Delegates' Summit:

– Best Practice and Definitions –

Quality of Knowledge and Quality of Data

September 19, 2022

The Twelfth Symposium on
Advanced Computation and Information in Natural and Applied Sciences (SACINAS)
The International Conference on Numerical Analysis and Applied Mathematics (ICNAAM 2022)
September 19 – 25, 2022, Heraklion, Crete, Greece

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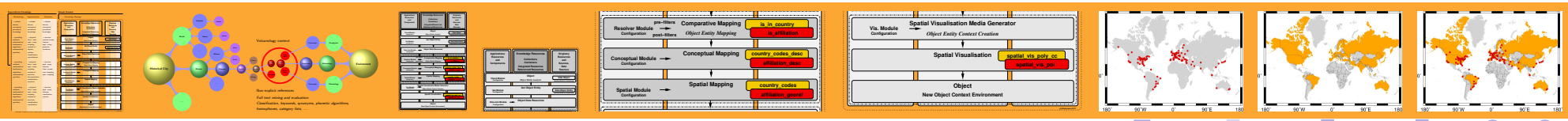

Abstract / Epitome

Abstract / Epitome

This comprehensive summary contains the committee of participants and contributors, the contributions, statements, summit results (p. 18), and references for the Delegates' Summit on Best Practice and Definitions: Quality of Knowledge and Quality of Data, part of the Symposium on Advanced Computation and Information in Natural and Applied Sciences (SACINAS).

Citation: *Rückemann, Claus-Peter; Kaloyanova, Kalinka; Kovacheva, Zlatinka; Naydenova, Ina; Hülsmann, Friedrich; Gersbeck-Schierholz, Birgit (2022): Post-Summit Results, Delegates' Summit: Best Practice and Definitions – Quality of Knowledge and Quality of Data; Sept. 19, 2022, The Twelfth Symposium on Advanced Computation and Information in Natural and Applied Sciences (SACINAS), The 20th Internat. Conf. of Numerical Analysis and Appl. Math. (ICNAAM), Sept. 19–25, 2022, Heraklion, Crete, Greece.*
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Post-Summit Results (Quality of Knowledge and Quality of Data)

Delegates' Summit: Best Practice & Definitions of . . . Structured . . .

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Program: `http://icnaam.org`

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.*
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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 beneficial 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://scienceparagon.de/cpr/x/publ/2016/delegatessummit2016/rueckemann_icnaam2016_summit_summary.pdf*

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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.*
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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.*
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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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Recall: Last Years' 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.

Citation: *Rückemann, Claus-Peter; Pavani, Raffaella; Gersbeck-Schierholz, Birgit; Tsitsipas, Athanasios; Schubert, Lutz; Hülsmann, Friedrich; Lau, Olaf; and Hofmeister, Martin (2019): Post-Summit Results, Delegates' Summit: Best Practice and Definitions of Formalisation and Formalism; Sept. 25, 2019, The Ninth Symposium on Advanced Computation and Information in Natural and Applied Sciences (SACINAS), The 17th Internat. Conf. of Numerical Analysis and Appl. Math. (ICNAAM), Sept. 23–28, 2019, Rhodos, Greece.*
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Recall: Last Years' Post-Summit Results

In 80 Words Around The World.

Structure and Cognostic Addressing Definition (Delegates and other contributors)

"Structure is an organisation of interrelated entities in a material or non-material object or system, on homogeneous intrinsic levels. Structure should be addressed by super- and sub-levels. Cognostic addressing applies to the wish to gain essential properties in science and scholarship in general, such as correlation, interrelation, and coherence and leads to a fundamental understanding. Cognostic identification, addressing, and continuous refinement of structures are essential prerequisites of creating new insight. In future, we consequently propose the term 'nucleal cognstructure'".

Structure can mean features and facilities. Links between knowledge and cognostics are unpredictable, especially by artificial and automated means in general. Structure can be deployed by methods, e.g., matching predefinable models, patterns, and precision. In practical programming many practicists prefer to define structure and cognostic addressing by formal aspects only.

Citation: *Rückemann, Claus-Peter; Pavani, Raffaella; Kovacheva, Zlatinka; Gersbeck-Schierholz, Birgit; Hülsmann, Friedrich; and Naydenova, Ina (2021): Post-Summit Results, Delegates' Summit: Best Practice and Definitions – Concepts of Cognostic Addressing Structured and Non-structured Data; Sept. 20, 2021, The Eleventh Symposium on Advanced Computation and Information in Natural and Applied Sciences (SACINAS), The 19th Internat. Conf. of Numerical Analysis and Appl. Math. (ICNAAM), Sept. 20–26, 2021, Rhodos, Greece.*
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Recall: Last Years' Post-Summit Results

In 80 Words Around The World.

Complements of Knowledge and Corresponding Sample Implementations:

- **Factual Knowledge** $\Leftrightarrow$ Numerical data, data ...
- **Conceptual Knowledge** $\Leftrightarrow$ Classification ...
- **Procedural Knowledge** $\Leftrightarrow$ Computing ...
- **Metacognitive Knowledge** $\Leftrightarrow$ Experience ...
- **Structural Knowledge** $\Leftrightarrow$ Standard hybrid formats ...
- ...

(Sources/references: SACINAS Delegates' Summit, 2015–2021; Rückemann, Keynote on Structured Data Comprehension, MIM 2021 [1] [2]; Knowledge Mapping, 2018 [3]; Aristotle, 350 B.C.E. / Platon's Phaidon, [4] [5] [6]; Anderson & Krathwohl, 2001 [7]);
Rückemann, Coherent Knowledge Solutions From Prehistory to Future, Lawrence Livermore National Laboratories (LLNL), ML4I 2021 [8]

Best Practice and Definitions: Quality of . . . (1/3)

In 80 Words Around The World.

Case: Information science, natural sciences, prehistory, universal applications

Source: Claus-Peter Rückemann, Friedrich Hülsmann, (KiM, DIMF)

- **Quality of knowledge and quality of data:**

  Knowledge can be approached being a complex non-technical asset of complements (DOI:10.15488/3409). Data are "things given". 'Data' cannot be 'turned' into 'information' or 'knowledge'. Quality is a secondary virtue. Fundaments of 'quality' and its measures are arbitrary. Often, quality approaches and practice result from hermeticism. Quality requires well-defined methods and precise, holistic, sufficiently complete specifications and documentation of contexts and purposes in order to be measured for a scenario. Quality of knowledge requires consideration of non-technical contexts.

  Formalisation and abstraction need to be documented and referenced to knowledge complements and data.

  Discovery levels need to be documented and referenced to knowledge complements and data.

  Trying to 'turn' data into 'information' or 'knowledge' consequently leads to arbitrary results and arbitrary organisational states.

  High quality for a defined scenario can mean no quality or even wrong for other scenarios.

Best Practice and Definitions: . . . Structured . . . (2/3)

In 80 Words Around The World.

Case: Biology

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

- **Quality of knowledge and quality of data:**

  'Quality' is a virtue strongly depending on precise specification. In natural sciences, e.g. biology, we have to define hard criteria in order to define quality for certain scenarios, making it measurable. Knowledge should best be approached by non-technical means due to its non-technical complements. Data are entities not sharing complexities comparable to knowledge complements. Therefore, quality of knowledge should be addressed by holistic means whereas quality of data mostly depends on transparently, precisely defining criteria for reproducible general framework conditions.

Best Practice and Definitions: . . . Structured . . . (3/3)

In 80 Words Around The World.

Case: Informatical point of view of practical implementation

Source: Kalinka Kaloyanova, Zlatinka Kovacheva, Ina Naydenova, (BAS Bulgaria)

- **Quality of knowledge and quality of data:**

  According to ISO 8000-2:2020, data is defined as "a reinterpretable representation of information in a formalized manner suitable for communication, interpretation or processing". Data quality reflects how a particular data set is suitable to serve its specific purpose. Data quality measures relate to data quality characteristics (attributes) such as accuracy, completeness, consistency, validity, uniqueness, and timeliness. Establishing adequate data quality attributes in the early phases of projects will ensure the right way for all data processing, starting with data collection.

Best Practice and Definitions

In 80 Words Around The World.

Statements on Concepts of Quality of Knowledge and Quality of Data

(Delegates and other contributors)

- **How should quality be defined?**
- **What is quality and what are inherent characteristics?**
- **What are essential differences of knowledge and data?**
- **Which Best Practice for quality of knowledge and quality of data can be summarised?**
- **Next Delegates' Summit Contexts:**

  Best Practice and Definitions of multi-disciplinary knowledge integration.

  Best Practice and Definitions [topics]
  aware of "Science Under Direction".

Best Practice Bibliography

Bibliography on Best Practice and Definitions (Delegates' Summits)

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[9] [10] [11] [12] [13] [14]

Networking and Outlook

Thank you for your attention!

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

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.

Quality of Knowledge and Quality of Data (Delegates and other contributors)

"Knowledge can be approached being a complex non-technical asset of complements (DOI:10.15488/3409). Data are "things given". 'Data' cannot be 'turned' into 'information' or 'knowledge'. Quality is a secondary virtue. Often, quality approaches and practice result from hermeticism. From the beginning on, quality of data requires well-defined methods and transparent, precise, consistent, holistic, sufficiently complete specifications and documentation of contexts and purposes to be reproducible and measured for a scenario. Quality of knowledge requires consideration of non-technical contexts accordingly.

Formalisation and abstraction need to be documented and referenced to knowledge complements and data. Discovery levels need to be documented and referenced to knowledge complements and data. Trying to 'turn' data into 'information' or 'knowledge' consequently leads to arbitrary results and arbitrary organisational states. Fundaments of 'quality' and its measures are arbitrary. High quality for a defined scenario can mean no quality or even wrong for other scenarios.The contextual nature of data quality requires scenario-dependent consideration of contexts, including measurability and re-interpretation, e.g., regarding criteria of ISO 8000-2:2020.

Citation: *Rückemann, Claus-Peter; Kaloyanova, Kalinka; Kovacheva, Zlatinka; Naydenova, Ina; Hülsmann, Friedrich; Gersbeck-Schierholz, Birgit (2022): Post-Summit Results, Delegates' Summit: Best Practice and Definitions – Quality of Knowledge and Quality of Data; Sept. 19, 2022, The Twelfth Symposium on Advanced Computation and Information in Natural and Applied Sciences (SACINAS), The 20th Internat. Conf. of Numerical Analysis and Appl. Math. (ICNAAM), Sept. 19–25, 2022, Heraklion, Crete, Greece.*
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