German
Research Center
for Artificial
Intelligence

Interactive and Explainable Machine Learning

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Artificial Intelligence (DFKI)

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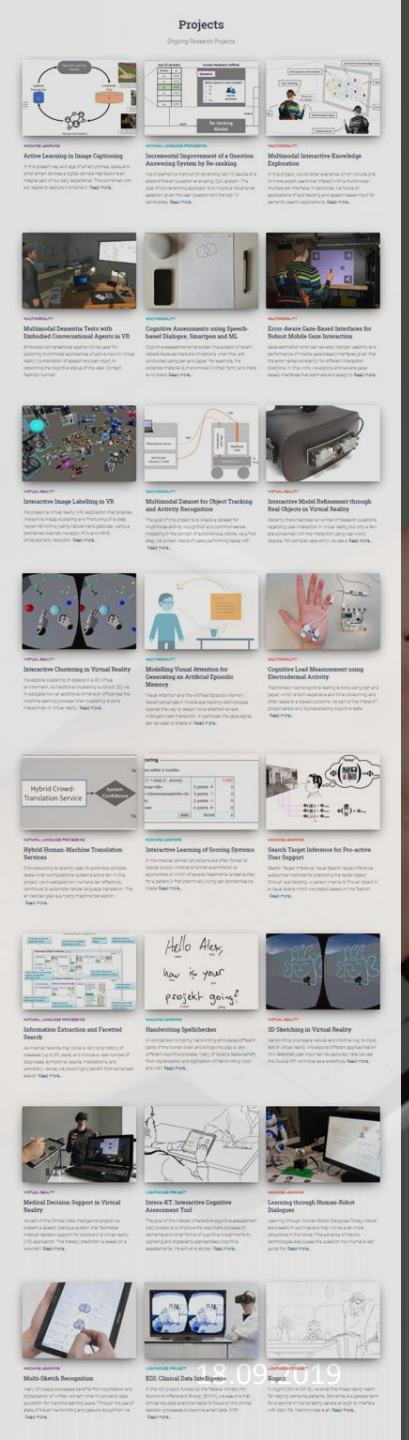

Interactive Machine Learning Lab

iml.dfki.de

NATURAL LANGUAGE PROCESSING

Incremental Improvement of a Question Answering System by Re-ranking

We implement a method for reranking top-10 results of a state-of-the-art question answering (QA) system. The goal of our reranking approach is to improve the answer selection given the user question and the top-10 candidates. We focus on improving deployed QA systems that do not allow retraining or when re-training Read more...

MULTIMODALITY

Multimodal Interactive Knowledge Exploration

In this project, we consider scenarios which include one or more expert users that interact with a multimodal/multisensor interface. In particular, we focus on applications of eye tracking and speech-based input for semantic search applications, e.g., interactive knowledge exploration. We aim at developing interaction techniques for individual modalities, combinations thereof Read more...

MULTIMODALITY

Error-Aware Gaze-Based Interfaces for Robust Mobile Gaze Interaction

Gaze estimation error can severely hamper usability and performance of mobile gaze-based interfaces given that the error varies persistently for different interaction positions. In this work, we explore error-aware gaze-based interfaces that estimate and adapt to gaze estimation error on-the-fly. We implement a sample error-aware user interface for gaze-based selection and Read more...

MULTIMODALITY

Modelling Visual Attention for Generating an Artificial Episodic Memory

Visual Attention and the Artificial Episodic Memory Recent advances in mobile eye tracking technologies expand the way to design novel attention-aware intelligent user interaction. In particular, the gaze signal can be used to create or improve artificial episodic memories for offline processing, but also real-time processing. We investigate different methods Read more...

NATURAL LANGUAGE PROCESSING

Hybrid Human-Machine Translation Services

Crowdsourcing is recently used to automate complex tasks when computational systems alone fail. In this project, we investigate how humans can effectively contribute to automate natural language translation. The envisioned goal is a hybrid machine translation service that incrementally adapts machine translation models to new domains by employing human computation to Read more...

MACHINE LEARNING

Search Target Inference for Pro-active User Support

Search Target Inference Visual Search target inference subsumes methods for predicting the target object through eye tracking. A person intents to find an object in a visual scene which we predict based on the fixation behavior. Knowing about the search target can improve intelligent user interaction. Introducing the Bag of Read more...

VIRTUAL REALITY

Medical Decision Support in Virtual Reality

As part of the Clinical Data Intelligence project we present a speech dialogue system that facilitates medical decision support for doctors in a virtual reality (VR) application. The therapy prediction is based on a recurrent neural network model that incorporates the examination history of patients. A central supervised patient database Read more...

MACHINE LEARNING

Learning through Human-Robot Dialogues

Learning through Human-Robot Dialogues Today, robots are present in our lives and they will be even more ubiquitous in the future. The advance of robotic technologies also poses the question how humans can guide the behavior of a robot and, in particular, how non-specialists can advise robots to learn new Read more...

Researcher

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PhD Student

SAARLAND UNIVERSITY

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People

Academic Research

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Mira Niemann
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Interactive machine learning in VR

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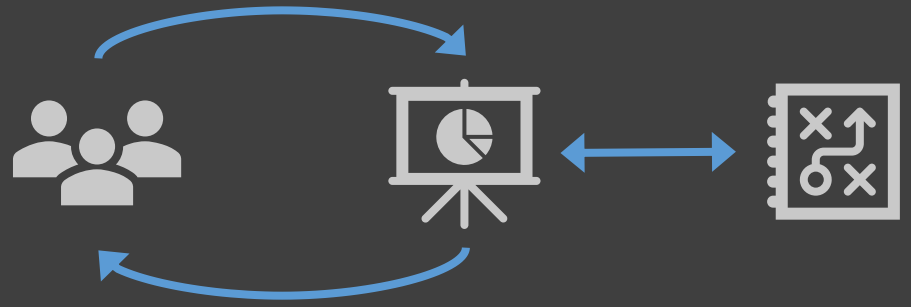
German Research Center for Artificial Intelligence

What is it and why is it important?

Interactive and Explainable Machine Learning

Interactive Machine Learning

Intelligent User Interface **Algorithms**

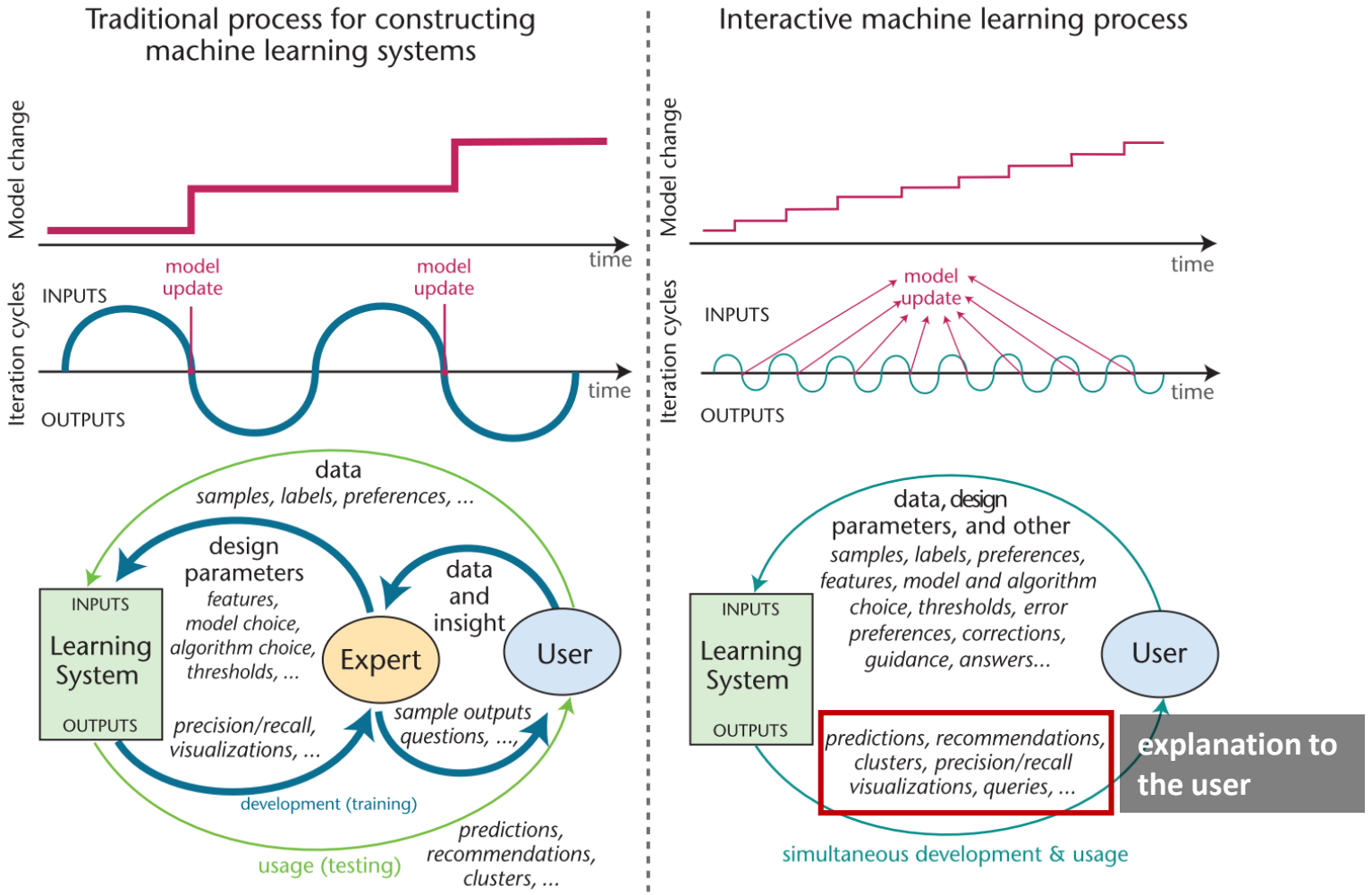


Interactive Machine Learning (IML) is the design and implementation of algorithms and intelligent user interface (IUI) frameworks that facilitate machine learning (ML) with the help of human interaction

Mixed Initiative Interaction

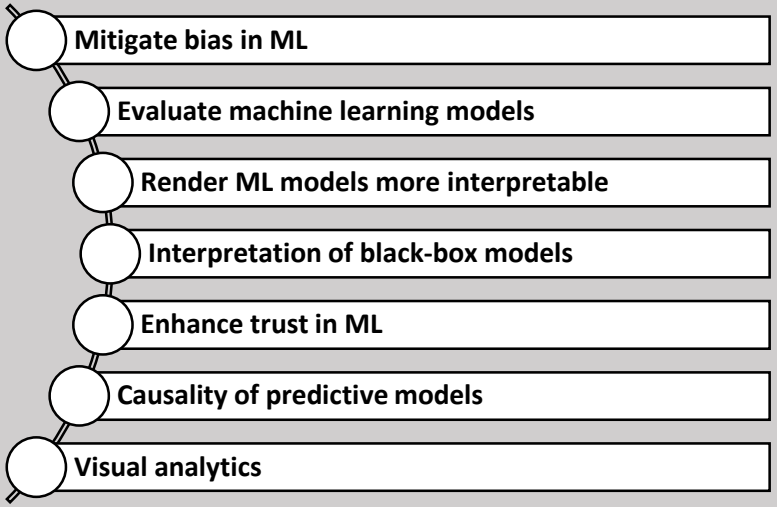
The ML system and the domain expert engage in a two-way dialogue.

Interactive Machine Learning



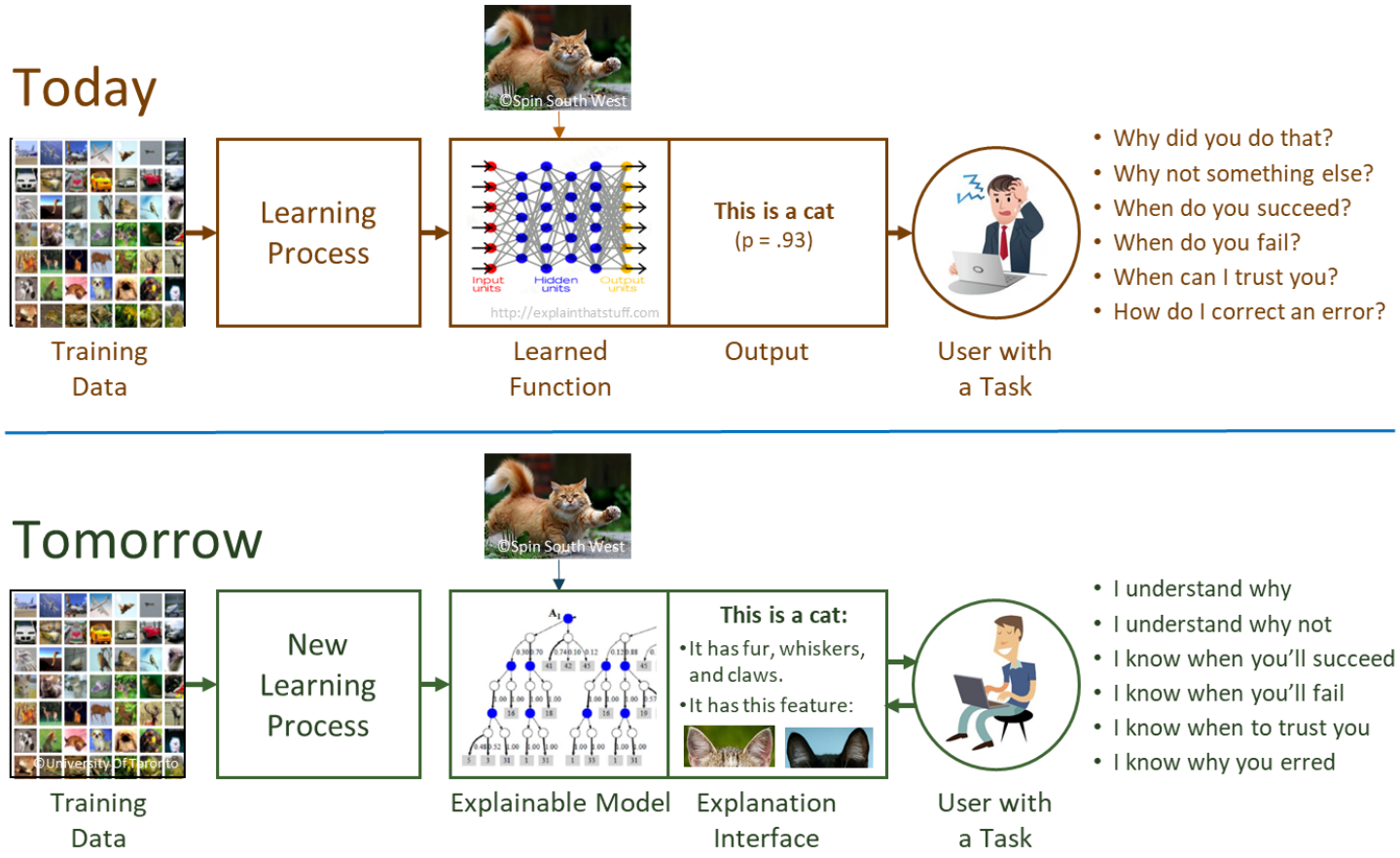
Amershi, S., Cakmak, M., Knox, W. B., & Kulesza, T. (2014). Power to the People: The Role of Humans in Interactive Machine Learning. *AI Magazine*, *35*(4), 105. https://doi.org/10.1609/aimag.v35i4.2513

Explainable Machine Learning

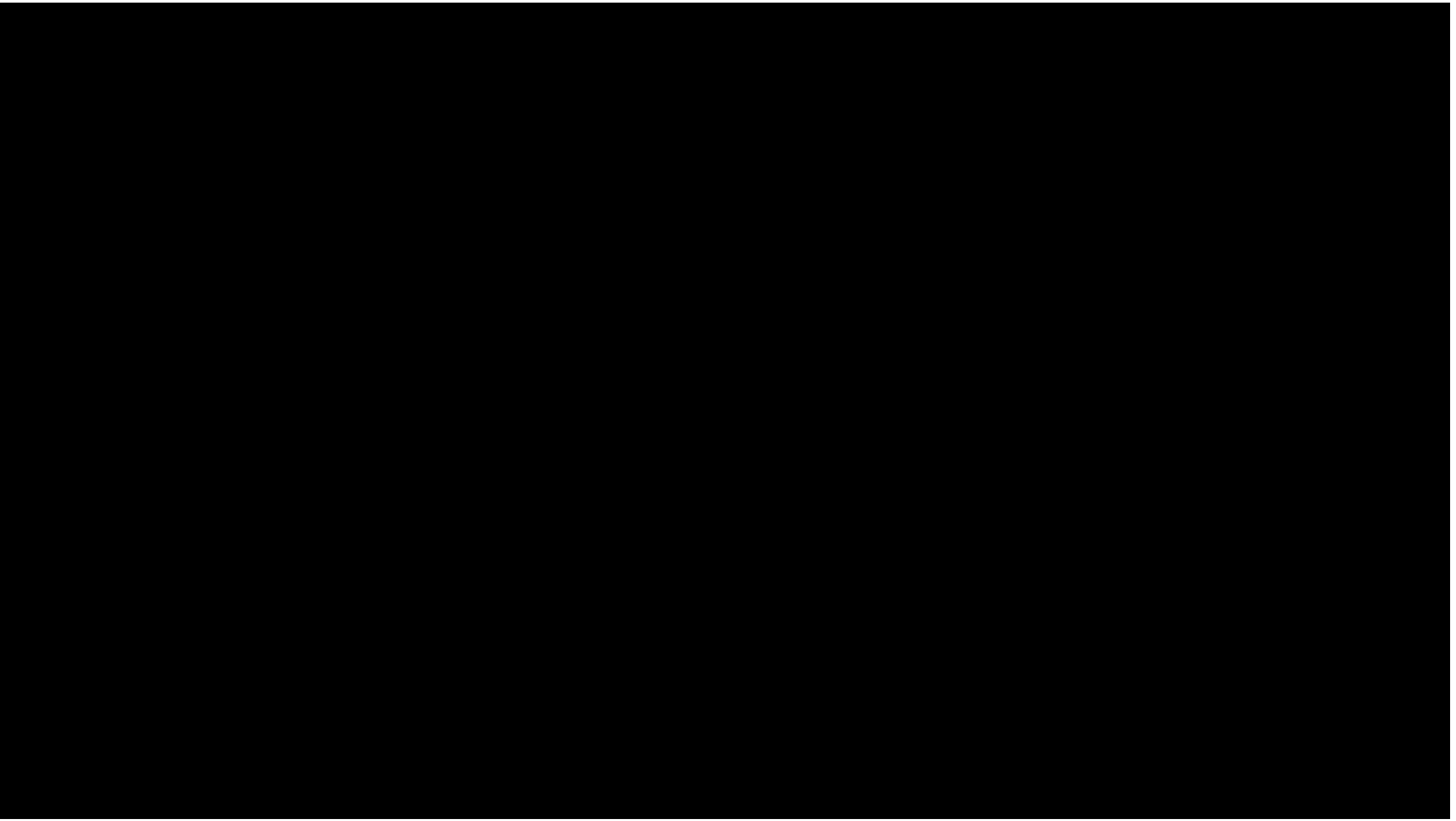


Explainable Machine Learning is a subfield of explainable artificial intelligence (XAI) which concerns transparency and human interpretability in machine learning (ML).

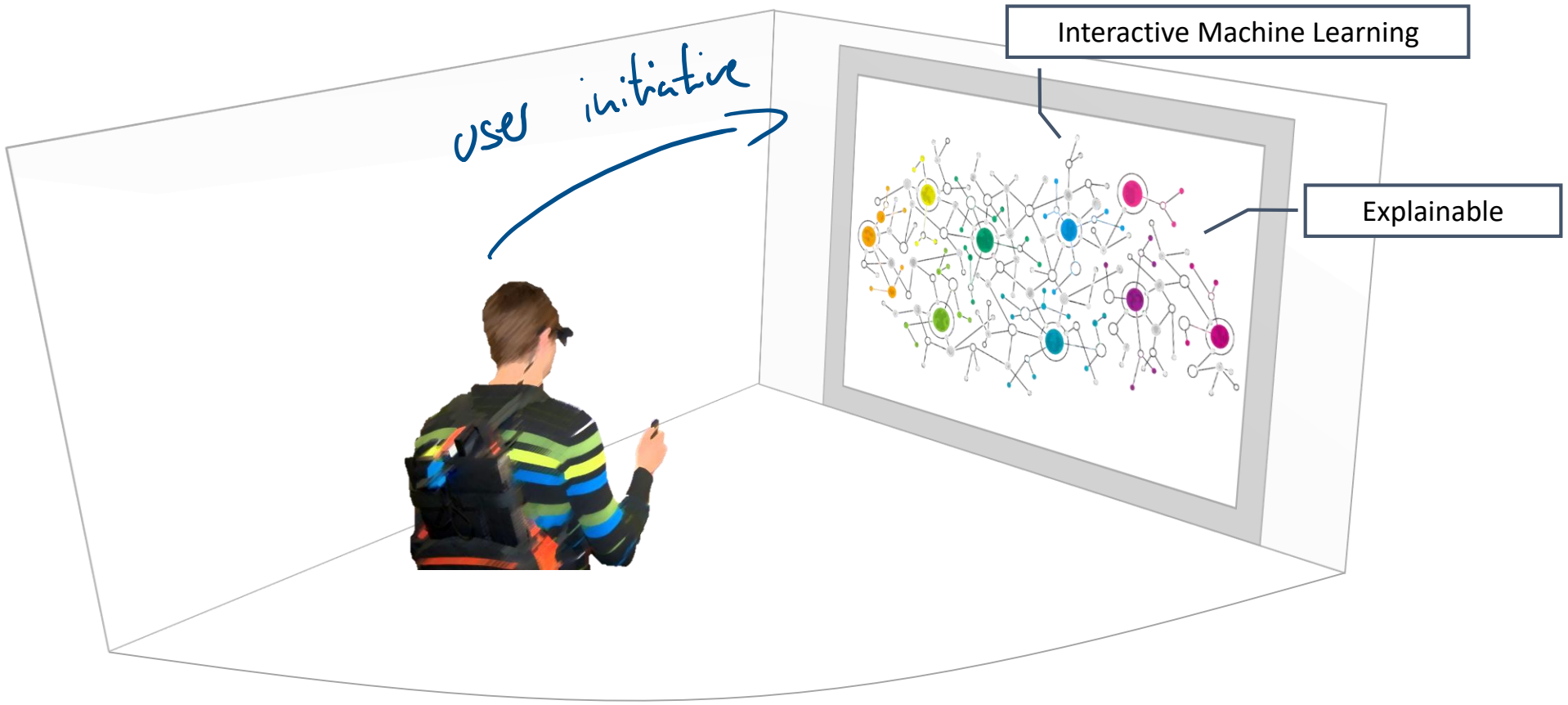
Explainable Machine Learning



Gunning, D., & Aha, D. (2019). DARPA's Explainable Artificial Intelligence (XAI) Program. AI Magazine, 40(2), 44–58. https://doi.org/10.1609/aimag.v40i2.2850

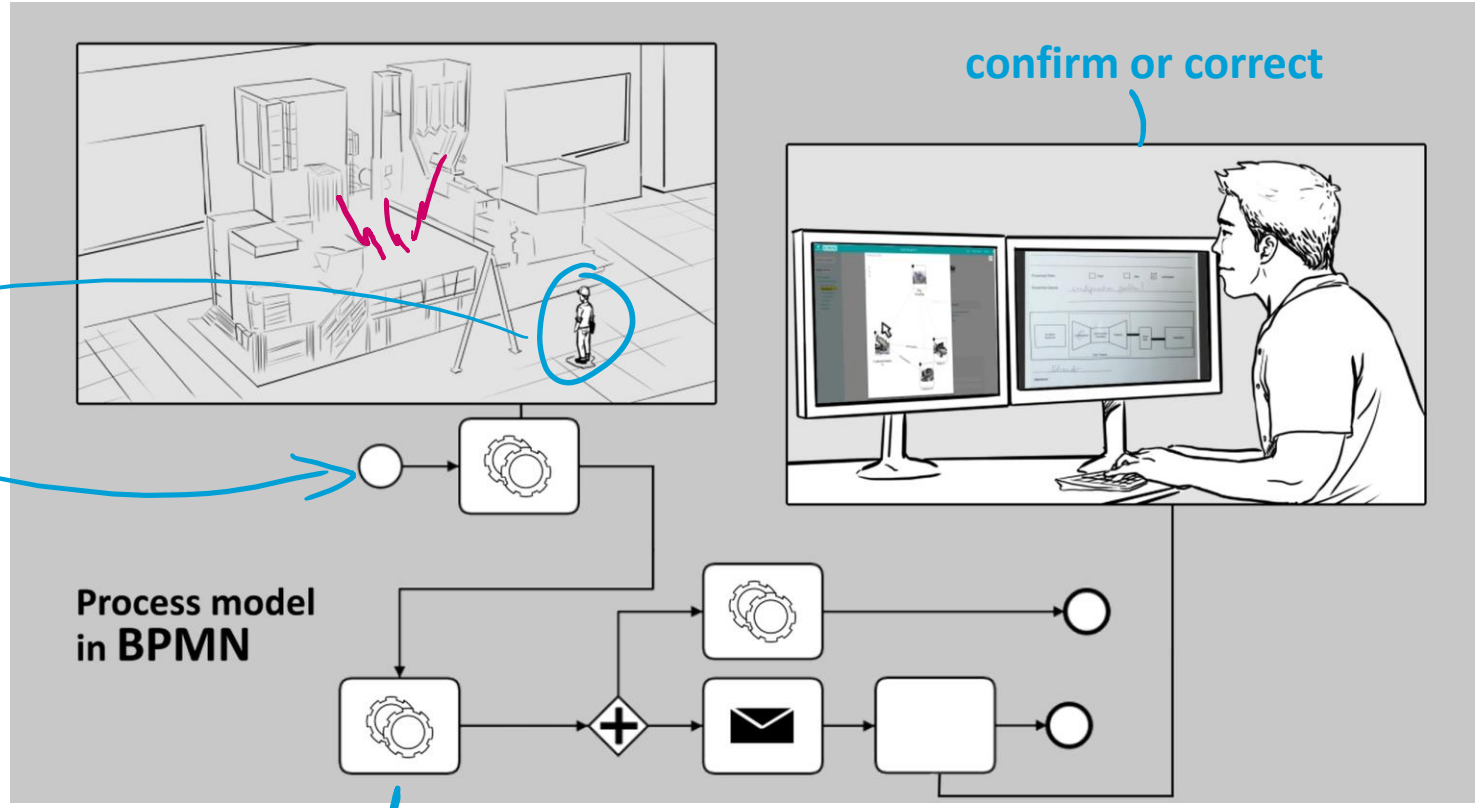


IML and XAI Systems: Application Sample 1

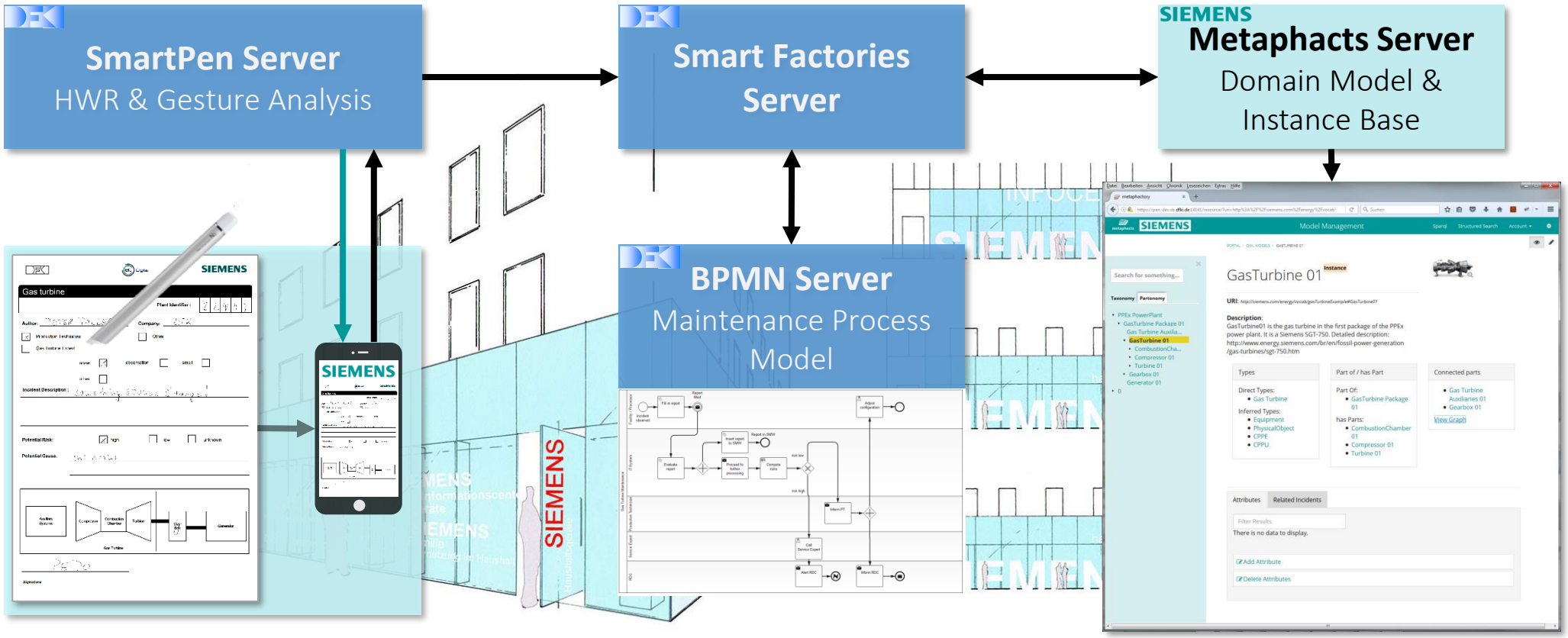


Interactive Report Analysis in Smart Factories

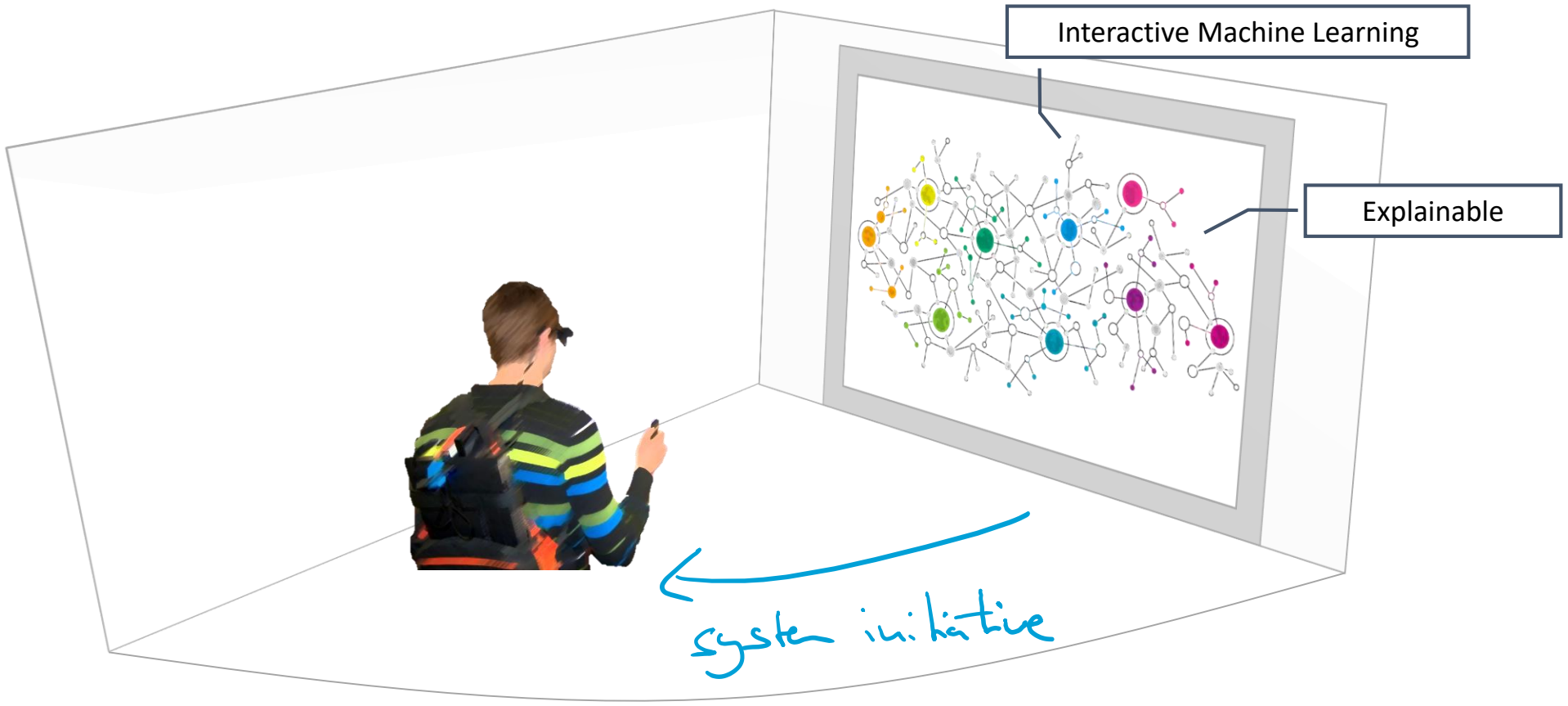
Barz, M., Poller, P., Schneider, M., Zillner, S., & Sonntag, D. (2017). Human-in-the-Loop Control Processes in Gas Turbine Maintenance. In V. Marík, W. Wahlster, T. I. Strasser, & P. Kadera (Eds.), Industrial Applications of Holonic and Multi-Agent Systems - 8th International Conference, HoloMAS 2017, Lyon, France, August 28-30, 2017, Proceedings (pp. 255–268). https://doi.org/10.1007/978-3-319-64635-0_19



Interactive Report Analysis in Smart Factories

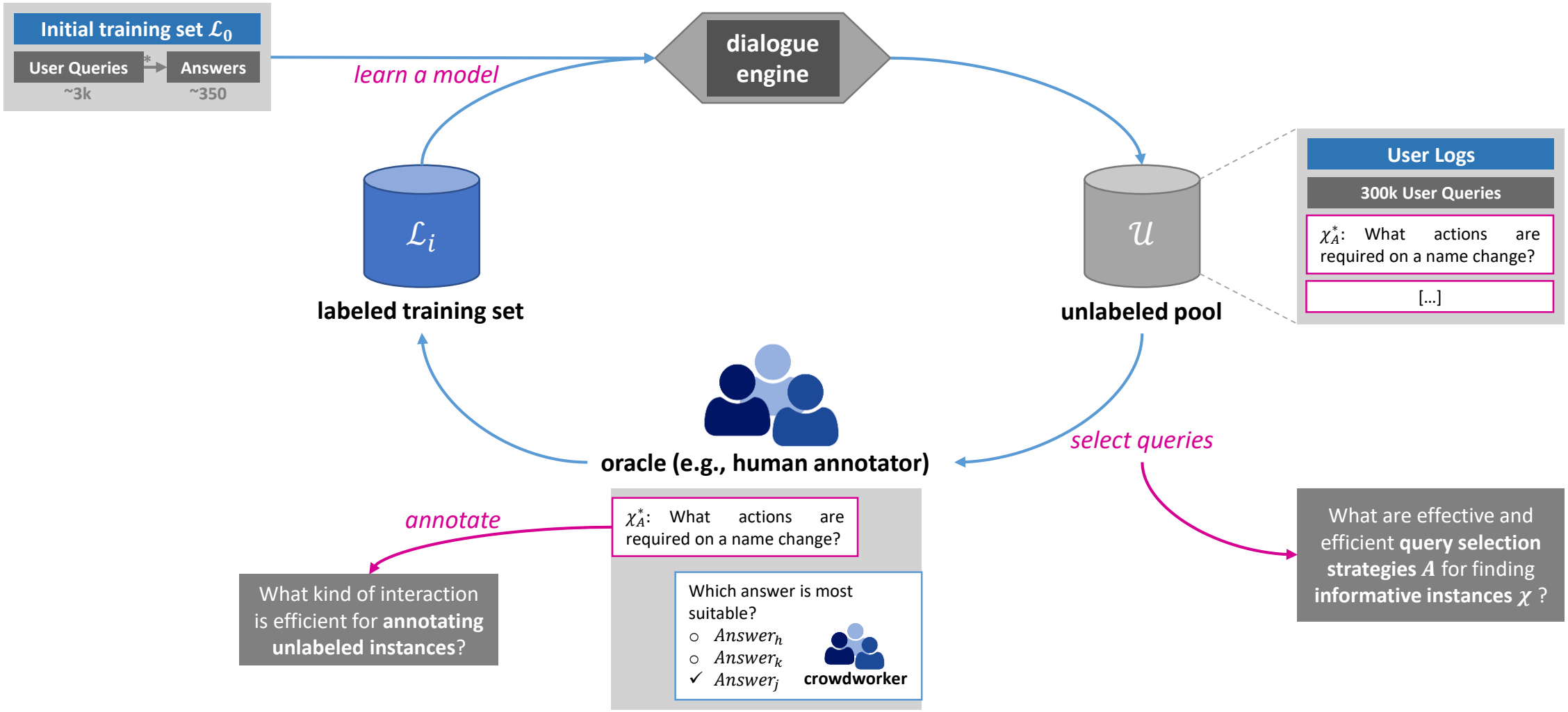


IML and XAI Systems: Application Sample 2

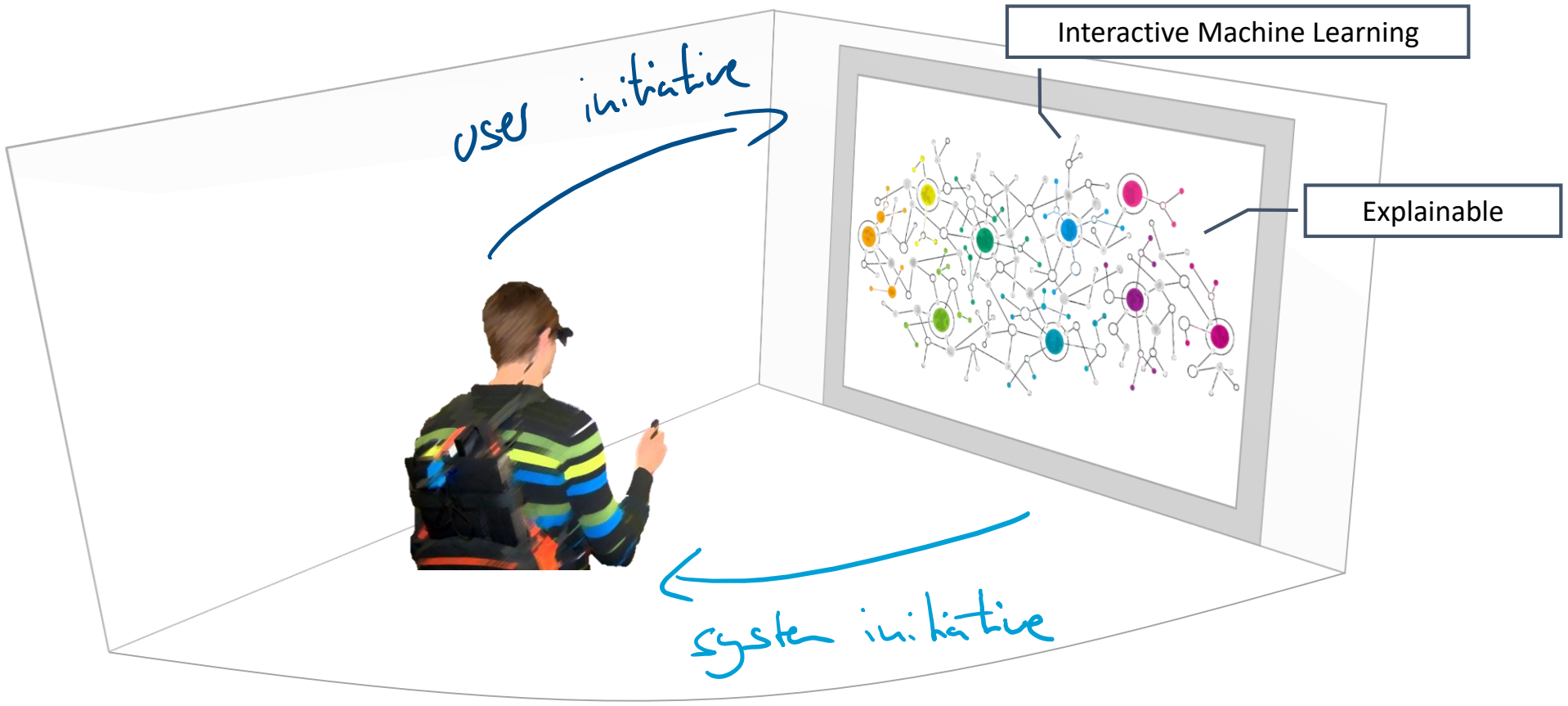


system initiative

Improve CRM Chatbot using Active Learning



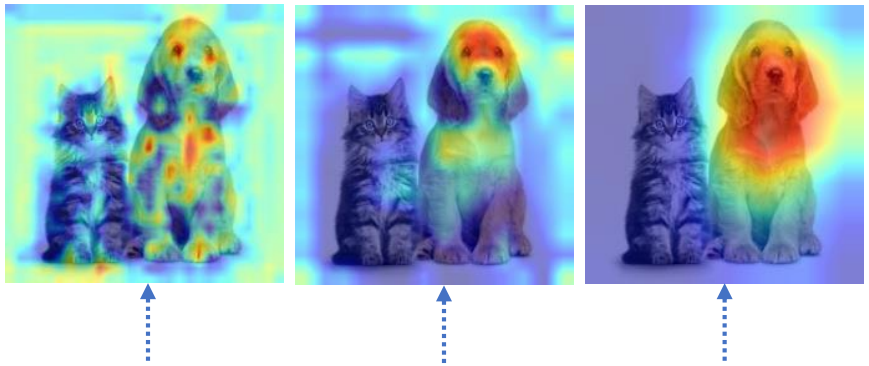
IML and XAI Systems: Application Sample 3



user initiative

"Why did you predict **dog**?"

visual explanations for **golden_retriever**



"Is it a **cat** or a **dog**?"

system initiative

Class	Probability
golden_retriever	0.334
cocker_spaniel	0.203
sussex_spaniel	0.132
tabby_cat	0.047
otterhound	0.041

dog

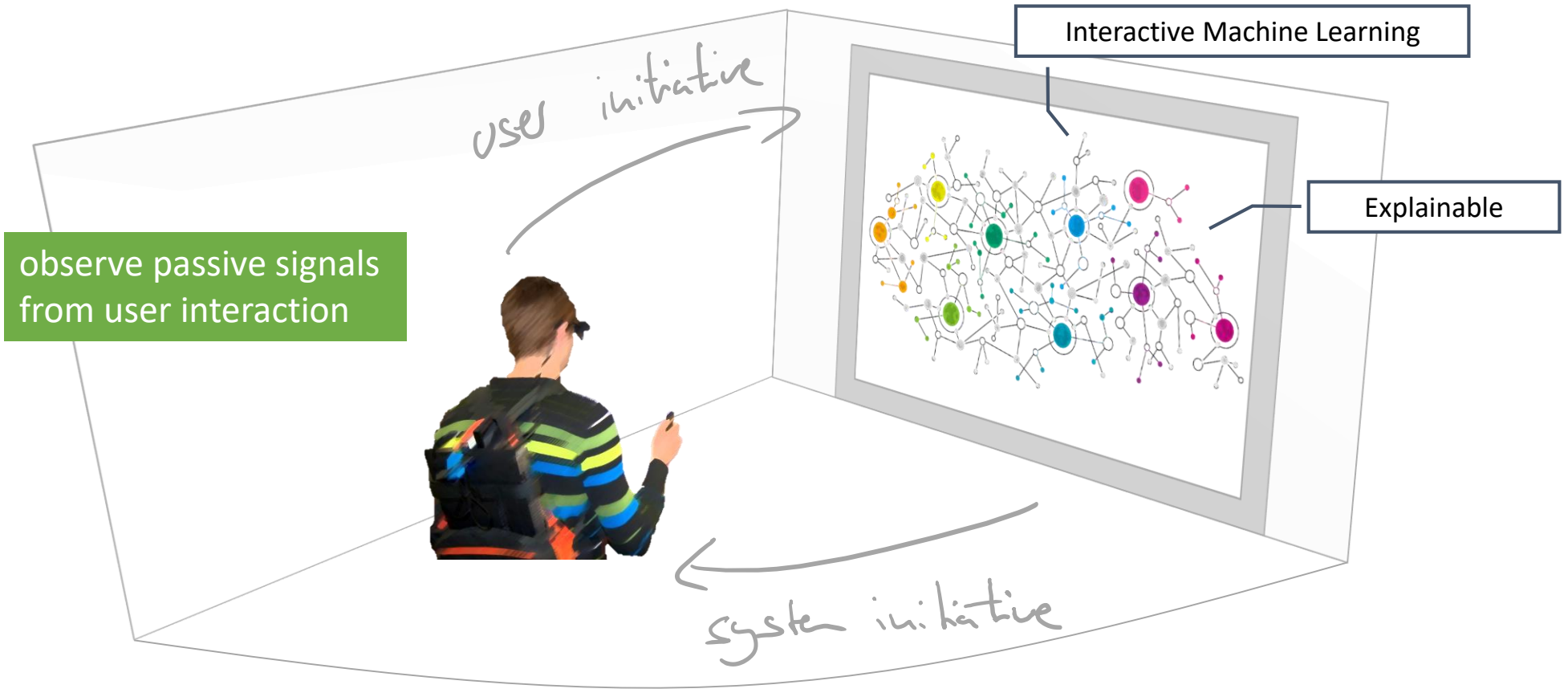
cat

visual explanations for **tabby_cat**

mixed initiative dialogue about the model

can be used to resolve uncertainties of the model about its outcomes and of the user about how the model works

IML and XAI Systems: Application Sample 4

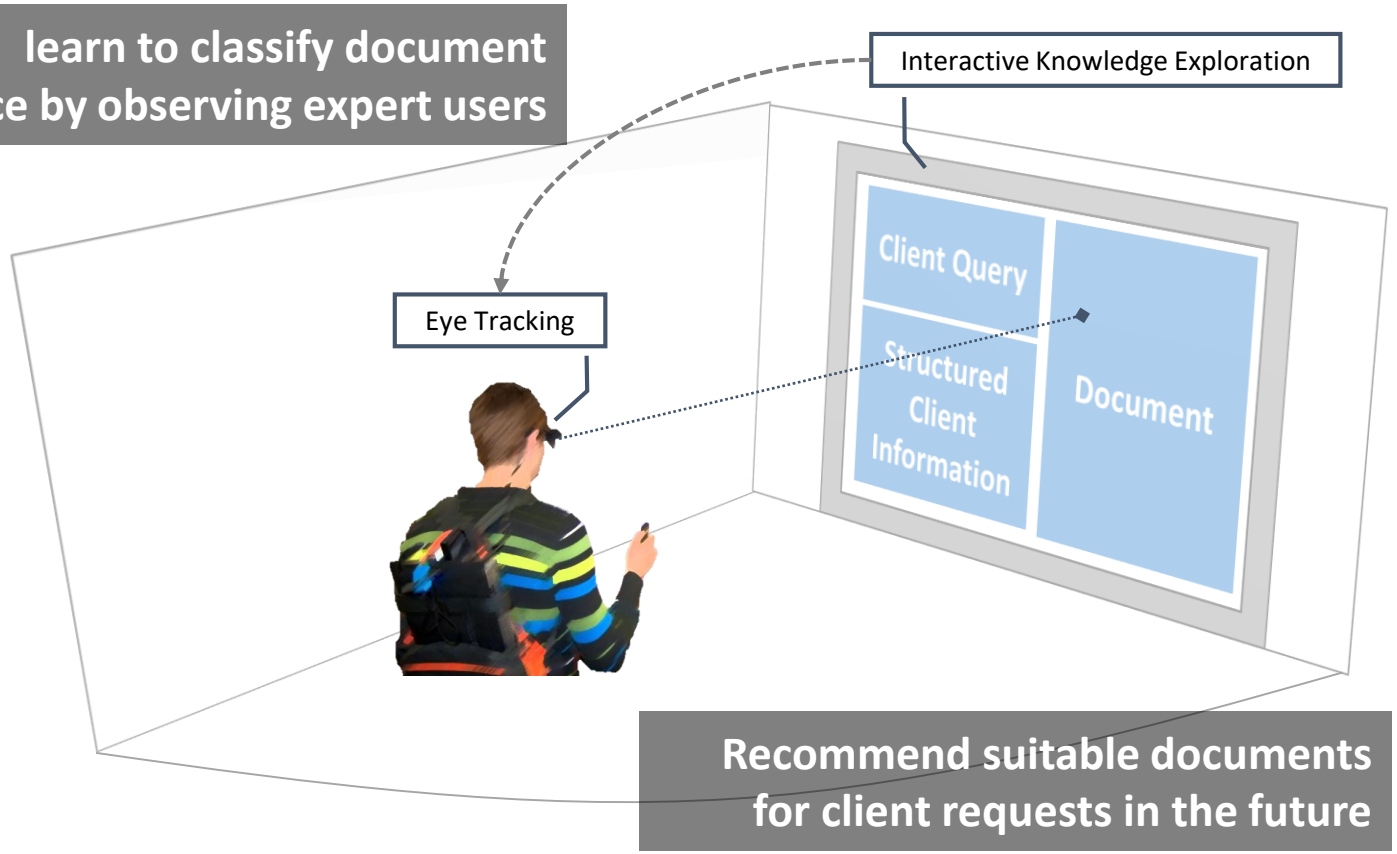


Passive collection of training data for document retrieval

Task | Answer Client Query

Which document is relevant?

Which additional information is relevant?



Summary

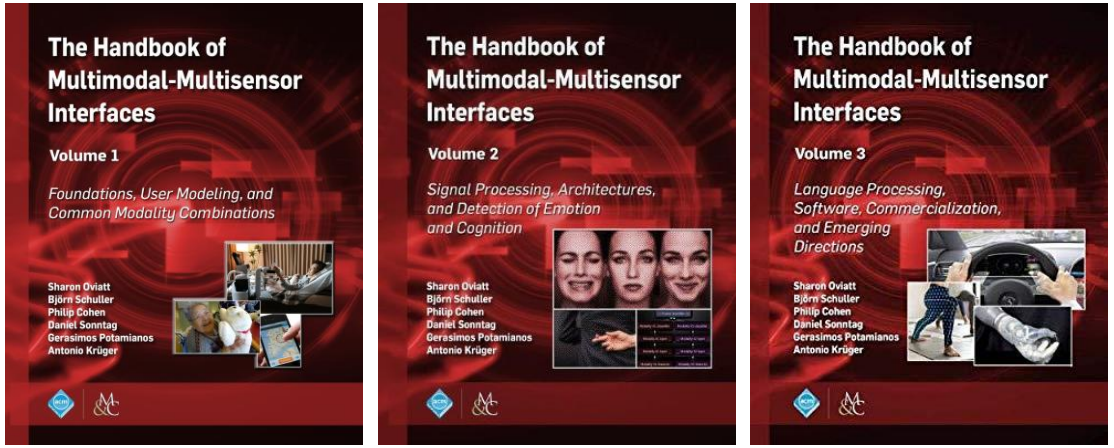
Take Away

In an IML / XAI system, the user and the system benefit from each other

- Mixed Initiative Interaction enables incremental learning and leads to more robust predictions.
- XAI improves transparency, trust and, thus, the interpretability of a model by the user.

Further Reading

ACM book series on multimodal interfaces and machine learning.



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Thanks for your Attention!

Questions?

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