# AIxPAC 2024-Preface to the 2nd Workshop on Artificial Intelligence for Perception and Artificial Consciousness *

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**Abstract**

The AIxPAC workshop seeks to unite academic and industry researchers to explore the latest developments in AI related to perception and consciousness. The event includes expert presentations on topics such as the physicalist ontology of consciousness, artificial consciousness, color perception, and computer vision. Key research questions addressed at AIxPAC include: Is it possible to integrate visual perception systems into machines? How effectively does AI handle visual attention processes? What is the connection between attention and consciousness? Can AI architectures and methodologies be leveraged to create Artificial Consciousness? What are the advantages and disadvantages of Large Language Models? These research questions encourage multidisciplinary collaboration and provide a foundation for critical analysis of the discussed topics

## 1. Background and Motivations

The remarkable progress achieved by Artificial Intelligence (AI) over the last few years has had a profound impact on the fields of perception and consciousness. These advancements have not only deepened our understanding of the human mind but have also paved the way for innovative technologies that enhance human capabilities. Building on the success of the first edition, the second edition of the workshop on **Artificial Intelligence for Perception and Artificial Consciousness (AIxPAC)** aims to further explore these transformative developments.

AIxPAC 2.0 continues its mission to bring together researchers from academia and industry to exchange knowledge, foster collaboration, identify emerging research directions, and accelerate the development of AI technologies that benefit society. This edition places a stronger emphasis on interdisciplinary approaches, integrating insights from neuroscience, cognitive science, and computer science to address the complex challenges of perception and consciousness.

The study of the **Human Vision System (HVS)** has provided critical insights for developing autonomous computer vision systems capable of identifying perceptually significant regions in visual scenes. Similarly, the rapid evolution of **Large Language Models (LLMs)** has demonstrated unprecedented performance in Natural Language Processing (NLP) tasks, pushing the boundaries of what AI can achieve. Additionally, biologically inspired principles have led to more robust and reliable face-detection techniques, further bridging the gap between human and machine perception.

These seemingly disparate research areas—ranging from visual perception to language models—can be viewed as interconnected pieces of a larger puzzle. This holistic perspective raises a fundamental question: **"Can consciousness be represented and interpreted using an internalist or externalist approach?"** AIxPAC 2.0 delves deeper into this question, exploring

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how advancements in AI can shed light on the nature of consciousness and its computational representation.

The workshop highlights the latest breakthroughs in AI, including:

**Large Language Models (LLMs):** GPT-based virtual chatbot agents have continued to evolve, demonstrating exceptional capabilities in text generation, question answering, language translation, and creative content creation. The second edition of AIxPAC explores how these models can be further refined to understand context, emotions, and even abstract reasoning.

**Visual Perception:** Models like **CLIP (Contrastive Language–Image Pretraining)** and **ViT (Vision Transformers)** have achieved state-of-the-art performance in image recognition tasks. These advancements enable AI systems to perceive and interpret the visual world with greater accuracy, opening new possibilities for applications in healthcare, autonomous systems, and augmented reality.

**Transformers:** This revolutionary neural network architecture has transformed not only NLP but also other domains, such as computer vision and speech processing. AIxPAC 2.0 examines how transformers can be adapted for multimodal tasks, integrating text, images, and audio to create more comprehensive AI systems.

**Artificial Consciousness:** A new focus of the second edition is the exploration of artificial consciousness. Researchers are investigating whether AI systems can develop a form of self-awareness or subjective experience, drawing parallels with human consciousness. This includes discussions on ethical implications, theoretical frameworks, and potential experimental approaches.

The impact of these advancements is already being felt across various industries. LLMs are being used to develop intelligent virtual assistants, generate personalised content, and enhance creative workflows. Visual perception models are powering autonomous vehicles, enabling them to navigate complex environments with precision. Transformers are driving real-time translation tools, breaking down language barriers and fostering global communication.

AIxPAC 2.0 provides a critical platform for researchers to discuss these cutting-edge developments and their societal implications. By fostering collaboration and interdisciplinary dialogue, the workshop aims to accelerate the development of AI technologies that are not only technologically advanced but also ethically sound and socially beneficial. In conclusion, the second edition of AIxPAC builds on the foundation laid by its predecessor, offering a deeper exploration of the intersection between AI, perception, and consciousness. As AI continues to evolve, workshops like AIxPAC play a vital role in shaping the future of this transformative technology, ensuring that it serves the greater good of humanity.

## 2. Accepted Papers

This collection of papers explores cutting-edge advancements in artificial intelligence, spanning topics such as the application of the Free Energy Principle and active inference in neural language models, the emergence of social sentience in AI systems, and innovative strategies for health misinformation detection. Additionally, the research delves into AI's ability to mimic human visual attention for e-commerce optimization, real-time oil spill detection using deep learning, and a comparative analysis of AI methodologies for defect wafer map classification, showcasing the diverse and transformative potential of AI across various domains.

The total number of received contributions is eight. Six out of them have been accepted. The complete list of accepted articles and contributing authors is reported below:

- *Free Energy Principle and Active Inference in Neural Language Models*
- *Social sentience in neural language models*
- *Health Misinformation Detection: A Chunking strategy integrated to retrieval-augmented generation*

- *Can AI mimic human visual attention to assess e-commerce landing page engagement?*
- *A Deep Learning Framework for Real-time Oil Spill Detection and Classification*
- *GenAI or not GenAI? Comparing AI methodologies to solve Defect Wafer Map Classification Problem*

## 3. Invited Talks

AIxPAC is enriched by two invited talks a respectively, by Antonio Chella from University of Palermo and Joachim Keppler from DIWISS, Department of Consciousness Research and a Guest of Honour with a talk given by Stephen Grossber from Boston University.

**Antonio Chella** is a Professor of Robotics and Director of RoboticsLab at the Department of Engineering, University of Palermo. He is a former Director of the Interdepartmental Center for Knowledge Technologies (CITC), Director of the Department of Computer Engineering (DINFO), Chairman of the Computer Engineering Graduate Program, Coordinator of the Ph.D. Program in Technological Innovation Engineering. He coordinated several Italian and European research projects. He is the author of more than 200 publications and an editorial director of scientific journals and of book series in the fields of Robot Consciousness, Computational Creativity, Cognitive Science and Artificial Intelligence. The research activities of prof. Chella has been the subject of many articles and interviews in national and international magazines and newspapers, including New Scientist and The Guardian. Antonio Chella's talk at AIxPAC is titled "Towards Conscious AI Systems".

**Joachim Keppler** studied physics at the Friedrich-Alexander University of Erlangen and received PhD in theoretical particle physics and quantum field theory. Subsequently, he worked in industrial research and development and held leading positions in the fields of data science and artificial intelligence. In 2012, he launched and directed the research institute DIWISS which is funded by private foundations and concentrates on the scientific exploration of consciousness pursuing an interdisciplinary approach at the intersection of theoretical physics, cognitive neuroscience, and philosophy of mind. His research focuses on the development of a conceptual framework that integrates consciousness seamlessly into the worldview of physics, sheds light on the universal mechanism underlying conscious processes, and provides a sound footing for a theory of consciousness. His current research activities deal with collective phenomena and self-organized criticality in the brain and aim at building a field-theoretical model of cortical dynamics.

Joachim Keppler's talk at AIxPAC is titled "The path to sentient robots: AI consciousness in the light of new insights into the functioning of the Brain".

**Stephen Grossber** is Professor Emeritus of Mathematics & Statistics, Psychological & Brain Sciences, and Biomedical Engineering, Founding Chairman, Department of Cognitive and Neural Systems, Founder and Director, Center for Adaptive Systems, Founding Director, Center of Excellence for Learning in Education, Science, and Technology, Founding President, International Neural Network Society, Founding Editor-In-Chief, Neural Networks, Founder and General Chairman, International Conference on Cognitive and Neural Systems (ICCNS), PhD, Mathematics, Rockefeller University. He develop brain models of vision and visual object recognition; audition, speech, and language; development; attentive learning and memory; cognitive information processing and social cognition; reinforcement learning and motivation; cognitive-emotional interactions; navigation; sensory-motor control and robotics; and mental disorders. These models involve many parts of the brain, ranging from perception to action, and multiple levels of brain organization, ranging from individual spikes and their synchronization to cognition. Many of these projects are done in collaborations with PhD students, postdoctoral fellows, and faculty. He also collaborated with experimentalist colleagues to design experiments to test theoretical predictions and fill conceptually important gaps in the experimental literature, carry out analyses of the mathematical dynamics of neural systems, and transfer biological neural models to applications in neuromorphic engineering and technology.

Stephen Grossber given a Lecture on "Consciousness" with Question & Answer live session.

## 4. Programme Committee

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