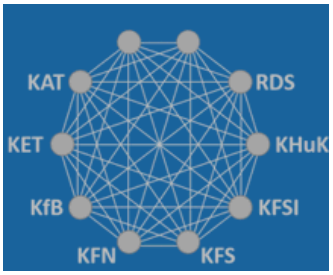

Contribution ID: **39** Type: **not specified**

Information field theory

Wednesday 1 January 2025 10:40 (5 minutes)

Information field theory (IFT) is a Bayesian framework for signal reconstruction and analysis, which builds on the mathematics of statistical field theory and machine learning (ML) inference schemes. Its practical usage is supported by Numerical Information Field Theory (NIFTy, git), a differentiable probabilistic programming library in Python. NIFTy permits to implement signal inference methods via generative models for the data. The fields, which are to be inferred, can live over multi-dimensional Euclidean spaces, the sphere, or even product spaces thereof. IFT and NIFTy have already been applied to a number of astronomical and astroparticle instruments and are suitable for many instruments of the ErUM-Data call. Here, we propose

1. to interface a number of ErUM-Data instruments to NIFTy by implementing digital twins of them, in order to permit IFT signal reconstruction for their users,
2. to advance the NIFTy algorithmics for faster performance, e.g. by parallelisation, GPU usage and others means,
3. to interface NIFTy to other ML frameworks for interoperability, speed gain, and usage of deep neural networks as priors.

Interested parties, which like to engage in any of these topics, are welcome and encouraged to contact Torsten Enßlin <ensslin@mpa-garching.mpg.de>.

Your ErUM - Committee is

More than one

List of Committees:

RDS, KAT

Please describe your expertise/areas in which you would like to contribute / advise.

Information field theory = Bayesian inference of field like quantities, numerical information field theory, astrophysics, astroparticle physics, and cosmology

Do you consent to the data usage and public abstract data posting in the ErUM-Data Community Information Exchange?

Yes

In ErUM-Data, what kind of data are you dealing with?

Astrophysical and astroparticle data, with a non-exclusive focus on radio interferometric, X-ray and gamma ray imaging with spectral and/or temporal resolution.

What is your expertise in computing and / or software development?

Numerical Information Field Theory (NIFTy)
https://gitlab.mpcdf.mpg.de/ift/nifty

What is your field and role?

I am research group leader in astrophysics and information field theory

Please describe areas in which you can contribute to "data handling"teaching.

A full course program covering information theory, information field theory, and numerical information field theory exists and is partly available online:
https://wwwmpa.mpa-garching.mpg.de/~ensslin/lectures/lectures.html
https://wwwmpa.mpa-garching.mpg.de/~ensslin/lectures/materials.html

My current most burning research question, I like to find partners for, is:

Information field theory

Please describe areas in which you would like to improve your knowledge / skills.

Digital twins of instruments, code parallelization, interfacing of ML frameworks

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Presenter: ENSSLIN, Torsten (MPA)