

## Efficient fuzzy systems for mining large scale, imprecise, uncertain and vague data

Pervasive sensor networks and internet services acquire, distribute and integrate a range of temporal scales of data. In line with these technological developments and availability of open data sources, there is almost no limit to generate and collect data. It is estimated that 2.5 quintillion bytes of data from a wide range of sources are generated daily, so called “big data”<sup>1</sup> with general characteristic features of higher volume and dimension, multi-source and higher velocity. It becomes a wider consensus that analysing and understanding big data is essential so as to extract life-saving, profitable and more accurate knowledge in various domains, which can be used to improve system performance and understand time-varying human needs and behaviours.

The big data being accumulated at fast-speed is potentially contaminated with fuzziness which is caused by imprecision, uncertainty and vagueness. The fuzziness is usually due to the granularity of information for generalization purposes, influence of human subjective judgment, partially available information, miss-recording or inaccurate measurements, and inconsistent human evaluation or measurement over time as well as uncertain issues including sudden changes in human and environmental behaviours. A wider range of research suggests that the fuzzy systems such as fuzzy classification, fuzzy regression, fuzzy feature selection, fuzzy clustering, and fuzzy case-based and rule-based learning are powerful to drive knowledge from fuzzy data contaminated with imprecision, uncertainty and vagueness. They are also effective on accounting fuzziness from the contaminated data. The fuzzy methods can also be used to develop intelligent decision-making models by intervening human expertise when the data is not quantitative or precise enough to generate the robust mathematical models.

The state-of-the-art fuzzy methods are however limited to deal with large volume of data streams with very high dimensions and data collected from multi-sources with different natures or degrees of fuzziness. In addition, human-like decision-making includes intervention of human expertise in decision-making process with which the fuzziness concept has only been utilised in small-scale problems, while the big data streams have not been successfully explored. A more robust learning system with better generalization capability can be developed, when fuzziness in big data is effectively evaluated and analysed. Given the promising use of the fuzzy concepts in data mining, efficient learning systems can be potentially developed for decision making processes from the big data. Through the efficient learning systems, intervention of human expertise can also be explored by the means of big data. Therefore, efficient fuzzy methodologies and technologies can be potentially utilised for analysing and handling the contaminated big data streams. In addition, powerful fuzzy decision models are necessary to cope with higher dimensions and larger fuzzy rule sets, as very high-dimensional data is required to be effectively managed under the big data concept.

Hence, this special issue aims to provide fuzzy systems-based innovative solutions for mining big data under imprecise, uncertain and vague conditions and their-real-world intensive data-driven applications in the following areas (but not limited to):

### Development of fuzzy methodologies

- Fuzzy modelling, classification, regression, clustering and feature selection for big data
- Accounting uncertainty in highly imbalanced big data for classification and feature selection
- Measuring, analysing and quantifying fuzziness in big data
- Fuzzy machine learning for big data mining
- Scaling and distributing big data with fuzziness
- Understanding and analysing uncertainty and vagueness in mining and integration of open data sources
- Dealing with fuzzy rule explosion for very high-dimensional data
- Exploring human expertise for fuzzy rule-based models with big data in dynamic or time-varying environment
- Hybrid, ensemble and distributed fuzzy methods for big data mining
- Temporal difference-based learning for self-growing data
- Scaling and distributing big data with fuzziness
- Web or text mining in social and service networks involving with perceptual evaluations
- Fuzzy data representation in big data systems
- Uncertainty information discovery in big data
- Fuzzy data mining for grid networks
- Fuzzy decision systems for big data
- Hybrid fuzzy system using the state-of art learning methods (such as Support Vector Machine, Extreme Learning Machine and Deep Learning)
- Parallel implementation of fuzzy systems for big data mining
- Scaling, distributing and/or parallelising big fuzzy-rule-based decision making models under big data concept
- Agent-based computing in handling fuzzy big data
- Type 1, 2 and n fuzzy systems for mining big data with fuzziness

<sup>1</sup> <http://www-01.ibm.com/software/data/bigdata/> [last accessed on 17/11/2012]

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Application areas for big and fuzzy data mining:

- Internet of things, Social networks
- Smart city, grid computing, mobile and wireless sensors, sensor networks
- Personalised data and business analytics
- Implementation and development of Cyber-physical systems
- Implementation of fuzzy big data mining tools using Cloud, GPU and FPGA
- Biological and clinical decision support systems
- Bio-medical informatics, bioinformatics, computational biology and systems biology
- Next generation genome sequencing
- Discovery of personalized diagnostic, prognostic and screening biomarkers, and therapy and drug, etc

**Submission Procedure:** Submitted papers should not have been previously published or be under consideration for publication elsewhere at the time of its submission. The papers should be submitted to the special issue via [the journal website](#) and should follow its standard formats. Authors should also include a statement in their cover letter that the paper is intended for the Special Issue entitled “Efficient Fuzzy systems for mining large scale, imprecise, uncertain and vague data”. In case of further details, contact the Guest Editors.

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