HELMHOLTZ **AI** | ARTIFICIAL INTELLIGENCE
COOPERATION UNIT

Helmholtz AI for accelerator physics
an introduction

HELMHOLTZ **AI**

Peter Steinbach
HZDR / Mar 9, 2021

What is AI?

**1956 Dartmouth Conference:
The Founding Fathers of AI**

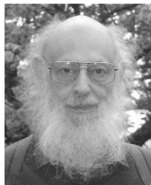John MacCarthy — Marvin Minsky — Claude Shannon — Ray Solomonoff — Alan Newell

Herbert Simon — Arthur Samuel — Oliver Selfridge — Nathaniel Rochester — Trenchard More

Figure: scienceabc.com

Machine Learning Landscape
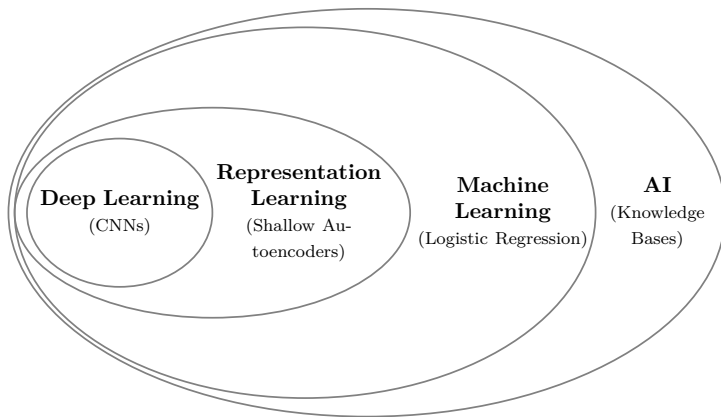
Figure: I. Goodfellow, Deep Learning, MIT Press

Deep Learning Boom in Classification

ImageNet competition results

en.wikipedia.org/ImageNet
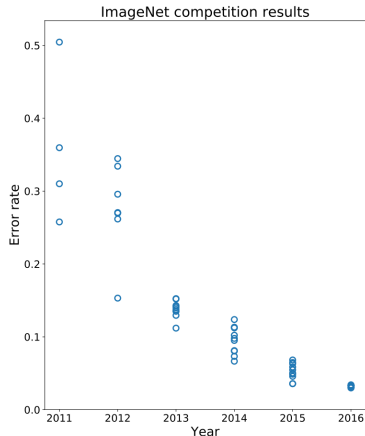
2012, three things merged:

✔ machine learning

🗄 (large) datasets

🎮 GPUs

Object Localisation and Segmentation

Figure: github.com/matterport/Mask_RCNN

Domain Transfer
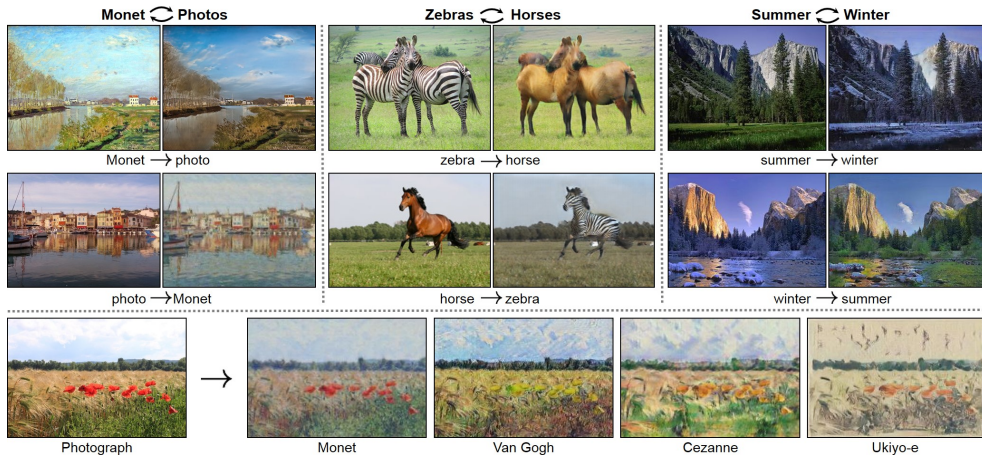
Figure: github.com/junyanz/CycleGAN

Helmholtz AI

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- central installation in Munich
  (universities and Helmholtz center)

Our Steering Board

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Scientific director HAICU
Helmholtz Zentrum München

FRANK JENKO
Max Planck Institute for Plasma Physics

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Helmholtz-Zentrum Dresden-Rossendorf

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ANDREAS KOSMIDER
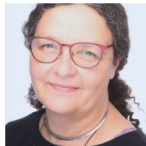Helmholtz Association

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German Aerospace Center

Two Funding Lines

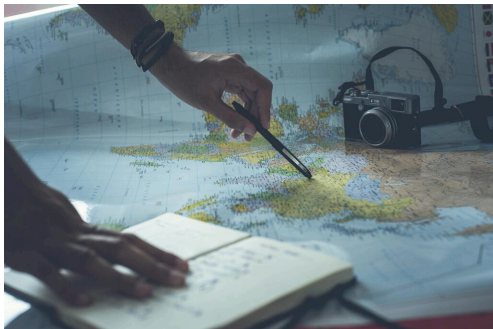## Helmholtz AI Projects

unsplash.com:Glenn Carstens-Peters

Helmholtz AI Vouchers

unsplash.com:Dominik Scythe

Helmholtz AI Projects

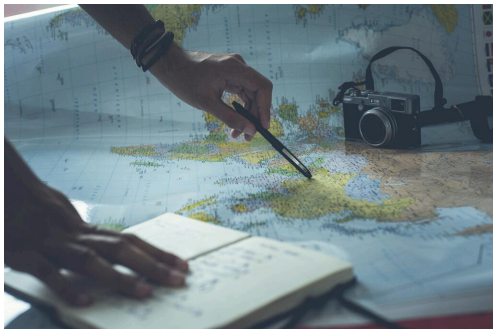

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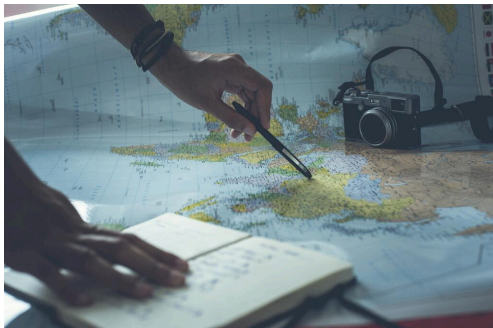unsplash.com:Glenn Carstens-Peters

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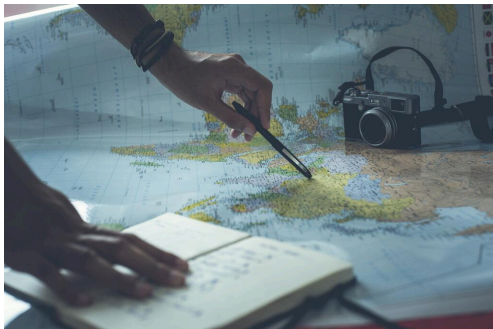
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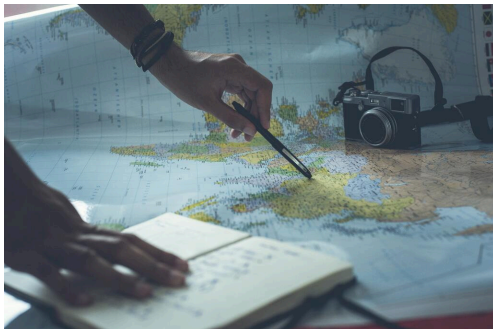
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  - 2020: 19/62 selected

Helmholtz AI Vouchers

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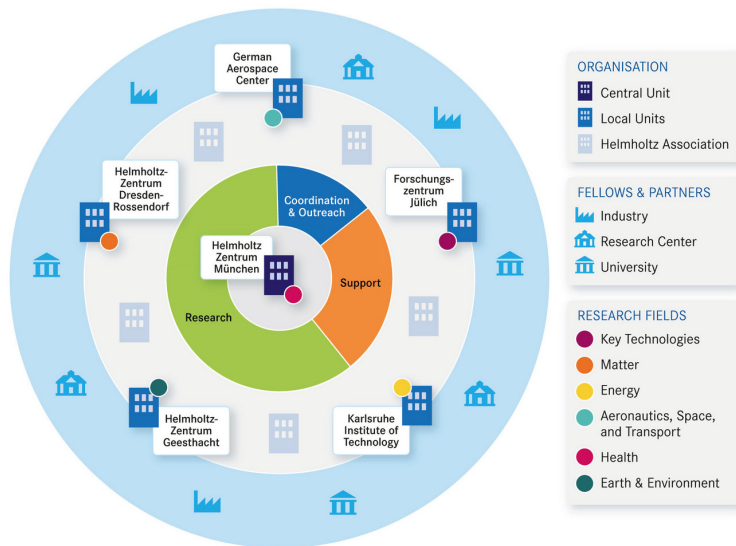
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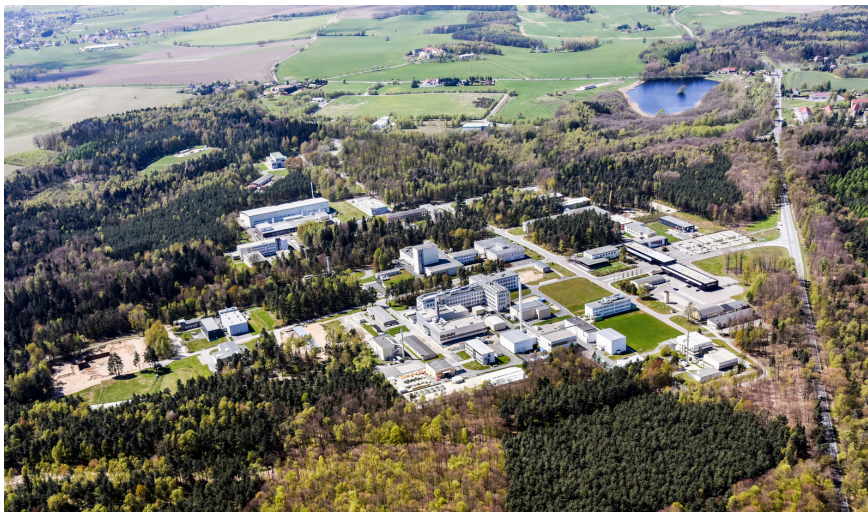- accepting pilot vouchers:
  `consultant-helmholtz.ai@`
  `hzdr.de`

Helmholtz AI localisation

Helmholtz AI at Helmholtz-Zentrum Dresden-Rossendorf

HZDR from above

Our Center

Figure: HZDR/Oliver Killig

- founded January 1st, 1992
- `1200` **employees**
- **sites**: *Dresden*,
  Freiberg, Görlitz, Grenoble (France),
  Leipzig, Schenefeld near Hamburg
- operating **large-scale facilities**
  (for external and internal users from
  around the world)

Helmholtz AI Local Unit For Matter At HZDR

Figure: Nico Hoffmann, YIG Lead

Figure: Peter Steinbach, Consultant Lead

Helmholtz AI Consultant Team at HZDR
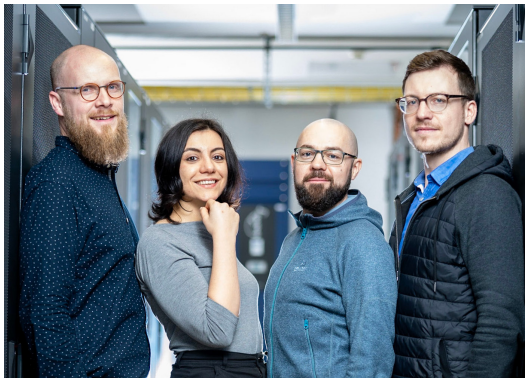
Figure: Peter Steinbach, Neda Sultova, Sebastian Starke, Helene Hoffmann, Steve Schmerler

- reproducible automated pipelines
- inverse problems
- (image) denoising
- anomaly detection
- (image) classification
- regression & pattern recognition
  (object localisation, image segmentation)

Example Voucher: Not so Liquid Metal with HZDR
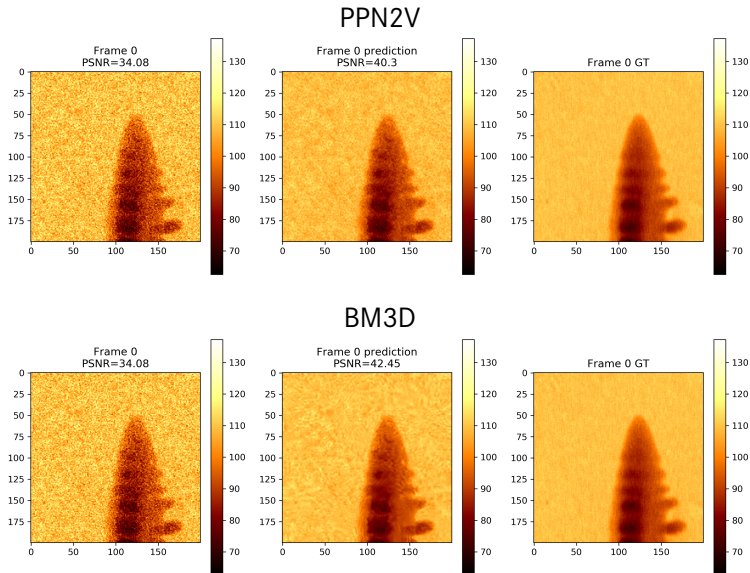
Example Voucher: Inverting a Beamline Simulation with HZB
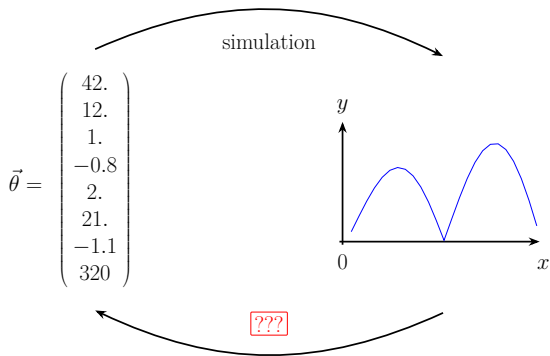
- application: beam profile of beamline paramters
- beam simulation of high precision available
- given experimental beamprofile, what are the simulation parameters?

Example Voucher: AI Teaching and Training with DESY HH

- challenge: from zero to hero
- sustainable teaching using the carpentries approach
- denovo material purpose fit to audience

Detailed Voucher: Anomaly Detection

by Helene Hoffmann

Summary

Helmholtz AI @ HZDR

- Helmholtz AI is an unprecedented investment within HGF
- Helmholtz AI Projects and **Vouchers** here to support science
- Local Unit for Matter Unit at HZDR installed and operational

Thank you for your Attention!
Questions, Concerns, Feedback?