

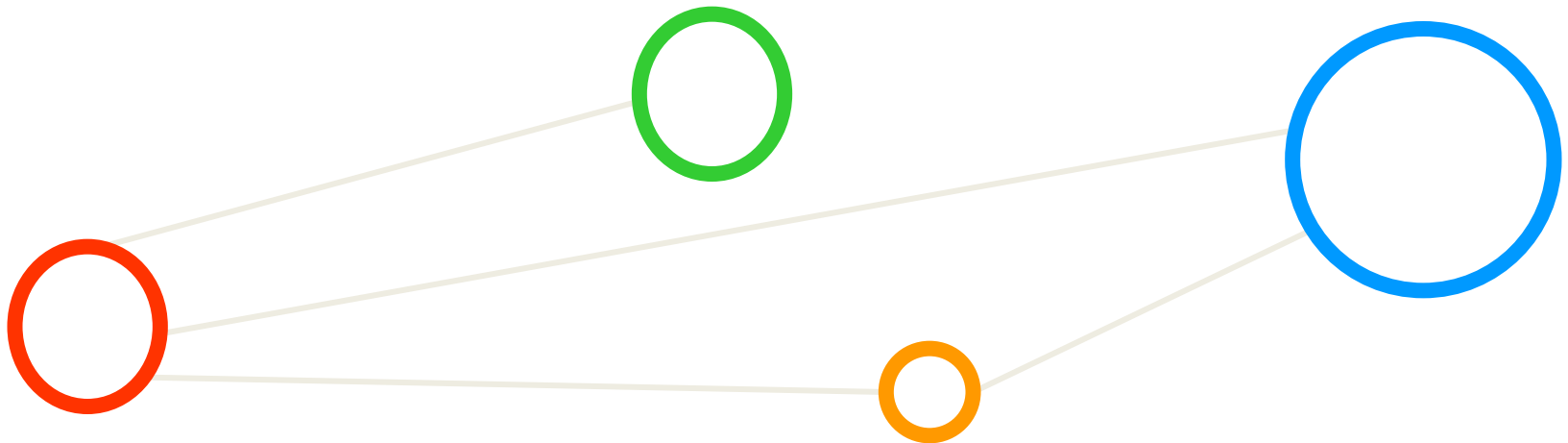


## **Eine Weltweite Initiative**

zur Steigerung von Interoperabilität und  
Wiederverwendbarkeit von Forschungsdaten

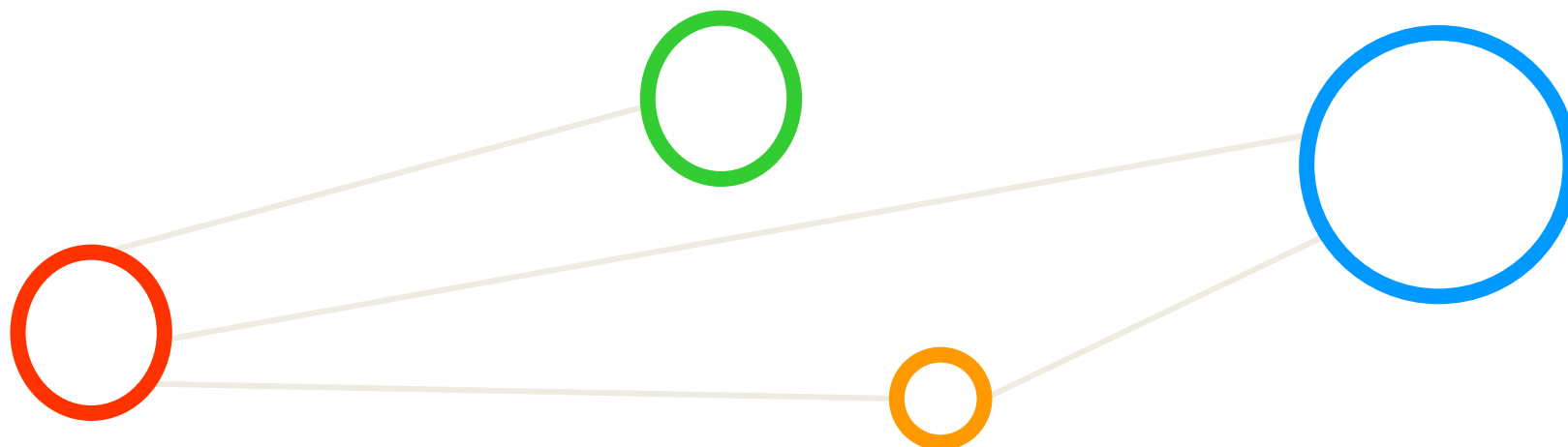
*Prof. Dr. – Ing. Morris Riedel, Helmholtz Association  
Co-Chair RDA Big Data Interest Group*

research data sharing without barriers  
[rd-alliance.org](http://rd-alliance.org)



- Überblick der Initiative
- Arbeitsweise
- Erste Resultate
- Umsetzungsbeispiele
  - Impuls zu unserer Diskussion:  
„Archivierung von Forschungsdaten“
- Einladung zur Mitarbeit**
- Zusammenfassung
- Referenzen

# Überblick der Initiative



- „RDA Vision“ verwirklichen
  - Weltweit: Überwindung von Ländergrenzen
  - Forscher können frei verfügbare Daten austauschen
  - Austausch über Technologiegrenzen und Disziplinen
- „RDA Mission“
  - Aufbau von „sozialen und technischen Brücken“ für den Datenaustausch
- Angestrebte Resultate
  - Erstellen von Empfehlungen für Organisationen aus diversen Bereichen
  - Beispiel: Klärung und gemeinsames Verständnis von Terminologie
  - Beispiel: Vorgehensweisen und gemeinsame Ansätze besser verstehen



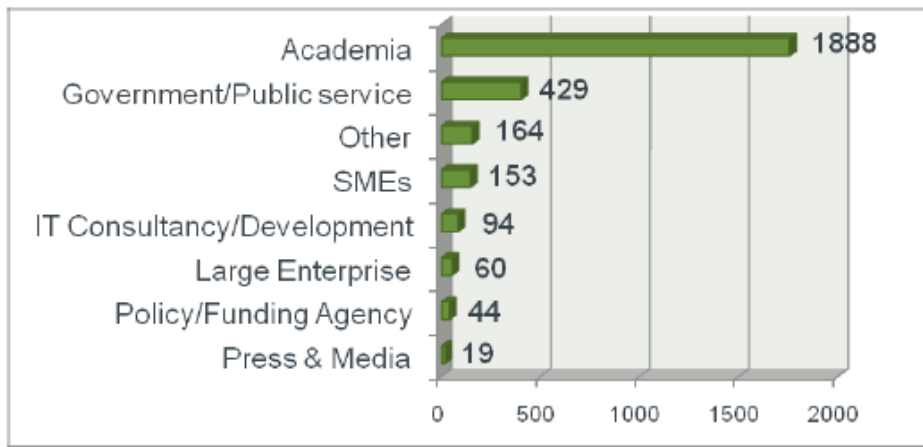
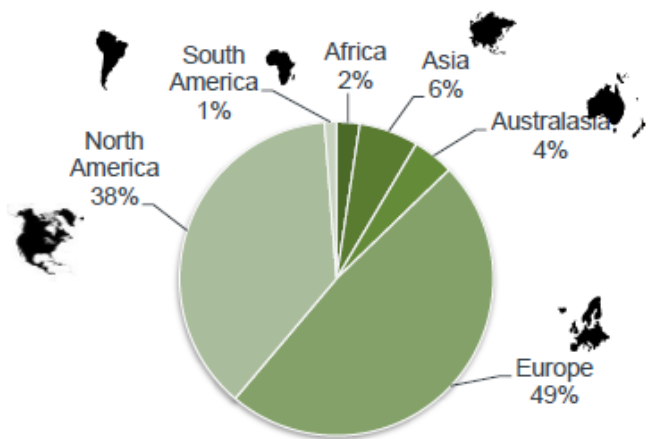
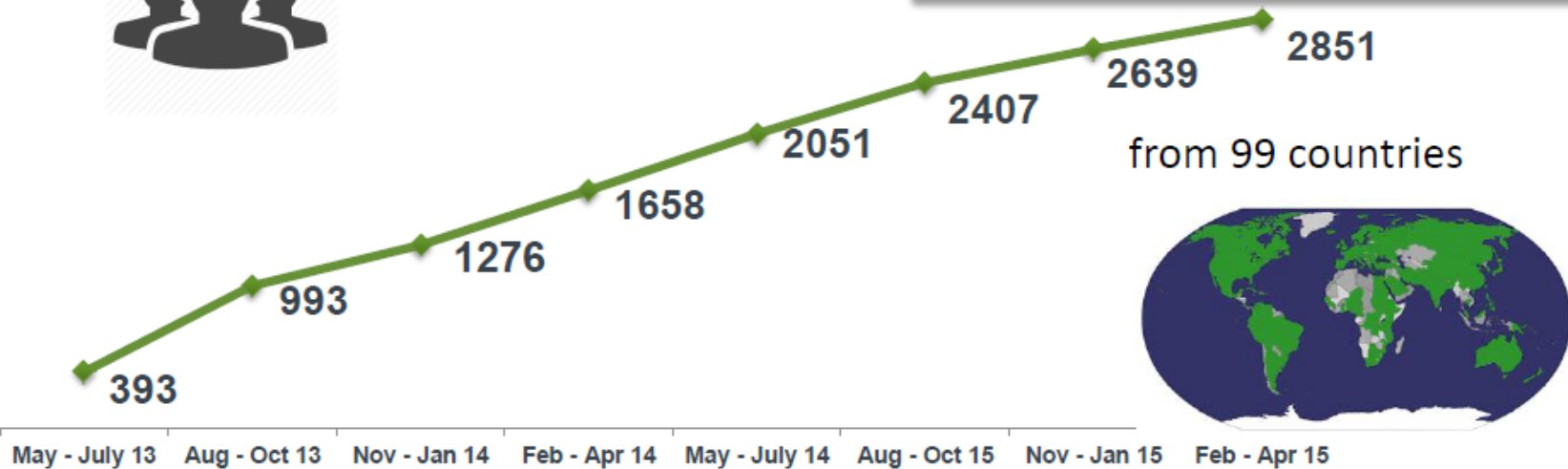
[1] RDA Website (Online)

**Wichtig: RDA fördert zwar den Datenaustausch – sammelt aber selbst keine Daten ein!**

# Internationale Mitglieder



**Totale Anzahl Mitglieder heute: ~3000**



# Mitglieder Organisationen

in 2016  
**HELMHOLTZ ASSOCIATION**

**Totale Anzahl Organisationen: ~38**

## □ Idee: Kräfte in Deutschland bündeln

- Diskussionen zur langfristigen RDA Teilnahme (auch Gelder)
- Kleinere Tagungen in Deutschland
- **Trainings anbieten zur Umsetzung!**
- Repräsentation größerer Forschungsgemeinschaften stärken
- Bspw. Helmholtz Gemeinschaft
- Bspw. Max- Planck Gesellschaft

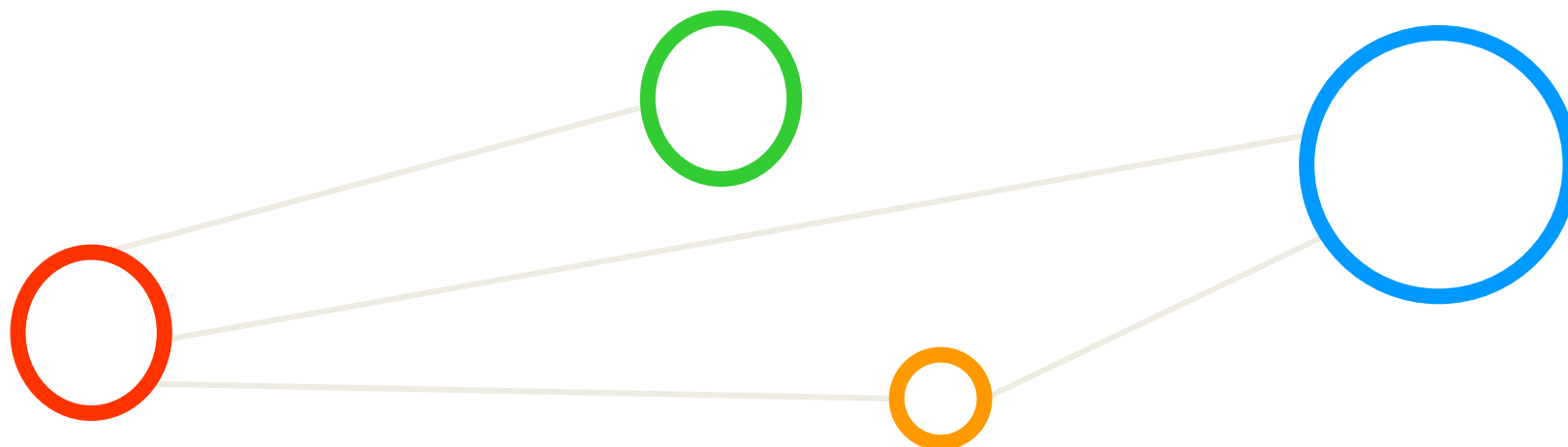
## □ Zwei Tagungen

1. 2014-11 – Potsdam
2. 2015-11 – Potsdam



MAX-PLANCK-GESELLSCHAFT





# Zwei Gruppenarten

## □ Interessen – Gruppen (engl. ‘interest groups’)

- Ziel: Identifikation gemeinsamer Schwerpunktthemen
- Zeitlich unbefristet, oft aus ‘Communities’ heraus
- Keine direkten Resultate angestrebt

**Totale Anzahl Interessen - Gruppen: ~45**

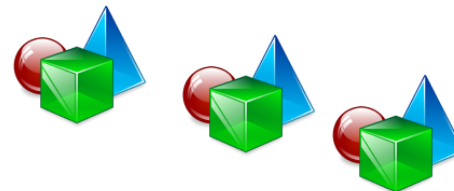


Im Idealfall  
ergeben sich  
1-3 konkrete  
Arbeitsgruppen

## □ Arbeits – Gruppen (engl. ‘working groups’)

- Ziel: Konkretes Resultat in einem Schwerpunktthema
- Zeitlich befristet, oft fokussiert auf ein Problem („case statements“)
- Klar meßbare Resultate verlangt

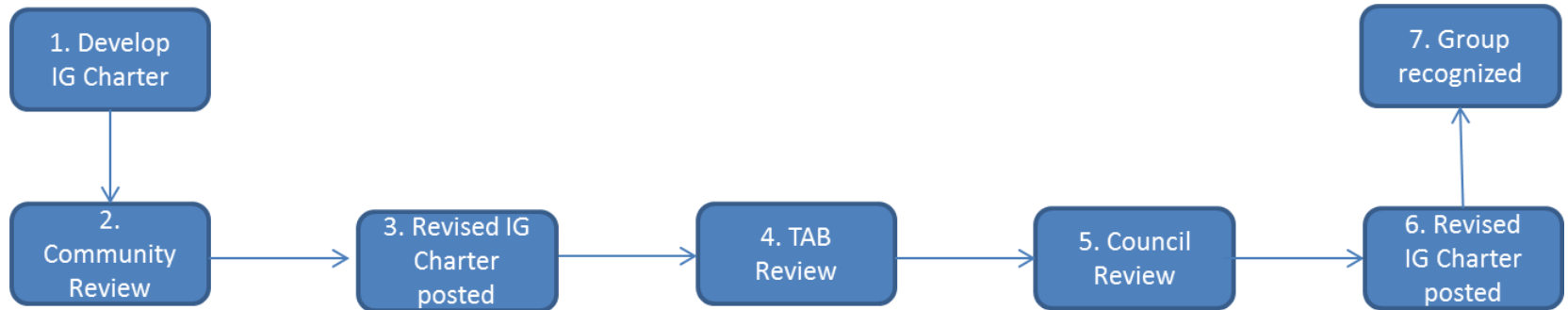
**Totale Anzahl Arbeits - Gruppen: ~27**



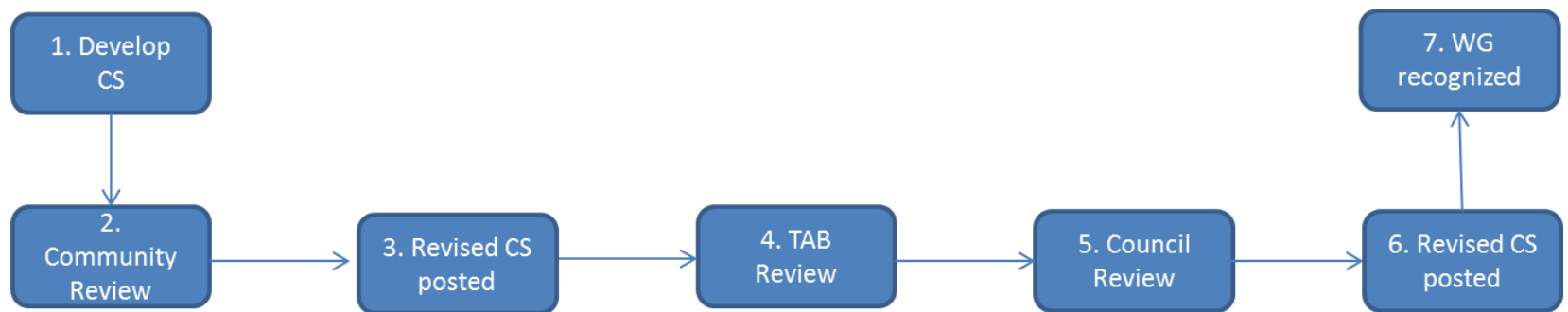
- Reproducibility IG
- Active Data Management Plans IG
- Big Data IG
- Biodiversity Data Integration IG
- Chemistry Research Data IG
- Data Fabric IG
- Data for Development IG
- Data Rescue IG
- ...
- Domain Repositories IG
- Ethics and Social Aspects of Data IG
- Federated Identity Management IG
- Global Water Information IG
- Agrisemantics WG
- Array Database WG
- BioSharingRegistry WG
- Brokering Framework WG
- Brokering Governance WG
- Data Citation WG
- Data Description Registry Interoperability WG
- ...
- Data Foundation and Terminology WG
- Data Type Registries WG
- Data Security and Trust WG
- Wheat Data Interoperability WG

**Gewähltes Technical Advisory Board (TAB)  
entscheidet zusammen mit RDA Council**

## □ Prozess für Interessen – Gruppen



## □ Prozess für Arbeits – Gruppen



## □ Ziele

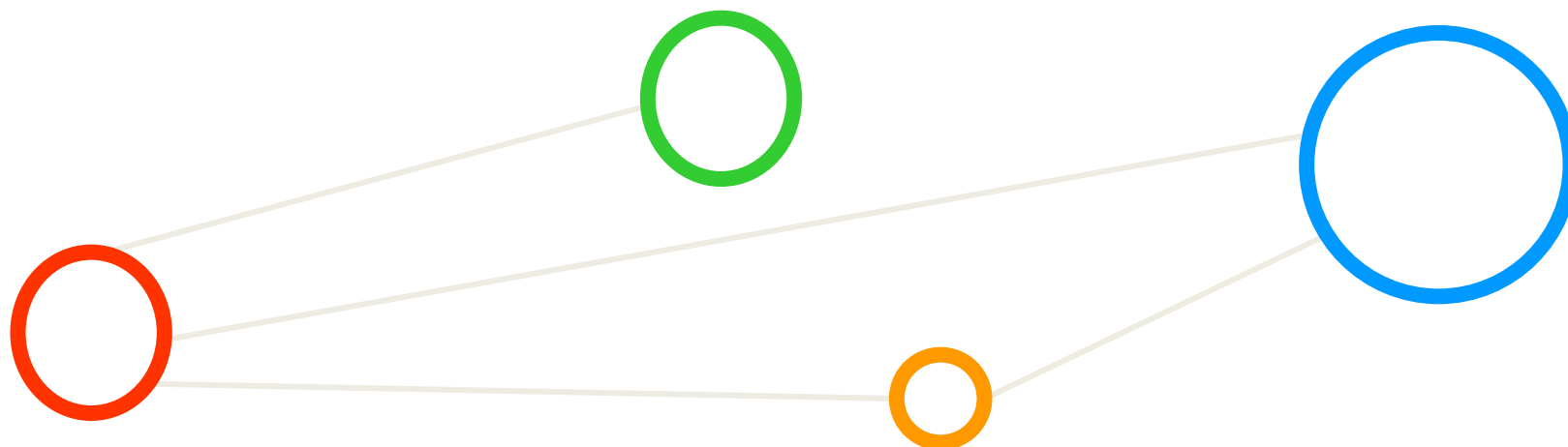
- Gruppentreffen mit schnellerem Fortschritt, Sitzungen werden beantragt
- Bündelung neuer Ideen zu Gruppen, bspw. „Birds of Feathers (BOFs)“
- Zeigen von Resultaten und Umsetzungen – auch „Special Focus“ / Events

## □ Bisherige Tagungen

1. 03-2013 – Göteborg, Schweden
2. 09-2013 – Washington, USA
3. 03-2014 – Dublin, Irland
4. 09-2014 – Amsterdam, Niederlande
5. 03-2015 – San Diego, USA
6. 09-2015 – Paris, Frankreich
7. 03-2016 – Tokio, Japan



# Erste Resultate



- Einige Arbeitsgruppen sind „fertig“
- Resultate sind in einem „Outputs Booklet“ zusammengefasst: hier nur einige Beispiele
- **Alle Resultate sind offen**
- Umsetzung in verschiedenen Einrichtungen beginnt
- Auch Interessen – Gruppen haben initiale Resultate
  - Bspw. Big Data IG
  - Idee: [www.big-data.tips](http://www.big-data.tips)  
**Webseite mit Empfehlungen auch für „nicht Experten“**



## BIG DATA TOOLS

### Using the Hadoop Big Data Tool

BY [WWW.BIG-DATA.TIPS](http://WWW.BIG-DATA.TIPS) · MARCH 11, 2016

[f Like](#) [Share](#)

The Hadoop Big Data tool provides a solution to **perform data analysis and analytics on large quantities of data**. This is possible, because Hadoop uses an approach of parallelization. In other words the data is not analyzed only on one machine or Laptop, but in parallel at the same time on a large server machine.

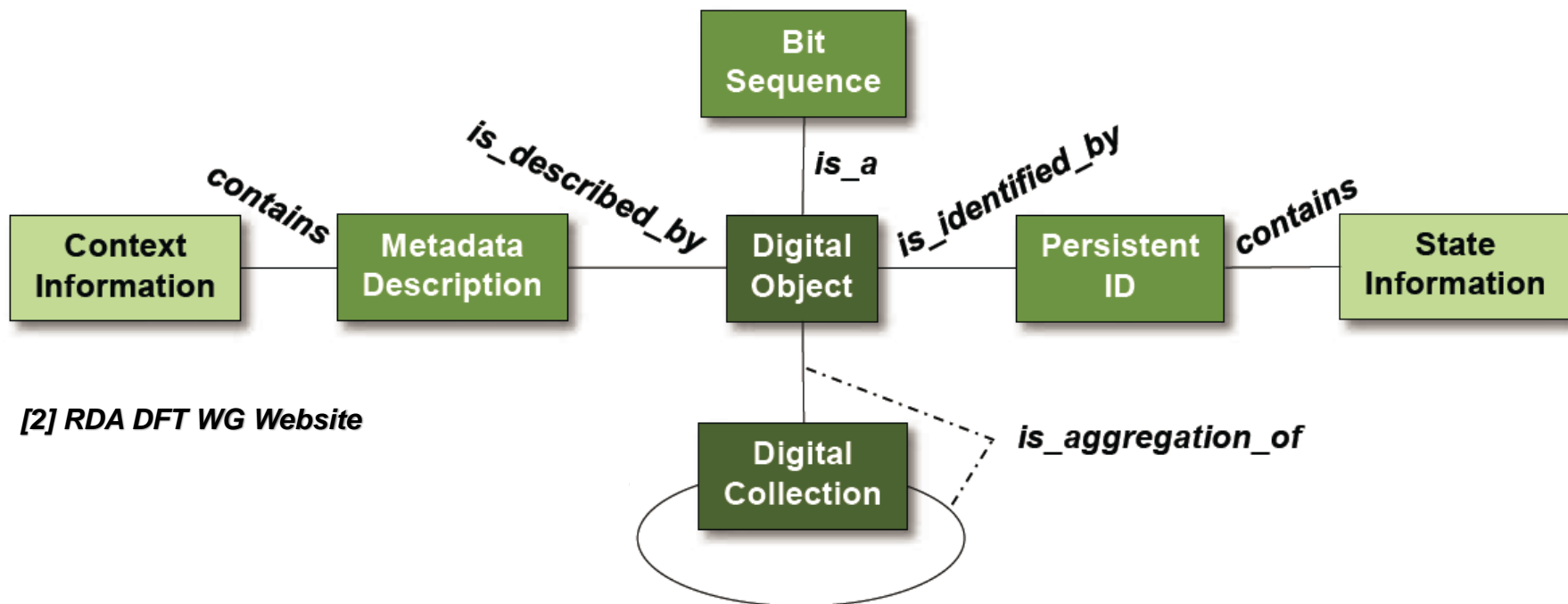
Hadoop is very powerful but it is important to understand that it requires an **underlying computing infrastructure that is different from a usual desktop computer or simple laptop**. It is thus not a solution like R or Matlab that you simply run on your own computer and therefore users of this tool usually work together with some data center that offers a computing infrastructure for it.

### Hadoop Tool Tutorials

There are many tutorials online, but [this](#) tutorial offers also a good Background

## □ Data Foundation and Terminology WG Resultat

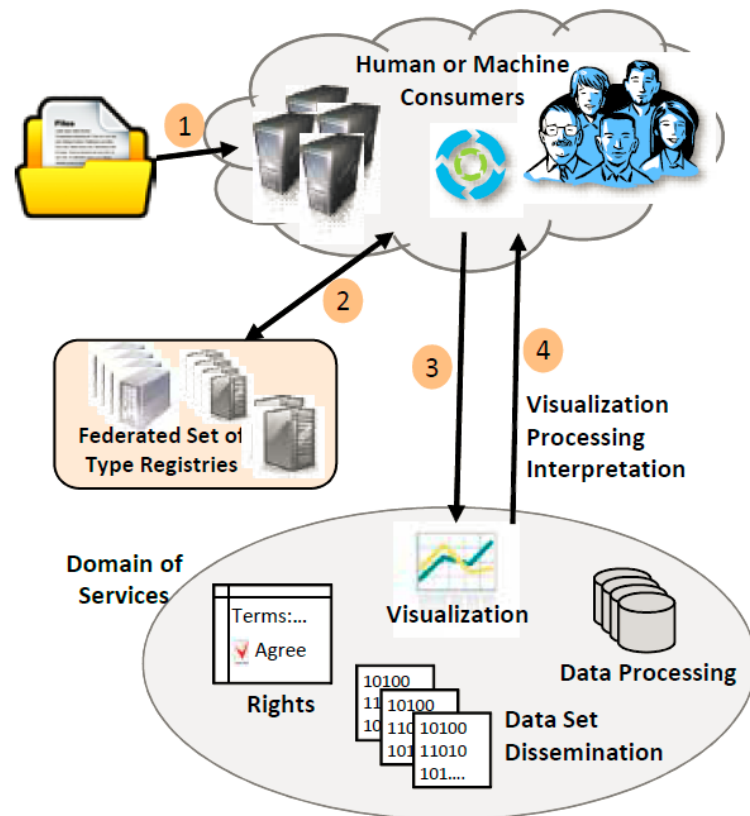
- Ziel: Einigung auf ein sehr einfaches Datenmodell wäre prima in der Praxis
- Diskussion der Frage: „Was ist ein digitales Objekt nun genau?“
- Enthält Definitionen: Persistent Identifier (PID), Digital Object, Metadata, ...



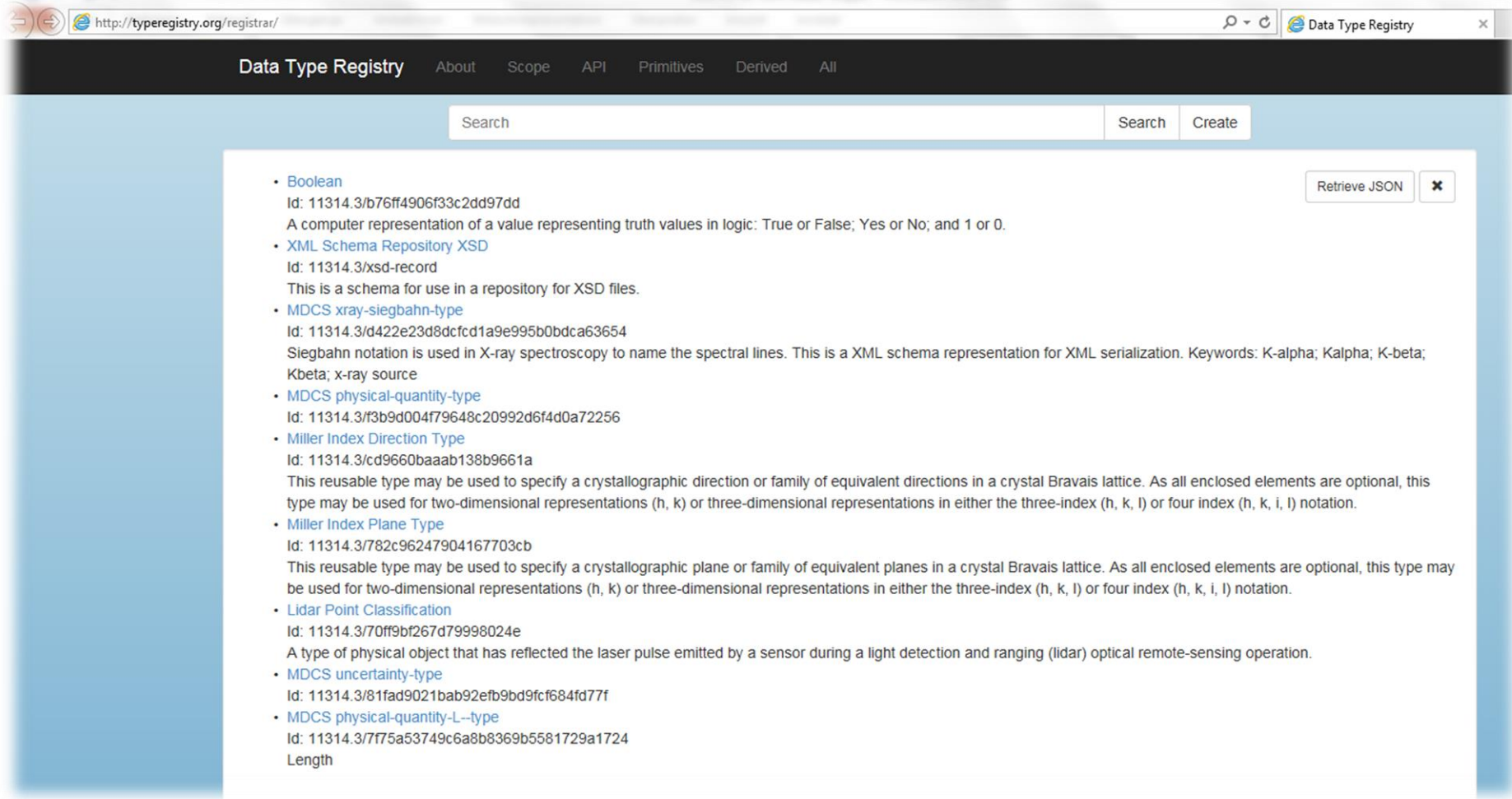
[2] RDA DFT WG Website



- Data Type Registries WG Resultat
  - Ziel: Einigung auf einen Ansatz damit unbekannte Datentypen automatisch bekannte Datentypen werden (ohne Wissen des Nutzers)
  - Diskussion der Frage: „Wie kann ich einen Datentyp nun genau festlegen?“
  - Enthält Ansatz wie „Type Registries“ und Datentypen Service Vorlage zur Implementierung (ähnlich wie MIME Typen im Browser)
  - Prototyp der Implementierung online: <http://typeregistry.org/>



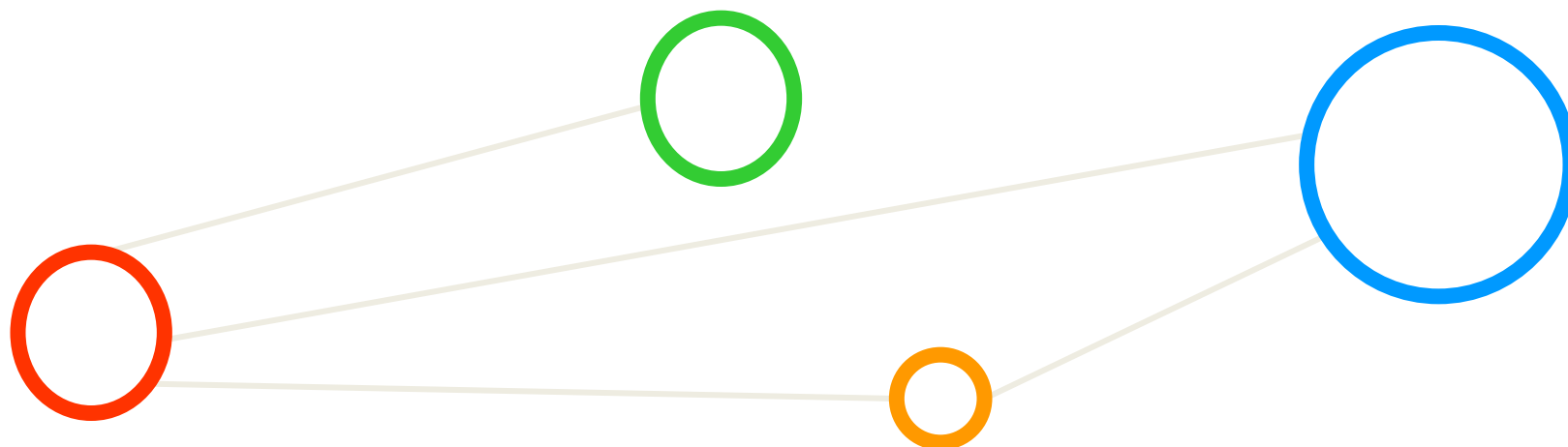
[3] RDA DTR WG Website



The screenshot shows the Data Type Registry website interface. At the top, there is a navigation bar with links for 'About', 'Scope', 'API', 'Primitives', 'Derived', and 'All'. Below the navigation bar is a search bar with a 'Search' button and a 'Create' button. The main content area displays a list of data types, each with a title, ID, and description. A 'Retrieve JSON' button is visible in the top right corner of the content area.

- [Boolean](#)  
Id: 11314.3/b76ff4906f33c2dd97dd  
A computer representation of a value representing truth values in logic: True or False; Yes or No; and 1 or 0.
- [XML Schema Repository XSD](#)  
Id: 11314.3/xsd-record  
This is a schema for use in a repository for XSD files.
- [MDCS xray-siegbahn-type](#)  
Id: 11314.3/d422e23d8dcfd1a9e995b0bdca63654  
Siegbahn notation is used in X-ray spectroscopy to name the spectral lines. This is a XML schema representation for XML serialization. Keywords: K-alpha; Kalpha; K-beta; Kbeta; x-ray source
- [MDCS physical-quantity-type](#)  
Id: 11314.3/f3b9d004f79648c20992d6f4d0a72256
- [Miller Index Direction Type](#)  
Id: 11314.3/cd9660baaab138b9661a  
This reusable type may be used to specify a crystallographic direction or family of equivalent directions in a crystal Bravais lattice. As all enclosed elements are optional, this type may be used for two-dimensional representations (h, k) or three-dimensional representations in either the three-index (h, k, l) or four index (h, k, i, l) notation.
- [Miller Index Plane Type](#)  
Id: 11314.3/782c96247904167703cb  
This reusable type may be used to specify a crystallographic plane or family of equivalent planes in a crystal Bravais lattice. As all enclosed elements are optional, this type may be used for two-dimensional representations (h, k) or three-dimensional representations in either the three-index (h, k, l) or four index (h, k, i, l) notation.
- [Lidar Point Classification](#)  
Id: 11314.3/70ff9bf267d79998024e  
A type of physical object that has reflected the laser pulse emitted by a sensor during a light detection and ranging (lidar) optical remote-sensing operation.
- [MDCS uncertainty-type](#)  
Id: 11314.3/81fad9021bab92efb9bd9fcf684fd77f
- [MDCS physical-quantity-L--type](#)  
Id: 11314.3/7f75a53749c6a8b8369b5581729a1724  
Length

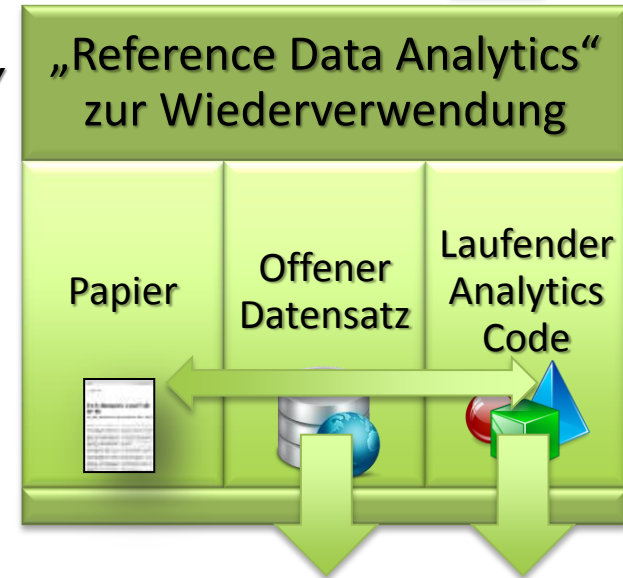
# Umsetzungsbeispiele



- Beispiel: Big Data IG Bereich „Big Data Analytics“
  - Bedeutet: Paralleles & Skalierbares Maschinelles Lernen
  - Wiss. Problem: Klassifikation der Erdbodenbedeckung



[4] G. Cavallaro & M. Riedel et al., 'On Understanding Big Data Impacts in Remotely Sensed Image Classification Using Support Vector Machines', IEEE Journal of Selected Topics in Applied Earth Observation, 2015



Satellitenaufnahmen



Parallel Support Vector Machines (SVM)



HPC/MPI, Map-Reduce & GPGPUs



„Best Practices“



Community-basierte Empfehlungen



[5] EUDAT B2SHARE



20/11  
[6] piSVM  
20/30

piSVM1.2.1 Analytics Training Indian Pines Images Processed 30 Features 52 Classes

Morris Riedel

23 February 2015

<https://b2share.eudat.eu>



[5] EUDAT B2SHARE



**Abstract:** piSVM version 1.2.1

Deployment JUDGE cluster of the Juelich Supercomputing Centre in Germany  
Parallel Support Vector Machine (SVM) classification runs to analyse  
remote sensing hyperspectral images  
(52 land cover classes, 30 features).  
Indian processed:1417x614x30 (training 10% and test)  
Data preprocessed with PCA, ESDAP, NWFE  
Supplemental material for paper study.  
Corresponding dataset (processed) available at:  
<http://hdl.handle.net/11304/7e8eec8e-ad61-11e4-ac7e-860aa0063d1f>

**Metadata**

**Daten und Skripte archiviert und vom Papier per PID referenziert  entspricht Definition RDA „Digital Object“ für die Papierdaten**

**Keyword(s):** SVM ; remote sensing ; analytics ; MPI ; classification

The record appears in these collections:

Generic

**Data (Bit sequence)**

Name	Date	Size	
2226457-indian_processed_training.el.model.model	24 Feb 2015	20.1 MB	Download
Pred-rec172-1-2-1.02236897.02236897	24 Feb 2015	221 Bytes	Download
2236893-checkjob.el	24 Feb 2015	1.2 kB	Download
2234622-results-1-8-4.txt	24 Feb 2015	793.1 kB	Download
2234612-submit-train-record172.sh	24 Feb	600	Download

**Export**  
Export as [BibTeX](#), [MARC](#), [MARCXML](#), [DC](#), [EndNote](#), [NLN](#), [RefWorks](#)

**PID handle**

**Metadata**

**PID:** <http://hdl.handle.net/11304/fe145db0-bc5f-11e4-ac7e-860aa0063d1f>

**Publication:** <https://b2share.eudat.eu>

**Publication Date:** 2015-02-23

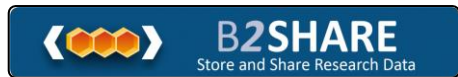
**Licence:** Unspecified

# Umsetzung PID: Archivierung von Forschungsdaten

- [62] F. García-Vilchez *et al.*, "On the impact of lossy compression on hyperspectral image classification and unmixing," *IEEE Geosci. Remote Sens. Lett.*, vol. 8, no. 2, pp. 253–257, Mar. 2011.
- [63] G. Cavallaro and M. Riedel. (2015). *Indian Pines Dataset Raw and Processed* [Online]. Available: <http://hdl.handle.net/11304/7e8ecc8e-ad61-11e4-ac7e-860aa0063d1f>
- [64] G. Cavallaro and M. Riedel. (2015). *piSVM Analytics 10-Fold Cross-Validation Results Scenario 1 (Raw)* [Online]. Available: <http://hdl.handle.net/11304/163ba8e8-fe60-11e4-8a18-f31aa6f4d448>
- [65] G. Cavallaro and M. Riedel. (2015). *piSVM analytics 10-fold cross-validation results scenario 2 (processed)* [Online]. Available: <http://hdl.handle.net/11304/5bba8e36-fe63-11e4-8a18-f31aa6f4d448>
- [66] G. Cavallaro and M. Riedel. (2015). *piSVM Analytics Results Scenario 1 (Raw)* [Online]. Available: <http://hdl.handle.net/11304/c06a8c7e-fe6c-11e4-8a18-f31aa6f4d448>
- [67] G. Cavallaro and M. Riedel. (2015). *piSVM Analytics Results Scenario 2 (Processed)* [Online]. Available: <http://hdl.handle.net/11304/c528998e-ff7c-11e4-8a18-f31aa6f4d448>

PID handle enables persistent link for changing locations (challenge for archiving)

handle  
PID  
links

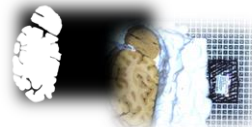


[5] EUDAT B2SHARE

enables data-sharing

more reputation for authors

enables reproducibility



This article has been accepted for inclusion in a future issue of this journal. Content is final as presented, with the exception of pagination.

CAVALLARO *et al.*: ON UNDERSTANDING BIG DATA IMPACTS IN REMOTELY SENSED IMAGE CLASSIFICATION 13

[58] L. Molise, J. Froment, and J. M. Morel, (1993, Nov.), *Megawave2* [Online]. Available: <http://megawave.cmla.ens-cachan.fr/index.php>

[59] P. Monasse and F. Guichard, "Fast computation of a contrast-invariant image representation," *IEEE Trans. Image Process.*, vol. 9, no. 5, pp. 860–872, May 2000.

[60] B.-C. Kuo and K.-Y. Chang, "Feature extractions for small sample size classification problem," *IEEE Trans. Geosci. Remote Sens.*, vol. 45, no. 3, pp. 756–764, Mar. 2007.

[61] A. Romero, C. Giatta, and G. Camps-Valls, "Unsupervised deep feature extraction of hyperspectral images," in *Proc. 6th Workshop Hyperspectral Image Signal Process. Evol. Remote Sens. (WHISPERS)*, 2014.

[62] F. García-Vilchez *et al.*, "On the impact of lossy compression on hyperspectral image classification and unmixing," *IEEE Geosci. Remote Sens. Lett.*, vol. 8, no. 2, pp. 253–257, Mar. 2011.

[63] G. Cavallaro and M. Riedel. (2015). *Indian Pines Dataset Raw and Processed* [Online]. Available: <http://hdl.handle.net/11304/7e8ecc8e-ad61-11e4-ac7e-860aa0063d1f>

[64] G. Cavallaro and M. Riedel. (2015). *piSVM Analytics 10-Fold Cross-Validation Results Scenario 1 (Raw)* [Online]. Available: <http://hdl.handle.net/11304/163ba8e8-fe60-11e4-8a18-f31aa6f4d448>

[65] G. Cavallaro and M. Riedel. (2015). *piSVM analytics 10-fold cross-validation results scenario 2 (processed)* [Online]. Available: <http://hdl.handle.net/11304/5bba8e36-fe63-11e4-8a18-f31aa6f4d448>

[66] G. Cavallaro and M. Riedel. (2015). *piSVM Analytics Results Scenario 1 (Raw)* [Online]. Available: <http://hdl.handle.net/11304/c06a8c7e-fe6c-11e4-8a18-f31aa6f4d448>

[67] G. Cavallaro and M. Riedel. (2015). *piSVM Analytics Results Scenario 2 (Processed)* [Online]. Available: <http://hdl.handle.net/11304/c528998e-ff7c-11e4-8a18-f31aa6f4d448>



Jón Atli Benediktsson (S'84–M'90–SM'99–F'04) received the Cand.Sc. degree in electrical engineering from the University of Iceland, Reykjavik, Iceland, in 1984, and the M.S.E.E. and Ph.D. degrees in electrical engineering from Purdue University, West Lafayette, IN, USA, in 1987 and 1990, respectively. He is currently Rector and Professor of Electrical and Computer Engineering at the University of Iceland. His research interests include remote sensing, biomedical analysis of signals, pattern recognition, image processing, and signal processing, and he has authored extensively in these fields.

Dr. Benediktsson was the 2011–2012 President of the IEEE Geoscience and Remote Sensing Society (GRSS) and has been on the GRSS AdCom since 2000. He is an Editor of the IEEE TRANSACTIONS ON GEOSCIENCE AND REMOTE SENSING (TGRS) from 2003 to 2008 and has served as an Associate Editor of TGRS since 1999, the IEEE GEOSCIENCE AND REMOTE SENSING LETTERS since 2003, and the IEEE ACCESS since 2013. He is on the International Editorial Board of the *International Journal of Image and Data Fusion* and was the Chairman of the Steering Committee of the IEEE JOURNAL OF SELECTED TOPICS IN APPLIED EARTH OBSERVATIONS AND REMOTE SENSING (ISTARS) from 2007 to 2010. He is a Co-founder of the biomedical start up company Oxymp ([www.oxymp.com](http://www.oxymp.com)). He is a Fellow of SPIE. He is a member of the Association of Chartered Engineers in Iceland (VIT), Societas Scientiarum Islandica, and Tau Beta Pi. He was the recipient of the Sleivan J. Kristólf Award from Purdue University in 1991 as Outstanding Graduate Student in remote sensing. In 1997, he was the recipient of the Icelandic Research Council's Outstanding Young Researcher Award; in 2000, he was granted the IEEE Third Millennium Medal; in 2004, he was a co-recipient of the University of Iceland's Technology Innovation Award; in 2006, he was the recipient of the yearly research award from the Engineering Research Institute, University of Iceland; and in 2007, he was the recipient of the Outstanding Service Award from the IEEE Geoscience and Remote Sensing Society. He is a co-recipient of the 2012 IEEE Transactions on Geoscience and Remote Sensing Paper Award. He was the recipient of the 2013 IEEE VFI Electrical Engineer of the Year Award; and in 2013, he was a co-recipient of the IEEE GRSS Highest Impact Paper Award.



Gabriele Cavallaro (S'14) received the B.S. and M.S. degrees in telecommunication engineering from the University of Trento, Trento, Italy, in 2011 and 2013, respectively. Currently, he is pursuing the Ph.D. degree with the University of Iceland, Reykjavik, Iceland. His research interests include remote sensing and analysis of very high geometrical and spectral resolution images with the current focus on mathematical morphology and high-performance computing.



Morris Riedel (M'10) received the Ph.D. degree from Karlsruhe Institute of Technology (KIT), Karlsruhe, Germany, and started the work in parallel and distributed systems in the field of scientific visualization and applications on large datasets. He is an Adjunct Professor at the School of Engineering and Applied Sciences at the University of Iceland. He is also the Head of a specific research group on high productivity data processing as a part of the Data Division. The given lectures in unives Iceland, University of Applied Sciences of Cologne, University of Technology Aachen (RWTH Aachen), and the University of Applied Sciences in Hamburg. His research interests include "high productivity processing of scientific computing applications."



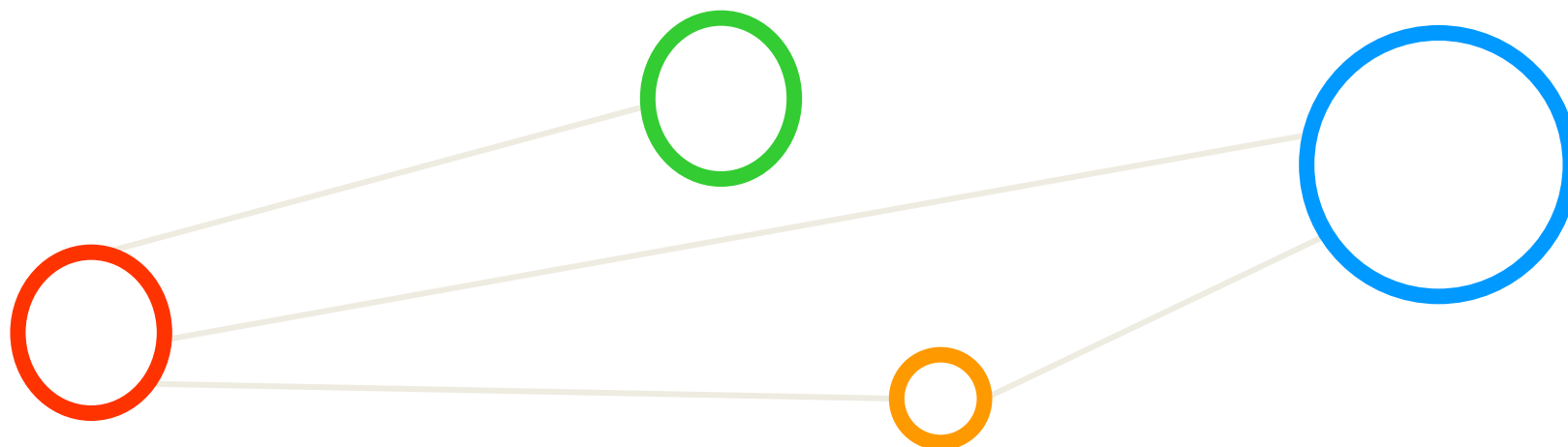
Matthias Riechers received the Ph.D. degree in scientific programming from the University of Applied Sciences in Aachen, Germany. He is a Development Engineer at the Institute of High Performance Computing and Data Science at the University of Applied Sciences in Aachen. His research interests include "high productivity processing of scientific computing applications."



Antonio Plaza (M'05–SM'07–F'15) received the Computer Engineering degree and the M.Sc. and Ph.D. degrees in computer engineering from the University of Extremadura, Badajoz, Spain, in 1998, 2000, and 2002, respectively.

**Nächste „RDA“ Schritte:**  
Datentypen per Type Registry definieren: Remote Sensing Daten, Resultate HPC Computer, SVM Datenformate, Feature Engineering Formate, etc.

# Einladung zur Mitarbeit



- Reproducibility
- Active Data Management
- Big Data IG
- Biodiversity Data
- Chemistry Research
- Data Fabric IG
- Data for Development
- Data Rescue IG
- ...
- Domain Repositories
- Ethics and Social
- Federated Identity
- Global Water Informatics

## Wenige Gruppen im Bereich Medizin:

Bspw. Health Data Interest Group existiert

## Einladung zur Mitarbeit:

Erzeugung neuer Gruppen nicht schwer

Bspw. TMF Dokumenten – Serie globaler?

*Achtung: RDA gibt kein direktes Geld  
(Ausnahme 'Early Career' Unterstützung)*

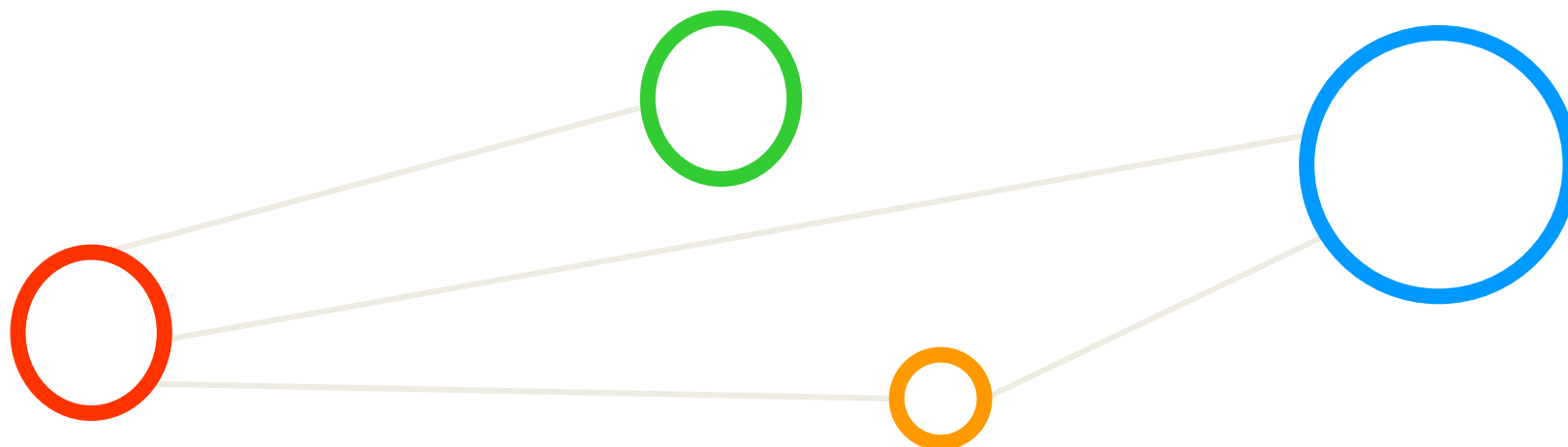
## Konkrete erste Schritte:

Registrierung auf der RDA Webseite

Bei existierenden Gruppen anmelden

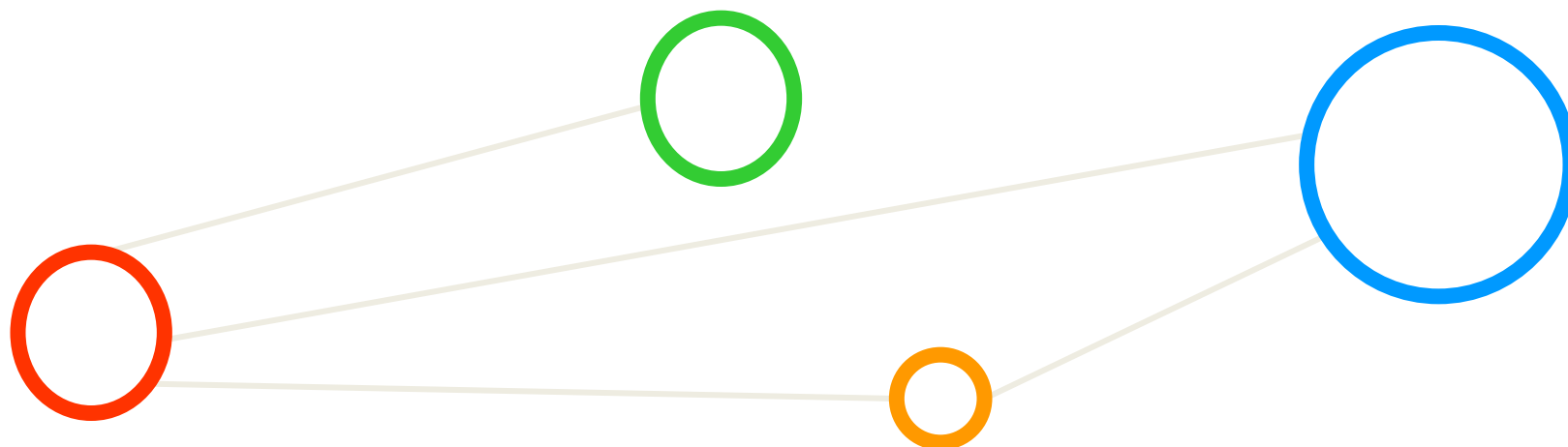
Neue Gruppen bei Tagungen vorschlagen





- Teilnahme an RDA für jeden offen
  - Arbeit wird vorangebracht durch aktive(!) Teilnehmer
  - Individuelle Teilnehmer sowie Organisationen können Mitglied werden
  - Erster Schritt : Registrierung auf der RDA Webseite & Gruppen suchen
  - Möglichkeit durchaus (relativ) einfach neue Gruppen zu erstellen
  
- Wichtig: **Resultate & Umsetzung**
  - Resultate werden von Arbeits-Gruppen erzeugt und sind offen verfügbar
  - Initiale Ergebnisse von Arbeitsgruppen sind nun verfügbar

**RDA funktioniert langfristig nur durch Umsetzung der Empfehlungen und „Best Practices“**



# Kurzer Hinweis: Smart Data Innovation Lab

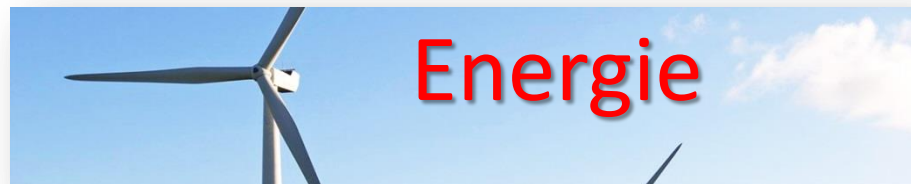


 ABB AG Forschungszentrum	 BASF SE	 Bayer Technology Services GmbH	 Carl von Ossietzky Universität Oldenburg, Abt. Wirtschaftsinformatik I / VLBA	 Deutsches Forschungszentrum für Künstliche Intelligenz GmbH	 Deutsches Krebsforschungszentrum
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**Smart Data  
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**Kern: Datenanalyse  
Wirtschaft & Wissenschaft**

**SDIL Medizin Bereich:  
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[7] SDIL Website (Online)

- [1] RDA Website (Online): <https://rd-alliance.org/>
- [2] RDA DFT WG (Online):  
<https://rd-alliance.org/group/data-foundation-and-terminology-wg.html>
- [3] RDA DTR WG (Online):  
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***On Understanding Big Data Impacts in Remotely Sensed Image Classification Using Support Vector Machine Methods***, IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing, Issue 99, pp. 1-13, 2015
- [5] EUDAT B2Share Service zur Archivierung (Online): <https://b2share.eudat.eu/>
- [6] piSVM – Parallel Support Vector Machine (Online):  
<http://pisvm.sourceforge.net/index.html>
- [7] SDIL Website (Online): <http://www.sdil.de/>



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