SPOKE 2
INTEGRATIVE AI

FONDAZIONE BRUNO KESSLER
Spoke Integrative AI Partners

FBK - Fondazione Bruno Kessler:
- Digital Industry Research Center
- Health and Well Being Research Center
- Digital Society Research Center

University of Trento:
- Dept. of Computer Science
- Faculty of Law
- Dept. of Psychology & Cognitive Science

University of Padova
- Department of Mathematics

University of Udine
- Dept. Math, Computer Science, & Physics

Critical mass
33 Professors/Senior Researchers
14 young Researchers
Integrative AI: The Starting Hypotheses

AI can overcome the barrier of complexity with an **overarching interdisciplinary approach** oriented to theories and techniques that integrate different **scientific methods, technologies, disciplines, and competences**.

Integration of different:

- **AI models and techniques** (e.g., neuro-symbolic, model based + data driven inference, ...)
- **AI areas** (e.g., perception, action, interaction, reasoning, ...)
- **AI with other fields** (e.g., formal methods, cognitive science, social sciences...)
Scientific Questions

How does Integrative-AI advance state of the art in:

(Q1) modeling, learning, and inference capabilities?
(Q2) interaction with the environment and humans?
(Q3) cooperation among multiple artificial and human agents?

We will provide experimental evidence of the impact of Integrative AI in key application sectors such as industry, health, and society.
(Q2.1) Modeling, Learning, and Inference

- **Definition of Integrative Models**, e.g. the integration of Neural Networks, Logic, Probabilities, Automata, ...

- **Learning of Integrative Models**, e.g. by (pre-)training with constraints / by interaction with humans and the environment, by planning to train neural networks ...

- **Inference with Integrative Models**, e.g. constraint-based NN inference, symbolic planning from continuous observations, ...

Fostering the continuous evolution of integrative models e.g. well-funded mechanisms to align data and models, ...
(Q2.2) Interaction with the environment and humans

- **Perception and Action in the Environment** by exploiting the Integrative Models and the algorithms for learning and inference

- **Interaction with humans** through inclusive, unbiased, trustworthy, sustainable language models

- **Affect-aware mixed initiative interaction**, digital tools that interacts with individuals respecting human’s cognitive capacities and social practices

**Connected to Transversal Projects:**
- Vision, Languages, and Multimodal Challenges
- Adjustable Autonomy and Physical Embodied Intelligence
- Legal and Ethical Design of AI
(Q2.3) Cooperation among multiple artificial and human agents

• How social rules / conventions affect the interactions in multi agent systems and how the rules emerge from the behavior of interacting agents

• Social and cooperative AI systems leveraging social learning, social influence, counterfactual learning

• Cooperation frameworks of AI and human agents to develop networks of AI and human agents achieving fairness and social well-being

Connected to Transversal Projects:
Learning and Reasoning from individual to communities and society
Legal and Ethical Design of AI
Integrative AI: Impact

Theories

Scientific & Technological Assets

Impact on Market and Society

Digital health

Digital industry

Digital Society
### (Q2.1) modeling, learning, inference

- WP2.1 Verification, Synthesis, and Autonomy

### (Q2.2) interaction with the environment and humans

- WP2.4 Multimodal Perceptions
- WP2.5 Natural Language Understanding
- WP2.6 Human Computer Interaction

### (Q2.3) cooperation

- WP2.7 Embodied Systems
- WP2.8 Cooperative and hybrid human-machine intelligence

### Other

- WP2.9 Applications in digital industry, digital health, and digital society
Integrative AI and Transversal Projects