

# Helmholtz AI Virtual Roadshow HZDR

Local Unit Energy



HELMHOLTZAI

Markus Götz

*Karlsruhe Institute of Technology / 2020-11-12*

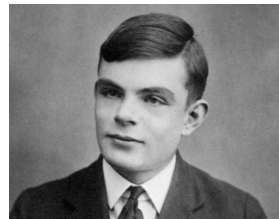
# Artificial Intelligence (AI)

# Artificial Intelligence

## What is AI?

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*“It is not difficult to devise a paper machine which will play a not very bad game of chess. Now get three men as subjects for the experiment. A, B and C. A and C are to be rather poor chess players, B is the operator who works the paper machine[...], A] game is played between C and either A or the paper machine. C may find it quite difficult to tell which he is playing.”, 1947.*



Alan Turing

# Artificial Intelligence

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*“Every aspect of learning or any other feature of intelligence can be so precisely described that a machine can be made to simulate it.”, 1956.*



Alan Turing

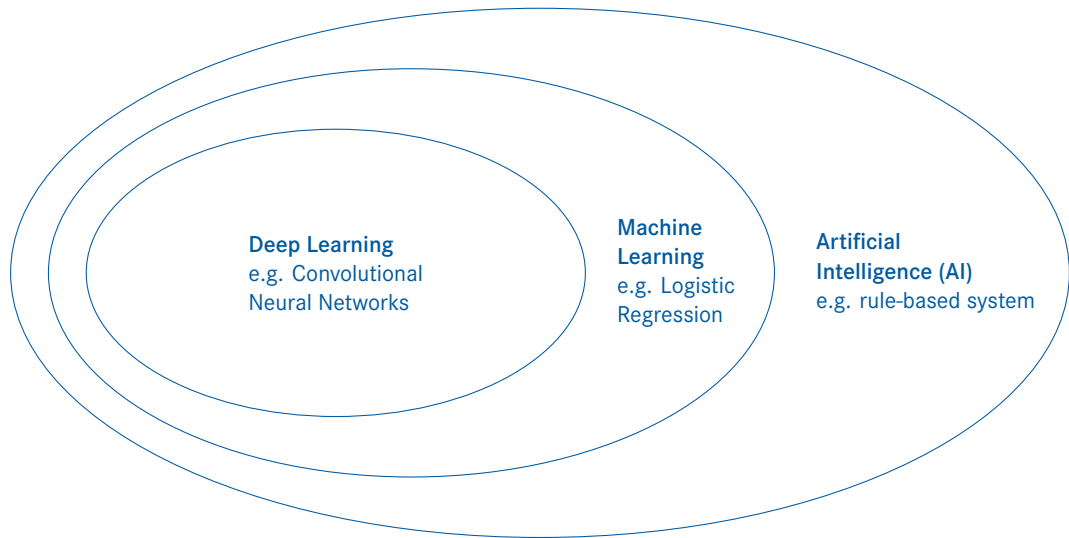


Dartmouth Conference on Artificial Intelligence

# Artificial Intelligence

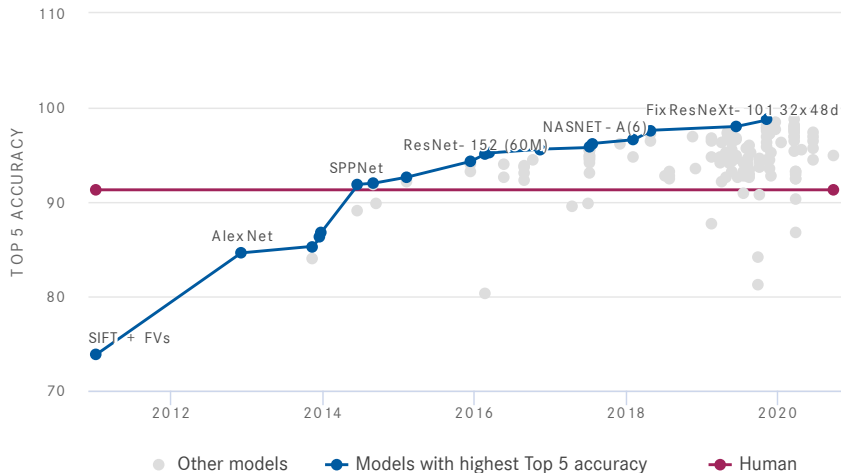
## Terminology

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# Artificial Intelligence

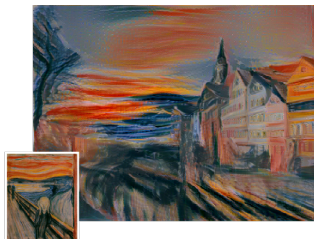
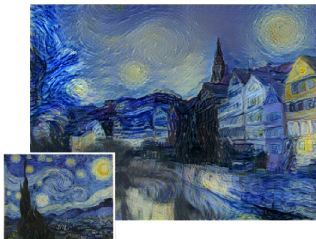
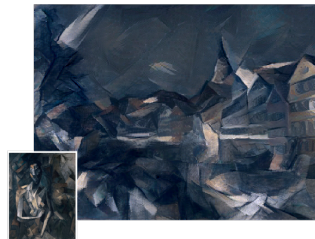
## Image Net – Super Human Performance



Modified version plot taken from <https://paperswithcode.com/sota/image-classification-on-imagenet>

# Artificial Intelligence

## Neural Style Transfer



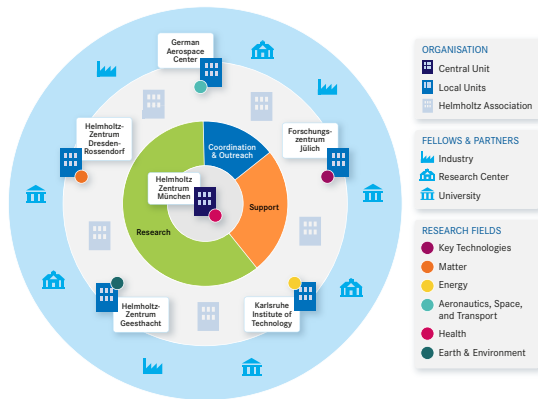
Gatys, L. A., Ecker, A. S., & Bethge, M. (2016). Image style transfer using convolutional neural networks. In Proceedings of the IEEE conference on computer vision and pattern recognition (pp. 2414-2423).

1. **Technology revolution** – parallel processors (e.g. GPUs), auto-gradient software
2. **Data availability** – large-scale, publicly available and labeled data
3. **Methodological advances** – new neuron types, training approaches, embeddings

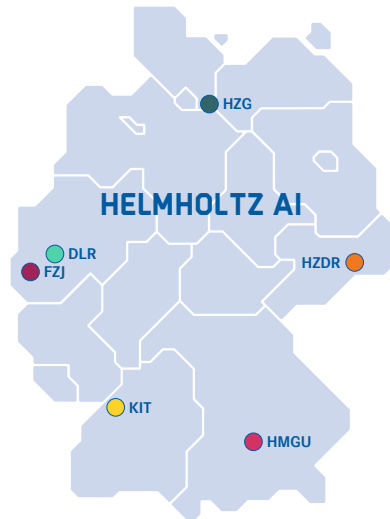


# Helmholtz AI

- Helmholtz incubator (INF) platform
- Launched mid 2019
- 12M € per year (overall)
- One central unit (30 FTEs)
- Five local units
  - AI YIG (3 FTEs)
  - Consultant group (5 FTEs)



1. **Interdisciplinary** platform for innovative **research** in **AI**
2. Compiles, develops and fosters **applied AI** methods nationwide across all **Helmholtz centers**
3. Aims to reach **international leadership** in **applied AI**



# Helmholtz AI

## Steering Board

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Fabian Theis  
SD, HMGU



Frank Jenko  
MPI



Guido Juckeland  
HZDR



Judith Katzy  
DESY



Andreas Kosmider  
HGF



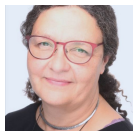
Lars Mehwald  
HGF



Ralf Mikut  
KIT



Morris Riedel  
FZJ



Corina Schrum  
HZG



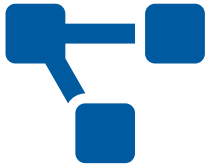
Oliver Stegle  
DKFZ



Frederik Tilmann  
GFZ



Xiaoxang Zhu  
DLR



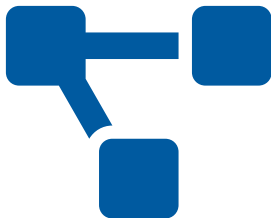
## Projects



## Vouchers

*Research on novel AI methods and applications*

- **High risk, high gain** AI research
- At least **two Helmholtz centers**, external partners possible
- **Duration:** 1-3 years (**usually: 2**)
- **50:50 matched funding**
  - Up to **200.000 €** from the INF
  - Same amount in **own contribution**
- **Bi-annual** call 2019: 18/58 selected
  
- **Current call deadline: December, 1st**
- Find partners at: [Project Workspace](#)



### *Support for applied AI activities*

- **Collaborative** work between **Research group** and **Consultant group**
- **Duration:** 2–26 weeks
- **Free of charge**, conditionally consultants acceptance
- Additional **low-cost funding** possible (travel, workshop fees, licenses, ...)



### *Support for applied AI activities*

#### ■ **Examples of voucher services**

- **Brainstorming** on AI approaches
- **Technology** advice
- **Implementation** of pipelines
- **Optimization** of existing code
- **Support** for projects, compute time proposal, funding calls...
- **Networking** in Helmholtz AI



#### ■ **Joint publication policy**

- Orients itself at **DGF guidelines**
- Only for major contributions

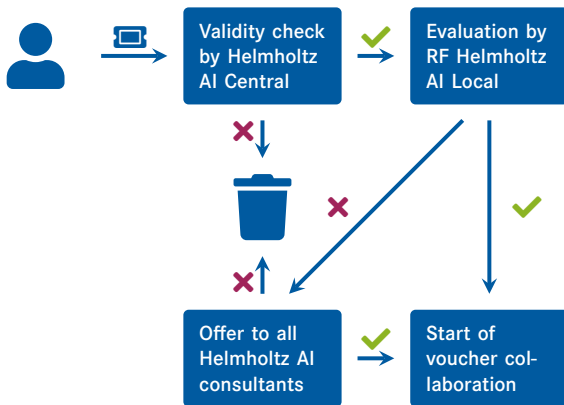


### ■ Centralized web-based system

- Log-in via Helmholtz center e-mail address
- Fill out form with voucher title, duration, abstract, ...

### ■ Voucher system

### ■ Formal assignment process



# Local Unit Energy@KIT

- Founded October, 1st 2009
- ~ **9.500 employees**
- Merger between University and Research Center Karlsruhe
- “**Research University in the Helmholtz Association**”
- **Large-scale research facilities** and regular **university**
- Sites in Karlsruhe, Ulm, Dresden, Garmisch-Partenkirchen



### YIG AI in Energy



W1 TBA



Postdoc, TBA



Benedikt Heidrich

### AI Consultants



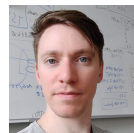
W1 TBA



Markus Götz



Charlotte Debus



James Kahn



Daniel Coquelin

### ■ AI in Energy research focus

- Future energy systems
- Renewable energy
- Smart grids

### ■ Consultants expertise

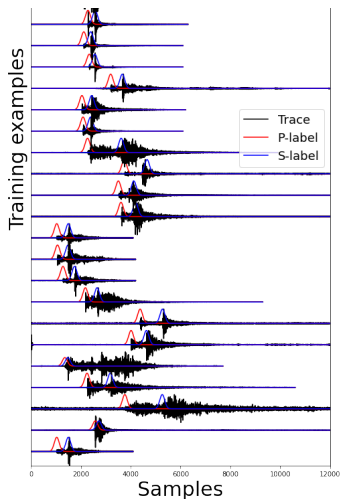
- Physics and informatics backgrounds
- Time series, images, graphs
- Model searches
- Uncertainty quantification
- Large-scale processing

### ■ Getting in touch

- ✉ [consultant-helmholtz.ai@kit.edu](mailto:consultant-helmholtz.ai@kit.edu)
- ☎ +49 721 608-29178



- Voucher partners
  - KIT-GPI
  - University of Liverpool
- Detection of seismic P- & S-waves
  - Sequence tagging problem
  - Existent initial pipeline
- Consulting request for
  - Handling class imbalance (**method**)
  - Neural architecture search (**software**)
  - Access to HPC systems (**support**)
- Duration: **ongoing**, three months in



# HAICORE

- **Compute resources for Helmholtz AI**
- **Free of charge for Helmholtz AI**
  - Vouchers
  - Projects
  - Research groups
- **Access support via consultants**
- **Technical details**
  - **Jupyter Notebook**  
(browser-computing)
  - **GPU-accelerated HPC systems**
- **Two installation sites**
  - **FZJ: JUWELS booster**
  - **KIT: HoreKa system**





# Discussion