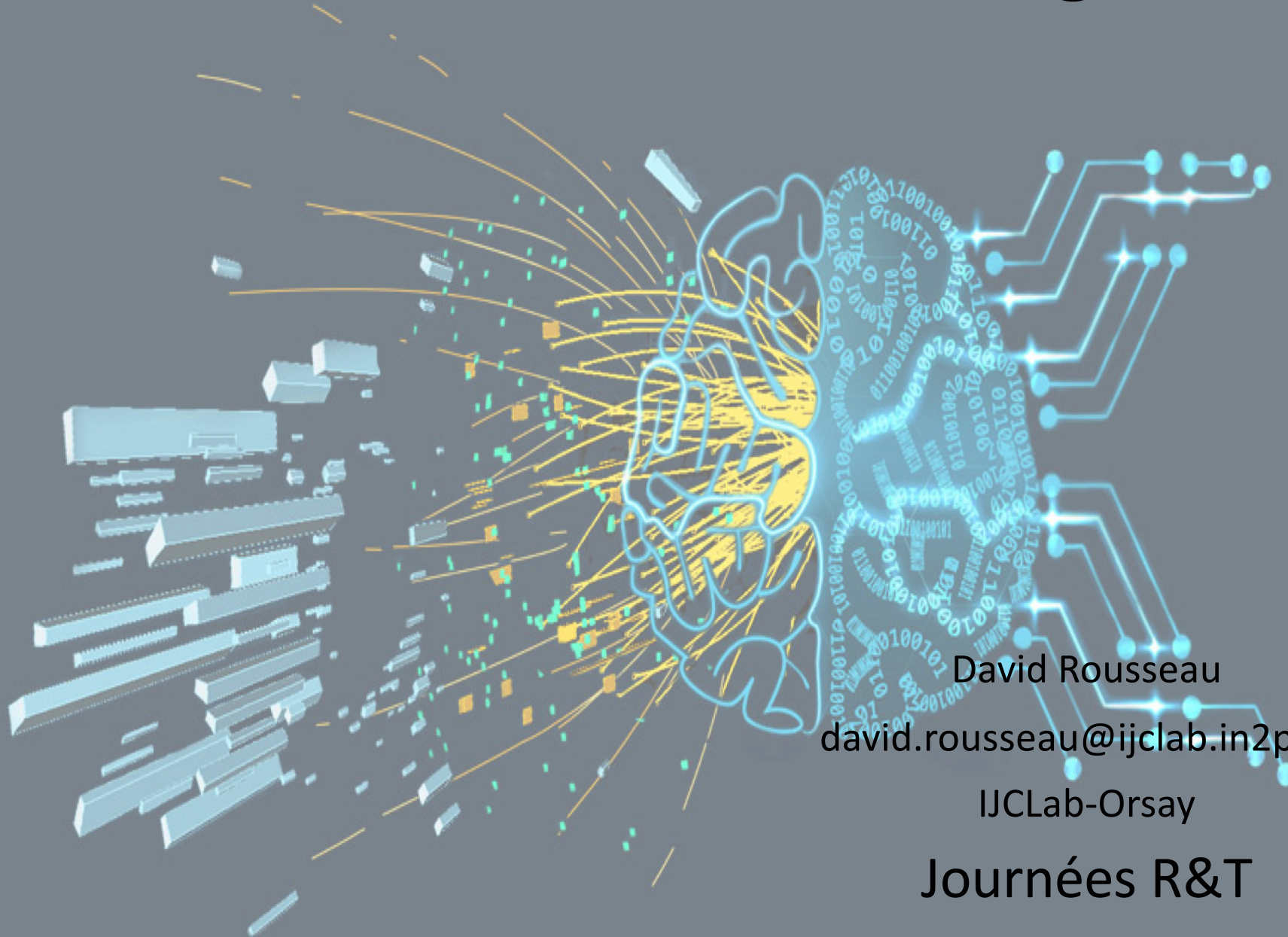


IN2P3 Machine Learning



David Rousseau

david.rousseau@ijclab.in2p3.fr

IJCLab-Orsay

Journées R&T

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Artificial Intelligence / Machine Learning in HEP



- ❑ Data reduction: locating energy
- ❑ Particle Identification and Regression
- ❑ Final State Identification and Regression
- ❑ Surrogate models: ML allows to train surrogate models from the original ones, which can be several order of magnitudes faster allowing to considerably extend the reach of the original models (Geant4 or Matrix Element computations)
- ❑ Control (possibly with Reinforcement Learning) of large infrastructures (Accelerators, computing facilities)
- ❑ Fast ML: the speed of inference and the genericity of Neural Networks make them ideal for online data processing, trigger, real time analysis or data quality monitoring, implemented on CPU, GPU or even FPGA

IN2P3 CompStat project



- ❑ 15k€ in 2021
- ❑ Overall goal is to favour development of ML at IN2P3
- ❑ Challenge
- ❑ Tutorial (but manpower ?), contributed to School of Statistics 2021
<https://indico.in2p3.fr/event/20220/> (online), School of Statistics may 2022
Carry-le-rouet
- ❑ Sending physicists to ML conference (not in 2020 2021)
- ❑ Also favour collaboration with ML scientists (or ML student, co-tutelle for example)
 - Inviting a ML scientist to a lab (or to CERN, for example)
 - Sending ML scientist to physics conference
- ❑ Use machine-learning-l@in2p3.fr to stay up to date
- ❑ Big impact of pandemic in 2020 2021

Prospectives IN2P3 recommendations



- ❑ **See GT09 report**
- ❑ **6 Facilitate AI:** Strengthen collaboration with ML Computer Scientists:
 - release of open data sets
 - funding of co-supervised PhD theses
 - collaborative projects.
- ❑ **7 Make use of and extend expertise in Real Time Analysis:**
 - Increase scientific throughput of experiments despite limited storage resources
 - Requires using in production advanced algorithms (ML in particular) on GPU/FPGA
 - Make use and extend IN2P3 expertise on ML/DL in real-time applications on innovative infrastructures.

Computing Resources



- ❑ What resources for ML work at IN2P3 ? (beyond laptop)
- ❑ Example : one PhD student evaluates he has used 10.000 hours GPU at CC for ATLAS calorimeter simulation with GAN (one training takes ~10 hours)
- ❑ Local university resources
- ❑ Jean Zay machine at Idris : need some paperwork but in principle « easy », but I do not know anyone at IN2P3 who uses it.
 - Discussion on-going to facilitates access
- ❑ Google Colab : free, perfect for tutorials but not for large scale
- ❑ Access to resources is one thing but efficient use ? E.g distribute training of one model on several GPU
- ❑ Access to resources not a limiting factor

(in)Visibilité française



- DR a co-organisé le workshop ML au CERN Oct 2020
<https://indico.cern.ch/event/852553/> (prochain March 2022 <https://indico.cern.ch/event/1078970/>
ouverture prochaine)
- A noter : très faible contribution IN2P3. 2 talks sur 38 (de la partie workshop) DR et EI
- A contraster avec les 23 talks au workshop ML @ IN2P3 janvier 2020 (<https://indico.in2p3.fr/event/20187/>) (voir aussi mars 2021 <https://indico.in2p3.fr/event/22938/> (souvent « work in progress » voir « EoI »))
- Attention : ne pouvait être montré que des résultats approuvés par les expériences. Si un français fait un peu de ML dans son analyse (souvent le cas) ça n'apparaîtra pas
- Explication possible : français peu incités à publier leurs travaux HEP ML
 - Pourtant pas très difficile dans journaux de physique et ML
 - Plus dans les conférences de Computer Science
- Autre explication possible : peu de thèse ou de post-doc HEP et ML en France, par rapport à l'étranger, car peu de financement dédiés (mais en train de changer)
- Profiter du rebond post-pandémie