Allegato A – "Objectives of the Call"

- **Obiettivo #1: Epistemic Multi-Agent FDIR.** The applicant is expected to propose a research program exploiting synergies with the WP2 themes, partners and tools aimed at the realization of a generic framework based on epistemic temporal logic for the Fault Detection Identification and Recovery (FDIR). The framework shall target autonomous agents having diagnosis and planning capabilities, possibly working with hybrid models combining discrete- and continuous-time dynamics. Moreover, it shall be applicable to single- and multi-agent scenarios, thus taking into account the cases of distributed diagnosers and planning for the coordination of multiple agents having different knowledge and goals. The activities funded by this call shall encompass the formal definition of the problem based on temporal epistemic logic and the development of the state-of-the art concerning automated epistemic planning and reasoning. This shall integrate various techniques for constraint satisfaction and optimization (also, meta-heuristics, local search …), as well as the applications of solvers for SAT, SMT, or ASP. The applicant is expected to propose synergies and collaboration with the FAIR WP2 consortium partners on these topics and to co-develop demonstrators using the following toolsets made available: nuXmv (https://nuxmv.fbk.eu), Unified Planning (https://github.com/aiplan4eu/unified-planning), NuRV (https://es-static.fbk.eu/tools/nurv/), and xSAP (https://xsap.fbk.eu/). The financed projects will run from the signing date up to the end of the project [M36].

- **Obiettivo #2: Graph Generative Models with Logical Weighted Constraints.** Graph generation is a crucial computational task on graphs with numerous real-world applications. It aims to learn the distribution of given graphs and then generate new graphs. In general, one could have prior knowledge of the properties of the graphs, that impose constraints on the topology of the graphs to be generated, or probabilistic priors on the graph distribution. The applicant is expected to extend the current state-of-the-art generative models for graphs (e.g., diffusion models) or to propose new generative models that allow the seamless incorporation of background knowledge expressed as weighted first-order formulas or similar symbolic expressions. The applicant is expected to provide also algorithms for learning and inference on such hybrid models. The applicant is expected to propose synergies and collaboration with the FAIR WP2 consortium partners. The financed projects will run from the signing date up to the end of the project [M36].

- **Obiettivo #3: Robust multi-perspective knowledge representation framework and Multi-Modal AI.** The applicant is expected to propose methods and techniques that support the construction of an holistic formal framework able to represent multi-perspective knowledge contained in the data describing dynamic scenarios. The methods should allow for the discovery of symbolic representations from data and techniques to reason on them. Moreover the applicant should propose multi-modal frameworks aiming to enhance the integration of AI-based strategies within solutions supporting humans during their daily tasks. All the methods above should integrate symbolic and subsymbolic approaches. The applicant should propose an experimental validation in one of the following sectors: industry and manufacturing, health and well-being, digital agriculture. The Applicant is expected to propose synergies and collaborations with the FAIR WP2 consortium partners. The financed projects will run from the signing date up to the end of the project [M36].

- **Obiettivo #4: Integrative AI for perception, situation awareness and planning in embodied systems.** The constant growth of the AI techniques has significantly raised the bar of the expectations toward robot applications. Robots are increasingly used in open environments and in close collaboration with humans. Typical applications include (but are not limited to) advanced manufacturing, precision agriculture, and robot assisted surgical and medical applications. The physical nature of the robots and the presence of humans requires high levels of robustness and explainability, which can only be achieved through the synergistic integration of different AI techniques. The applicant is required to deliver convincing solutions with proved levels of robustness and explainability in the area of perception, situation awareness and planning. The solutions will be experimented either in outdoor applications (e.g., precision agriculture) or in indoor applications (e.g., robot assisted surgery and diagnostics). The Applicant is expected to propose synergies and collaborations with the FAIR WP2 consortium partners. The financed projects will run from the signing date up to the end of the project [M36].
- **Obiettivo #5: Learning with Imperfect Multimodal Data.** The applicant is expected to investigate learning models dealing with imperfect multimodal data, i.e., models operating in scenarios having either multimodal (e.g., speech, text, image, video, sensors) annotated or unlabeled data, noisy labeled data, imbalanced data or a mix of the previous scenarios. In this context, the research should explore models along the following research lines: 1) self-supervised learning approaches when multimodal data label information is absent or noisy; 2) domain adaptation methods considering multimodal data as coming from different domains; 3) data augmentation strategies able to generate/transform data item compensating the absence or the scarcity of a certain data modality; 4) distillation architectures able to perform cross-modal transfer, possibly coping with missing modalities in test phase, while simultaneously allowing the optimization of the network to run on non-specialized (non GPU) hardware in real-time. The Applicant is expected to propose synergies and collaborations with the FAIR WP2 consortium partners. The financed projects will run from the signing date up to the end of the project [M36].
- **Obiettivo #6: LLM for Trustworthy Hybrid Decision Making.** The applicant is expected to investigate how large language model technology could be adapted so as to increase the reliability of its outcomes when used as a component of a decision-making process. The underlying idea is that of complementing LLM with access to external memories, external knowledge bases and AI systems and exploring advanced human-machine interaction strategies that can help increase the effectiveness of the machine as a decision support tool for critical and ethical-compliant decisions. The Applicant is expected to propose synergies and collaborations with the FAIR WP2 consortium partners. The financed projects will run from the signing date up to the end of the project [M36].