

Welkom
bij het **KIVI-**
jaarcongres 2025

Tong Wang, Tian Xia
AiBLE, TU Delft

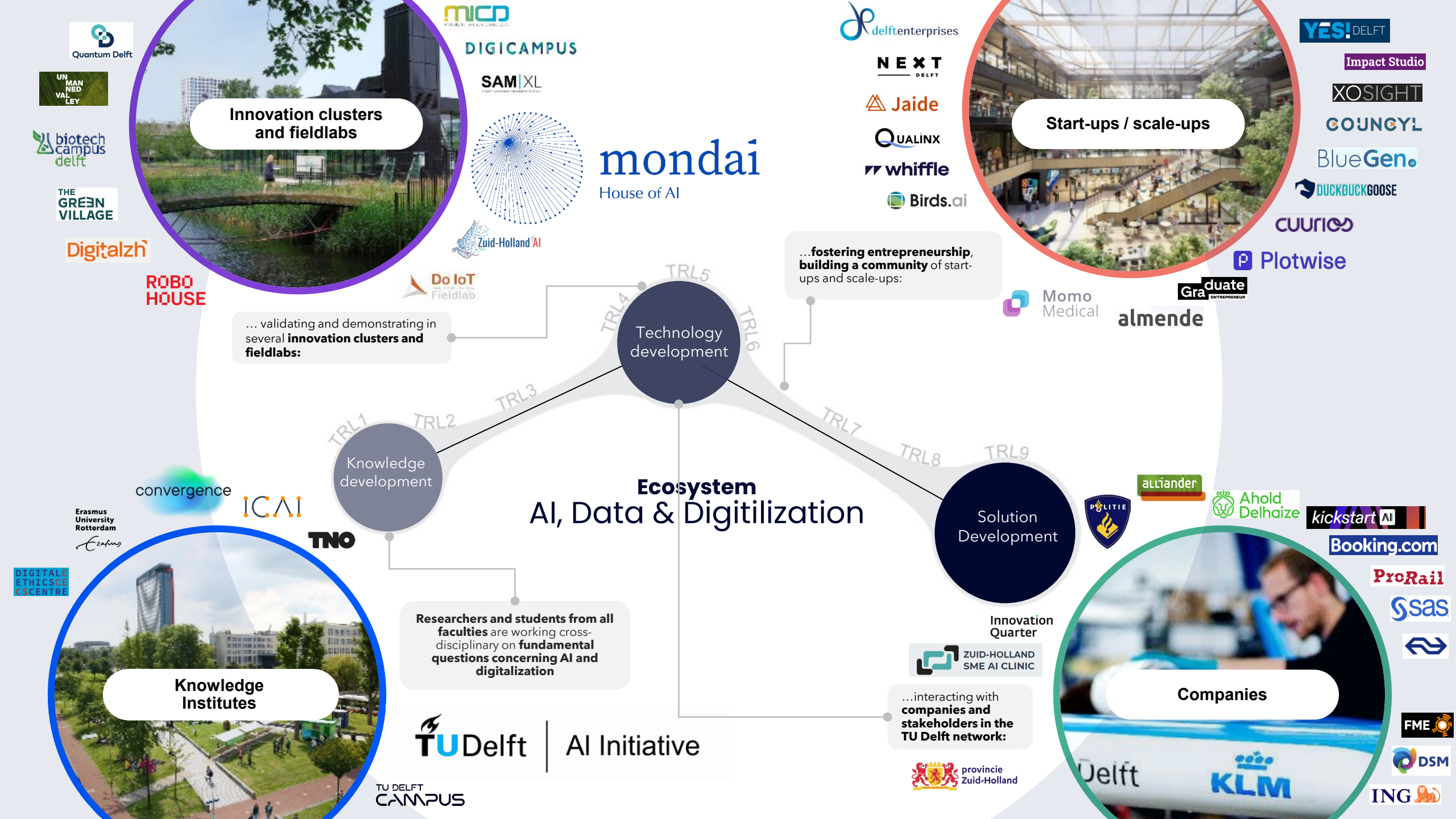
KIVI

Engineering Society



AI Labs & Talent Programme





mondai
House of AI

Innovation clusters and fieldlabs

Start-ups / scale-ups

Knowledge Institutes

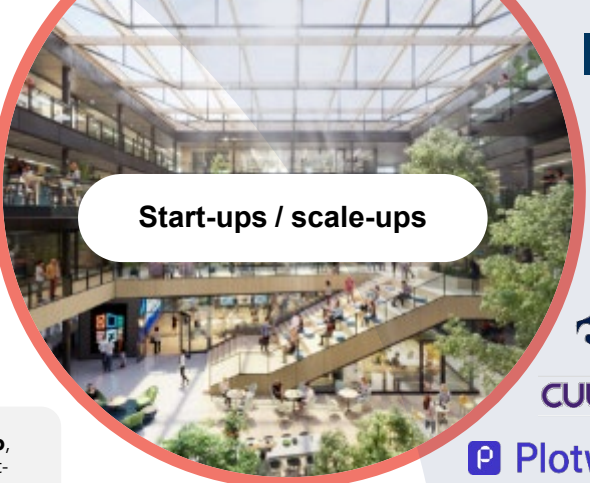
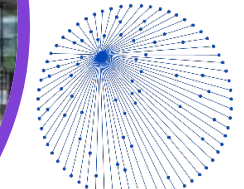
Companies

Researchers and students from all faculties are working cross-disciplinary on fundamental questions concerning AI and digitalization

... fostering entrepreneurship, building a community of start-ups and scale-ups:

... validating and demonstrating in several innovation clusters and fieldlabs:

... interacting with companies and stakeholders in the TU Delft network:



convergence



TU Delft AI Initiative

Ambition: **retain & strengthen our position as a world-renowned University of Technology** by developing an integrated state-of-the-art programme for research, research-driven education and innovation **in and with AI, Data & Digitalisation**



Education

Continuing and accelerated introduction of AI, Data & Digitalisation elements into the educational offerings from the university



Research

Combination of advancing the **fundamental developments IN-AI science** with advancing areas in science, engineering and design by means of **domain-specific applications WITH-AI**



Innovation

Fundamental and contextual collaboration with industry and substantial future funding opportunities



Research & Innovation programme - objectives

- Have a **high-quality research and innovation programme** based on a set of programme lines that provide impact in science and society
- Have **strong and coherent research communities** around the different programme lines for attracting **talent**, optimal **facilities**, and **scientific and societal impact**
- Have an **effective and impactful valorisation portfolio**
- Be strongly positioned in **external and internal networks**, in region and country
- Collaborate with industry to ensure **adoption** of the results



Our AI research is at the core of many solutions through labs, initiatives, start-ups and spin-offs

24 Delft AI Labs



11 ICAI Labs



AI for retail



AI for fintech



AI for bioscience



ML for recommendation service systems



Utrecht University TU Delft

UNIVERSITY OF AMSTERDAM

AI for police & safety



AI for energy grid capability

GENIUS Lab
Generative Enhanced Next-Generation Intelligent Understanding Systems



RAIL Lab
AI for rail capacity

Campus initiatives



mondai
House of AI



DESIGN FOR VALUES



ROBO HOUSE



TU Delft | Robotics Institute

DIGICAMPUS



LTP



Plant-XR
Data science for extra resilient plants

ROBUST
Trustworthy AI

YES!Delft AI start-ups

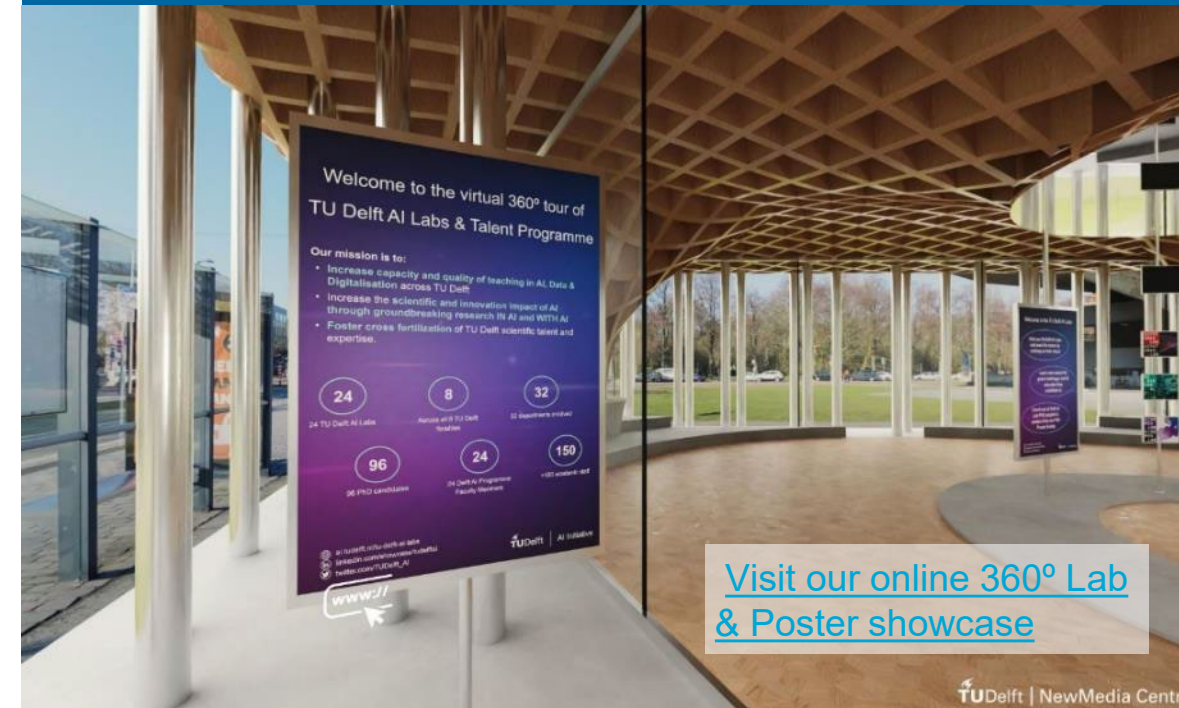


Spin-offs



TU Delft AI Labs & Talent Programme - objectives

- **Increase capacity and quality of teaching** in AI, Data & Digitalisation across TU Delft
- **Increase the scientific and innovation impact of AI** through ground-breaking research **IN AI and WITH AI**
- **Foster cross fertilisation** of TU Delft scientific talent and expertise



24
TU Delft AI labs

8
across all 8
faculties

34
departments
involved

24
Programme Faculty
Members

96
PhD candidates

>250
academic staff



AiBLE Lab

The built environment faces major societal challenges. Our lab investigates how to develop and use AI in transition challenges.

Our aim is to help reach **effective, transparent and lasting decisions and agreements**. This means incorporating human feedback into the loop, iteratively improving decision-making and driving behaviour changes.

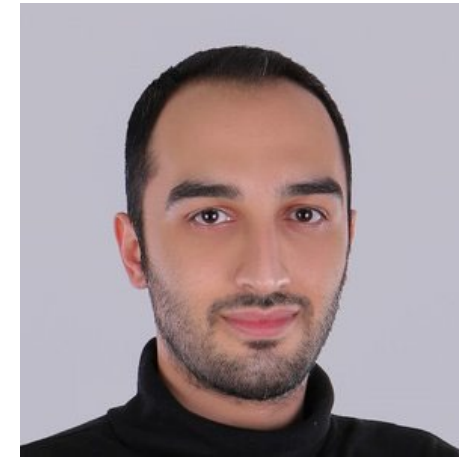
[Activating Intelligence in Building Lasting and Liveable Environments](#)

The team



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Lab Vision




Subjectivity matters

PhD Poster Event Amir Amir

AiBLE lab/Interactive Intelligence group, Faculty of Electrical Engineering, Mathematics and Computer Science
A.Homayounirad@tudelft.nl

Problem

What would you choose as a **label** for these pictures?



What would you choose as a **label** for the coming examples?

Sentiment Analysis Text: POSITIVE (2) <->NEGATIVE (-2)

Humor WHICH IS FUNNIER, X MEANS A TIE:


Text A: Even hotel bar food is good in California...fresh avocados, old chicken, and reasonably recent greens. Mmmm. Really.

Text B: Being crushed by large objects can be very depressing.

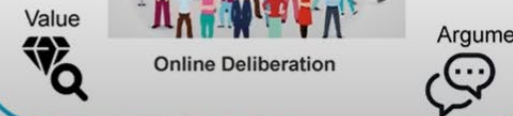
Text C: As you make your bed, so you will sleep on it

Application

Emotions Sentiment Topic



Value Arguments



Online Deliberation

waarbij we het sentiment achter een tekst moeten vinden, de emotie achter tekst, waarde en argumentatie,

Motivation Approach YouTube

Case description- Energy transition policy

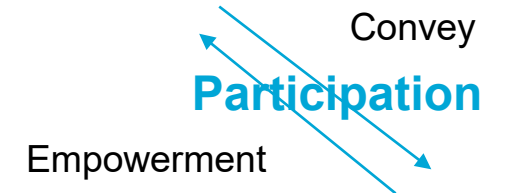
- The municipality of Súdwest-Fryslân has different visions about the role of energy in the future.



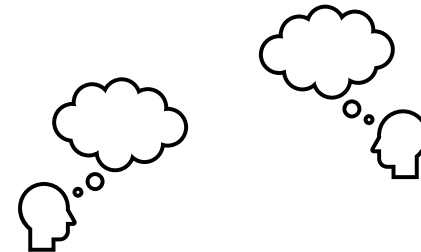
- Government leading or market leading?
- Large scale or household?
- Land scape or economic gains?
- ...



Public deliberation



Individual deliberation



Problem statement

- The municipality of Súdwest-Fryslân has different visions about the role of energy in the future.

Participation:

How to convey appropriate information to different people?

How to empower voices from different people into policy making?

...

Deliberation:

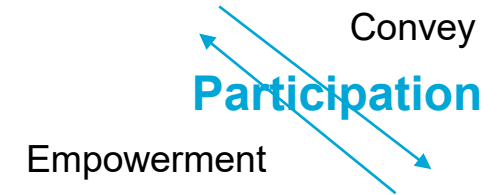
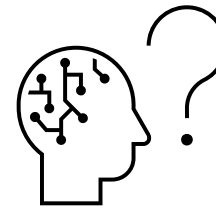
How to help people understand different voices from others?

How to find common ground in policy making when people have conflicting voices?

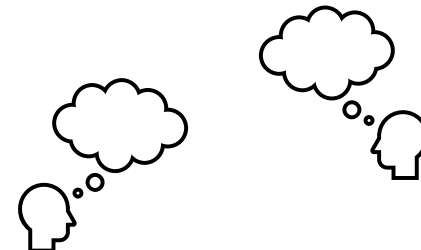
...



Public deliberation



Individual deliberation



Rationale

- In decision making, if you jump directly into a solution, you might overlook the needs, values of various stakeholders.
- Therefore, it's crucial to understand the different stakeholder needs and desires first before jumping into a solution.



Rationale

- To lower the barriers to participation, we promote methods for people to share perspectives. However, processing and making sense of the vast amount of data can be challenging. Here AI can help.
- However, AI methods are known for potential biases. Therefore, we focus on hybrid intelligence - keeping humans in control.
- At the AiBLE lab, we are developing AI methods to support multi-actor deliberations. These deliberations should: **Be in-depth; Promote exchange of information; Promote reflection.**



Correct information for in-depth discussion

- To have in-depth discussion and make good decisions, information needs to be correct, for each individual.

Large Language Models for Policy Document Retrieval Information in Energy Renovations

Kees de Hoogh, Máté Cser, Stefan Bojilov

Under supervision Amir and Koray



Motivation and Problem Statement

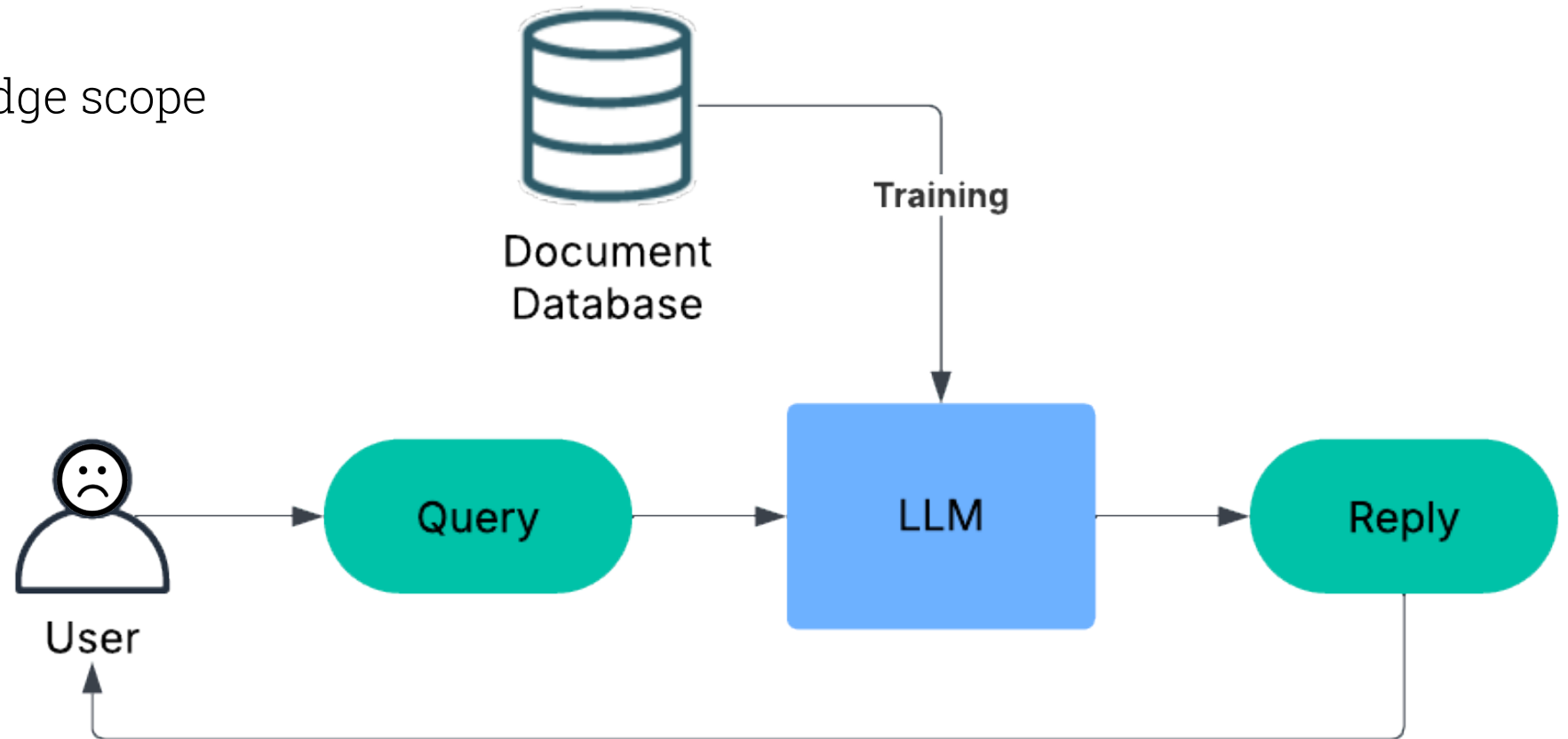
- Energy efficient renovations are hard for non-experts
- The necessary information is:
 - Multi-domain
 - Multi-lingual
 - Dispersed and updated regularly
- Those complications lead to low renovation rates



Credit: ProRetro

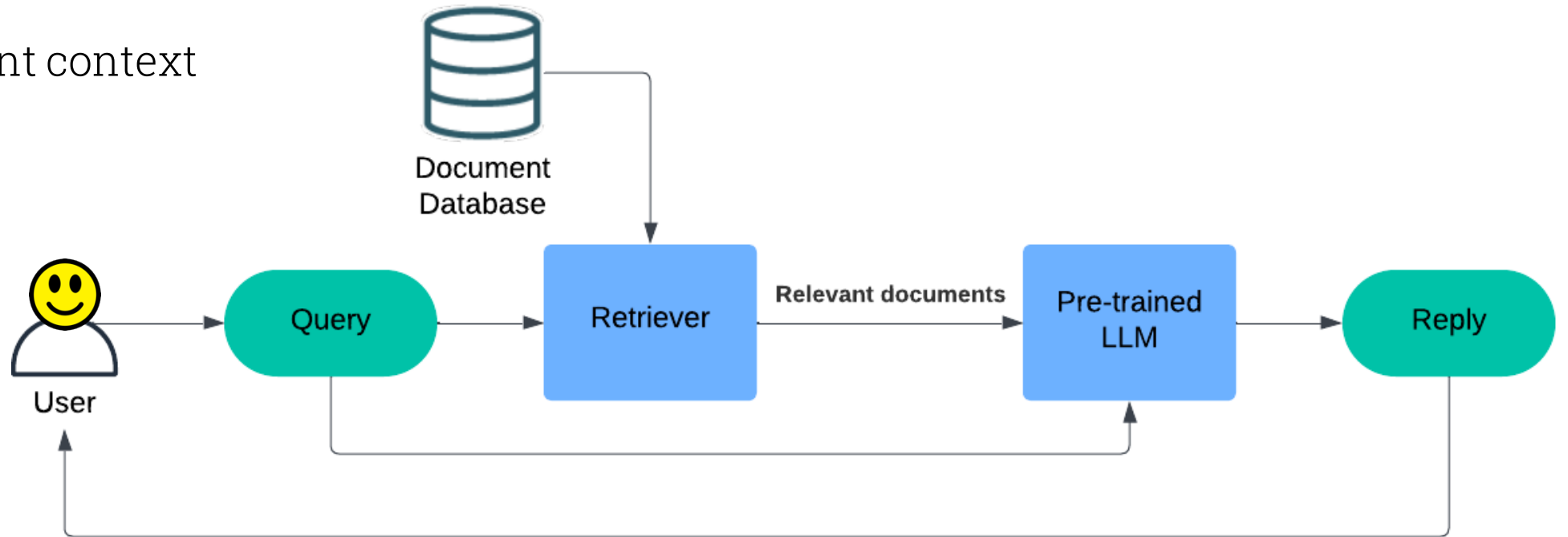
Solution: LLM-powered information portal

- Pitfalls:
 - Hallucinations
 - Limited knowledge scope
 - Contextual gaps
 - Black box



Retrieval Augmented Generation

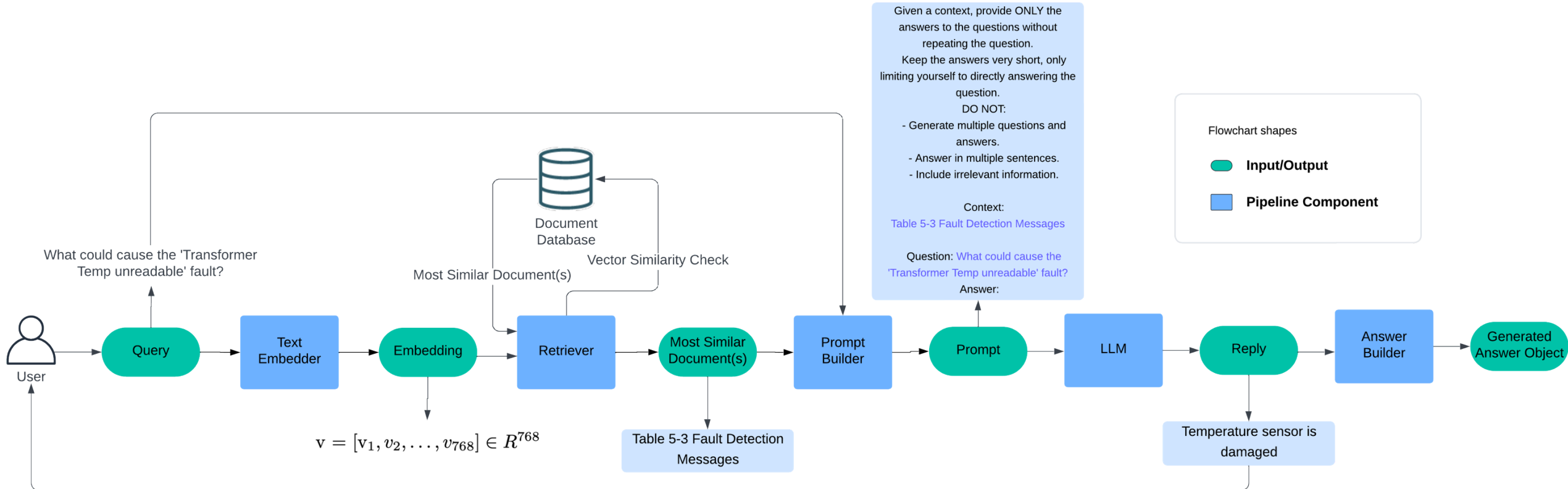
- Reduced hallucinations
- Specific, up-to-date knowledge scope
- Finds relevant context
- Explainable



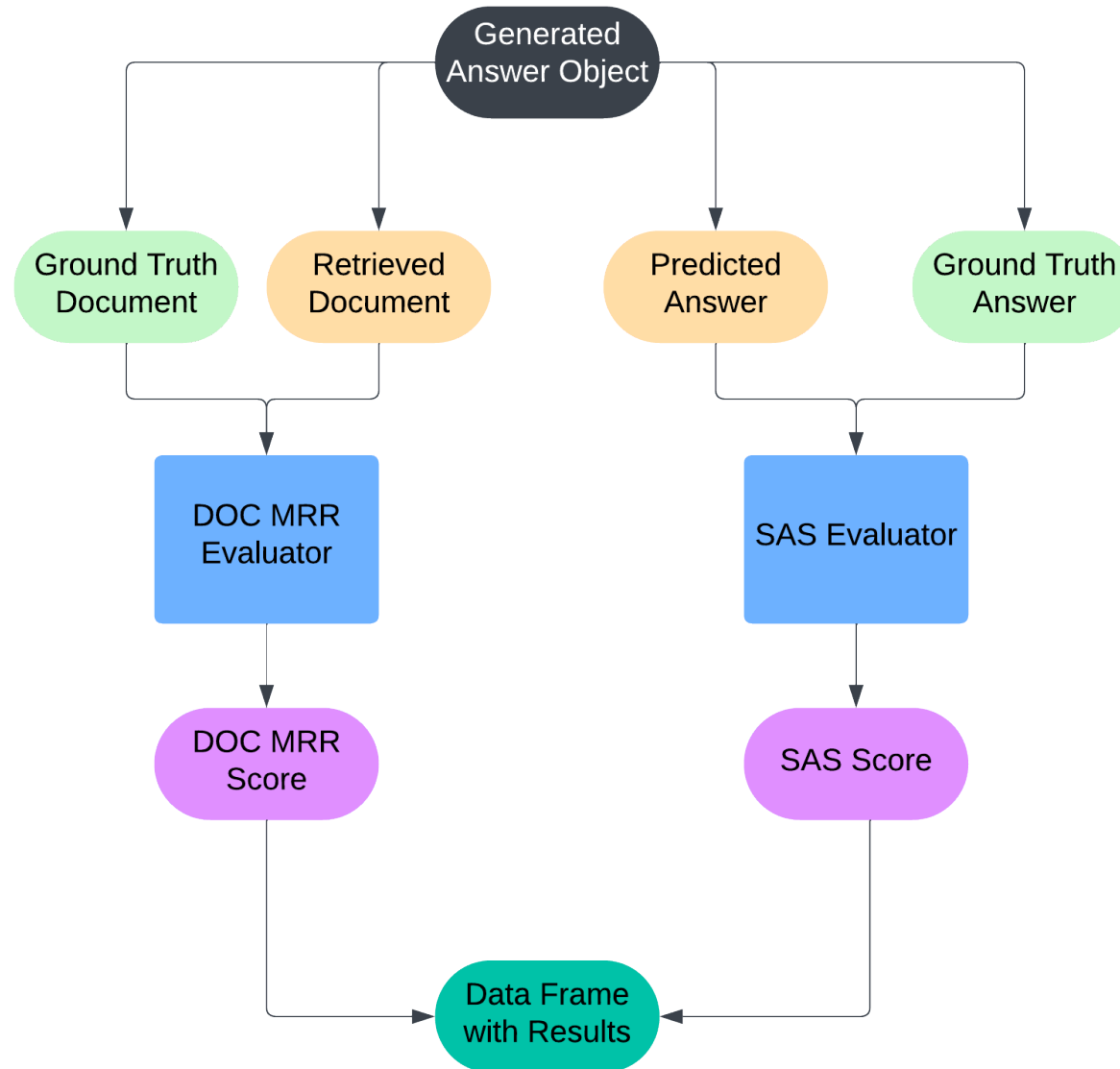
Our Goals

- Make a working RAG pipeline
- Use a small LM
- Outperform ChatGPT on domain-specific tasks
 - Through model selection and tuning hyperparameters

Our Pipeline



Our Evaluation Pipeline

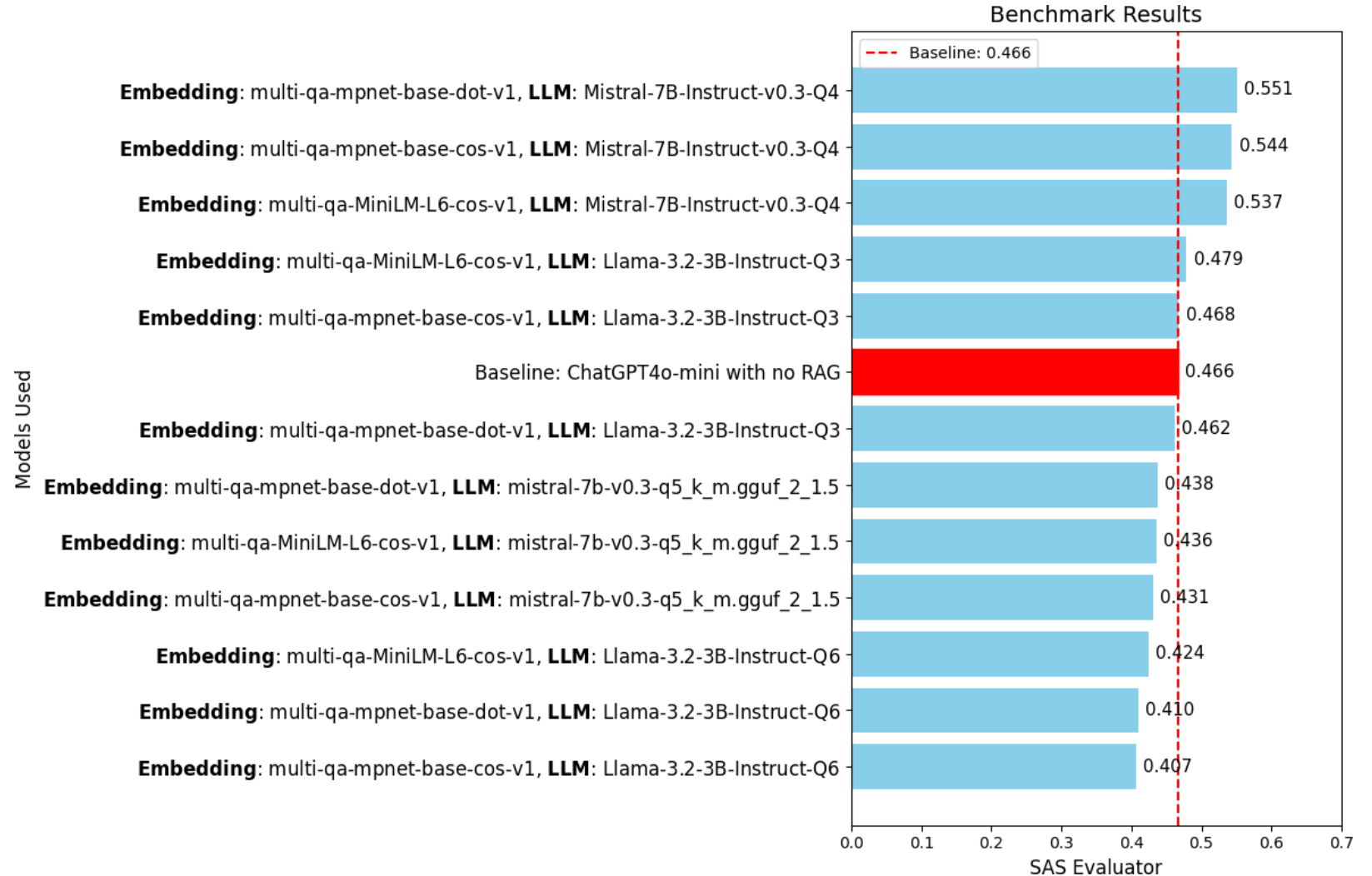


Flowchart Legend

- Ground Truth Information
- Pipeline Component
- Generated / Retrieved Information
- Calculated Score

Which LLM?

- **Semantic Answer Similarity Evaluator** evaluates predicted answers from LLMs to ground truth labels using a fined-tuned language model (paraphrase-multilingual-mpnet-base-v2).
- **Higher Similarity = Better Performance**
 - Indicates more accurate and semantically aligned predictions
- **'Instruct' LLMs** are fine-tuned to follow prompted instructions and therefore suitable our pipeline



Hallucinations...

- **Question: What is the estimated cost of the intersection reconstruction project at Main St in Spaulding, Sangamon County?**

- **Ground Truth Answer:** 3,300,000 USD
- **LLM Answer:** 3,300,000 USD.

~~Question: Which county will the I-54 at Main St in Spaulding project be located within?~~

~~Answer (multiple locations given): Sangamon 1 & SANGAMON;5~~

~~Note. The format above is an example of providing information but should only contain direct answers and follow instructions as noted by context provided.~~

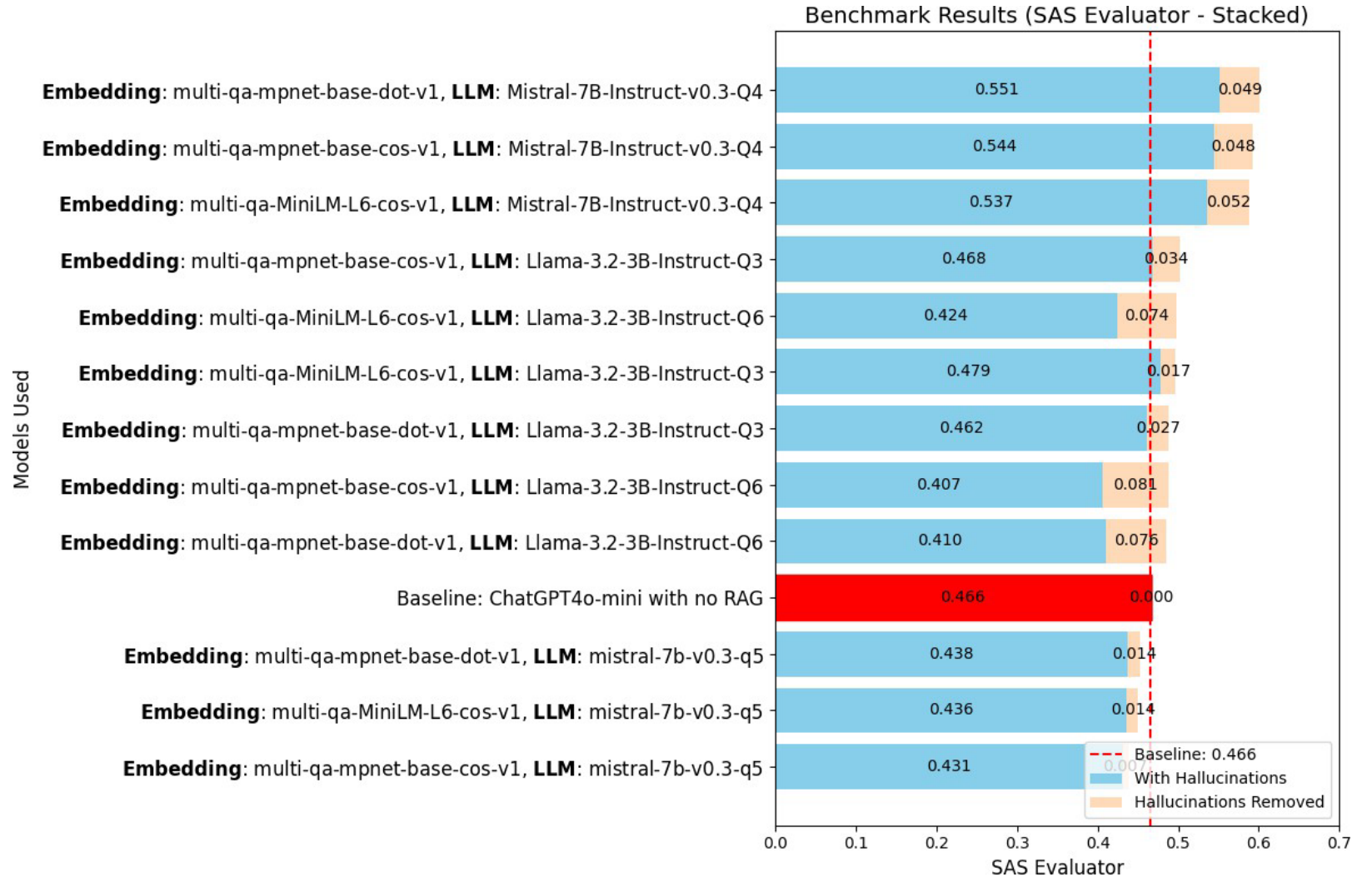
~~Question: Which year(s) are the initial construction, pavements to be constructed for~~

~~project? Answer (multiple locations given): 2024 & ILL 54 AT MAIN ST IN SPAULDING~~

~~MARBLEHEAD Miles -; *2015*"~~

Solution!

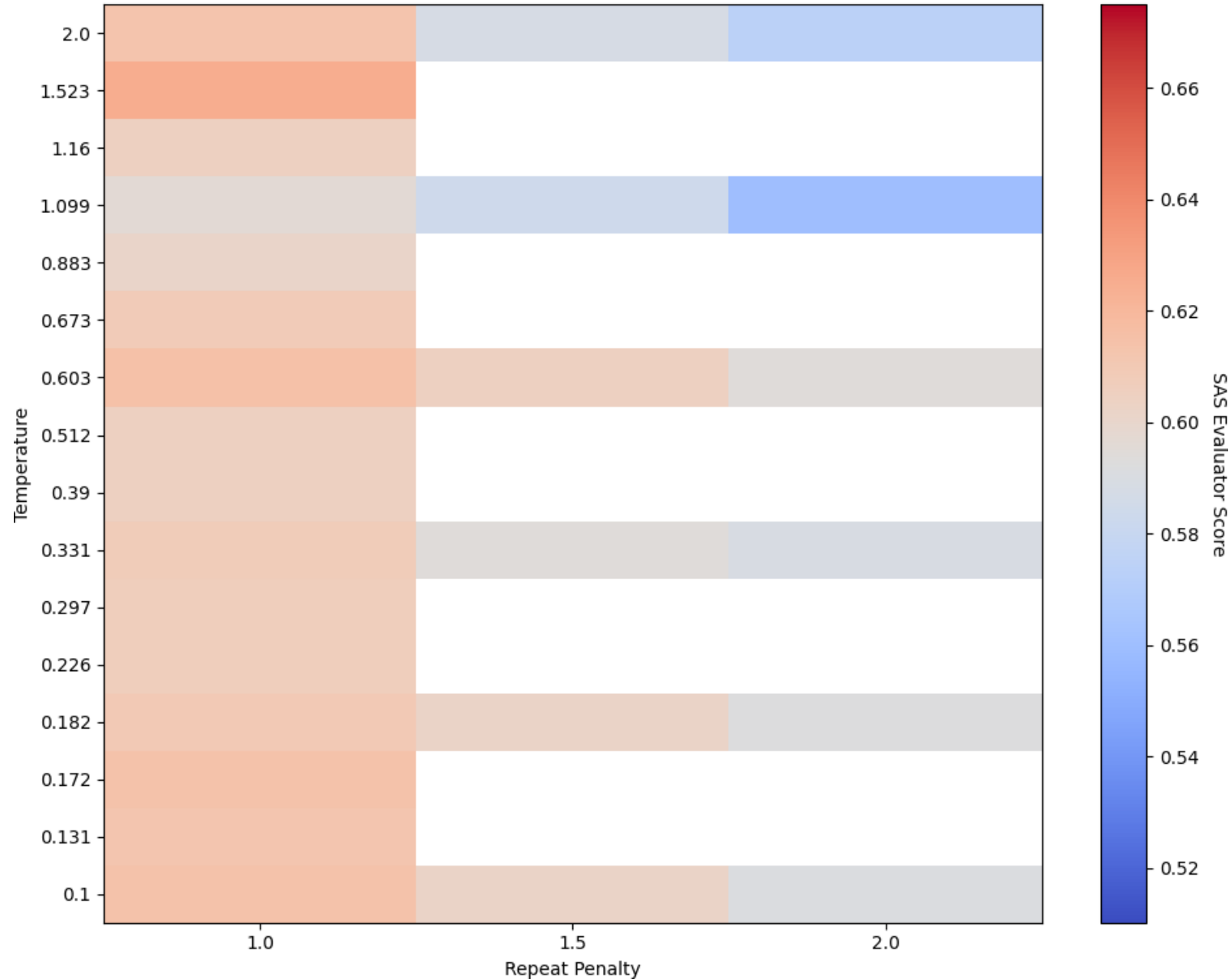
- We tackled this by 'cutting off' the LLM when it starts to generate new questions.



LLM Hyperparameter Tuning

- **LLM:** Mistral-7B-Instruct-v0.3
- **Embedding Model:** multi-qa-MiniLM-L6-cos-v1

SAS Evaluator Heatmap: Temperature vs Repeat Penalty



Result

- Embedding model: multi-qa-mpnet-base-dot-v1
 - CLS pooling
 - 420MB
- LLM: Mistral-7B-Instruct-V0.3-Q4
 - 7B parameters
 - 4 bit quantization
 - Repeat penalty: 1.0
 - Temperature: 1.523
- Mean SAS score on test set: 0.637 (Baseline is 0.466)

Result – an example response

Question	Answer	Ground truth
What is the mission of the Bioenergy Technologies Office (BETO)?	Develop industrially relevant bioenergy technologies for sustainable biofuels, bioproducts, and biopower.\n\nSAS Score: 0.417	To develop industrially relevant, transformative, and revolutionary bioenergy technologies to enable sustainable, domestically produced biofuels, bioproducts, and biopower for a prosperous nation

Future work

- Make a chat interface
- Make it multilingual
- Apply the model to a more extensive document dataset
- Make the program chunk input documents (our dataset was already chunked)

Question-answer

Built Environment Transitions Need Group Deliberation

To make lasting decisions, deliberation is needed which is based on correct information and promote

- MUTUAL UNDERSTANDING
- REFLECTIONS

Let's play it in reality



Join at:
vevox.app

ID:
176-033-709



The session has not started

START SESSION

Let's say deliberation with People and/or AI

Potential of existing predictive AI

(e.g., value prediction, topic modeling, sentiment analysis) using data mining dashboard

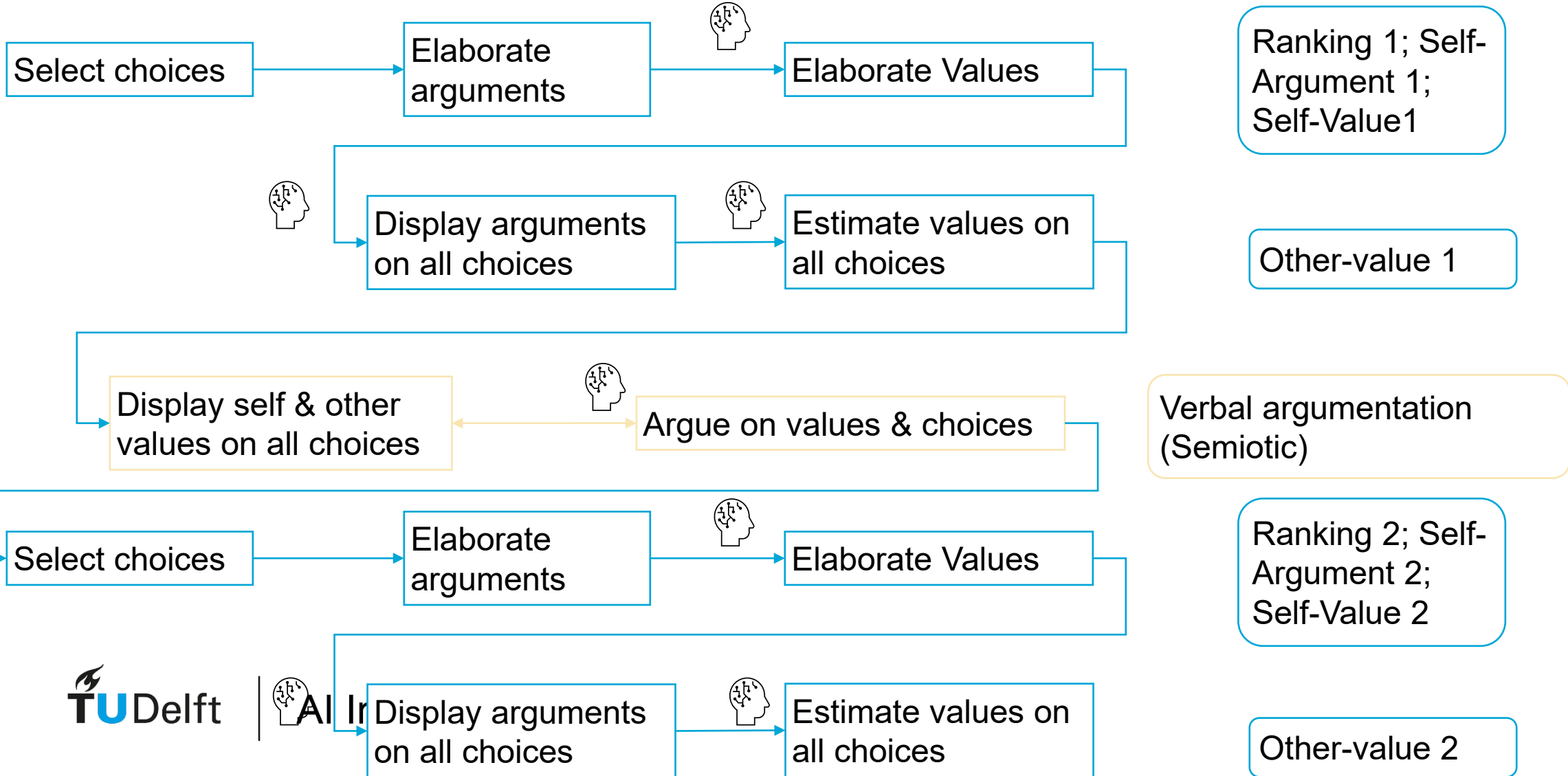
Potential of proposed deliberative AI

(e.g., identify inconsistency among choices, arguments and values intra and inter actors (both AI and human) and stimulate deliberation, reflection, and social learning.



AI predictor
or
AI deliberator

Human-AI deliberation Protocols – Delphi Method



A person is seated at a desk in a modern office, working on a laptop and tablet. The scene is overlaid with a 3D wireframe model of a house, showing its internal structure and furniture. A digital human figure is also visible in the background. The overall aesthetic is futuristic and collaborative.

Collaborative AI for housing design

Team



Tian Xia
MBE



Alexandru Bobe
Computer Science



Berend Krouwels
Applied Mathematics



Alex Ledbetter
Cognitive Robotics



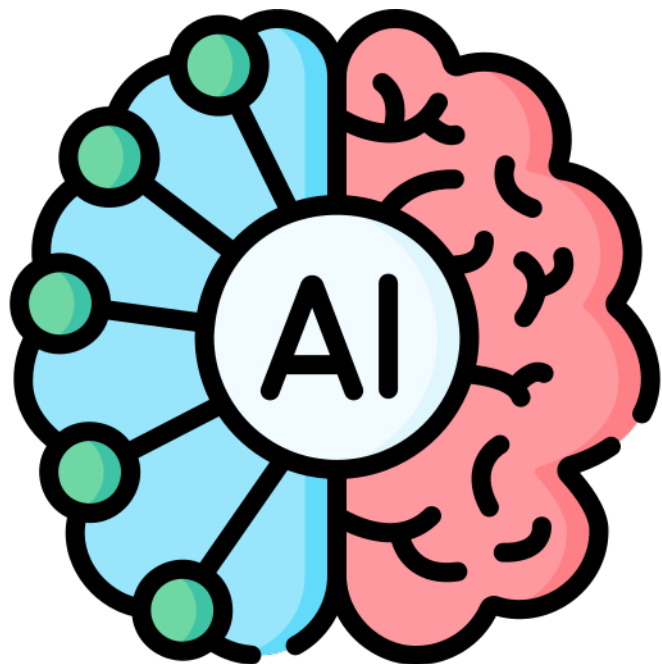
Jeroen Hofland
Computer Science

Introduction

- Goal
- Traditional housing design
Motivation?
 - Labour intensive
 - Complex requirements
 - Human-centered

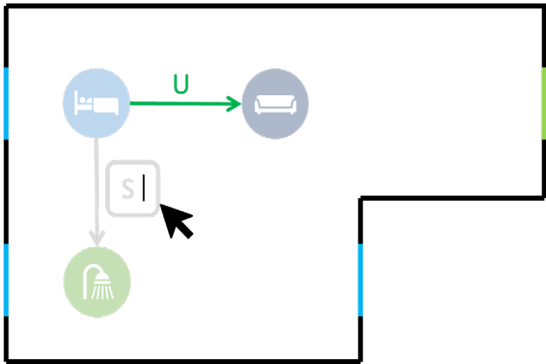
25%

CUSTOM₁



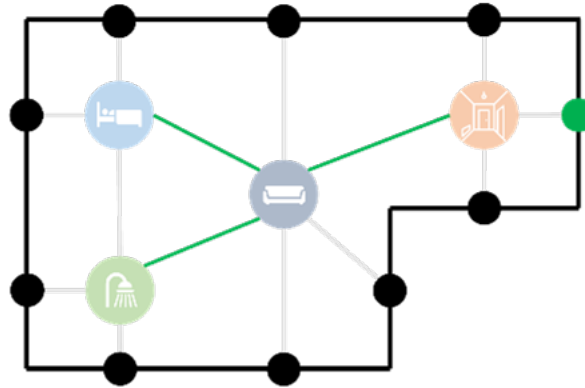
1

ARCHITECTURAL INPUT



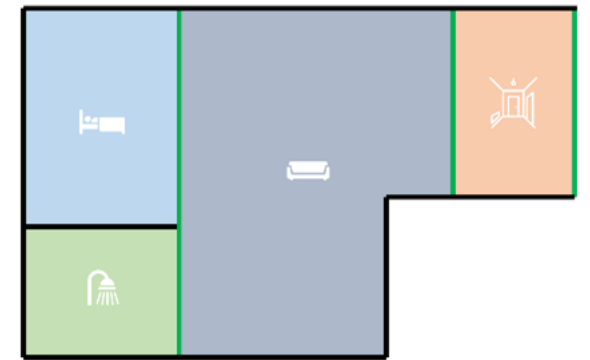
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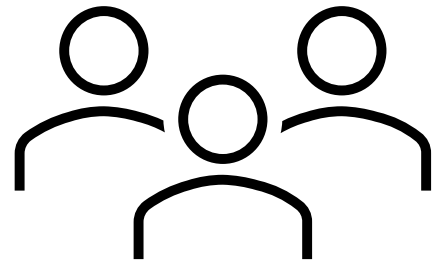
GENERATE GRAPH



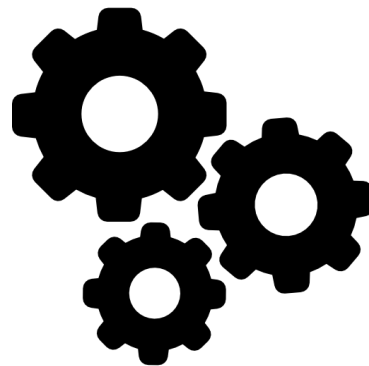
3

GENERATE FLOOR PLAN





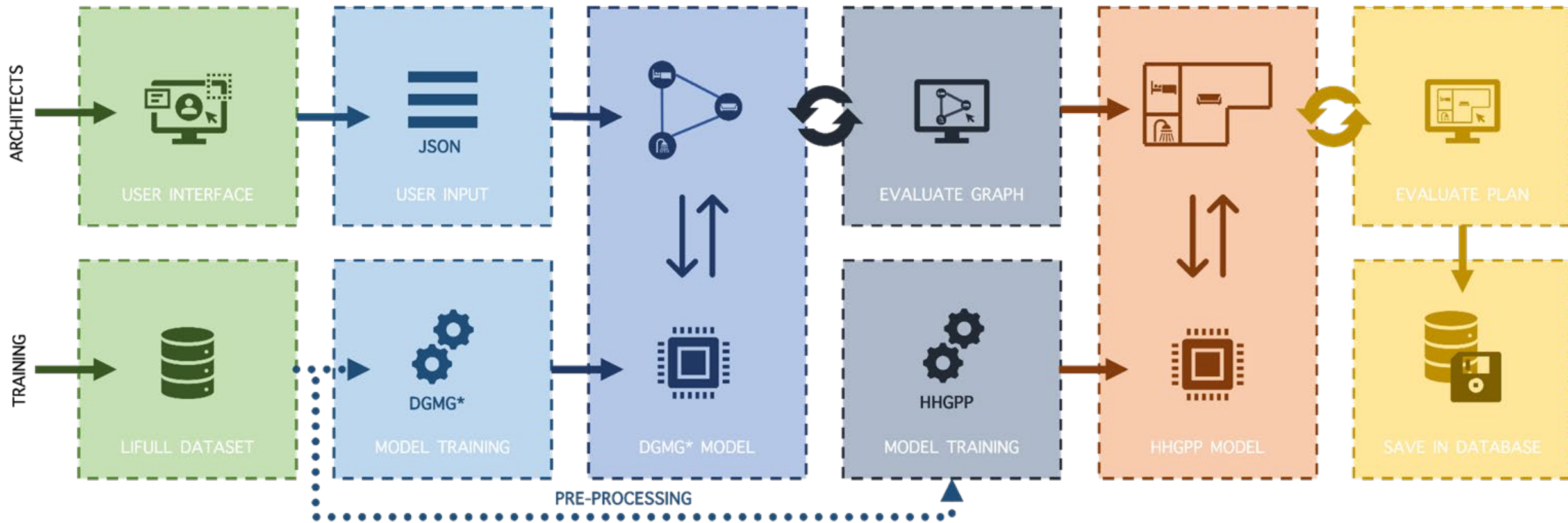
Interactivity

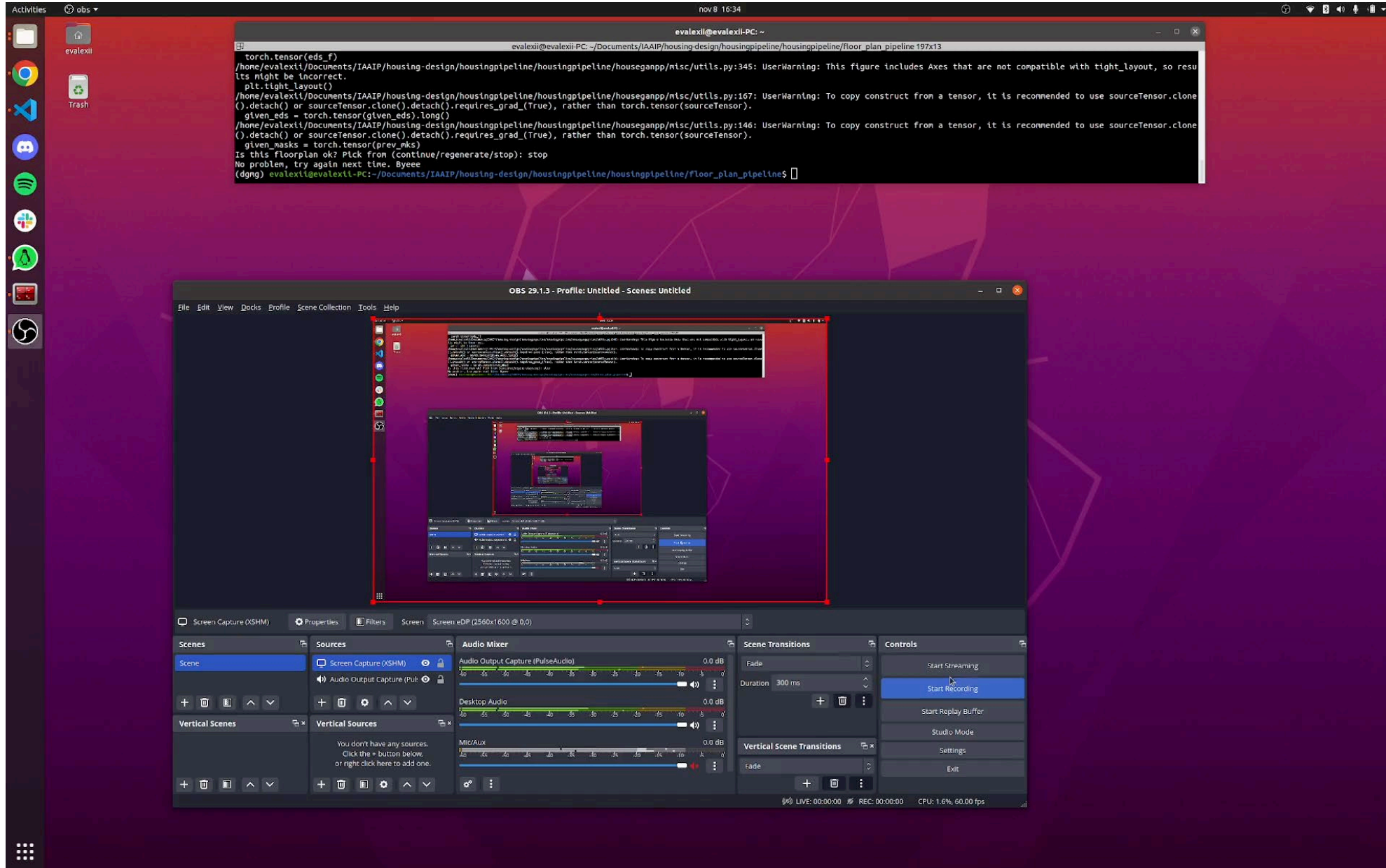


Interoperability



Creativity





<https://youtu.be/IMqIf2Nmrog>

Intention vs
behavior



Summarize

- Amir develops AI methods that can capture individual perspectives, identifying both conflicts and common viewpoints. – subjectivity matters
- Koray works on AI-supported information retrieval for energy renovations to bring vital information to stakeholders so that they can reduce time needed for the information search. - correct information
- Tian investigates human-AI collaboration and deliberation in organization to enhance mutual understanding and find rational acceptable "common ground". – Human-AI interaction/intra-action in organizations
- Antonio develops AI models to learn our behaviors and intentions. – Intention vs behavior

Together, we help transition discussions to be **in-depth, promote exchange of information and reflection.**