Delegates' Summit:

Best Practice and Definitions of Formalisation and Formalism

September 25, 2019

The Ninth Symposium on
Advanced Computation and Information in Natural and Applied Sciences (SACINAS)
The International Conference on Numerical Analysis and Applied Mathematics (ICNAAM 2019)
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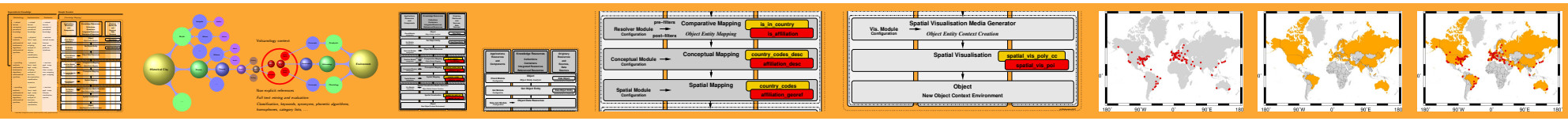
Dr. rer. nat. Claus-Peter Rückemann[1,2,3]

[1] Westfälische Wilhelms-Universität Münster (WWU), Münster, Germany
[2] Leibniz Universität Hannover, Hannover, Germany
[3] KiM, DIMF, Germany
ruckema(at)uni-muenster.de



Delegates' Summit: Best Practice & Definitions of Data Value . . .

Delegates and Contributors

- *Claus-Peter Rückemann* (Moderator), Westf. Wilhelms-Univ. Münster (WWU) / Knowledge in Motion, DIMF / Leibniz Universität Hannover, Germany
- *Raffaella Pavani,* Department of Mathematics, Politecnico di Milano, Italy
- *Birgit Gersbeck-Schierholz,* Knowledge in Motion, DIMF, Germany
- *Athanasios Tsitsipas,* University of Ulm, Germany
- *Lutz Schubert,* University of Ulm, Germany
- *Friedrich Hülsmann,* Knowledge in Motion, DIMF, Germany
- *Olaf Lau,* Knowledge in Motion, DIMF, Germany
- *Martin Hofmeister,* Knowledge in Motion, DIMF, Germany

The Ninth Symp. on Advanced Computation and Information in Natural and Applied Sciences (SACINAS), The International Conference on Numerical Analysis and Applied Mathematics (ICNAAM 2019),
CfP: `https://research.cs.wisc.edu/dbworld/messages/2018-11/1541177430.html`
Program: `http://icnaam.org/sites/default/files/Preliminary%20Program%20ICNAAM%202019%20Working%2042.pdf`

Recall: Last Years' Post-Summit Results

In 80 Words Around The World.

Knowledge and Computing (Delegates and other contributors)

- **"Knowledge is created from a subjective combination of different attainments as there are intuition, experience, information, education, decision, power of persuasion and so on, which are selected, compared and balanced against each other, which are transformed, interpreted, and used in reasoning, also to infer further knowledge. Therefore, not all the knowledge can be explicitly formalised. Knowledge and content are multi- and inter-disciplinary long-term targets and values. In practice, powerful and secure information technology can support knowledge-based works and values."**

- **"Computing means methodologies, technological means, and devices applicable for universal automatic manipulation and processing of data and information. Computing is a practical tool and has well defined purposes and goals."**

Citation: *Rückemann, C.-P., Skurowski, P., Staniszewski, M., Hülsmann, F., and Gersbeck-Schierholz, B. (2015): Post-Summit Results, Delegates' Summit: Best Practice and Definitions of Knowledge and Computing; Sept. 23, 2015, The Fifth Symposium on Advanced Computation and Information in Natural and Applied Sciences (SACINAS), The 13th Internat. Conf. of Numerical Analysis and Applied Mathematics (ICNAAM), Sept. 23–29, 2015, Rhodes, Greece. URL: http://www.user.uni-hannover.de/cpr/x/publ/2015/delegatessummit2015/rueckemann_icnaam2015_summit_summary.pdf*

Delegates and contributors: *Claus-Peter Rückemann, Friedrich Hülsmann, Birgit Gersbeck-Schierholz, Knowledge in Motion / Unabhängiges Deutsches Institut für Multi-disziplinäre Forschung (DIMF), Germany;Przemysław Skurowski, Michał Staniszewski, Silesian University of Technology, Gliwice, Poland; International EULISP post-graduate participants, ISSC, European Legal Informatics Study Programme, Leibniz Universität Hannover, Germany*

Recall: Last Years' Post-Summit Results

In 80 Words Around The World.

Data-centric and Big Data (Delegates and other contributors)

- **"The term data-centric refers to a focus, in which data is most relevant in context with a purpose. Data structuring, data shaping, and long-term aspects are important concerns. Data-centricity concentrates on data-based content and is benefitial for information and knowledge and for emphasizing their value. Technical implementations need to consider distributed data, non-distributed data, and data locality and enable advanced data handling and analysis. Implementations should support separating data from technical implementations as far as possible."**
- **"The term Big Data refers to data of size and/or complexity at the upper limit of what is currently feasible to be handled with storage and computing installations. Big Data can be structured and unstructured. Data use with associated application scenarios can be categorised by volume, velocity, variability, vitality, veracity, value, etc. Driving forces in context with Big Data are advanced data analysis and insight. Disciplines have to define their 'currency' when advancing from Big Data to Value Data."**

Citation: *Rückemann, C.-P., Kovacheva, Z., Schubert, L., Lishchuk, I., Gersbeck-Schierholz, B., and Hülsmann, F. (2016): Post-Summit Results, Delegates' Summit: Best Practice and Definitions of Data-centric and Big Data – Science, Society, Law, Industry, and Engineering; Sept. 19, 2016, The Sixth Symposium on Advanced Computation and Information in Natural and Applied Sciences (SACINAS), The 14th Internat. Conf. of Numerical Analysis and Applied Mathematics (ICNAAM), Sept. 19–25, 2016, Rhodes, Greece. URL: http://www.user.uni-hannover.de/cpr/x/publ/2016/delegatessummit2016/rueckemann_icnaam2016_summit_summary.pdf*

Delegates and contributors: *Claus-Peter Rückemann, Knowledge in Motion / Unabhängiges Deutsches Institut für Multi-disziplinäre Forschung (DIMF), Germany;Zlatinka Kovacheva, Middle East College, Department of Mathematics and Applied Sciences, Muscat, Oman; Lutz Schubert, University of Ulm, Germany; Iryna Lishchuk, Leibniz Universität Hannover, Institut für Rechtsinformatik, Germany; Birgit Gersbeck-Schierholz, Friedrich Hülsmann, Knowledge in Motion / Unabhängiges Deutsches Institut für Multi-disziplinäre Forschung (DIMF), Germany*

Recall: Last Years' Post-Summit Results

In 80 Words Around The World.

Data Science Definition (Delegates and other contributors)

- **"Qualified Data, especially for an enterprise, represents frozen knowledge or in other words frozen value.**
  The abilities to understand and manage these data is what we call data science.
  Data results from action, hence, data science can be defined secondary to data. The essence of Data Science is to give qualified access to relevant data to owners and users.
  Hardware and software and their implementation represent the tertiary level of qualified and high level data."

Citation: *Rückemann, C.-P., Iakushkin, O. O., Gersbeck-Schierholz, B., Hülsmann, F., Schubert, L., and Lau, O. (2017): Post-Summit Results, Delegates' Summit: Best Practice and Definitions of Data Sciences – Beyond Statistics; Sept. 25, 2017, The Seventh Symposium on Advanced Computation and Information in Natural and Applied Sciences (SACINAS), The 15th Internat. Conf. of Numerical Analysis and Applied Mathematics (ICNAAM), Sept. 25–30, 2017, Thessaloniki, Greece. URL: http://www.user.uni-hannover.de/cpr/x/publ/2017/delegatessummit2017/rueckemann_icnaam2017_summit_summary.pdf*

Delegates and contributors: *Claus-Peter Rückemann, Knowledge in Motion / Unabhängiges Deutsches Institut für Multi-disziplinäre Forschung (DIMF), Germany; Oleg O. Iakushkin, Department of Computer Modelling and Multiprocessor Systems at the Faculty of Applied Mathematics and Control Processes, Saint-Petersburg State University, Russia; Birgit Gersbeck-Schierholz, Knowledge in Motion / Unabhängiges Deutsches Institut für Multi-disziplinäre Forschung (DIMF), Germany; Friedrich Hülsmann, Knowledge in Motion / Unabhängiges Deutsches Institut für Multi-disziplinäre Forschung (DIMF), Germany; Lutz Schubert, IOMI, University of Ulm, Germany; Olaf Lau, Knowledge in Motion / Unabhängiges Deutsches Institut für Multi-disziplinäre Forschung (DIMF), Germany.*

Recall: Last Years' Post-Summit Results

In 80 Words Around The World.

Data Value Definition (Delegates and other contributors)

"Data value is the primary ranked value in scenarios comprised of data and computing context. In general, processing of data, is the cause for computing. In consequence, data, including algorithms and other factual, procedural, and further knowledge, have to be ranked primary on the scale of values whereas machinery for processing data, including computing, are providing means of secondary ranked value. In addition, further values, including economic values, can be associated with consecutive deployment of data and machinery."

This is unaffected by varying views and attributions, including quality. Nevertheless, different views can scale values.

Citation: *Rückemann, Claus-Peter; Pavani, Raffaella; Schubert, Lutz; Gersbeck-Schierholz, Birgit; Hülsmann, Friedrich; Lau, Olaf; and Hofmeister, Martin (2018): Post-Summit Results, Delegates' Summit: Best Practice and Definitions of Data Value; Sept. 13, 2018, The Eighth Symposium on Advanced Computation and Information in Natural and Applied Sciences (SACINAS), The 16th Internat. Conf. of Numerical Analysis and Applied Mathematics (ICNAAM), Sept. 13–18, 2018, Rhodos, Greece.*
URL: http://www.user.uni-hannover.de/cpr/x/publ/2018/delegatessummit2018/rueckemann_icnaam2018_summit_summary.pdf,
URL: https://doi.org/10.15488/3639 (DOI).

Delegates and contributors: *Claus-Peter Rückemann, Knowledge in Motion / Unabhängiges Deutsches Institut für Multi-disziplinäre Forschung (DIMF), Germany; Raffaella Pavani, Department of Mathematics, Politecnico di Milano, Italy; Lutz Schubert, IOMI, University of Ulm, Germany; Birgit Gersbeck-Schierholz, Knowledge in Motion / Unabhängiges Deutsches Institut für Multi-disziplinäre Forschung (DIMF), Germany; Friedrich Hülsmann, Knowledge in Motion / Unabhängiges Deutsches Institut für Multi-disziplinäre Forschung (DIMF), Germany; Olaf Lau, Knowledge in Motion / Unabhängiges Deutsches Institut für Multi-disziplinäre Forschung (DIMF), Germany. Martin Hofmeister, Knowledge in Motion / Unabhängiges Deutsches Institut für Multi-disziplinäre Forschung (DIMF), Germany.*

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Best Practice and Definitions: Formalisation . . . (1/6)

In 80 Words Around The World.

Case: Natural sciences & research Source: Rückemann, Hülsmann, (KiM, DIMF)

- **Formalisation and formalism:**

  Formalisation is the process of creating a defined set of rules, allowing a formal system to infer theorems from axioms.

  A formal system may represent a well-defined system of abstract thought. Description and analysis of any detail of any more or less complex system and physical background essentially require a process of formalisation. The process includes abstraction and reduction of knowledge, keeping the preconditioned importance of the respective context.

  All mathematical-machine based systems, e.g., computers, are formal systems.

  Formalisation should be created by educated experts within the respective discipline.

Best Practice and Definitions: Formalisation . . . (2/6)

In 80 Words Around The World.

Case: Mathematics and algorithms Source: Raffaella Pavani, (Politecnico di Milano)

- **Formalisation and formalism:**

  In mathematics a long debate about the role of formalism and intuitionism (as well as logicism) happened since the beginning of last century. Actually, I would suggest to add references from all the mathematical areas.

  However, since it is not feasible, I just remind that a wise position is not extremist in the field of philosophy of mathematics as well as in all the other fields: all the ingredients are required to produce a good cake by a good recipe.

Best Practice and Definitions: Formalisation . . . (3/6)

In 80 Words Around The World.

Case: Biology Source: Birgit Gersbeck-Schierholz, (KiM, DIMF)

- **Formalisation and formalism:**

  In Biology, the targets of formalisation are entities of the real natural world.

  Formalisation is necessary for abstraction and reduction of context in order to allow employment and application of systematics, methods, and tools.

  Formalisation is created by scientists within their respective discipline and based on facts, plausibility, and established formal frameworks.

  Conditions and context of formalisation may be matter of continuous observation.

Best Practice and Definitions: Formalisation . . . (4/6)

In 80 Words Around The World.

Case: Programming Source: Athanasios Tsitsipas, Lutz Schubert, (IOMI, Univ. Ulm)

- **Formalisation and formalism:**

  In programming languages there is a tendency to create more high-level abstractions to program infrastructures and control systems. Although, we abstract from the low-level details and implementation we need to be careful to find the right level of abstraction we are looking for.

  Our linchpin should be formal methods that have proven to be correct and will axiomatize the way of programming, moving towards malleable and composable programs that prove correctness with congruence to their intention.

Best Practice and Definitions: Formalisation . . . (5/6)

In 80 Words Around The World.

Case: Insurance business Source: Olaf Lau, Insurance Expert, (KiM, DIMF)

- **Formalisation and formalism:**

  In insurance business and practice formalisation is required for abstraction and reduction regarding relevant business scenarios.

  Formalisation is required in a wide range of applications, e.g., insurance cases, selected context, forms / questionaires, documentation, and exception handling.

  Formalisation allows the application of specialised implementations and solutions.

  Formalisation is done by experts in insurance business.

Best Practice and Definitions: Formalisation . . . (6/6)

In 80 Words Around The World.

Case: Statics / construction in civil engineering

Source: Martin Hofmeister, (KiM, DIMF)

- **Formalisation and formalism:**

  Target is object-related statics. The base formal policies ("Regelwerk") include standards, formal data, and equations. Properties/qualities of material are significant.

  Formalisation is required for abstraction and reduction (of context) within well defined application scenarios. Formalisation has to support relevant entities and representations, esp., point, line, area, and 3D.

  Formalisation must be done by experts in the discipline and cannot be automated.

Best Practice and Definitions

In 80 Words Around The World.

Statements on Formalisation and Formalism (Delegates and other contributors)

- **How should formalisation be defined?**
- **Which Best Practice for formalisation can be summarised?**
- **Next Delegates' Summit:**
  Best Practice and Definitions [topics]
  aware of "Science Under Direction".

Bibliography

In 80 Words Around The World.

Bibliography on Best Practice and Definitions (Delegates' Summits)

- *Rückemann, Claus-Peter; Pavani, Raffaella; Schubert, Lutz; Gersbeck-Schierholz, Birgit; Hülsmann, Friedrich; Lau, Olaf; and Hofmeister, Martin (2018): Post-Summit Results, Delegates' Summit: Best Practice and Definitions of Data Value; Sept. 13, 2018, The Eighth Symposium on Advanced Computation and Information in Natural and Applied Sciences (SACINAS), The 16th Internat. Conf. of Numerical Analysis and Applied Mathematics (ICNAAM), Sept. 13–18, 2018, Rhodos, Greece.*
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  URL: https://doi.org/10.15488/3639 (DOI).

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  URL: https://www.tib.eu/en/search/id/datacite%3Adoi~10.15488%252F3411/Best-Practice-and-Definitions-of-Data-Sciences/,
  URL: https://doi.org/10.15488/3411 (DOI).

- *Rückemann, Claus-Peter; Kovacheva, Zlatinka; Schubert, Lutz; Lishchuk, Iryna; Gersbeck-Schierholz, Birgit; and Hülsmann, Friedrich (2016): Post-Summit Results, Delegates' Summit: Best Practice and Definitions of Data-centric and Big Data – Science, Society, Law, Industry, and Engineering; Sept. 19, 2016, The Sixth Symposium on Advanced Computation and Information in Natural and Applied Sciences (SACINAS), The 14th Internat. Conf. of Numerical Analysis and Applied Mathematics (ICNAAM), Sept. 19–25, 2016, Rhodes, Greece.*
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  URL: https://www.tib.eu/en/search/id/datacite%3Adoi~10.15488%252F3410/Best-Practice-and-Definitions-of-Data-centric-and/,
  URL: https://doi.org/10.15488/3410 (DOI).

- *Rückemann, Claus-Peter; Hülsmann, Friedrich; Gersbeck-Schierholz, Birgit; Skurowski, Przemyslaw; and Staniszewski, Michal (2015) Post-Summit Results, Delegates' Summit: Best Practice and Definitions of Knowledge and Computing; Sept. 23, 2015, The Fifth Symposium on Advanced Computation and Information in Natural and Applied Sciences (SACINAS), The 13th Internat. Conf. of Numerical Analysis and Applied Mathematics (ICNAAM), Sept. 23–29, 2015, Rhodes, Greece.*
  URL: http://www.user.uni-hannover.de/cpr/x/publ/2015/delegatessummit2015/rueckemann_icnaam2015_summit_summary.pdf,
  URL: https://www.tib.eu/en/search/id/datacite%3Adoi~10.15488%252F3409/Best-Practice-and-Defnitions-of-Knowledge-and-Computing/,
  URL: https://doi.org/10.15488/3409 (DOI).

Networking and Outlook

Thank you for your attention!

Wish you an inspiring conference and a pleasant stay on Rhodos!

Looking forward to seeing you again next year for the Symposium on Advanced Computation and Information!

Post-Summit Results

In 80 Words Around The World.

Formalisation Definition (Delegates and other contributors)

"Formalisation is the process of creating a defined set of rules, allowing a formal system to infer theorems from axioms. Formal systems may represent well-defined systems of abstract thought. Description and analysis of any detail of any more or less complex system and physical background essentially require a formalisation process. The process includes abstraction and reduction of knowledge, keeping the preconditioned importance of respective context. Consequently, formalisation should be created and context observed by educated experts within the respective discipline."

All mathematical-machine based systems, e.g., computers, are formal systems.
Ideologies should be kept outside of formalisation.

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URL: http://www.user.uni-hannover.de/cpr/x/publ/2019/delegatessummit2019/rueckemann_icnaam2019_summit_summary.pdf,
URL: https://doi.org/10.15488/5241 (DOI).

Delegates and contributors: *Claus-Peter Rückemann, Knowledge in Motion / Unabhäng. Deutsches Inst. für Multi-disziplˌ. Forschung (DIMF), Germany; Raffaella Pavani, Department of Mathematics, Politecnico di Milano, Italy; Birgit Gersbeck-Schierholz, Knowledge in Motion / Unabhäng. Deutsches Inst. für Multi-disziplˌ. Forschung (DIMF), Germany; Athanasios Tsitsipas, IOMI, University of Ulm, Germany; Lutz Schubert, IOMI, University of Ulm, Germany; Friedrich Hülsmann, Knowledge in Motion / Unabhäng. Deutsches Inst. für Multi-disziplˌ. Forschung (DIMF), Germany; Olaf Lau, Knowledge in Motion / Unabhäng. Deutsches Inst. für Multi-disziplˌ. Forschung (DIMF), Germany. Martin Hofmeister, Knowledge in Motion / Unabhäng. Deutsches Inst. für Multi-disziplˌ. Forschung (DIMF), Germany.*

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