Opening Remarks

3rd Summer School on High-Performance and Disruptive Computing in Remote Sensing (HDCRS)

Jón Atli Benediktsson, Rector and President
University of Iceland

THE IEEE GEOSCIENCE AND REMOTE SENSING SOCIETY (GRSS)

IEEE

The largest academic and professional Society with ~430,000 members in 160 countries

https://www.ieee.org/

https://www.grss-ieee.org/

Location: All over the world

Beginnings: Founded in 1961

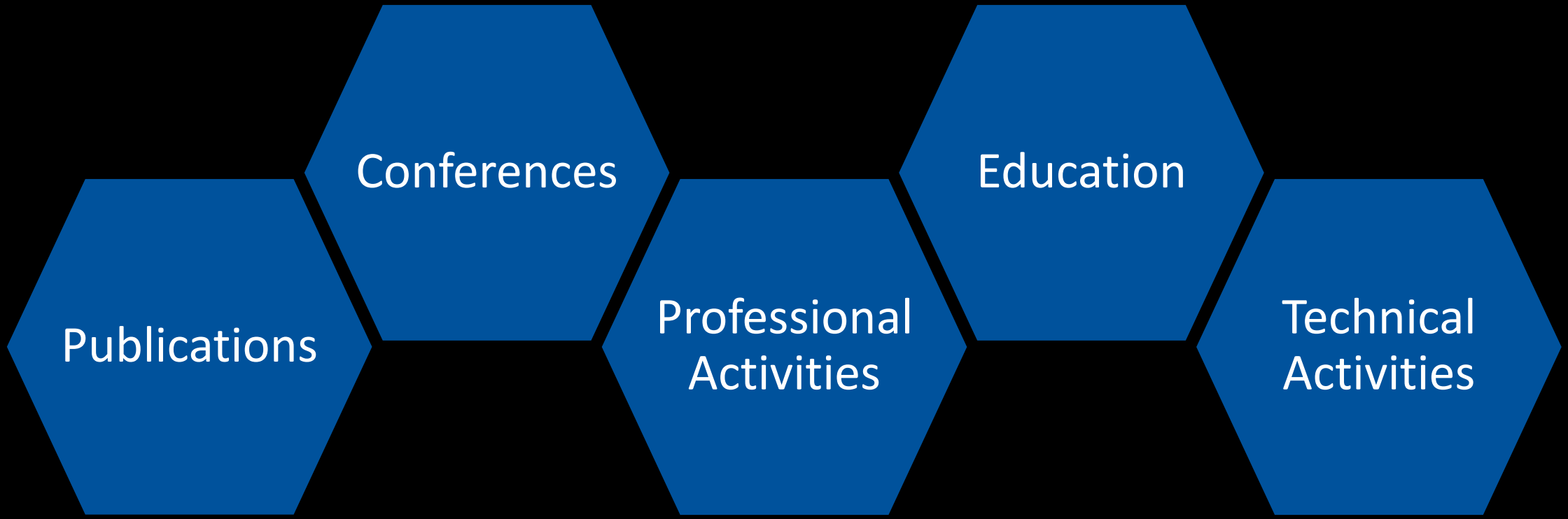
Mission: One of 39 IEEE Technical Societies. Fosters engagement for the benefit of society through science, engineering, applications, and education related to geoscience and remote sensing

Scope: Includes theory, concepts, and techniques of remote sensing of the Earth, oceans, atmosphere, and space, as well as processing, interpretation, and dissemination of this information

Members: ~5,000 members in 94 countries

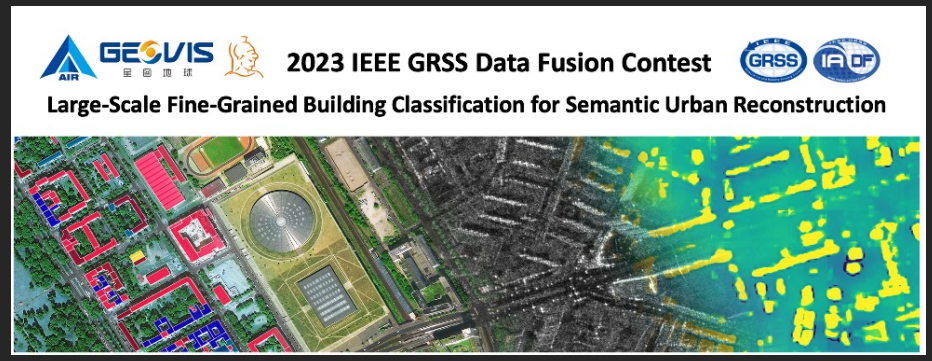
Chapters: 69 chapters, 22 student chapters, and 11 ambassadors all over the world

Geoscience and Remote Sensing Society (GRSS)



GRSS Technical Committees

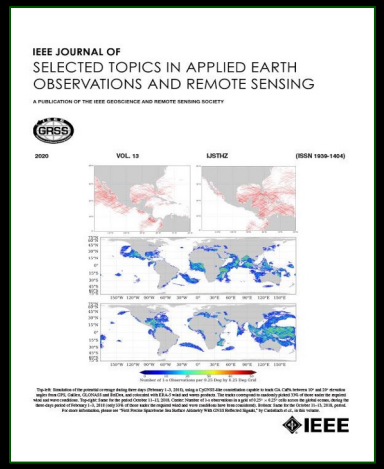
- ESI: Earth Science Informatics
- FARS: Frequency Allocation in Remote Sensing
- GRSS Standards for Earth Observations
- GSIS: Geoscience Spaceborne Imaging Spectroscopy
- IADF: Image Analysis and Data Fusion
- IFT: Instrumentation and Future Technologies
- MIRS: Modeling in Remote Sensing
- REACT: Remote sensing Environment, Analysis and Climate Technologies



Example of activity:
https://www.grss-ieee.org/technical-committees/image-analysis-and-data-fusion/?tab=data-fusion-contest

GRSS Technical Publications

- TGRS: Transactions on Geoscience and Remote Sensing
- GRSL: Geoscience and Remote Sensing Letters
- J-STARS: Journal of Selected Topics in Applied Earth Observation and Remote Sensing
- GRSM: Geoscience and Remote Sensing Magazine
- RSCL: Remote Sensing Code Library
- J-MASS: Journal of Miniaturization for Air and Space Systems
- Conference Publication Committee
- Future Publications Committee
- Committee on Plagiarism



https://www.grss-ieee.org/publications/

Why join the Geoscience and Remote Sensing Society (GRSS)?

To share your ideas, methods, and datasets, and to stay informed about recent developments and job opportunities in your field.

To enjoy discounts when publishing in our top-tier journals and joining our conferences.

To propose and lead special topic journal issues in our high-impact publications.

To make GRSS funds available for students (GRSS schools, IGARSS student grants, GRSS student grand challenges), and young professionals (GRSS sponsorship).

To give back to the community by attending or organizing meetings in your local GRSS chapter and promoting activities in your geographical area.

To organize workshops and events sponsored by GRSS through local chapters.

To foster collaborations that build community through standards and conferences.

To take part in exclusive mentoring and young professional activities.

To meet other communities and learn from their perspectives.

To access valuable content available to members on the GRSS Resource Center, IEEE Xplore, and IEEE DataPort.

Geoscience and Remote Sensing Society (GRSS)

Join GRSS

Subscribe to the GRSS eNewsletter

The University of Iceland

STUDENTS

UNDER-GRADUATES
9,376

MASTER'S STUDENTS
5,691

DOCTORAL STUDENTS
599

INTERNATIONAL STUDENTS
1,550

STUDENT SATISFACTION
83%

EMPLOYMENT RATE AFTER GRADUATION
83%

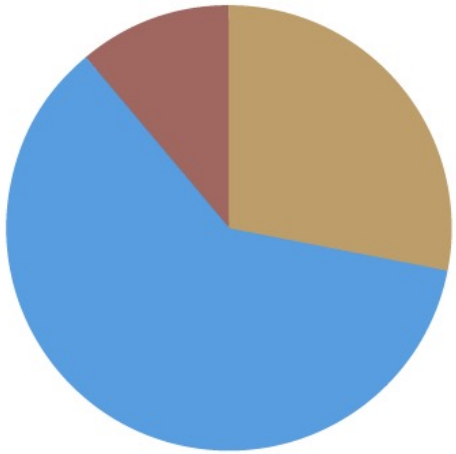
AVERAGE GRADUATE SALARY (ISK)
680,000

TOTAL NUMBER OF STUDENTS
15,666

STAFF

TEACHING AND RESEARCH
1,300

SESSIONAL LECTURERS
2,800

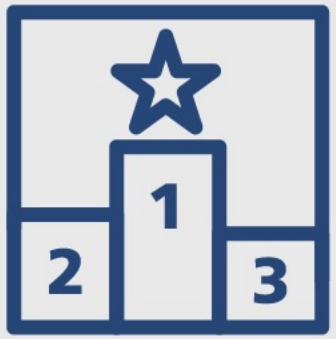


PROFESSIONAL STAFF
500

INTERNATIONAL STAFF
430

PROPORTION OF ACADEMIC STAFF WITH A PHD
80%

OVERALL STRENGTH



RANKED AMONG THE BEST UNIVERSITIES IN THE WORLD BY RESPECTED PUBLICATIONS* FOR TEN YEARS RUNNING

THE ONLY ICELANDIC UNIVERSITY INCLUDED IN BOTH THE MOST PRESTIGIOUS RANKINGS, SHANGHAI AND THE

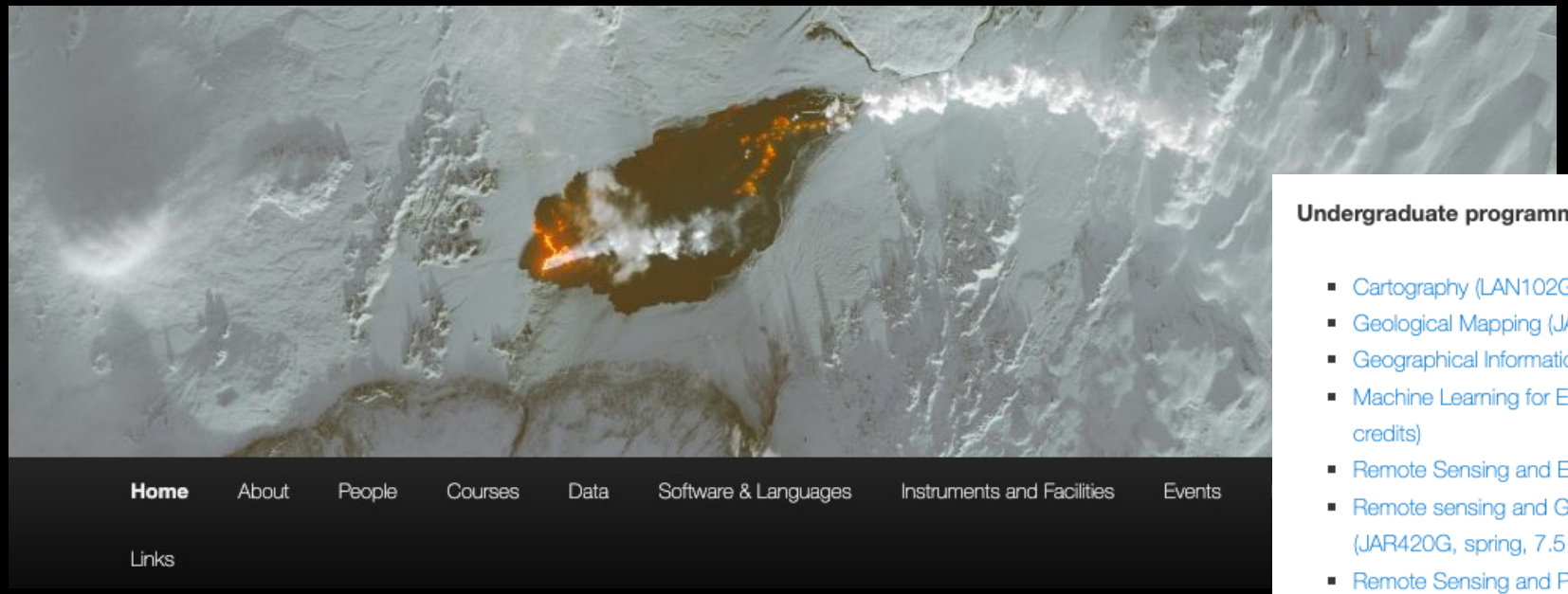
AMONG THE BEST 400 UNIVERSITIES IN THE WORLD FOR SOCIETAL IMPACT

*TIMES HIGHER EDUCATION

NUMBER OF FIELDS INCLUDED IN INTER-NATIONAL RANKINGS: 9

NUMBER OF FACULTIES INCLUDED IN INTER-NATIONAL RANKINGS: 19

Center of Remote Sensing



https://crs.hi.is/

Undergraduate programmes

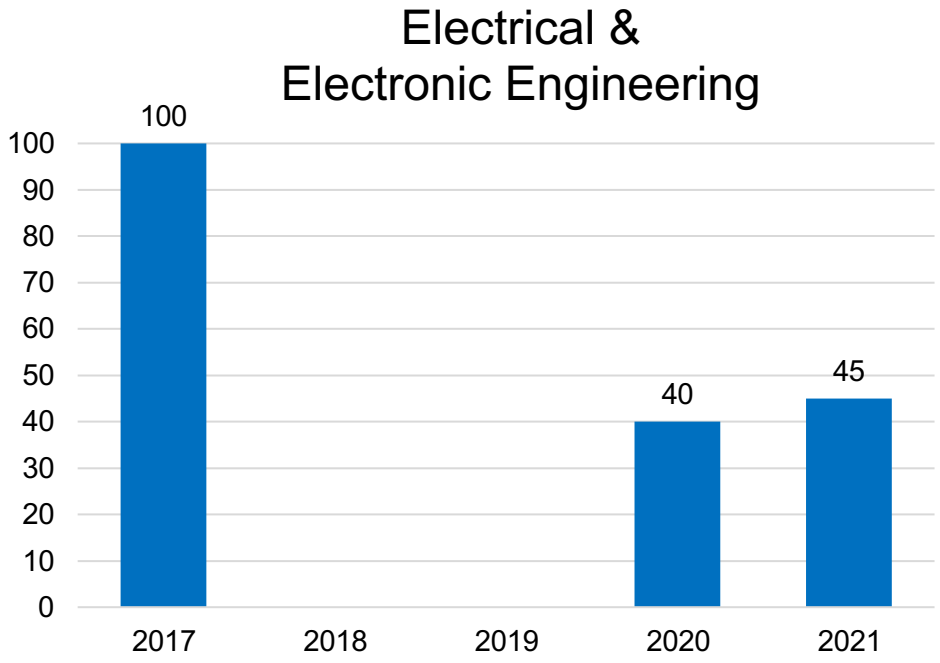
- Cartography (LAN102G, fall, 8 credits)
- Geological Mapping (JAR513G, fall, 7.5 credits)
- Geographical Information Systems 1 (UMV401G, spring, 6 credits)
- Machine Learning for Earth Observation powered by Supercomputers (REI506M, 6 credits)
- Remote Sensing and Environmental Monitoring (LAN616G, spring, 8 credits)
- Remote sensing and Geographical Information Systems in geological observations (JAR420G, spring, 7.5 credits)
- Remote Sensing and Processing of Remote Sensing Data (RAF512, fall, 10 credits)

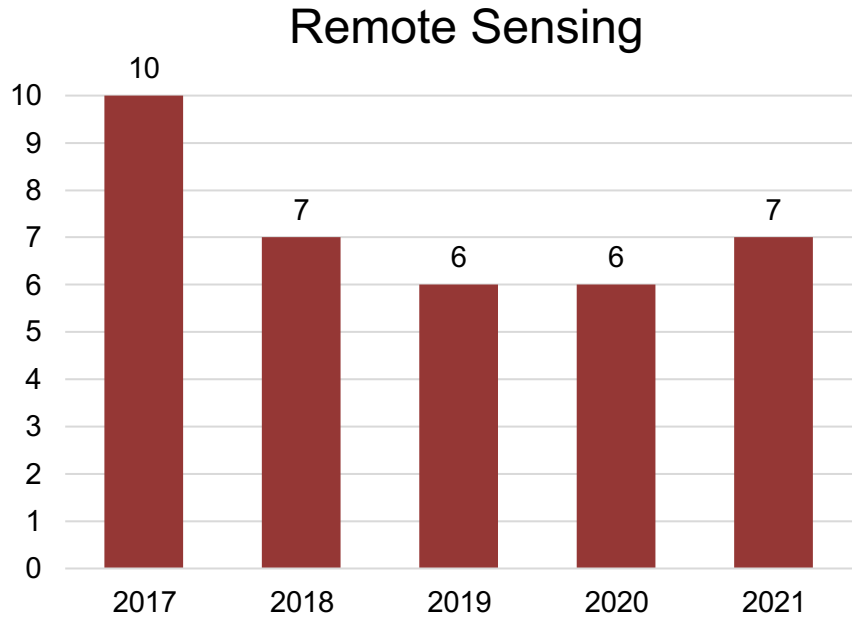
Graduate programmes

- Remote Sensing and Processing of Remote Sensing Data (RAF512, fall, 10 credits)
- Application of Remote Sensing in Earth Sciences (JAR251F, spring, 7.5 credits)
- Geographical Information Systems 2 (LAN212F, spring, 10 credits)
- Remote Sensing and Environmental Monitoring (LAN211F, spring, 10 credits)
- Visualisation and Science Communication (LAN024F, spring, 5 credits)

UI'S POSITION ON ARWU SUBJECT RANKINGS

Electrical & Electronic Engineering and Remote Sensing





- Jülich Supercomputing Centre, Germany
- University of Extremadura, Spain
- University of Trento, Italy
- Grenoble Alpes University, France
- Hunan University, China
- University of Genoa, Italy
- Purdue University, USA

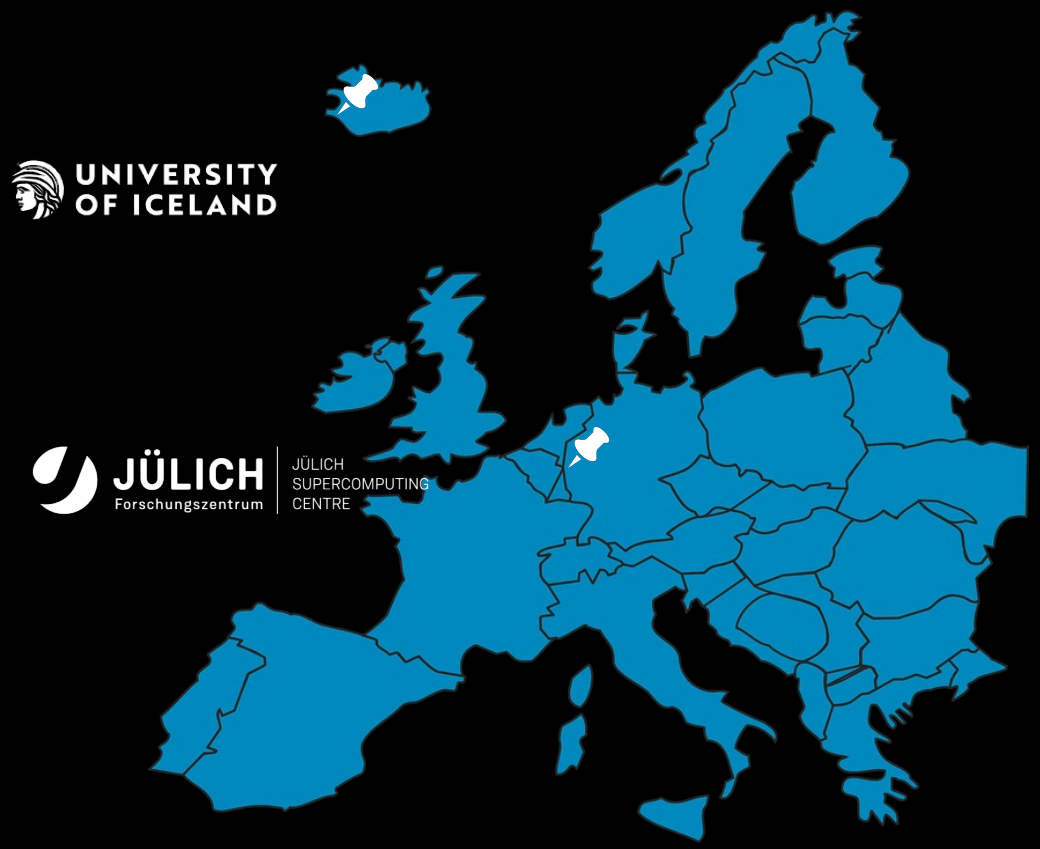
UI‘s MAJOR COLLABORATING INSTITUTIONS IN REMOTE SENSING

ICELANDIC HIGH-PERFORMANCE COMPUTING (IHPC) COMMUNITY

GRÓSKA – NEW INNOVATION AND BUSINESS GROWTH CENTER

https://www.eurocc-access.eu/

Simulation and Data in Remote Sensing



Jón Atli Benediktsson

Gabriele Cavallaro

Morris Riedel

(plus 5 PhD students, 1 Postdoc and master students)

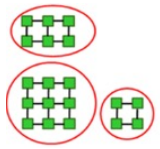
- International cooperation with the Jülich Supercomputing Centre (Forschungszentrum Jülich, Germany)
- Joint activities that include research projects, teaching courses, community support and supervision of students at different academic levels

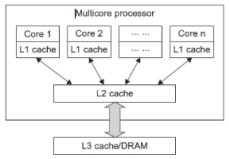
Jülich Supercomputing Centre, Forschungszentrum Jülich, https://www.fz-juelich.de/en/ias/jsc
School of Engineering and Natural Sciences, University of Iceland, https://english.hi.is/school_of_engineering_and_natural_sciences
SDL AI and ML for Remote Sensing, https://www.fz-juelich.de/en/ias/jsc/about-us/structure/simulation-and-data-labs/sdl-ai-ml-remote-sensing
Simulation and Data Lab Remote Sensing, https://ihpc.is/simulation-and-data-lab-remote-sensing/

Why using High-Performance Computing (HPC)?

✓ Benefit #1: Faster Training of AI Models → Speed-up!

High Performance Computing (HPC) & Supercomputing



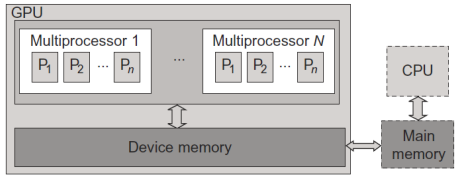


Multi-Core CPUs as Cluster

Large number of processors with high single thread performance and cache hierarchies

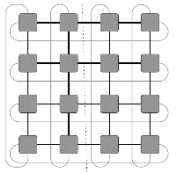
Additional Many-Core GPUs

Accelerators attached to host CPUs with moderate speed, but 100 – 1000



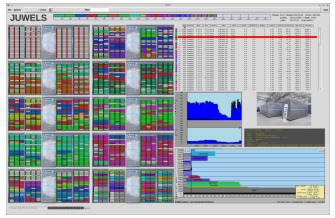
Fast Interconnects

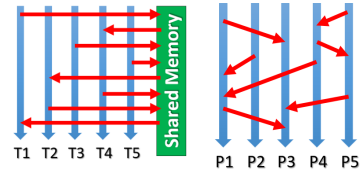
Cluster nodes interconnected with a low-latency high-bandwidth network (e.g. Infiniband)



Parallel Programming Environmer

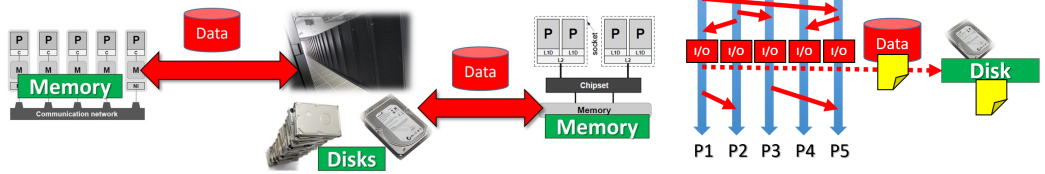
Schedulers, monitoring systems, parallel libraries





Parallel File Systems & Storage

Using binary parallel file formats & large storage capacities on different levels (NVRAM, Disk, Tapes)



Building Infrastructure

Cooling, cables, fire safety, etc.

Parallel & Scalable Machine & Deep Learning – AI & Big Data needs HPC/Clouds

@MorrisRiedel

High Performance Computing & Cloud Computing

Large Deep Learning Networks

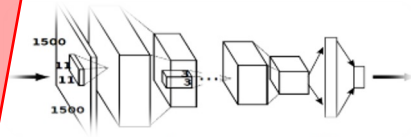
Training Time

Model Performance / Accuracy

'small datasets'

manual feature engineering' changes the ordering

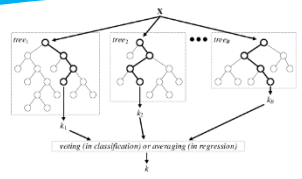
Medium Deep Learning Networks



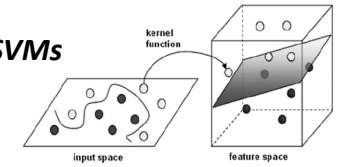
Small Neural Networks

Traditional Learning Models

Random Forests



SVMs



Statistical Computing with R

MatLab

scikit-learn *Weka* *Octave*

Dataset Volume

→ 'Big Data'

Summary and Outlook

- HPC needed for science & engineering
- Industry usage of HPC can be advanced

- Landscape of HPC gets increasingly complex
- Large inter-disciplinary teams strive

- Wide variety of great tools exist for HPC
- Mastering the toolsets is not trivial

Research challenges: Handle complexity of domains + AI + HPC via Interaction Rooms & Software Engineering Approaches

Urgent need of more HPC experts on the intersection of AI, HPC and specific scientific & engineering domains 'finding good talent in HPC is a world-wide problem we all face in academia (PhD recruiting problem)'

UNIVERSITY
OF ICELAND