

Helmholtz AI for Matter Research at HZDR



HELMHOLTZ AI

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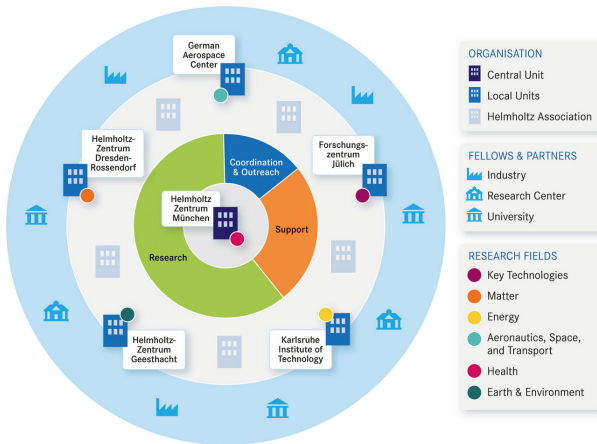
Helmholtz AI - a quick recap

What is Helmholtz AI?



- initiative by President of the Helmholtz Association, Prof. Otmar D. Wiestler
- running over 7 years, 2019 - 2026
- 12 M€ per year
(people + projects)
- central installation in Munich
(universities and Helmholtz center)

Helmholtz AI: hub and spoke model

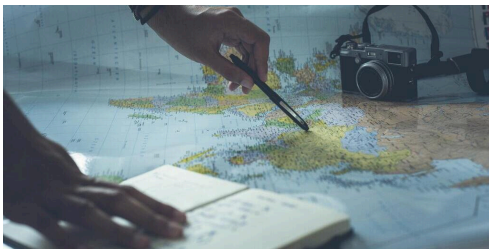


from www.helmholtz.ai

- five centers host a **local unit**
- each local unit:
 - **young investigator group**
 - **consultant team**
- central unit in Munich (universities and HMGU)
- **planned staff:**
 - 37 FTEs research
 - 35 FTEs consulting
 - 6 FTEs coordination, outreach, management

Two Funding Lines

Helmholtz AI Projects



unsplash.com:Glenn Carstens-Peters

- current call likely open until end of 2022
- max. 3 years, max. 200k € (must be matched)

Helmholtz AI Consulting



unsplash.com:Dominik Scythe

- formal help request open anytime
- maybe get in touch first:
consultant-helmholtz.ai@hzdr.de

Helmholtz AI Consulting?

Intentions and Goals

- **audience:** any staff member of Helmholtz (focus on academic staff)
- **collaboration-as-a-service** (consultant becomes full member of partnering research for the time of the voucher)
- **duration:**
 - **exploration voucher:** max. 2 weeks
 - **implementation voucher:** 2 weeks to 6 months
- **free of charge**

How to

1. talk to us, please!
`consultant-helmholtz.ai@hzdr.de`
2. pull-up the voucher system (Helmholtz AAAI authentication)
`voucher-system.helmholtz.ai`
3. fill in the voucher document:
 - what is it about?
 - who is it for?
 - what is the context?
 - what data do you have?
 - ...

Helmholtz AI Consulting Examples

- “Let’s test this ML on our data!” (2 weeks)
- “Let’s test this new ML model on our data!” (2 weeks)
- “How do we train faster on the cluster?” (2 weeks)
- “Can you teach our Ph.D. student ML fundamentals?” (2 weeks)
- “We need an ML course to educate ourselves!” (2 weeks)
- “I have student who should do ML.” (2 weeks)
- “We have a CNN/VAE, but didn’t do Hyperparameter optimisation yet” (20 weeks)
- “The community uses this tensorflow tool, but need something in pytorch” (26 weeks)
- ...

Matter Helmholtz AI

Helmholtz AI Consultant Team at HZDR

Part of Computational Science Department at HZDR



LEAPS-INNOV
(H2020)

- **reproducible automated** (ML) pipelines
- **inverse problems** & generative modelling
- (image) **denoising**
- **anomaly detection**
- regression & pattern recognition
(object localisation, **image segmentation**)
- aspects of trustworthy ML (**uncertainties**, **robustness** and interpretability)
- **Training** on ML fundamentals and beyond
- **Data compression** for photon science

Hoffmann Lab: Helmholtz AI Young Investigator Group

Part of Institute of Radiation Physics at HZDR



ELBE. HiBEF

Digital twins of future laser-driven particle accelerators

Surrogate modeling

ML-driven optimizer

Inverse Problems

Theory:
laser-plasma acceleration

$$\begin{aligned}\nabla \cdot \mathbf{D} &= \rho \\ \nabla \cdot \mathbf{B} &= 0 \\ \nabla \times \mathbf{E} &= -\frac{\partial \mathbf{B}}{\partial t} \\ \nabla \times \mathbf{H} &= \mathbf{J} + \frac{\partial \mathbf{D}}{\partial t}\end{aligned}$$



Experimental Data

