IEEE CIS Newsletter, Issue 95, December 2020

Announcements

The First Issue (Volume 1, Number 1, 2020) of *IEEE Transactions on Artificial Intelligence* is Out!

The table of contents is below:

For more information please visit the *IEEE Transactions on Artificial Intelligence* website.

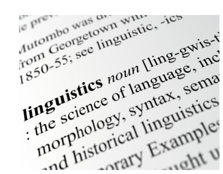
Research Frontier

Procedural Generation of Multistory Buildings With Interior

This article is about the procedural generation of accessible multistory buildings including stairwells. We present an algorithm featuring a natural bottom-up approach, where each building is defined by a set of rooms that can be connected by doors or stairways and are equipped with windows. Our approach is robust so that neither the rooms, nor the connections, nor the objects can be placed in invalid positions. In the second part, we enhance the process by a procedural growth algorithm with automatic corridor detection and stairwell placement. Finally, we propose an automatic mesh generation for either procedurally or manually designed buildings. We evaluate our approach by creating a full implementation of the algorithm and judge it based on the resulting realism, accessibility, and diversity of a generated test set of buildings. Read More

IEEE Transactions on Games, Sept. 2020

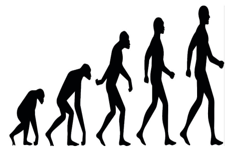
Computing With Comparative Linguistic Expressions and Symbolic Translation for Decision Making: ELICIT Information



Many real-world decision making (DM) problems present changing contexts in which uncertainty or vagueness appear. Such uncertainty has been often modeled based on the linguistic information by using single linguistic terms. Dealing with linguistic information in DM demands processes of computing with words whose main characteristic is to emulate human beings' reasoning processes to obtain linguistic outputs from linguistic inputs. However, often single linguistic terms are limited or do not express properly the expert's knowledge, being necessary to elaborate richer linguistic expressions easy to understand and able to express a greater amount of knowledge, as it is the case of the comparative linguistic expressions based on hesitant fuzzy linguistic terms sets. Nevertheless, current computational models for comparative linguistic expressions present limitations both from understandability and precision points of view. The 2-tuple linguistic representation model stands out in these aspects because of its accuracy and interpretability dealing with linguistic terms, both related to the use of the symbolic translation, although 2-tuple linguistic values are still limited by the use of single linguistic terms. Therefore, the aim of this article is to present a new fuzzy linguistic representation model for comparative linguistic expressions that takes advantage of the goodness of the 2-tuple linguistic representation model and improve the interpretability and accuracy of the results in computing with words processes, resulting in the so-called extended comparative linguistic expressions with symbolic translation. Taking into account the proposed model, a new computing with words approach is presented and then applied to a DM case study to show its performance and advantages in a real case by comparing with other linguistic decision approaches. Read More

IEEE Transactions on Fuzzy Systems, Oct. 2020

A Multifactorial Evolutionary Algorithm for Multitasking Under Interval Uncertainties



Various real-world applications with interval uncertainty, such as the path planning of mobile robot, layout of radio frequency identification readers and solar desalination, can be formulated as an interval multiobjective optimization problem (IMOOP), which is usually transformed into one or a series of certain problems to solve by using evolutionary algorithms. However, a definite characteristic among them is that only a single optimization task can be catched up at a time. Inspired by the multifactorial evolutionary algorithm (MFEA), a novel interval MFEA (IMFEA) is proposed to solve IMOOPs simultaneously using a single population of evolving individuals. In the proposed method, the potential interdependency across related problems can be explored in the unified genotype space, and multitasks of multiobjective interval optimization problems are solved at once by promoting knowledge transfer for the greater synergistic search to improve the convergence speed and the quality of the optimal solution set. Specifically, an interval crowding distance based on shape evaluation is calculated to evaluate the interval solutions more comprehensively. In addition, an interval dominance relationship based on the evolutionary state of the population is designed to obtain the interval confidence level, which considers the difference of average convergence levels and the relative size of the potential possibility between individuals. Correspondingly, the strict transitivity proof of the presented dominance relationship is given. The efficacy of the associated evolutionary algorithm is validated on a series of benchmark test functions, as well as a real-world case of robot path planning with many terrains that provides insight into the performance of the method in the face of IMOOPs. Read More

IEEE Transactions on Evolutionary Computation, Oct. 2020

When Gaussian Process Meets Big Data: A Review of Scalable GPs

The vast quantity of information brought by big data as well as the evolving computer hardware encourages success stories in the machine learning community. In the meanwhile, it poses challenges for the Gaussian process regression (GPR), a well-known nonparametric, and interpretable Bayesian model, which suffers from cubic complexity to data size. To improve the scalability while retaining desirable prediction quality, a variety of scalable GPs have been presented. However, they have not yet been comprehensively reviewed and analyzed to be well understood by both academia and industry. The review of scalable GPs in the GP community is timely and important due to the explosion of data size. To this end, this article is devoted to reviewing state-of-the-art scalable GPs involving two main categories: global approximations that distillate the entire data and local approximations that divide the data for subspace learning. Particularly, for global approximations, we mainly focus on sparse approximations comprising prior approximations that modify the prior but perform exact inference, posterior approximations that retain exact prior but perform approximate inference, and structured sparse approximations that exploit specific structures in kernel matrix; for local approximations, we highlight the mixture/product of experts that conducts model averaging from multiple local experts to boost predictions. To present a complete review, recent advances for improving the scalability and capability of scalable GPs are reviewed. Finally, the extensions and open issues of scalable GPs in various scenarios are reviewed and discussed to inspire novel ideas for future research avenues. Read More

IEEE Transactions on Neural Networks and Learning Systems, Nov. 2020

Member Activities

Webinar Speaker: Prof. James C. Bezdek

Webinar Chair: Dr. Sansanee Auephanwiriyakul

Webinar Title: How big is too big? Clustering in BIG DATA with the Fantastic 4

Date and Time: 14 December 2020 at 08:00 AM. (GMT – 6 or Florida USA time zone) (This is a 90-minute talk)

Registration URL:
https://attendee.gotowebinar.com/register/5020444169982879502

Abstract: What is big data? For this talk "big" refers to the number of samples (n) and/or number of dimensions (p) in static sets of feature vector data; or the size of (similarity or distance) matrices for relational clustering. Objectives of clustering in static sets of big numerical data are acceleration for loadable data and feasibility for non-loadable data. Three ways currently in favor to achieve these objectives are (i) streaming (online)clustering, which avoids the growth in (n) entirely; (ii) chunking and distributed processing; and (iii) sampling followed by very fast (usually 1-2% of the overall processing time) noniterative extension to the remainder of the data. Kernel-based methods are mentioned, but not covered in this talk.

This talk describes the use of sampling followed by non-iterative extensions that extend each of the "Fantastic Four" to the big data case. Three methods of sampling are covered: random, progressive, and minimax. The last portion of this talk summarizes a few of the many acceleration methods for each of the Fantastic Four. Four classical clustering methods have withstood the tests of time. I call them the Fantastic Four:

- Gaussian Mixture Decomposition (GMD, 1898)
- Hard c-means (often called "k-means," HCM, 1956)
- Fuzzy c-means (reduces to HCM in the limit, FCM, 1973)
- SAHN Clustering (principally single linkage (SL, 1909)

The first three models apply to feature vector data. All three define good clusters as part of the extrema of optimization problems defined by their objective functions, and in this talk, alternating optimization (known as expectation-maximization (EM) for GMD) is the scheme for approximating solutions. Approximate clustering with HCM, FCM and GMD based on literal clustering of a sample followed by non-iterative extension is discussed. Numerical examples using various synthetic and real data sets (big but loadable) compare this approach to incremental methods (spH/FCM and olH/FCM) that process data chunks sequentially. This portion of the talk concludes with a "recommendation tree" for when to use the various c-means models.

The SAHN models are deterministic, and operate in a very different way. Clustering in big relational data by sampling and non-iterative extension proceeds along these lines. Visual assessment of clustering tendency (VAT/iVAT) builds and uses the minimal spanning tree(MST) of the input data. Extension of iVAT to scalable iVAT (siVAT) for arbitrarily large square data is done with minimax sampling, and affords a means for visually estimating the number of clusters in the literal MST of the sample. siVAT then marries quite naturally to single linkage (SL), resulting in two offspring: (exact) scalable SL in a special case; and clusiVAT for the more general case. Time and accuracy comparisons of clusiVAT are made to crisp versions of three HCM models; HCM (k-means), spHCM and olHCM; and to CURE.

Experiments with synthetic data sets of Gaussian clusters, and various real world (big, but loadable) are presented.

Biography:

Jim received the PhD in Applied Mathematics from Cornell University in 1973. Jim is past president of NAFIPS (North American Fuzzy Information Processing Society), IFSA (International Fuzzy Systems Association) and the IEEE CIS (Computational Intelligence Society): Founding Editor of the *International Journal of Approximate Reasoning* and the *IEEE Transactions on Fuzzy Systems*: Life fellow of the IEEE and IFSA; and a recipient of the IEEE 3rdMillennium, IEEE CIS Fuzzy Systems Pioneer, and IEEE technical field award Rosenblatt medals. Jim's interests: woodworking, optimization, motorcycles, pattern recognition, cigars, clustering in very large data, fishing, co-clustering, blues music, wireless sensor networks, poker and visual clustering. Jim retired in 2007.

Educational Activities

2021 Graduate Student Research Grants: Call for Applications

The IEEE Computational Intelligence Society (CIS) funds scholarships for deserving undergraduate, graduate and PhD students who need financial support to carry out their research during an academic break period. The primary intent of these scholarships is to cover the expenses related to a visit to another university, institute or research agency for collaboration with an identified researcher in the field of interest of the applicant. Funds can be used to cover travel expenses as well as certain living expenses (such as housing). The field of interest of applicants is open but should be connected with an identifiable component of the CIS (neural networks, fuzzy systems, or evolutionary computation). The call for the next round of applications will be announced soon and will have a deadline for submission of Mar 15 2021.

More information on the scheme can be found on the CIS Graduate Student Research Grants webpage.

Journal Special Issues

- IEEE TCDS Special Issue on Emerging Topics on Development and Learning (15 Jan 2021)
- IEEE TFS Special Issue on Fuzzy Systems Toward Human-Explainable Artificial Intelligence and Their Applications (1 Feb 2021)
- IEEE CIM Special Issue on Explainable and Trustworthy Artificial Intelligence (15 Feb 2021)
- IEEE TCDS Special Issue on Towards autonomous evolution, (re)production and learning in robotic eco-systems (15 Feb 2021)
- IEEE TNNLS Special Issue on Deep Learning for Earth and Planetary Geosciences (12 Mar 2021)
- IEEE TNNLS Special Issue on Deep Neural Networks for Graphs: Theory, Models, Algorithms and Applications (31 Jul 2021)

CIS Conferences

Due to the outbreak of the COVID-19 pandemic, dates and details of CIS sponsored conferences should be monitored closely.

The situation is changing very quickly. Please consult the conference web pages frequently to obtain the latest information.

You can find the most recent announcements and updates from all of our Society's conferences and events at https://cis.ieee.org/volunteer-resources/covid-19-notice as our organizers make decisions.

2021 10th International Conference on Pattern Recognition Applications and Methods (ICPRAM)
Vienna, Austria
4-6 Feb. 2021

2021 International Conference on Machine Vision and Augmented Intelligence (MAI 2021)
IIITDM Jabalpur, India
11-14 Feb. 2021

2021 12th International Conference on Agents and Artificial Intelligence (ICAART)

Vienna, Austria
4-6 Feb. 2021

2021 IEEE Congress on Evolutionary Computation (CEC)
Kraków, Poland
28 Jun. - 1 Jul. 2021
Full paper submission deadline: 31 Jan. 2021

2021 IEEE International Conference on Computational Intelligence and Virtual Environments for Measurement Systems and Applications (IEEE CIVEMSA 2021)
Virtual Conference
18-20 Jun. 2021

2021 IEEE International Conference on Fuzzy Systems (FUZZ-IEEE)
Luxembourg
11-14 Jul. 2021
Full paper submission deadline: 10 Feb. 2021

2021 IEEE International Conference on Development and Learning (ICDL)
Beijing, China
23-26 Aug. 2021

2021 International Conference on Emerging Techniques in Computational Intelligence (ICETCI)
Hyderabad, India
24-26 Aug 2021

2021 IEEE Conference on Computational Intelligence in Bioinformatics and Computational Biology (CIBCB)
Melbourne, Australia
13-15 Oct. 2021

2021 IEEE Latin American Conference on Computational Intelligence (LA-CCI)
Temuco, Chile
2-4 Nov. 2021

2021 IEEE Symposium Series on Computational Intelligence (SSCI)
Orlando, FL USA
5-8 Dec. 2021

2022 IEEE World Congress on Computational Intelligence (IEEE WCCI)
Padua, Italy
18-23 Jul. 2022

2022 IEEE Conference on Games (IEEE CoG 2022)
21-24 Aug. 2022
Beijing, China

2022 IEEE Symposium Series on Computational Intelligence (SSCI)
Singapore, Singapore
4-7 Dec. 2022

CIS sponsors and co-sponsors a number of conferences across the globe.

View Full Schedule

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