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PIANO NAZIONALE DI RIPRESA E RESILIENZA

FAIR
FUTURE AI RESEARCH

Human Understanding Capabilities of Symbiotic AI systems in FAIR

Pierluigi Amodio, Linda Antonella Antonucci, Pierpaolo Basile, Marco De Gemmis, Felice Iavernaro, Pasquale Lops, Francesca Mazzia, Cataldo Musto, Marco Polignano, Giovanni Semeraro, Lucia Siciliani, Cristiano Tamborrino, Paolo Taurisano

University of Bari Aldo Moro (Dept. of Computer Science, Dept. of Mathematics, and Dept. of Translational Biomedicine and Neuroscience)

Ital-IA
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cini National Lab AIIS

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Spoke 6 - WP6.2 Human Understanding Capabilities of SAI systems

Symbiotic-AI: Merging human intelligence with AI to improve capabilities

- enabling people to benefit from AI's speed, efficiency, and processing capacity
- granting machines human-like judgment, reasoning, and creativity

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WP6.2 Human Understanding Capabilities of SAI systems

This WP ensures that SAI systems show **human understanding capabilities** in order to improve the effectiveness of information access and decision-making

The approach is twofold:

- studying methods to understand ***what*** is the semantics of the signals coming from the users
- studying methods to learn ***who*** is interacting with the system

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T6.2.1. Understanding language-based human signals (*what*)

*(Connected to the transversal project **TP Vision, Language, and Multimodal Challenges**)*

Approaches for intelligent access to information are characterized by the joint use of *exogenous semantics*, based on structured knowledge sources (e.g., Knowledge Graphs (KGs), Linked Open Data) and *endogenous semantics*, based on word embeddings and fostered by Large Language Understanding Models

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T6.2.1. Understanding language-based human signals (*what*)

*(Connected to the transversal project **TP Vision, Language, and Multimodal Challenges**)*

Approaches for intelligent access to information by joining:

- *exogenous*

semantics

- *endogenous semantics*

Rome = [0.91, 0.83, 0.17, …, 0.41]

Paris = [0.92, 0.82, 0.17, …, 0.98]

Italy = [0.32, 0.77, 0.67, …, 0.42]

France = [0.33, 0.78, 0.66, …, 0.97]

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T6.2.1. Understanding language-based human signals (*what*)

*(Connected to the transversal project **TP Vision, Language, and Multimodal Challenges**)*

Combine *exogenous* and *endogenous* semantics to:

- transform human-understandable language signals (text documents, conversational data, etc.) into machine-understandable semantics
- create a *semantic layer* that can be exploited by systems requiring human-level intelligence

Enhance SAI's “deeper understanding” of the information they deal with

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T6.2.1. Understanding language-based human signals (*what*)

*(Connected to the transversal project **TP Vision, Language, and Multimodal Challenges**)*

- Data curation and ingestion: create, organize and maintain corpora/data for training large language models
  - also to support explainability, transparency, and interpretability
- Combination of exogenous and endogenous semantics
  - multimodal (word/sentence) embeddings and generative tasks through attentive, self-supervised training, and large scale-based transfer learning
  - Linked Data / KGs / Linguistic Knowledge
- Training, fine-tuning, and prompting of Large Language Understanding Models (LLUMs)
  - taking into account multimodality and adaptivity
- Exploiting LLUMs for intelligent information access
  - Information Extraction, Question Answering, Information Search & Seeking, Discovery, Decision Making, and Recommendation

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T6.2.2. Understanding human needs *(who)*

To improve human-AI relationships, AI needs to understand users better and adapt to their needs

Current user models only use a limited amount of information, which leads to less optimal representations

This task is devoted to bridge this gap by

I. **defining strategies to elicit information** by combining ***explicit approaches*** (information that is directly provided by users, e.g., through dialogue or natural language statements) and ***implicit ones*** (e.g., data gathered from social networks and IoT sensors)
II. **defining conceptual models** that encode the different facets and characteristics of humans, by ensuring an appropriate level of privacy and transparency

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T6.2.2. Understanding human needs *(who)*

- Methods for Preference (and Needs) Elicitation
  - from Conversational Data, KGs, and LLUMs
- Methods to Predict Users' Personal Characteristics
  - from Conversational Data, KGs, and LLUMs
- Methods to Provide Users with Personalized Information Access (i.e., RecSys)
  - based on Preferences, Needs, and Personal Characteristics
  - from Conversational Data, KGs, and LLUMs
  - exploiting Holistic User Modeling (HUM)
  - Narrative Representations for Recommendation and Decision Making

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T6.2.3. Improve the data quality and the algorithms in human understanding capabilities of AI Systems

Provide innovative techniques for analyzing data collected in tasks 6.2.1-6.2.2 through two subtasks:

- Determination of outliers

  Explore new methods, including regression techniques and entropy, to identify outliers while fitting models to the data

- Tensor decompositions and analysis of deep learning as dynamical systems

  Exploit Ordinary Differential Equations and Partial Differential Equations to improve deep learning strategies which will be combined with data representation through tensors and the use of decompositions to handle data dimensionality

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People

Critical Mass

- Pierluigi Amodio (PA, 12 p/m)
- Linda Antonella Antonucci (RTD-B, 6 p/m)
- Pierpaolo Basile (PA, 9 p/m)
- Felice Iavernaro (PA, 12 p/m)
- Pasquale Lops (PA, 9 p/m)
- Francesca Mazzia (PO, 12 p/m)
- Cataldo Musto (RTD-B, 9 p/m)
- Giovanni Semeraro (PO, 9 p/m)
- Lucia Siciliani (RTD-A, 36 p/m)
- Cristiano Tamborrino (RTD-A, 36 p/m)
- Paolo Taurisano (PA, 6 p/m)

Personnel external to FAIR

- Pierluigi Cassotti (Ph.D. Student)
- Marco de Gemmis (PA)
- Marco Polignano (RTD-A)
- Giuseppe Spillo (Ph.D. Student)

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Thank you for the attention

Any questions?