

INSAIGHT

AI-based Data Analysis for Knowledge Discovery in Metallurgical Processes



Pro²Future

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MOTIVATION & GOALS

Industrial production processes generate large volumes of multivariate sensor data. Identifying similar historical process situations can support **root-cause analysis**, **anomaly investigation**, and **process optimization**. The **Subsequence Search Toolbox** enables operators to search large sensor datasets for patterns similar to a selected reference sequence through an intuitive visual analytics interface. Hence, the goals for this project are:

- Enable efficient **search for similar process events** in industrial time series.
- Support domain experts through **interactive and explainable analytics**.
- Compare and evaluate different similarity concepts for sensor data.
- Facilitate **knowledge discovery** and data-driven decision-making.

Project FactBox

Project Name INSAIGHT
Project ID MFP II A.2-1
Duration 48 Months

Area 3
Area Analytics

Project Lead
DI Dr. Belgin Mutlu

APPROACH

- Interactive query selection from sensor signals
- Noise-aware preprocessing of data
- Fast DTW-based multivariate subsequence search
- Computation of an intuitive similarity score
- Ranking and visual comparison of found matches
- Human-in-the-loop validation for knowledge discovery and root-cause analysis

CONTRIBUTION

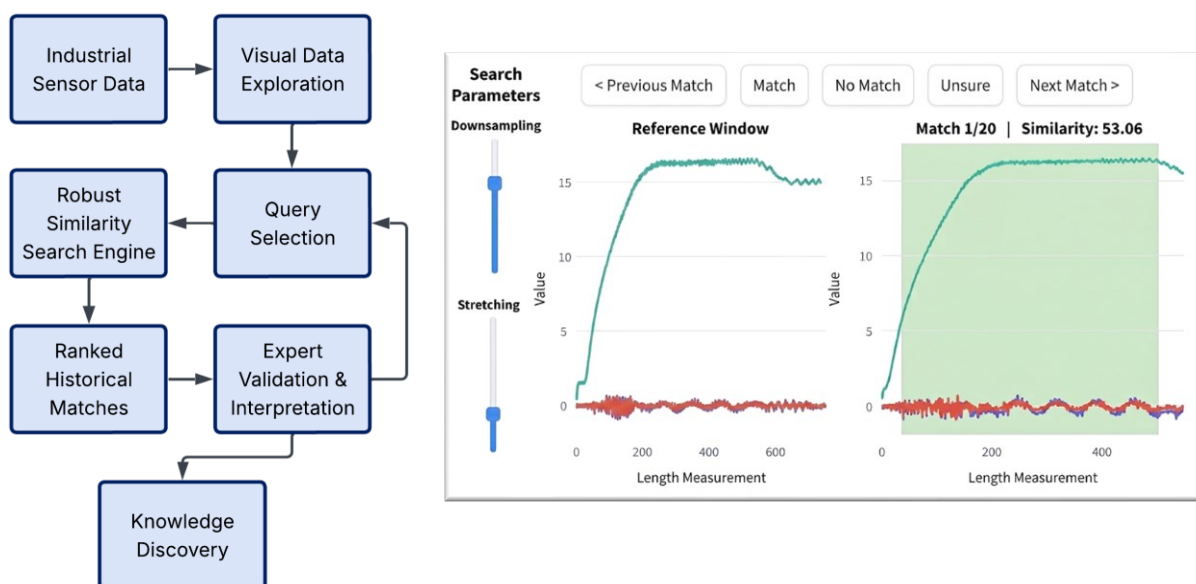
Scientific contribution

- Human-in-the-loop framework for multivariate industrial subsequence search.
- Mitigation of noise amplification effects in industrial sensor data.
- User study with domain experts evaluating usability and retrieval quality.
- Validation on real-world metallurgical production datasets.

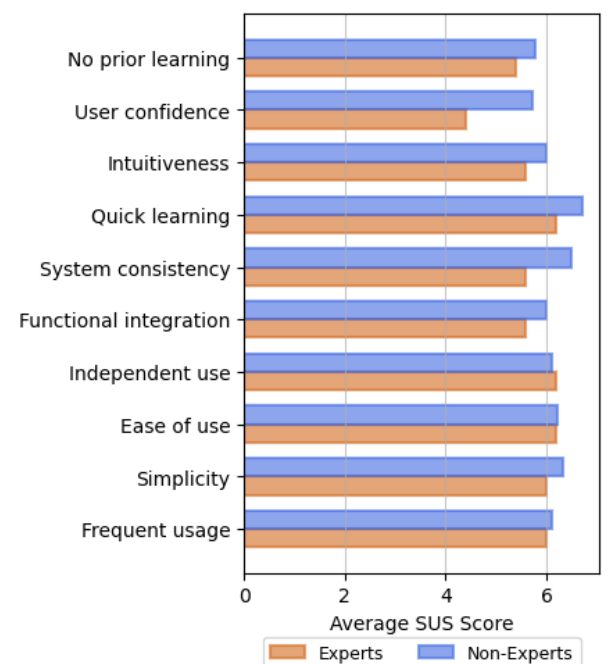
Economic contribution

- Faster retrieval of comparable historical process events.
- Reduced manual effort during data analysis.
- Improved support for root-cause analysis and operational decision-making.

SYSTEM ARCHITECTURE



EVALUATION



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