Artificial Intelligence at CERN in Research

Machine Learning has been used at CERN since the 1990s
Since early 2000s Deep Learning provides powerful techniques, applicable to a wide range of use cases

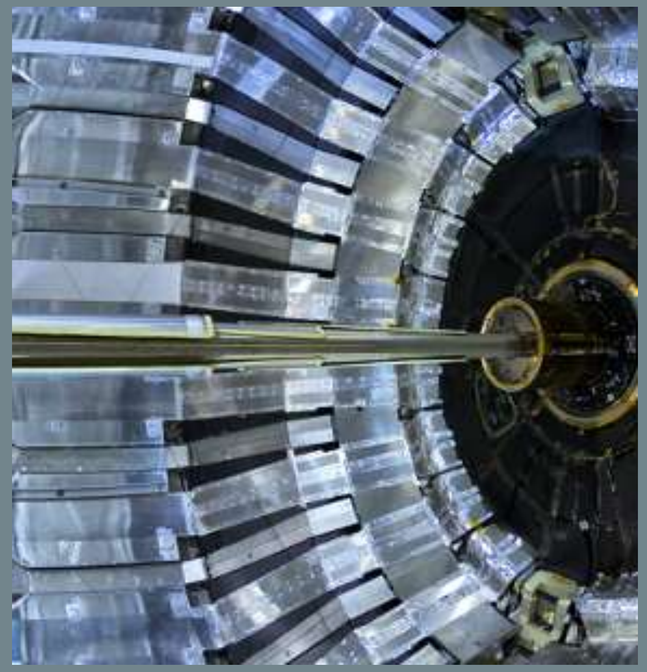
Data processing for LHC experiments :

- ⊙ Anomaly detection and real time data selection
- ⊙ Data analysis and pattern recognition
- ⊙ Synthetic data generation and simulation

Operations and research in the field of particle accelerators

Engineering and Infrastructure

- ⊙ Robotics and computer vision



AI-based real time data selection:

In just a few microseconds, the complex system can determine whether the information about a given collision event is worth keeping or not.

NB:

None of the above applications triggers (Personal) Data Protection issues

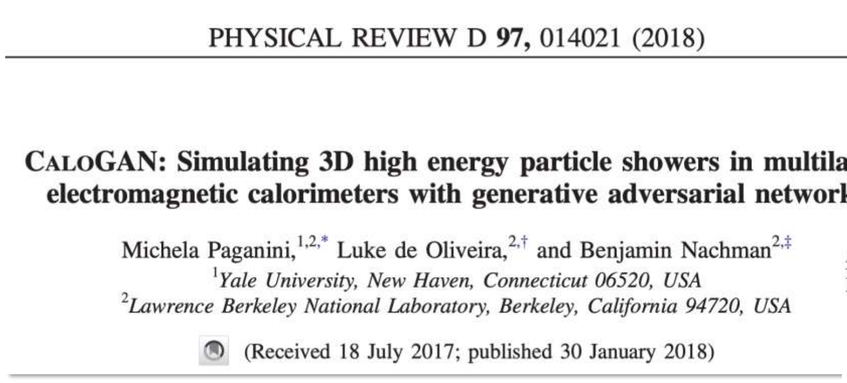
Ex. Generative Models in HEP

Generative AI today «translates to LLMs» but it is actually a much broader class:

Boltzmann Machines exist since the 1980s

and in HEP we have used them since 2014!

Ex. CaloGAN (2017), 3DGAN (2017)…



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CALOGAN: Simulating 3D high energy particle showers in multilayer electromagnetic calorimeters with generative adversarial networks

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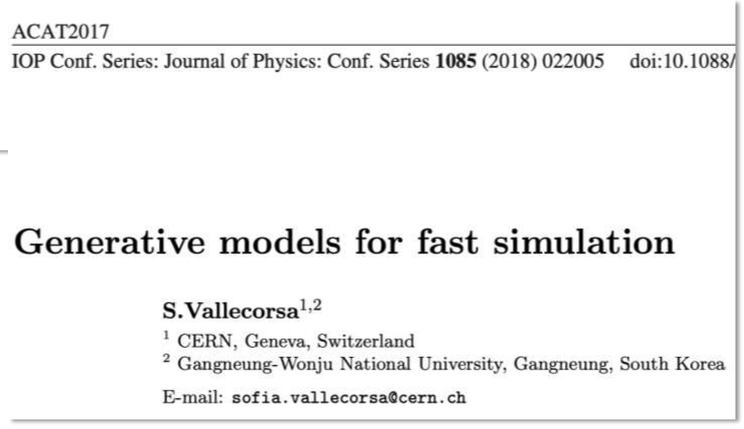

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Generative models for fast simulation

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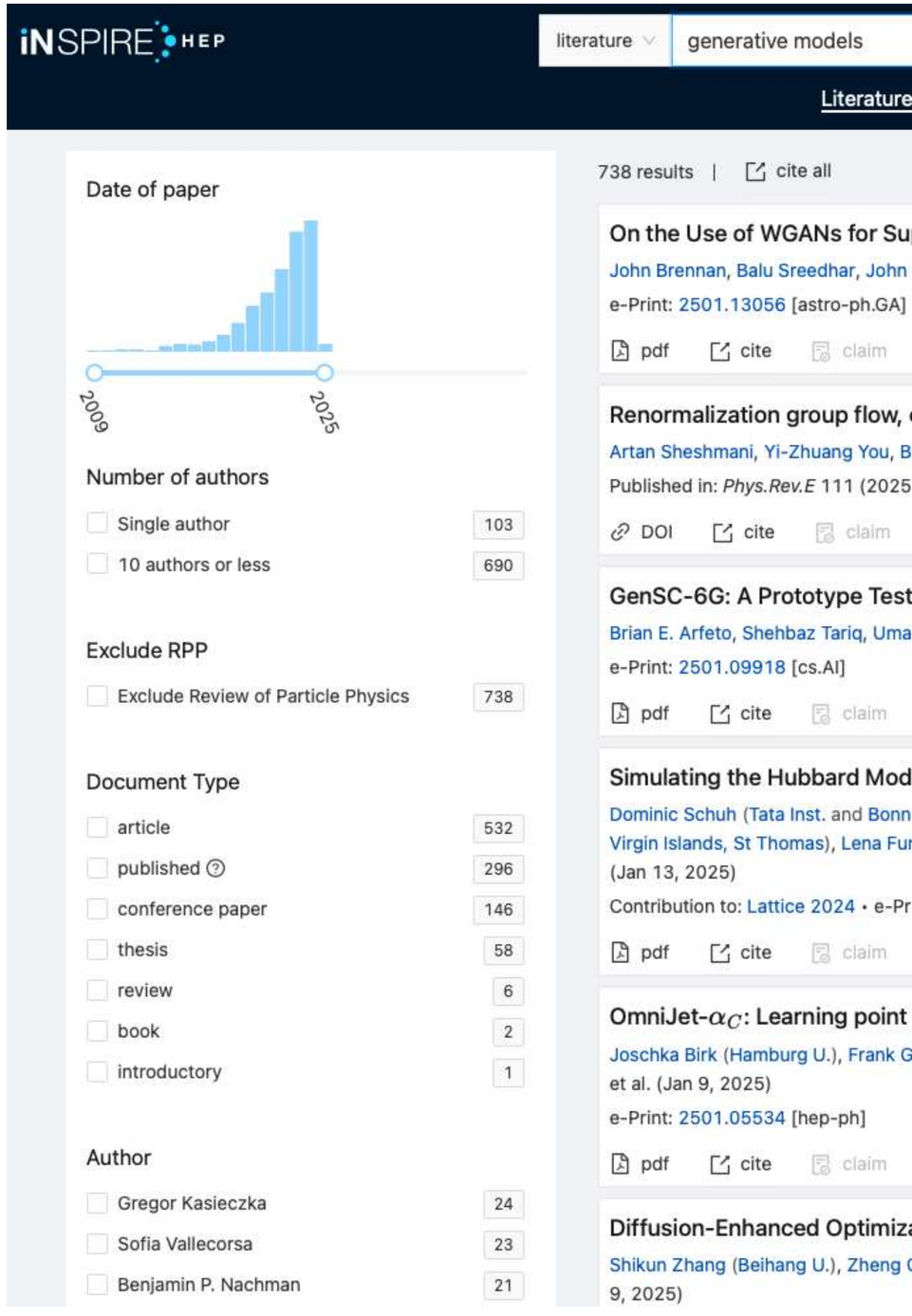


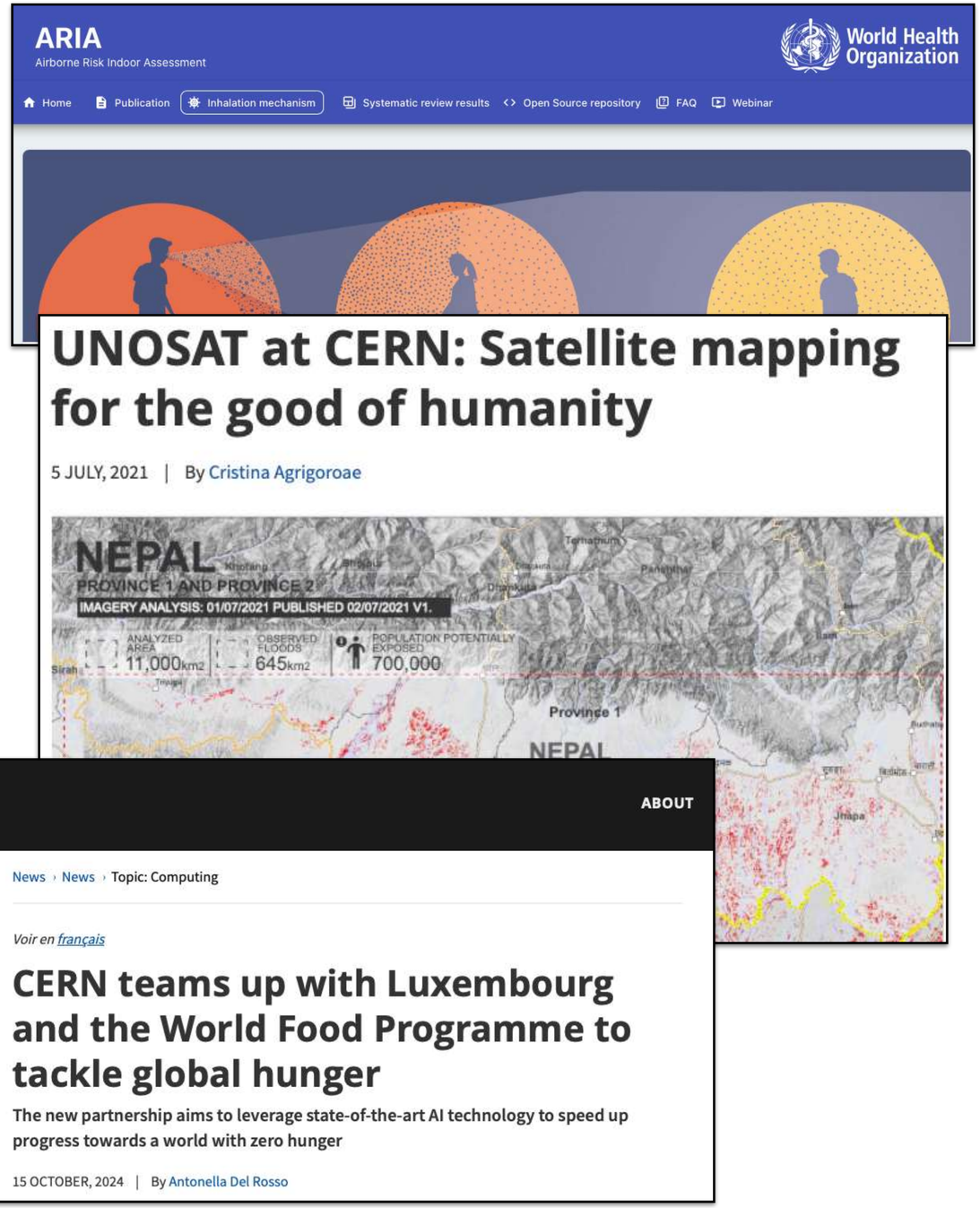
AI for humanity at CERN

“Unite people from all over the world to push the frontiers of science and technology, for the benefit of all”

from the CERN mission statement

CERN builds collaboration with humanitarian agencies and takes concrete actions to support human rights

- ARIA project with WHO
- AI-based satellite image analysis with UNOSAT (UNITAR)
- Most recently, new collaboration with Luxembourg, LIST and WFP on a series of AI based tools to help improving WFP operations



AI strategy at CERN

Setup an AI Initiative coordinating different issues related to scientific AI applications development and AI use for productivity & efficiency

In particular addressing the need for policies, strategy and data privacy risks

Scientific applications at CERN do not suffer from the same kind of risks limiting application in other domains (e.g. AI for Human Right report)

Biases, performance and systematic errors are fully evaluated and characterized during the R&D process by design

Introduction of AI-based assistants to improve productivity at different levels for non-scientific tasks require addressing risks as in any other organisation