Flexible Querying and Analytics for Smart Cities and Smart Societies in the Age of Big Data: Overview of the FQAS 2019 International Conference

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Abstract. This paper contains a brief overview on issues and challenges of the emerging topic recognized as *flexible querying and analytics for smart cities and smart societies*, which is strictly related to the actual *big data management and analytics* research trend, along with a brief overview of the FQAS 2019 international conference.

Keywords: Big data · Flexible query answering · Flexible analytics · Big data intelligence · Smart cities · Smart societies

1 Introduction

Nowadays, *big data management and analytics* is playing the major role in the academic and industrial research community (e.g., [1, 2]). In this context, several research challenges can be recognized, among which *effectively and efficiently supporting flexible querying and analytics* are major issues to be addressed (e.g., [3, 4]).

These topics become particularly critical when connected to systems and tools that fall in the broad application scenario represented by *smart cities and smart societies* (e.g., [5, 6]). Here, well-known big data features induct a plethora of research challenges, among which we recall: (*i*) heterogeneity of data types; (*ii*) streaming nature; (*iii*) data quality. These challenges can be reasonably intended as actual obstacles towards obtaining flexibility in query and analytics tools over big data repositories.

By looking into details, big data for smart cities and smart society includes rather a wide collection of emerging application domains, such as energy systems, transportation systems, building design systems, healthcare systems, environmental monitoring systems, and so forth. Indeed, this is actually a "hot-topic", even as demonstrated by a plethora of real-life smart city and smart society projects developed in cities like London, Amsterdam, Singapore, San Francisco, and so forth. The main idea here consists in improving the quality of life in these cities and societies, thanks to smart ICT technologies (among which big data management and analytics play the role of main enabling technologies), but also other scientific disciplines like physics, city planning, medicine, biology, electronics, cultural heritage, and so forth, by empowering the interdisciplinary nature of such projects.

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Within the so-delineated framework, in this paper we provide a brief overview on these research issues, along with a brief overview of the *13th International Conference on Flexible Query Answering* (FQAS 2019), held in Amantea, Italy, during July 2–5, 2019.

2 Flexible Querying and Analytics for Smart Cities and Smart Societies in the Age of Big Data: Issues and Challenges

As mentioned in Sect. 1, heterogeneity of data types, streaming nature, and data quality are actually the major research challenges for big data research, with particular regards to the emerging smart city and smart society application scenario.

Heterogeneity of data types in big data sources is a well-known issue of smart city and smart society applications and systems (e.g., [7]). Here, big data sources occur in different formats, including graph data (e.g., social networks), XML data (e.g., Web information systems), sensor data (e.g., environmental monitoring networks), relational data (e.g., legacy systems), and so forth. How to deal with such (big) data heterogeneity is still an open problem.

Streaming nature of big data is widely-accepted as an enabling feature of big data applications themselves (e.g., [8]). Indeed, almost all the popular big data sources are streaming sources, such as sensor networks, social networks, industrial plants in industry 4.0 settings, and so forth. As a consequence, supporting mining and analytics over such data sources exposes to several drawbacks. For instance, how to compute OLAP-based aggregations over streaming data? When the computation should be blocked? How to evaluate concept drifting (e.g., for classification purposes) over streaming data? When data for class induction should be considered completely observed? Questions like the latter are still open problems in actual literature.

Quality of big data is an emerging topic at now (e.g., [9]). Indeed, consumers of big data applications are used to process big data repositories but they do not really know about the origin of such (big) data. Therefore, there is not any external authority that can ensure about the quality of (processed) big data. This problem is recognized in literature as the so-called *big data provenance problem* (e.g., [10]), and it consists in detecting who/which-application has originated and pre-processed the target big data source, for quality of data assessment purposes.

By addressing research challenges like the ones discussed above, next-generation big data analytics tools will be prone to incorporate flexibility in query and analytics tools over big data repositories, for enhanced smart city and smart society applications and systems.

3 13th International Conference on Flexible Query Answering Systems (FQAS 2019): Overview

FQAS 2019 has been held in Amantea, Italy, during July 2–5, 2019. The conference focuses on the special theme *flexible querying and analytics for smart cities and smart societies*, whose fundamental research challenges have been highlighted in Sect. 1. The

conference program has comprised three invited speeches, namely: (*i*) V.S. Subrahmanian, from Dartmouth College, NH, USA, "*Logic, Machine Learning, and Security*"; (*ii*) Josep Domingo-Ferrer, Universitat Rovira i Virgili, Spain, "*Personal Big Data, GDPR and Anonymization*"; (*iii*) Enrico Franconi, Free University of Bozen-Bolzano, Italy, "*Querying Databases with Ontologies: 17 Years Later*". In addition to this, the conference program has also comprise two tutorials, namely: (*i*) Alejandro Moreo and Fabrizio Sebastiani, ISTI-CNR, Italy "*Supervised Learning for Prevalence Estimation*"; (*ii*) Matthias Thimm, Universitat Koblenz-Landau, Germany, "*Algorithmic Approaches to Computational Models of Argumentation*".

FQAS 2019 has collected high-quality papers from Europe, North America, South America, Asia, and Africa. These papers focus the attention on different topics, including:

- *flexible database management and querying*;
- *ontologies and knowledge bases*;
- *argumentation-based query answering*;
- *data mining and knowledge discovery*;
- *advanced flexible query answering methodologies and techniques*;
- *flexible query answering methods and techniques*;
- *flexible intelligent information-oriented and network-oriented approaches*;
- *big data veracity and soft computing*;
- *flexibility in tools*;
- *systems and miscellanea*.

The positive news that one can derive from these contributions is that smart ICT technologies, and, particularly, big data management and analytics, can really provide a critical contribution to smart city and smart society applications and systems, thus improving the quality of life of people significantly.

We firmly believe that the conference has been a milestone in the exciting research road represented by the issue of effectively and efficiently supporting flexible query answering for smart cities and smart societies in the big data era.

4 Conclusions

This paper has provided a brief overview on issues and challenges of the emerging topic flexible querying and analytics for smart cities and smart societies, along with a brief overview of the FQAS 2019 international conference.

References

1. Zikopoulos, P., Eaton, C.: Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data, 1st edn. McGraw-Hill Osborne Media, Plano (2011)
2. LaValle, S.: Big data, analytics and the path from insights to value. MIT Sloan Manag. Rev. **52**, 21–32 (2011)

3. Zou, H., Yu, Y., Tang, W., Chen, H.-W.: Flex analytics: a flexible data analytics framework for big data applications with I/O performance improvement. Big Data Res. **1**, 4–13 (2014)
4. Zhao, D., Qiao, K., Zhou, Z., Li, T., Lu, Z., Xu, X.: Toward efficient and flexible metadata indexing of big data systems. IEEE Transact. Big Data **3**(1), 107–117 (2017)
5. Rani, S., Chauhdary, S.H.: A novel framework and enhanced QoS big data protocol for smart city applications. Sensors **18**(11), 3980 (2018)
6. Silva, B.N., et al.: Urban planning and smart city decision management empowered by real-time data processing using big data analytics. Sensors **18**(9), 2994 (2018)
7. Gal, A., Gunopulos, D., Panagiotou, N., Rivetti, N., Senderovich, A., Zygouras, N.: REMI: a framework of reusable elements for mining heterogeneous data with missing information - a tale of congestion in two smart cities. J. Intell. Inf. Syst. **51**(2), 367–388 (2018)
8. Rodríguez, J.Y.F., Álvarez-García, J.A., Arias-Fisteus, J., Luaces, M.R., Magaña, V.C.: Benchmarking real-time vehicle data streaming models for a smart city. Inf. Syst. **72**, 62–76 (2017)
9. Bertino, E., Jahanshahi, M.R.: Adaptive and cost-effective collection of high-quality data for critical infrastructure and emergency management in smart cities - framework and challenges. J. Data Inf. Q. **10**(1), 1 (2018)
10. Wu, D., Sakr, S., Zhu, L.: HDM: optimized big data processing with data provenance. In: Proceedings of EDBT 2017 (2017)