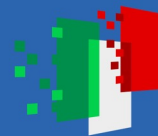




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SPOKE 2

INTEGRATIVE AI



Future Artificial Intelligence Research

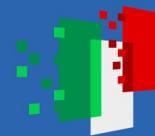
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ON KNOWLEDGE



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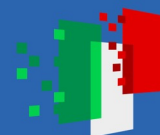
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Spoke Integrative AI Partners



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Critical mass

33 Professors/Senior Researchers

14 young Researchers

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

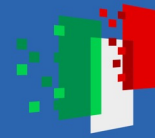
Dept. Math, Computer Science, & Physics



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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:

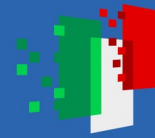
- **AI models and techniques** (e.g., neuro-symbolic, model based + data driven inference, ...)
- **AI areas** (e.g., perception, action, interaction, reasoning, ...)
- **AI with other fields** (e.g., formal methods, cognitive science, social sciences...)



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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?**



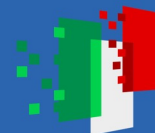
We will provide experimental evidence of **the impact of Integrative AI**
in key application sectors such as industry, health, and society



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(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, ...



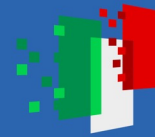
Fostering the **continuous evolution** of integrative models
e.g. well-funded mechanisms to align data and models, ...



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(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



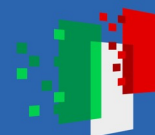
*Connected to Transversal Projects:
Vision, Languages, and Multimodal Challenges
Adjustable Autonomy and Physical Embodied Intelligence
Legal and Ethical Design of AI*



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(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



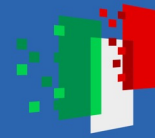
*Connected to Transversal Projects:
Learning and Reasoning from individual to communities and society
Legal and Ethical Design of AI*



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Integrative AI: Impact



Theories

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Scientific & Technological Assets

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Impact on Market and Society



Digital
health



Digital
industry



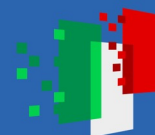
Digital
Society



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**(Q2.1) modeling, learning,
inference**

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

(Q2.3) cooperation

WP2.1
Verification, Synthesis,
and Autonomy

WP2.2
Models
for Integrative AI

WP2.3
Multiperspective
Knowledge

WP2.4
Multimodal
Perceptions

WP2.5
Natural
Language
Understanding

WP2.6
Human
Computer
Interaction

WP2.7
Embodied
Systems

WP2.8
Cooperative and hybrid human-machine intelligence

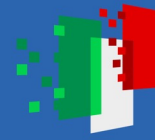
WP2.9
Applications in digital industry, digital health, and digital society



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Integrative AI and Transversal Projects

