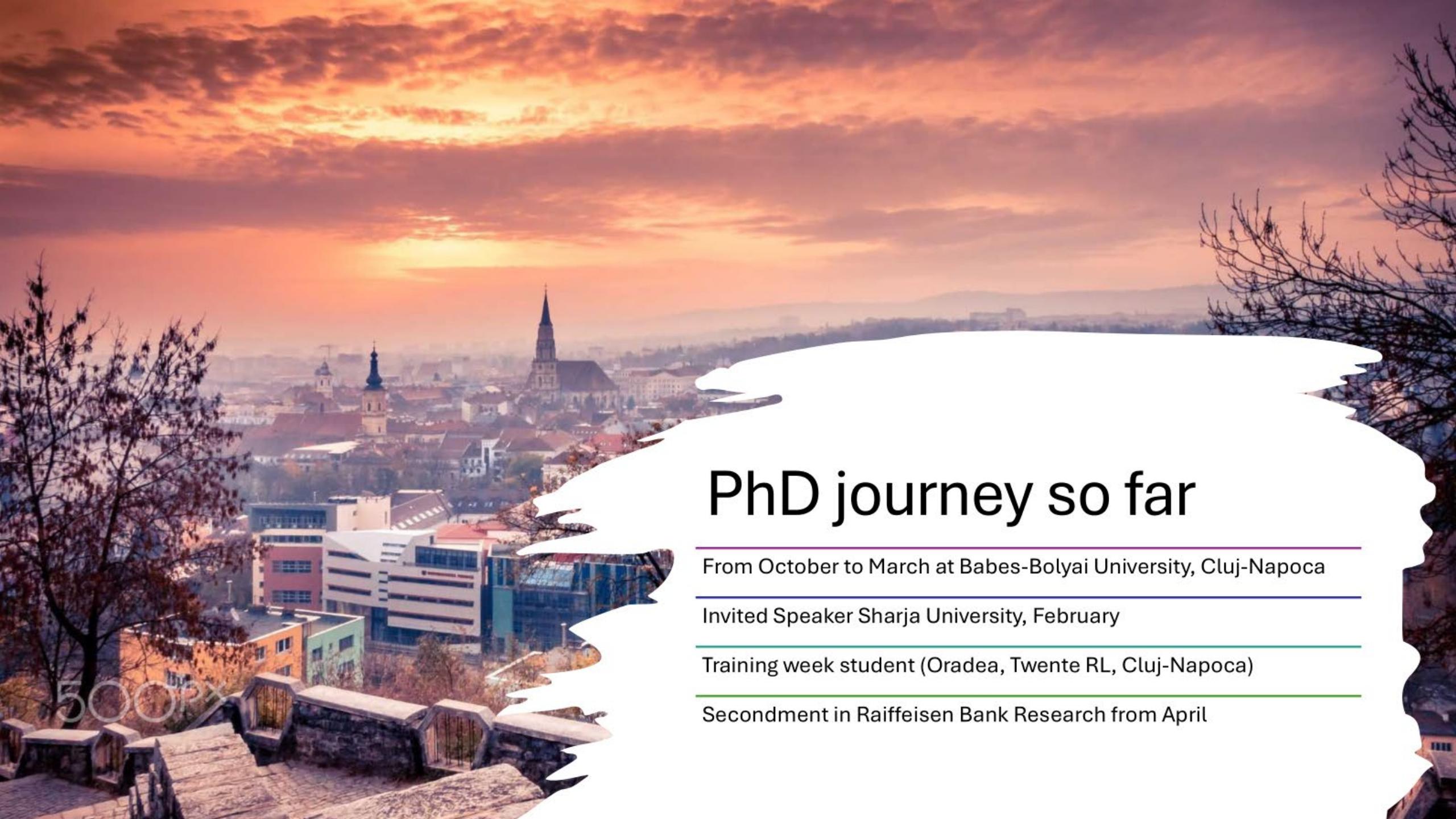
Predicting financial trends using text mining and NLP

Fulvio Raddi, Babes-Bolyai University

Background

- Bachelor Degree and Master Degree in Mathematics (University of Salerno)
- Master Degree in Mathematical Engineering
- Data Scientist in Information Security (CSI Piemonte, 4 years)
- Trainee in Financial Markets (DG Statistics ECB, 1 year)
- Currently PhD student at Babes-Bolyai University and Researcher at Raiffeisen Bank International (Vienna HQ)





PhD journey so far

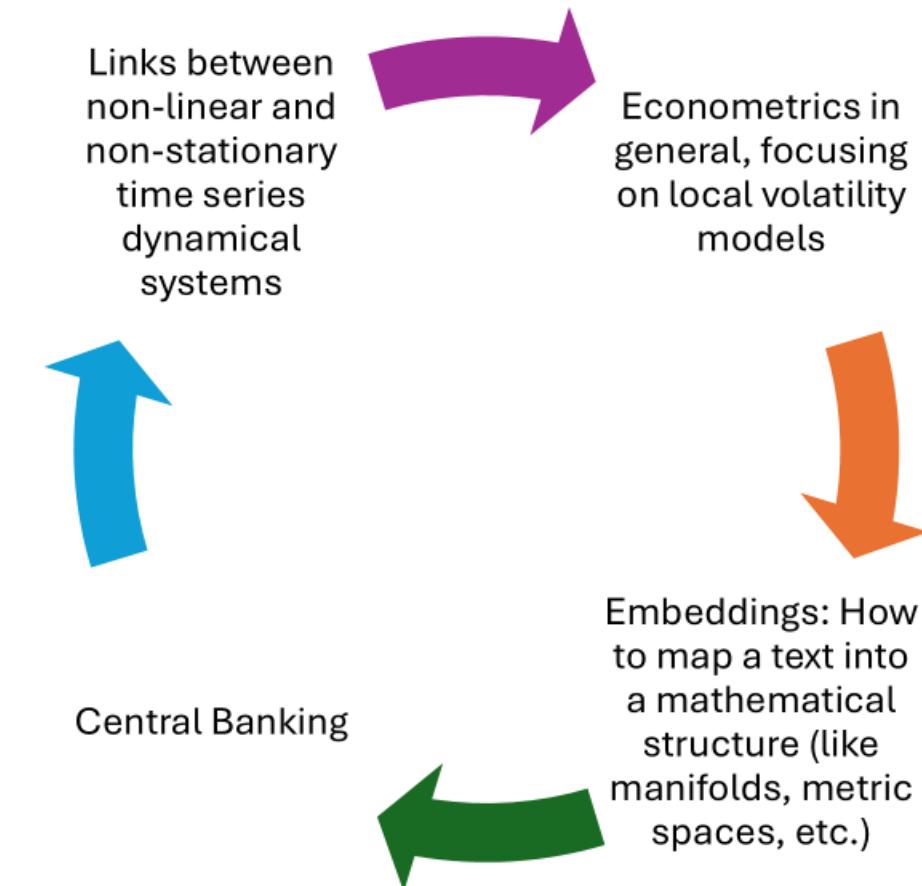
From October to March at Babes-Bolyai University, Cluj-Napoca

Invited Speaker Sharja University, February

Training week student (Oradea, Twente RL, Cluj-Napoca)

Secondment in Raiffeisen Bank Research from April

Research Interests





Call for papers

Sustainability data issues and central banks' experience (BIS + IFC)

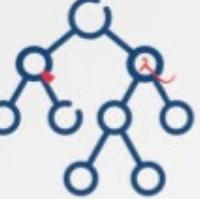
Annual Scientific Conference of Romanian Academic Economists from Abroad (ERMAS)

BdF AI Methods Conference 2025

Next goal: To submit a paper to a Q1 journal by 30 September.

Thank You!





IRP14 : Challenges and opportunities for the up-taking of technological development by industry

Owen Chaffard

Supervisors : Ralf Korn, Wolfgang Karl Haerdle

Ladislaus von Bortkiewicz Professor of Statistics
Humboldt-Universität zu Berlin
CardoAI
theIDA.net



Background

- ENS de Lyon (2019-2024)
 - ▶ Theoretical and applied Physics (Msc. 2022)

- Research experience
 - ▶ Master's thesis : *Complementarity of unsupervised machine learning techniques for turbulent large scales analysis of von Kármán swirling flows* @ LISN, Saclay, 2022
 - ▶ *Enhancing Large Language Models for Bitcoin Time Series Forecasting* @ NII, Tokyo, 2023
 - ▶ *Exploring multimodality for Time Series classification of patient consciousness* @ INSA, Lyon, 2024



IRP14 : Timeline

IRP 14: Individual Research Project

Topic	Involvement
Challenges and opportunities for theuptaking of technological development by industry	<ul style="list-style-type: none">IRP belongs to WP2 (AI for financial markets)WP Leader: WWU (Vienna)One supervisor from secondments: UKL
Objectives	Deliverables
The building blocks of any institutional investor's loan portfolio are cash flows. Using public and proprietary data, the doctoral candidate will conduct research and develop a machine learning tool capable of performing grouped time series forecasting on a private debt portfolio spanning multiple geographies, sectors, and whose features can also be grouped at other levels, such as loan amount and interest rate. In our innovation-driven industry, we analyse the obstacles and opportunities associated with adopting technological advances.	The project's outcomes will contribute to the expanding body of knowledge concerning the applications of cutting-edge machine learning and artificial intelligence techniques to traditional financial problems. Specifically, the first phase of the project will concentrate on missing value imputation for loan payment time series , while the second phase will adopt a more general predictive approach, that of grouped time series forecasting , possibly incorporating the first step. The anticipated outcome will be three research/conference papers describing the data analysis, modelling approaches, and experimental results.

IRP 14 TIMELINE

Cardo S.R.L

M9

DC starts

M33

Kaiserslautern-Landau University

DC ends

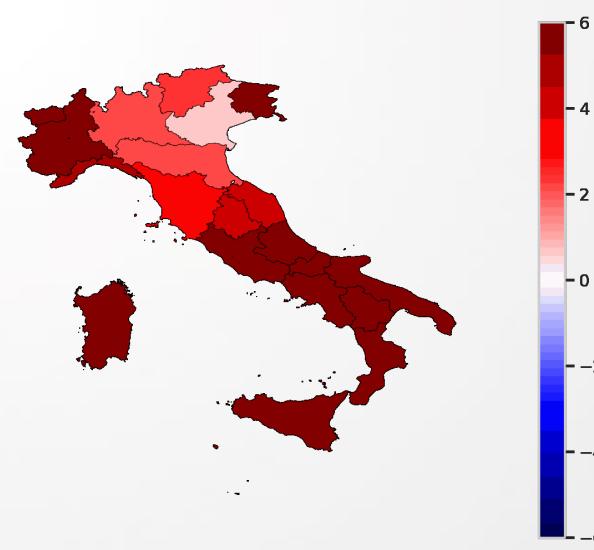
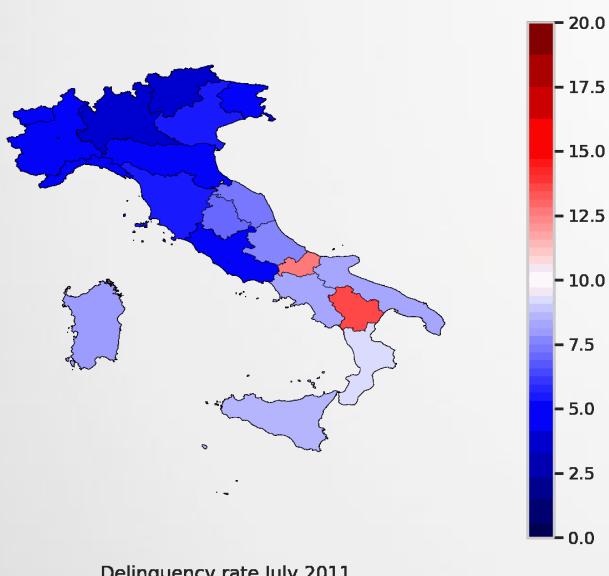
M45

Contribution to the theoretical and applied expertise in machine learning, times-series forecasting and credit portfolio analysis

DIGITAL

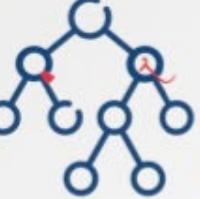
Current work : Hierarchical Loan Forecasting

- Literature review : SOTA of end-to-end coherent probabilistic models
- Data collection and EDA (bancaditalia)
- Implementation and benchmarking of promising architectures
- Conversion to industry-ready product



Current Objectives

- Beyond normal assumptions
 - ▶ Normalising flows, parametrised distributions
- Missing value imputation
 - ▶ Inconsistent reporting (bancaditalia)
- Scalability of ML solutions
 - ▶ Grouped Time Series
- Cross temporal Hierarchies
 - ▶ Research gap



IRP14 : Challenges and opportunities for the up-taking of technological development by industry

Owen Chaffard

Supervisors : Ralf Korn, Wolfgang Karl Haerdle

Ladislaus von Bortkiewicz Professor of Statistics
Humboldt-Universität zu Berlin
CardoAI
theIDA.net



IRP16: Investigating the utility of classical XAI methods in financial time series

Jens Reil



About IRP 16 / WP3

WP3 “Towards explainable and fair AI-generated decisions”

IRP16 “Investigating the utility of classical XAI methods in financial time series”



Planned Secondments



European Central Bank: Dr. Lukasz Kubicki, M27, 12 months, exposure to globally leading central bank research, training on EU principles



Fraunhofer (FRA): Prof. Dr. Ralf Korn, M39, 6 months



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Personal Background

Education



PhD

MSCA Digital Finance

Specialization: Explainable AI (XAI) for financial time series



MSc(s)

Financial Engineering & Management

Data Science & Business, Enterprise Architecture & IT Management



Pre-MSc

Industrial Engineering & Management

Specialization: Financial Engineering & Management



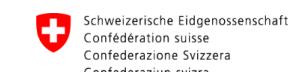
BSc

Electrical Engineering

Specialization: Embedded & Wireless Systems



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State Secretariat for Education,
Research and Innovation SERI



Experience

...

Personal Background

Education

...

Experience



ING

Integrated Risk Model Development (Wholesale)
ESG factor integration impact on corporate credit ratings



Triple A –
Risk Finance

Data & AI
Looking into potential XAI usage within insurance pricing



University of
Twente

Teaching Assistant (TA)
Mathematical Finance, Machine Learning, Data Science, Finance
for Engineers



Teqram

Software Engineer Robotics
Focus: Development and implementation of 3D plane scans for
robotic applications



TME

Software & Hardware Engineer



MARIE CURIE ACTIONS



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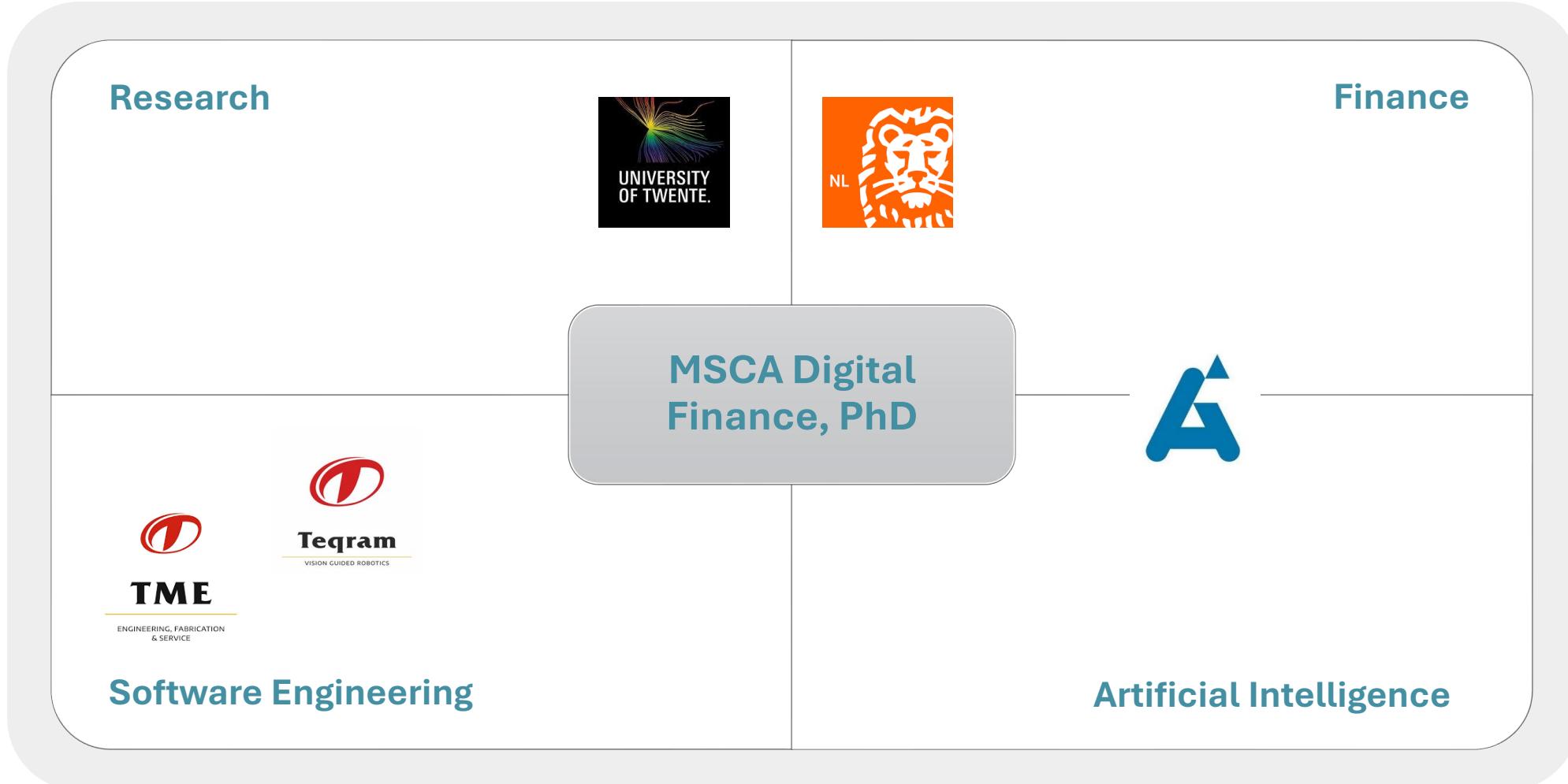
Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

State Secretariat for Education,
Research and Innovation SERI



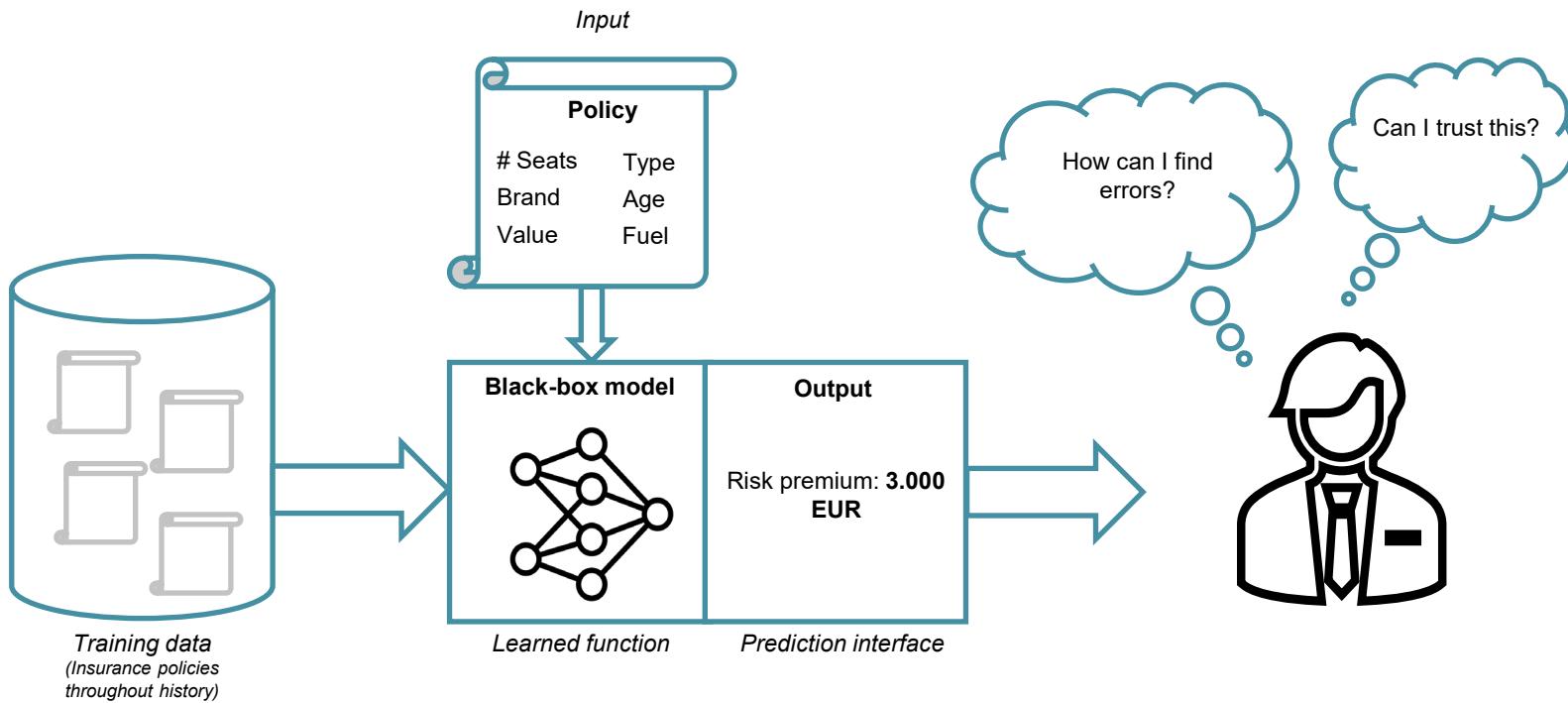
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Research Interests



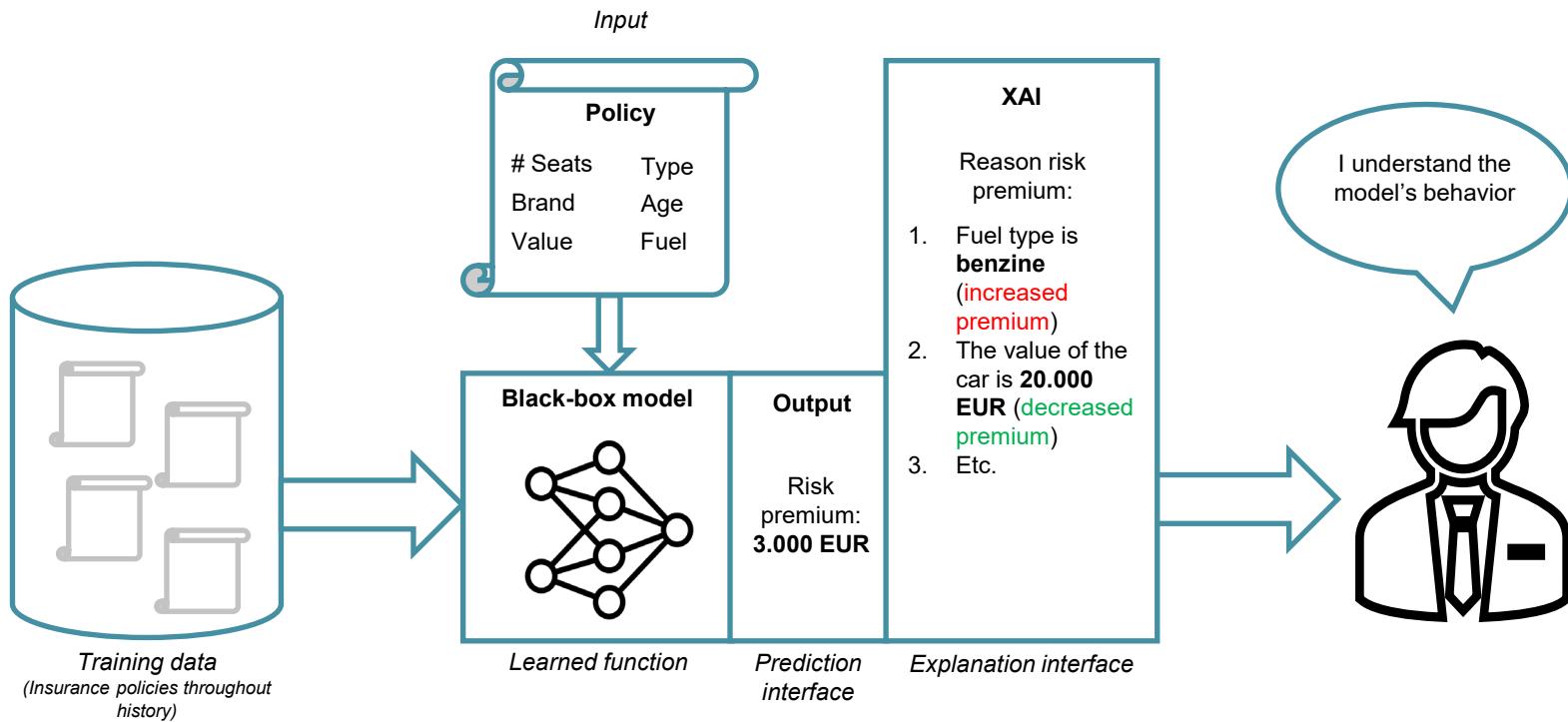
Research Interests

A



Research Interests

A



PhD Journey So Far

WP3 “Towards explainable and fair AI-generated decisions”

IRP16 “Investigating the utility of classical XAI methods in financial time series”

Structured Literature Review

Summary of XAI methods in temporal data:
Cataloged and analyzed the primary methods employed in the literature to enhance explainability in AI models designed for time series data

Identification of crucial challenges in current XAI methodologies

Hands-On

Trainings: conducted various trainings within the MSCA network (Oradea, Enschede, Cluj-Napoca)

Prototyping: Initiated prototyping efforts by developing explainability techniques specially suited for AI-based forecasting systems

Presentations

Ethics presentation: During the MSCA Digital Training Week: Ethics in AI Training School, Jens conducted a presentation about ethics in his research area

WP5 Seminar: Within the “Sustainability of Digital Finance” work package (WP5). Seminar focusing on ESG integration in credit risk



MARIE CURIE ACTIONS



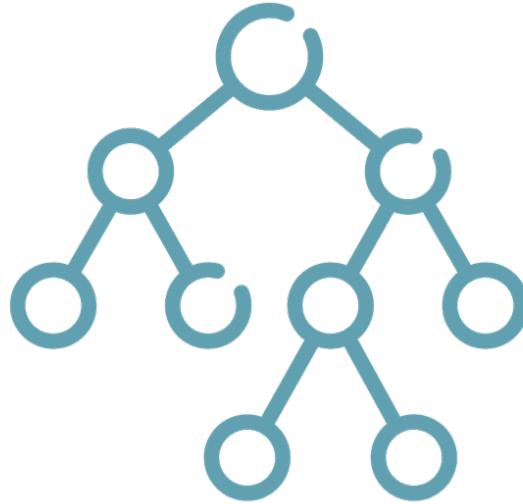
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Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

State Secretariat for Education,
Research and Innovation SERI



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IRP17: Fair Algorithmic Design and Portfolio Optimization under Sustainability Concerns

Rebecca Di Francesco





Research Project

Official MSCA DIGITAL Midterm Meeting

Enschede, Netherlands

May 2025

Academic & Professional Journey



Rebecca Di Francesco
PhD Doctoral Candidate

Education Background

Bachelor's Degree in Economics
University of Bologna

Work Experience

Master's Degree in Data Science
University of Padova

2 years of Experience in the Industry
as a Data Analyst/
Data Scientist

PhD

MSCA Digital Finance PhD
IRP 17
WP3

PhD Industry Experience

Secondments
European Central Bank
Bank for International Settlements

Research Interests

Research Interest 1

**Portfolio Design
with Climate-risk
Metrics**

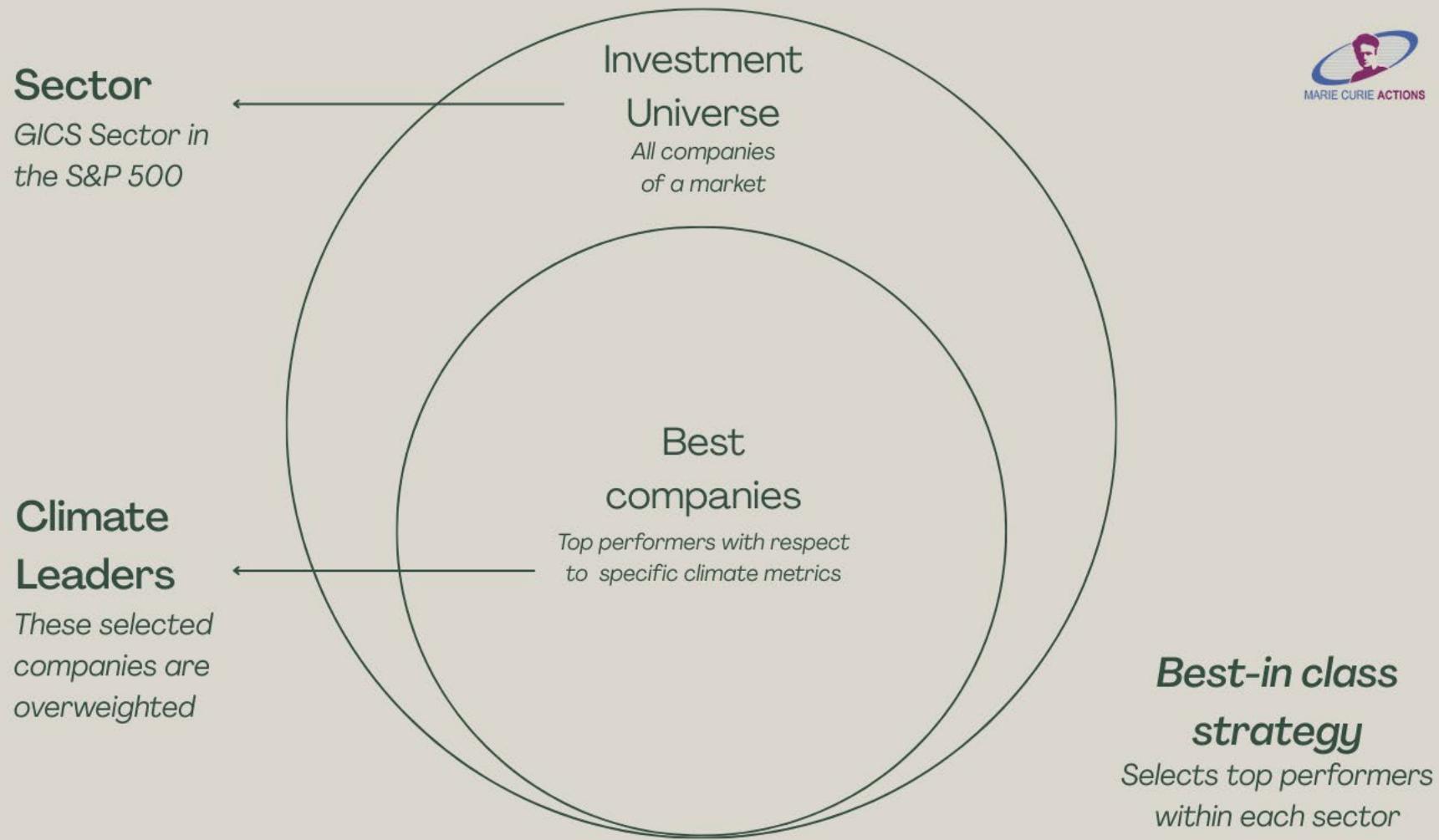
How climate-related data
can inform investment
strategies.

Research Interest 2

**AI in Sustainable
Finance**

Investigating the usage
of LLMs to improve
decision-making in
responsible investing.





Portfolio Decarbonisation



Thank you.
