

Special issue for the 23rd workshop “from objects to agents” (WOA 2022)

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The first Workshop “From Objects to Agents” (WOA) was held in Parma in May 2000. The workshop started as a joint initiative of the Agents and Multi-Agent Systems Working Group of the Italian Association for Artificial Intelligence (MAS-AIXIA) together with the Italian Association for Advanced Technologies based on Object-Oriented Concepts (TABOO). The workshop was meant to provide a forum for researchers and practitioners interested in understanding the possibilities that the intricate connection between agent technologies and object-oriented technologies could open. The first WOA counted more than fifty registered participants from both the academia and the software industry. In the years, MAS-AIXIA took full charge of the workshop, which shifted its focus towards all topics related to agents and multi-agent systems, and became a stand-alone initiative with an international perspective organised by an independent community of researchers and practitioners based in Italy. As such, the workshop has always been located in Italy, with the workshop Steering Committee constantly committed to involve every major Italian research group working on agents and multi-agent systems. The workshop was hosted in the following venues (in alphabetical order): Bologna (twice), Camerino, Catania (three times), Genova (twice), Milano (twice), Modena, Napoli, Palermo

(twice), Parma (three times), Rende, Rimini, Scilla, Torino (twice), and Villasimius. Occasionally, workshop was co-located with international events to promote the participation of researchers and practitioners from foreign countries.

The 23rd edition of the workshop has been held on September 1–3, 2022 in Genova. During these three days, 21 speakers joined the workshop and the mini-school, almost 30 attendees (out of which, 14 students) joined in presence, and 20 joined remotely. The travel and accommodation of four students was partly supported by AIXIA.

This edition was structured in two mini-school sessions, two keynote speeches, and in seven technical sessions. The seven technical sessions hosted the presentation of 17 papers, of which 7 are collected in this special issue.

The topics discussed in the papers covered some of the hottest topics laying under the umbrella of “Emotional and Believable Human-Agent Interaction”, as requested by the call for papers. The choice of this theme was deliberate.

In 1950, in the attempt of formulating the question: “Does a machine think?”, Alan Turing devised what in future would have been called The Turing Test, even though for him The Imitation Game would suffice. This test was meant to test a machine’s ability to exhibit intelligent behavior equivalent to, or indistinguishable from, that of a human. Now, 72 years later, we still find ourselves fascinated by such question, that became more important than ever, and that integrated new dimensions besides “being intelligent”:

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interactions between humans and machines are now expected to be believable and to take emotions into account.

When talking about Agents, we cannot indeed avoid to talk about believable interactions; be them amongst other agents, or even human beings. By interacting, agents establish a means to enhance the chances of succeeding in their goals. In the modern age, we are used to have technology around us, but how much technology is used to have us around? How much the agents are capable of exploiting such interactions? How much such interactions are believable and “emotionally-aware” from the human’s viewpoint?

Naturally, the ability of interacting with human beings is not a sole problem of MAS, but a more general issue for the entire AI world. This becomes of paramount importance especially when the AI component has to instill trust in the human user. Such aspect finds a strong connection with the macro area of Explainability in AI (XAI); since the notion of being Believable and Emotional is not orthogonal to the notion of being Explainable to humans.

The 17 papers collected presented at WOA 2022 were organised into seven thematic sessions. The final versions of the 7 papers invited to this special issue also include the outcomes of the discussions that followed the presentations at the workshop. The authors’ contributions cover extremely relevant research areas that include (i) Human-agent interaction and emotions, (ii) Symbolic knowledge injection and extraction, (iii) Trust and autonomy in agent interactions, (iv) Agent-Based Modeling and Simulation, (v) Emotionality and rationality, (vi) Applications and projects, (vii) Risk mitigation, robustness and security.

The seven papers collected in this special issue are contributions selected based on the reviewers’ suggestions, which extend and improve preliminary versions presented at WOA 2022. The papers of this special issue also include the outcomes of some of the discussions that followed the presentations at the workshop.

The first paper of this special issue extends [7] and presents how to use speech act to enable a coalition of agents to exhibit inner speech capabilities to explain their behavior, but also to guide and reinforce the creation of an inner model triggered by the decision-making process through actions applied to the surrounding world and to themselves. The BDI agent paradigm is used to keep the agents rational and with the innate ability to act in a human-like manner.

The proposed solution continues the research path that began with the definition of a cognitive model and architecture for human-robot teaming interaction, and aims to integrate the believable interaction paradigm into it.

The second paper of this special issue extends [5] and presents the potential capabilities offered by an integrated multi-agent system comprising logical agents and a neural network, specialized in monitoring flood events for civil protection purposes. Here the authors describe the idea of a framework – at the moment only partially developed – consisting of a set of intelligent agents, which perform various tasks and communicate with each other to efficiently generate alerts during flood crisis events, collaborating with a neural network, derived from the PSP-Net model, which is dedicated to the inspection and analysis of satellite images.

The third paper of this special issue extends [4] and discusses several recent additions to the Jadescript agent-oriented programming language that regard the effective detection and handling of exceptional and erroneous situations at runtime. These new features were introduced to better support the mission-critical level of robustness that software agents are normally demanded to exhibit. The description of these new features is supported by an analysis of the state of the art of exception handling in programming languages, and it is complemented by a discussion on planned future developments.

The fourth paper of this special issue extends [1] and reports on the modelling choices and general advancements since the first publication of OASIS, especially after its profitable adoption by an European project. The OASIS ontology — An Ontology for Agent, Systems, and Integration of Services, presented in 2019 — pursues the behaviouristic approach to deliver a higher-level, semantic representation system as well as a communication protocol for agents and their commitments. Following the profitable adoption of OASIS as a foundational ontology for agents in the context of blockchain-oriented e-commerce, the ontology has been maintained and substantially updated over the years.

The fifth paper of this special issue extends [6] and focuses upon a quite general class of SKE techniques, namely hypercube-based methods. Despite being commonly considered as regression-specific, the authors discuss why hypercube-based SKE methods are flexible enough to deal with classification problems as well. More generally, the authors propose a common generalised model for hypercube-based

methods, and they show how they can be exploited to perform SKE on datasets, predictors, or learning tasks of any sort.

The sixth paper of this special issue extends [2] and considers an extended version of sabotage games played over Attack Graphs. Such games are two-player zero-sum reachability games between an Attacker and a Defender. This latter player can erase particular subsets of edges of the Attack Graph. To reason about such games the authors introduce a variant of Sabotage Modal Logic (that they call Subset Sabotage Modal Logic) in which one modality quantifies over non-empty subset of edges. They show that they can characterize the existence of winning Attacker strategies by formulas of Subset Sabotage Modal Logic.

The seventh paper of this special issue extends [3] and considers how agents can be endowed with emotions. For the tasks of improving caregiving in medicine and other sectors (i.e., teaching) and of constructing effective human-AI teams, agents should be endowed with an emotion recognition and management module, capable of empathy, and of modelling aspects of the Theory of Mind, in the sense of being able to reconstruct what someone is thinking or feeling. In this paper, the authors propose an architecture for such a module, based upon an enhanced notion of Behavior Trees. They illustrate the effectiveness of the proposed architecture on a significant example, and on a wider case study.

In the end, the Organising Scientific Committee gratefully thanks all those who, with their work and their enthusiasm, have contributed to the success of this edition of WOA: the members of the Program Committee, the Department of Informatics, Bioengineering, Robotics and Systems Engineering (DIBRIS) of the University of Genova, AIxIA, the University of Genova, Genova Municipality, Casa Paganini’s staff that opened the beautiful Casa Paganini venue for hosting the event, the local organiser Andrea Gatti, the speakers of the workshop sessions, the mini-school lecturers, the sponsors, the special issue editors, and all collaborators who participated in the organisation. Overall, they would like to thank the lively, creative and sometimes volcanic community that has been regularly meeting for 23 years at the workshop.

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