Master's Project Market · FS 2024

Nathan Labhart, Academic Coordinator

Daniela Bärtschi, Study Coordinator

Projects and presentations by:

Mostafa Chegenizadeh, Krzysztof Gogol, Tao Yan, Raphael Beckmann, Gabi Morgenshtern, Madhav Sachdeva, Clara-Maria Barth, Rosni Vasu, Alexander Lill, Roland Schläfli, and Andy Bucher.

Important to know: The Master's Project…

… is a **group project** of 2 to 5 members.
If you are a group of two and one person has to cancel, the whole project has to be canceled.

… must be done **with an Ifi professor**.
You may be required to have passed certain modules. External co-supervision may be possible.

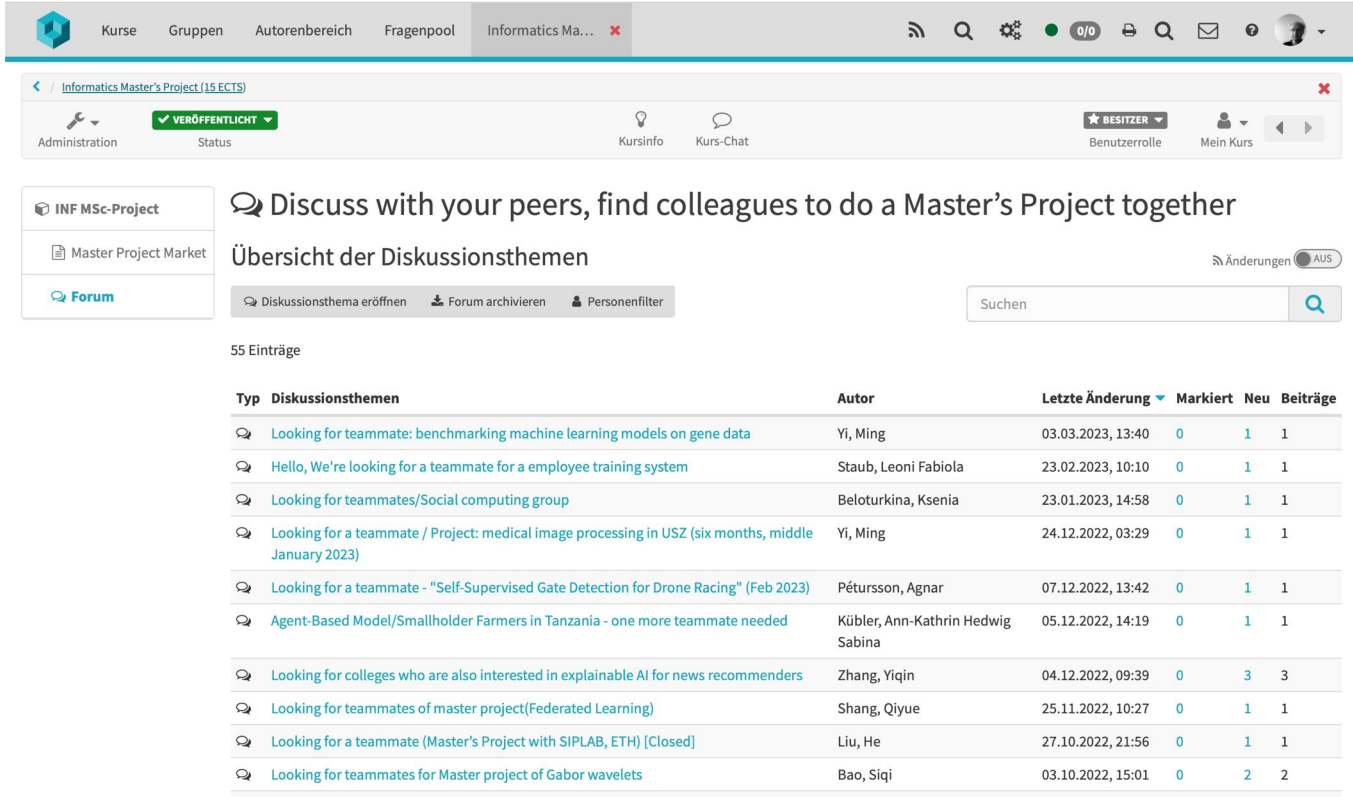
… is carried out with **scientific methods**, requires **final report**.
And usually a presentation or demonstration of the solution.

… yields 15 ECTS Credits.

… is ideally carried out during the summer break; **max. 1 year** to complete.
Usually 6 months (part-time), 3 months (full-time). Start date depends on context and supervisors.

Master's Project: Procedure

1. Find a project, e.g., here at the Master's Project Market, on the IfI website for MSc https://www.ifi.uzh.ch/en/studies/msc-info.html, in OLAT http://t.uzh.ch/yi, or on the individual group pages.
2. Build groups (find peers here, in OLAT, …)
3. Meet with supervisor and submit the registration form.
4. Start.



University of Zurich[UZH]

Department of Informatics

Master's Project presentations (1 minute each, 15 seconds in-between).

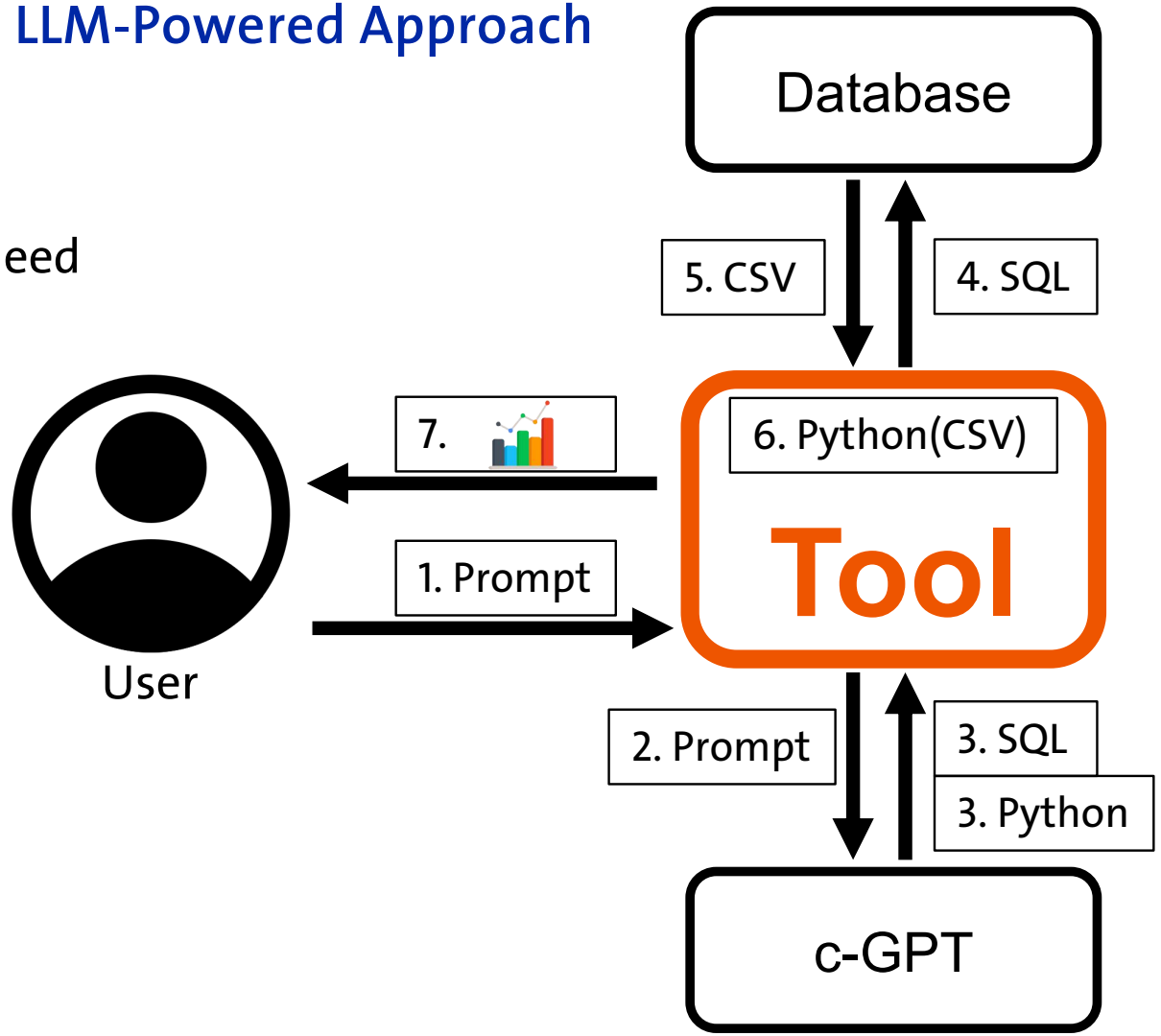
http://t.uzh.ch/yi

The slides will be uploaded tonight.

Ready… set…

AI-Enhanced Blockchain Analytics: An LLM-Powered Approach

- Prompt engineering
- Leverage customized LLM to parse user need
- Query data from PostgreSQL database
- Apply Python script to data
- Visualize the output result



Project Description and References: https://www.ifi.uzh.ch/en/bdlt/Thesis/AI-Enhanced-Blockchain-Analytics--An-LLM-Powered-Approach.html

Design and Implementation of a Data Visualisation Platform

Goal: To provide ready-to-use plots via an interactive and flexible front-end.

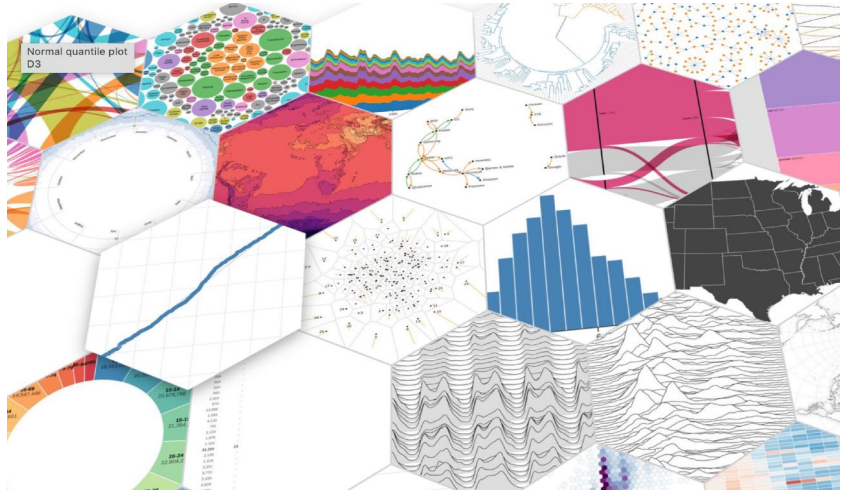
Scope: Blockchain data visualisation

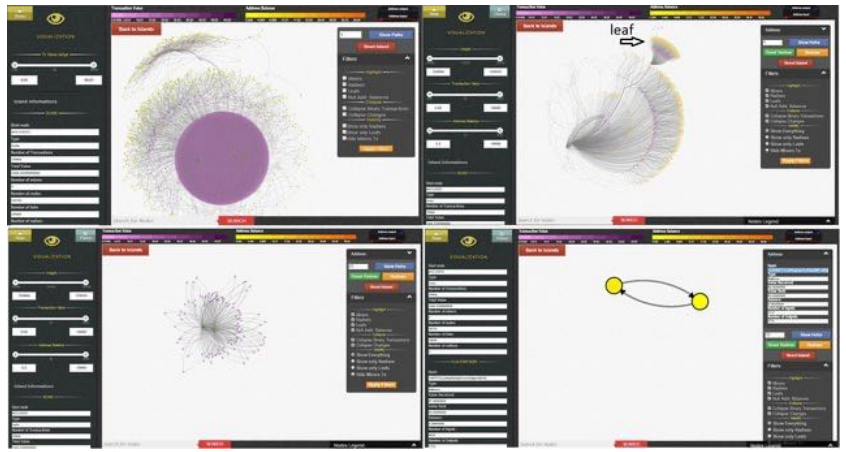
Technology stack: JavaScript, React, Typescript, Python

Supervisor: Dr. Sina Rafati (rafati@ifi.uzh.ch)

Group: Blockchain and Distributed Ledger Technologies (BDLT)

Start: ASAP





Design and Implementation of a Data Warehouse

Goal: To provide an efficient data processing platform integrating streaming and analysis units

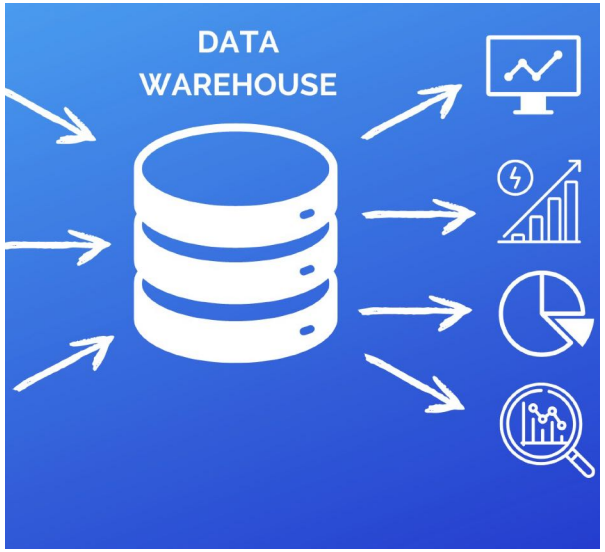
Scope: Data Engineering, DataBase Management, Streaming, Distributed Processing

Technology stack: JavaScript, React, Typescript, Python, Apache Kafka, Apache Spark, Postgresql, GraphQL

Supervisor: Dr. Sina Rafati (rafati@ifi.uzh.ch)

Group: Blockchain and Distributed Ledger Technologies (BDLT)

Start: ASAP



Security and Scalability on Layer-2 Blockchains DeFi Platform for Token Trading

System Design/Set-up

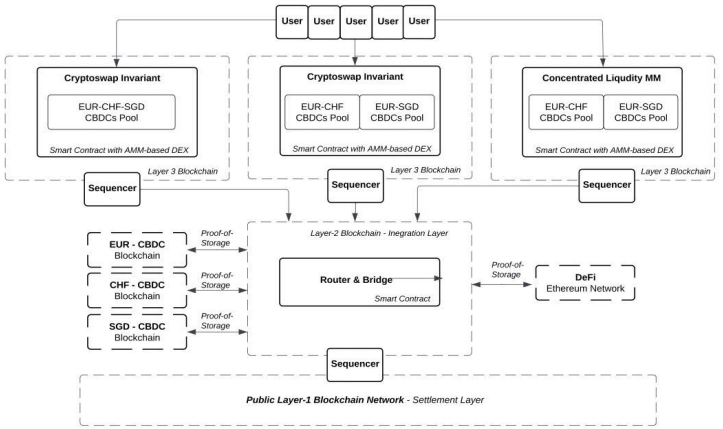
- Layer-2 on Ethereum
  (private zkSync Era/Arbitrum rollup)
- Fork of DeFi Smart Contracts and Tokens

Parametrization

- zkML - zero knowledge Machine Learning

Prototyping

- Cross roll-up communication of smart contracts



System Architecture

Malicious users and contracts detection on Ethereum

Supervisor: Tao Yan (yan@ifi.uzh.ch), Prof. Claudio Tessone (tessone@ifi.uzh.ch),

Group: Blockchain & Distributed Ledger Technologies

- **What will we do?**

  Using deep learning or machine learning methods to predict the malicious user addresses and smart contract addresses based on the transaction patterns.

- **Methods**
  - Collecting on-chain data and Identifying the transaction patterns
  - Constructing the large-scale transaction networks
  - Using Graph Machine Learning to predict the malicious users and contracts

- **Requirements**

  Familiar with Graph Machine Learning, basic knowledge of Ethereum and DeFi.

University of Zurich[UZH]

IVDA INTERACTIVE VISUAL DATA ANALYSIS

SDG SCOUT

How does UZH research with its collection of over 100'000 publications address sustainability?

How can publications which address SDGs be detected?

How can ML algorithms like LLMs be leveraged to present SDG contributions of single publications or the publications of UZH as a whole?

Goal: Implement a user-interface which allows university stakeholders to explore UZH publications with respect to their contributions to the SDGs.

Contacts: Prof. Dr. Jürgen Bernard bernard@ifi.uzh.ch

Raphael Beckmann raphael.beckmann@uzh.ch

Modular Software Library for **Sensor Data Analytics**

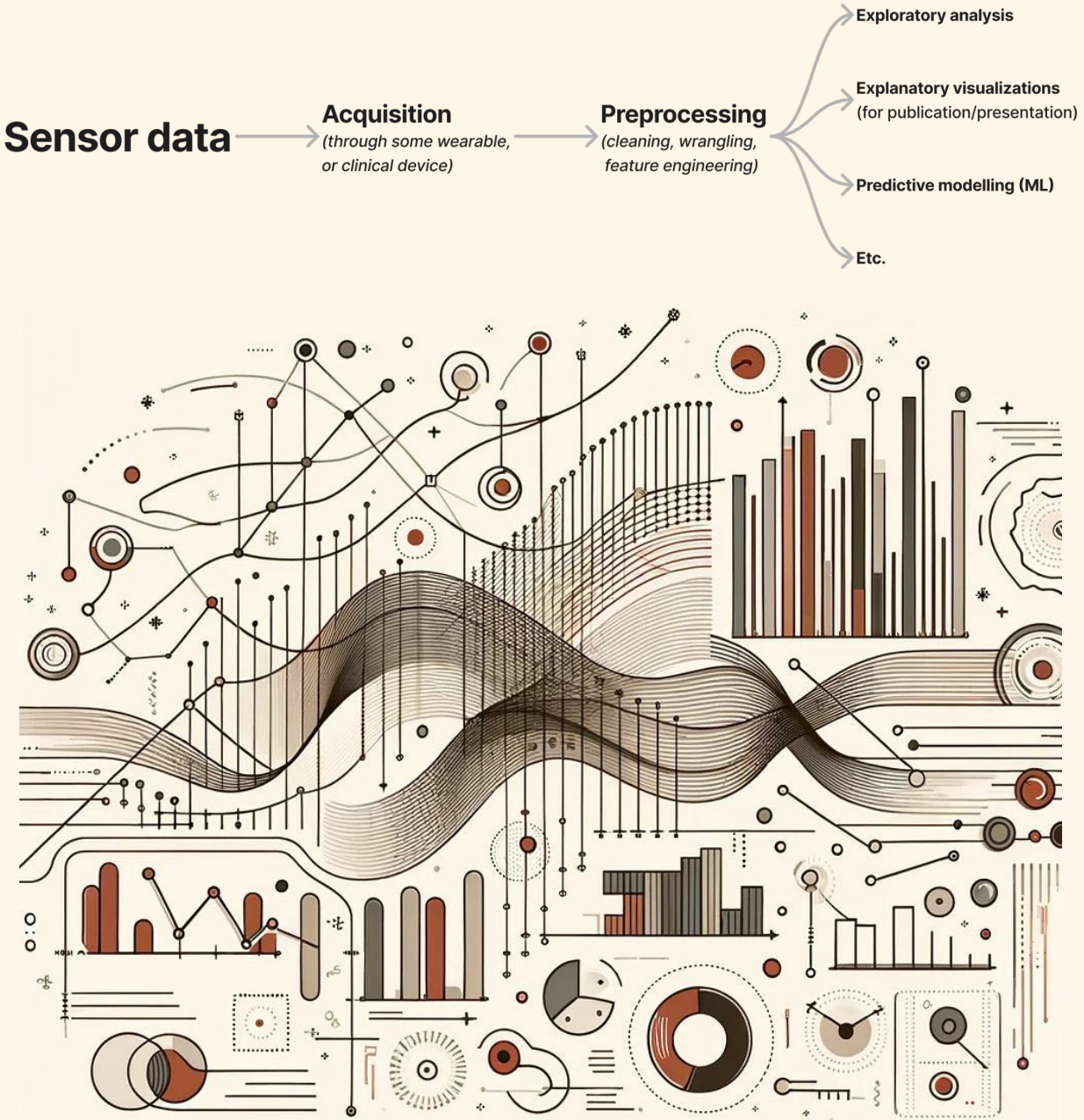
Join us in building a visual analysis pipeline for **wearables'** sensor data

To enable user-tailored data exploration and **machine learning**

Requirements:

- Interest in interactive visual analysis
- Strong skills in software engineering

Interested?
Contact us here:



Discovering relations through interactive visual analytics

A Data Science Journey

Master Project | Master's Thesis

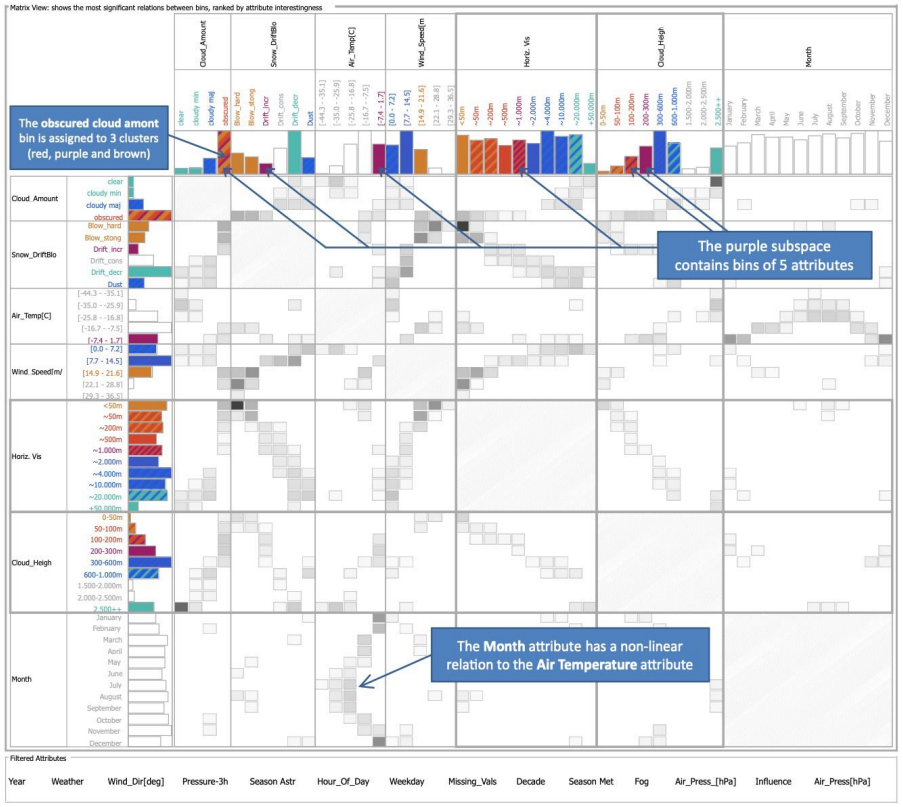
Motivation: Relation-seeking is everywhere!

1. How can humans and ML work together to find interesting relations?
2. How do relations change over time?

Approach

1. Transform features from the given datasets
2. Develop a **visual interface** to support the exploration and human-centered **relation-discovery** of the datasets
3. Create a pipeline to add external data sources to the tool
4. Evaluate the tool with a user study

Apply at sachdeva@ifi.uzh.ch and bernard@ifi.uzh.ch



Source: Bernard, Jürgen, et al. "Visual-interactive Exploration of Interesting Multivariate Relations in Mixed Research Data Sets." *Computer Graphics Forum*. Vol. 33. No. 3. 2014.

Universität Zürich[UZH]

IVDA INTERACTIVE VISUAL DATA ANALYSIS GROUP

Similarity search in health data through IVDA

Motivation: Similarity search in multivariate time series health data to support chronic disease decision-making.

Approach: Build a visual analytics solution that allows…

…finding similar past situations

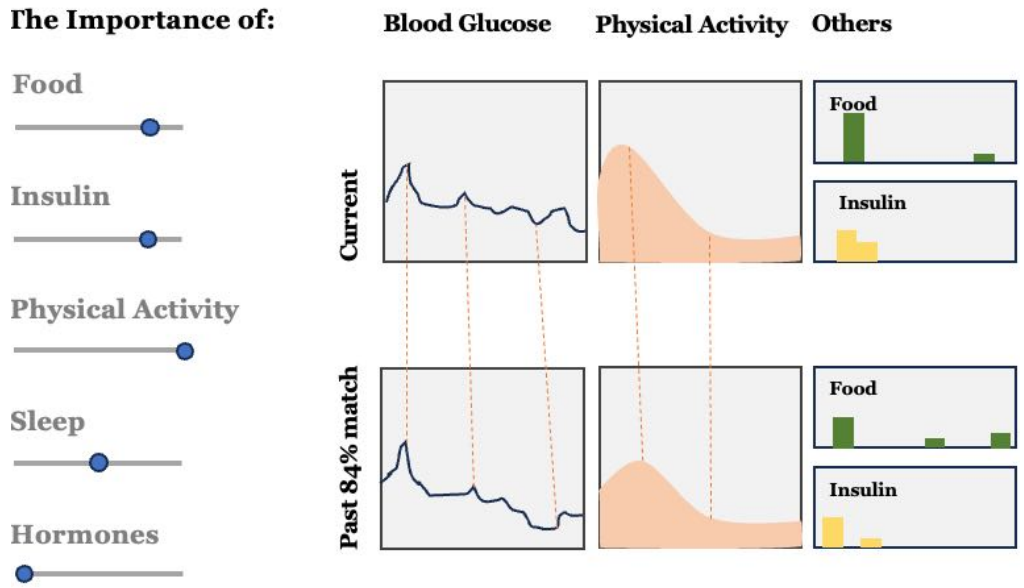
…personalizing the similarity search (human-in-the-loop)

…understanding and exploring similarity

…exploring the different dimensions of the healthcare data

Your group profile:

- Profound FE and BE programming experience
- Interest in healthcare
- Independent and creative work
- Ideally a background in VA



Source: Illustration by Clara-Maria Barth

Apply at cbarth@ifi.uzh.ch and bernard@ifi.uzh.ch

Universität Zürich[UZH]

IVDA INTERACTIVE VISUAL DATA ANALYSIS GROUP

Dynamic and Distributed Information Systems

Intelligent Scientific Paper Annotator

Using CrowdAlytics Ontology and LLMs

Contact: rosni@ifi.uzh.ch

More Details

Goal

Enhance our *CrowdAlytics Annotation Tool* with Intelligence

Tasks:

(1) modular solution that integrates advanced pre-trained LLMs to automatically identify and highlight key scientific constructs such as hypotheses and/or arguments

(2) expand the existing annotation capabilities

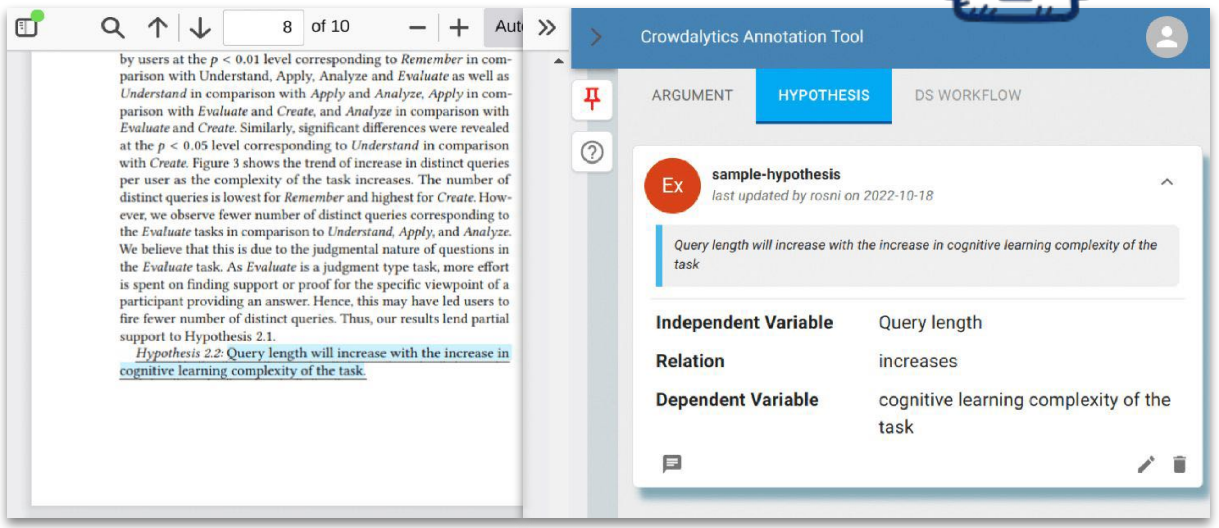
(3) evaluate the framework

We are looking for:

2-4 students (With programming skills)

AI students who have knowledge about Semantic Web Technologies and LLMs

Expected to start: ASAP



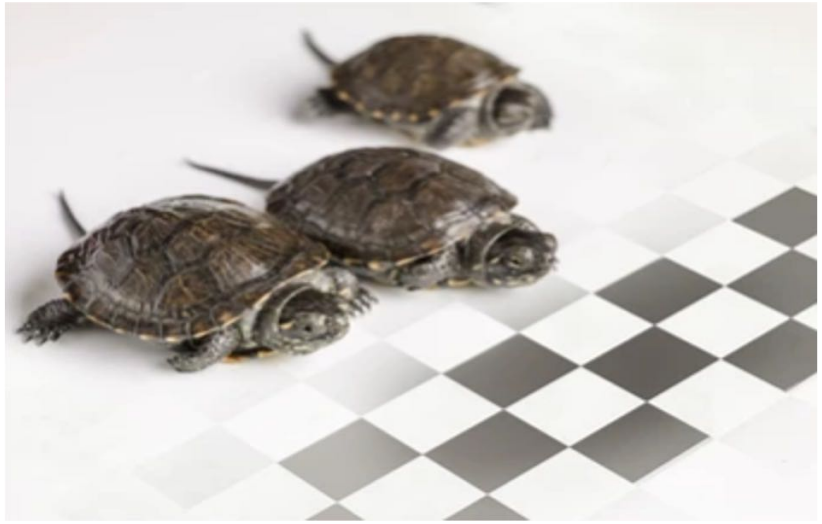
Gamified Team Awareness

Motivation

While software teams are aware of their collective progress, developers are rarely aware of what their colleagues are working on, and how everyone contributes to the team effort.

Goals

- Increase awareness about what each developer is working on by **aggregating several scores**, for example, time spent reading/writing documents, programming, or communicating
- **Visualize these scores** in an engaging and privacy-preserving way
- **Implement a prototype** that collects and aggregates data, and presents the results to the team members
- **Evaluate** the prototype in a **small user study**



Group Size

2 - 5

Contact

lill@ifi.uzh.ch

Group Work and Peer Evaluation - KlickerUZH

Motivation

Incorporating peer feedback and reflection into group work helps students develop critical skills in providing constructive criticism, reflecting on their work, and collaborating effectively. In this project, you will develop your own feedback mechanisms and apply them in a real-world setting using KlickerUZH, adding value for both students and instructors.

Goals

- Design a **peer feedback** concept for students (giving and receiving feedback) and lecturers (insights into group work) based on the open-source audience interaction platform KlickerUZH
- Design and develop backend and frontend components and end-to-end tests building on the existing open-source **KlickerUZH** codebase
- If possible (timing): Implement and **evaluate** your peer feedback approach in a lecture with group assignments as a **small user study**
- Stretch goal: Investigate the **potential of AI** to assist in the feedback or self-assessment process (e.g., nudge towards constructive reviews, screening for feedback quality, sentiment analysis, suggesting rubrics)

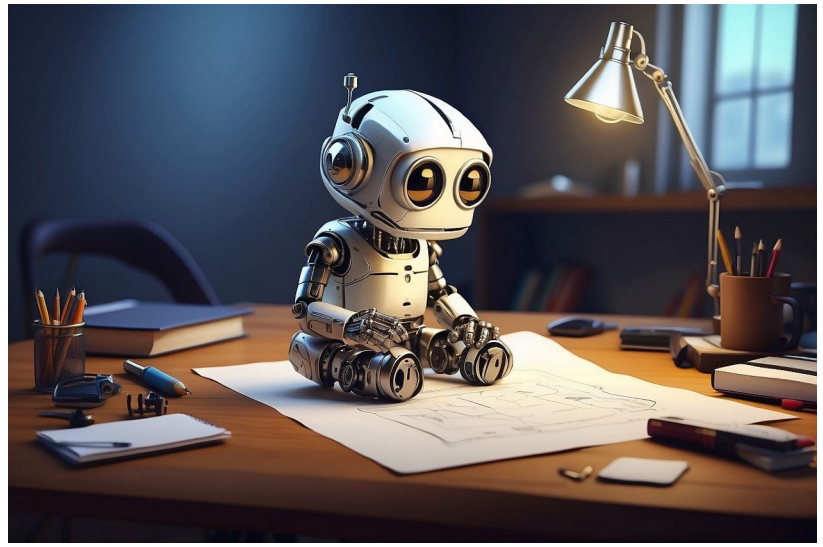
Group Size

2 - 4

Contact

fritz@ifi.uzh.ch

AI-assisted Content Generation - KlickerUZH



Motivation

Lecturers are often concerned about the effort required to create interactive learning components such as live quizzes and microlearning for their lectures. Learn how to work with large language models by developing an LLM-based API and extending KlickerUZH to suggest new content based on existing lecture material, reducing the workload for instructors.

Goals

- Design and develop an **LLM-based architecture** and API (preferably Python) that processes teaching materials (e.g., PDF) and proposes learning materials (e.g., questions, summaries, flashcards, quizzes)
- Incorporate your new API into the open-source audience interaction platform **KlickerUZH** by building backend and frontend components
- Implement and evaluate your approach with a selected set of lecturers from different domains as a **small user study**
- Stretch goal: Explore **multimodality in LLMs** to, e.g., generate elements based on images in teaching materials or to generate images and image-based elements based on textual contents

Group Size

3 - 4

Contact

fritz@ifi.uzh.ch

Conversational Government – MP1

Leveraging GenAI to automatically answer calls of citizens

Description of the overall research project

Citizen services in public administrations is struggling with a high turnover of employees who switch jobs or resign due to increasing workload, while citizens complain about long waiting times. To support public servants in their daily work, we want to develop a telephone agent that can automatically answer calls, provide information to standard requests, and, if necessary, hand over the call to an expert. For this, we are currently working in a research project with multiple German public administrations to develop and test such an agent.

What will you do?

You will help us in developing the first prototype of such an agent. This will include:
1) definition of the target architecture, 2) design and development of a software prototype, and 3) evaluation of the prototype. You will directly work with the public administrations in this project.

When can you start?

As soon as possible

What skills should you have?

Programming skills (Java, Python, knowledge about APIs, …), NLP and ML, good communication skills

Contact:

Andreas Bucher (IMRG)
bucher@ifi.uzh.ch

University of Zurich[UZH]

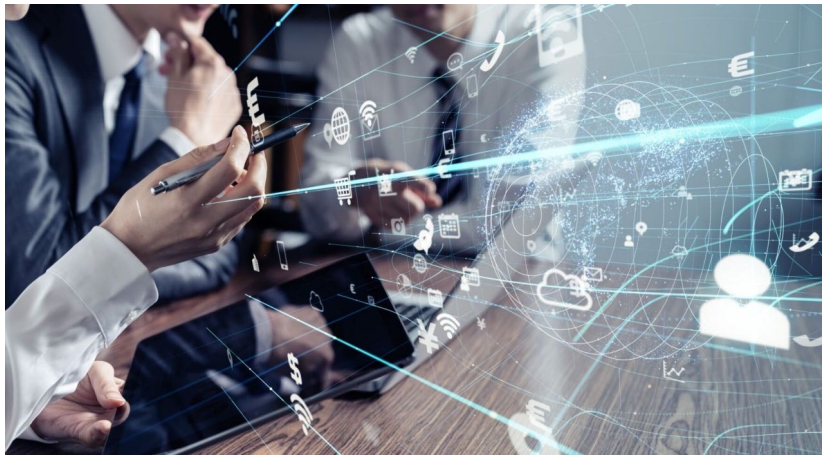
Conversational Government – MP2

AI-powered Support Agent for Employees at the Immigration Office

Information Management Research Group

Description of the overall research project

Due to increased immigration, unclear and complex legislation, and demographic changes, many immigration offices in Germany are challenged to effectively and efficiently manage associated tasks. In this project, we want to develop an AI-powered Support Agent that can automatically provide employees with feedback concerning the status of immigration processes of an applicant and support them in their daily work, e.g., by generating automatic summaries of conversations with applicants.



What will you do?

You will help us in developing the first prototype of such an agent. This will include:
1) definition of the target architecture, 2) design and development of a software prototype, and 3) evaluation of the prototype. You will directly work with the public administrations in this project.

When can you start?

As soon as possible

What skills should you have?

Programming skills (Java, Python, knowledge about APIs, …), NLP and ML, good communication skills

Contact:

Andreas Bucher (IMRG)
bucher@ifi.uzh.ch

Interested in a project? Talk to representatives and form groups!

http://t.uzh.ch/yi

The slides will be uploaded tonight.

Good luck with your Master's Project!