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FRANCE 2030
PROGRAMME DE RECHERCHE
NUMÉRIQUE POUR L'EXASCALE

GT IA

Objectives and works for 2024

Sommaire

1. **The GT IA**
    1. Composition
    2. Objectives
1. **In 2024**
    1. Roadmap
    2. Numpex call
    3. Discussion and interviews
1. **En 2025**
    1. Thematic semester ASSAI
    2. What is ASSAI

1. The GT IA

1.1 Composition

Composition

GT IA members

- **Thomas Moreau** (INRIA), GT leader. Signal processing and AI, PC3 (WP3 leader)
- **Emmanuel Franck** (INRIA), GT leader . SciML and scientific computing, PC1 (WP2 co-leader), PEPR PDE-IA
- **Jerôme Bobin** (CEA), GT leader. Signal processing and ML for physics, co-leader PC0, co-leader WP of PC5
- **Alfredo Buttari** (IRIT), Linear Algebra and numerical libraries, co-leader PC2
- **Jean-Pierre Vilotte** (CNRS), Signal processing and ML for physics, co-leader PC5, member of Copil ASSAI
- **Marianne Clausel** (Univ Lorraine), AI and causality, PC1 (WP2), PEPR AI-causality
- **Philippe Helluy** (Unistra), Scientific computing, PC1 (WP1), GT GPU
- **Redouane Lguensat** (IPSL, IRD), climatology, SciML, signal processing, co-leader WP of PEPR TRACCS
- **Julien Le sommer** (CNRS), climatology, scientific computing, SciML, co-leader WP of PEPR TRACCS

1.2 Objectives

Objectifs:

- **Audit of AI in NumPEx:** pooling of knowledge, actions and research on AI in NumPEx (across the various PCs).
- **NumPEx AI scientific coordination :** Management of IA-related activities (workshops, thematic semesters, etc.)
- **Writing a roadmap for interaction between HPC and AI for science:** Identification of expertise, gaps and tools for HPC and AI (important for AAP and to complement NumPEx in terms of expertise)
- **Follow-up on prospects for non-NumPEx AI-related calls for projects :** NumPEx-EU, InPEx, TPC ….

Organization:

- In theory: a meeting every 2 months
- In practice: 4 meetings for 2024

IA works in Numpex (to be updated)

- **PC1** : not really an AI expert, but good knowledge. ML algorithms are also seen in part as new numerical methods. In practice: *Reduced models, neural numerical methods (WP 2), Inverse problem and optimization (WP 4 and 5), Uncertainty (WP 6).*

- **PC2** : no AI expert. **In practice**: *Using AI for trace analysis. Library for parallel tensor calculus.*

- **PC3** : within WP 3, more AI and signal processing experts. No link with scientific computing. **In practice**: *Online or distributed model training, simulation-based inference, rare event detection.*

- **PC5** : at the interface with applications, many demonstrators have AI issues.

2. In 2024

2.1 Roadmap

Roadmap

- **Objective**: define a “vision” for the AI aspects of Numpex
- Useful for future European calls for projects and international discussions
- **Redaction**: J. Bobin, T. Moreau, E. Franck
- NumPEx will contribute to:
  - Accelerating the use of AI in science
  - Bridging the gap between the application AI and AI communities
  - Encourage collaboration and initiatives at national and international level
- Areas to promote:
  - HPC, scientific computing and hybridation with AI
  - HPC and data analysis
  - Taking AI to exascale and beyond

2.2 Numpex call

AAP Numpex:

- ANR and PC0 have identified IA for HPC and HPC for IA as a theme for the Numpex AAP..
- The WG discussed the second sub-axis: HPC for high-performance learning and very large-scale AI. Strong interaction with Numpex is expected. Application aimed at LLMs. Discussion with O. Baumont.

- We also discussed the first sub-axis for code rewriting tools. Discussion with Y. Curé. How to finance or facilitate code transitions to “AI” frameworks like Torch or Jax.

2.3 Discussion and interviews

Discussion and interviews:

Interviews:

- We've started interviewing various application experts about their uses of AI, the impact of AI in their fields of application, and so on.
- **Interviews**: A. Vidard (climat, Numpex, Grenoble), R. Ibata (astrophysic, Unistra), F. Lanusse (astrophysic and LLM, CNRS, Flariton), I Caron (LLM, LightOn)
- Strong interest in LLM and foundation models (MF). MF for processing CDS astro data (R. Ibata), MF for EDP solvers (F. Lanusse).
- Big impacts in the climate community and many developments in the astrophysics community.

Discussion:

- In the climate. GCM neural paper creates a impact in the community. Not only the results, but also the time and resources required to achieve them.
- May raise the question of how to manage physical simulation codes.

3. In 2025

In 2025:

Thematic semester:

- Thematic semester on AI and HPC at the ASSAI center in preparation
- The AISSAI Center (AI4Science and Science4AI) was created by CNRS in 2022 and became a UAR in 2024.
- This is an AI Institute without walls, whose aim is to be the analog of the IHP for Artificial Intelligence in relation to other disciplines
- It relies on the ten CNRS institutes that are represented in the AISSAI Center and that are a driving force behind its proposals.

In 2025:

Principle of AISSAI semester

- **Duration**: from one month to one quarter, or even one semeste
- **Place** : all the partners.
- Multi-site events are widely encouraged in order to disseminate a theme throughout France.
- Audience: industrialists, Master's students, PhD and post-doctoral students and senior researchers.
- We can even envisage events for the general public, such as presentations in secondary schools!

In 2025:

Principle of AISSAI semester

- Main events: workshops, research schools, Master or ED courses, SEME, industrial events... Anything is possible!
- Possibility of guest researchers
- Organizers: an organizing committee and a scientific committee
- Organizers may have half a CNRS delegation
- Possible partnerships with IA clusters
- Possible partnerships with AI clusters Substantial budget (several hundred thousand euros) and real scientific support from CNRS

In 2025:

Feedback: Causality trimester

- Website: https://quarter-on-causality.github.io/
- Avril to September 2023
- Place : Paris, Grenoble and Saclay.
- Support of SCAI, MIAI et DATAIA for organization
- Pre-quarter events in partnership with the datacraft business club
- Three workshops, two research schools, an AMIES SEME on causality
- Budget: 150kE, researchers from the US, Canada and Europe

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