IEEE CIS Newsletter, Issue 94, November 2020

Announcements

Open Calls for Competition Proposals

Competitions have become an integral part of many IEEE conferences. We would like to promote some competition calls for the coming year. In case you are interested in hosting a competition, please visit the pages below and check out the respective call for competition proposals.

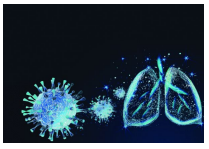
- 2021 IEEE IJCNN - Competition proposal submission deadline: 15 December 2020
- 2021 IEEE CEC - Competition proposal submission deadline: 17 December 2020.
- 2021 IEEE ICETCI - Competition proposal submission deadline: 30 December 202

We would like to note that the IEEE CIS Competitions Subcommittee is actively funding competition prizes of competitions accepted at IEEE CIS conferences. Information about the funding application process is available here.

Alexander Dockhorn, Chair of the IEEE CIS Competition Subcommittee

Research Frontier

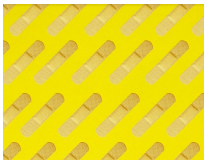
Computational Intelligence Techniques for Combating COVID-19: A Survey



Computational intelligence has been used in many applications in the fields of health sciences and epidemiology. In particular, owing to the sudden and massive spread of COVID-19, many researchers around the globe have devoted intensive efforts into the development of computational intelligence methods and systems for combating the pandemic. Although there have been more than 200,000 scholarly articles on COVID-19, SARS-CoV-2, and other related coronaviruses, these articles did not specifically address in-depth the key issues for applying computational intelligence to combat COVID-19. Hence, it would be exhausting to filter and summarize those studies conducted in the field of computational intelligence from such a large number of articles. Such inconvenience has hindered the development of effective computational intelligence technologies for fighting COVID-19. To fill this gap, this survey focuses on categorizing and reviewing the current progress of computational intelligence for fighting this serious disease. In this survey, we aim to assemble and summarize the latest developments and insights in transforming computational intelligence approaches, such as machine learning, evolutionary computation, soft computing, and big data analytics, into practical applications for fighting COVID-19. We also explore some potential research issues on computational intelligence for defeating the pandemic. Read More

IEEE Computational Intelligence Magazine, Nov. 2020

Patch Learning

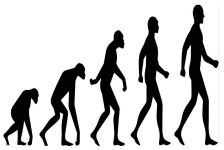


There have been different strategies to improve the performance of a machine learning model, e.g., increasing the depth, width, and/or nonlinearity of the model, and using ensemble learning to aggregate multiple base/weak learners in parallel or in series. This article proposes a novel strategy called patch learning (PL) for this problem. It consists of three steps: first, train an initial global model using all training data; second, identify from the initial global model the patches that contribute the most to the learning error, and train a (local) patch model for each such patch; and, third, update the global model using training data that do not fall into any patch. To use a PL model, we first determine if the input falls into any patch. If yes, then the corresponding patch model is used to compute the output. Otherwise, the global model is used. We explain in detail how PL can be implemented using fuzzy systems. Five regression problems on one-dimensional (1-D)/2-D/3-D curve fitting, nonlinear system identification, and chaotic time-series prediction, verified its effectiveness. To our knowledge, the PL idea has not appeared in the literature before, and it opens up a promising new line of research in machine learning. Read More

IEEE Transactions on Fuzzy Systems, Sept. 2020

Boosting Data-Driven Evolutionary Algorithm With Localized Data Generation

By efficiently building and exploiting surrogates, data-driven evolutionary algorithms (DDEAs) can be very helpful in solving expensive and computationally intensive problems. However, they still often suffer from two difficulties. First, many existing methods for building a single ad hoc surrogate are suitable for some special problems but may not work well on some other problems. Second, the optimization accuracy of DDEAs deteriorates if available data are not enough for building accurate surrogates, which is common in expensive optimization problems. To this end, this article proposes a novel DDEA with two efficient components. First, a boosting strategy (BS) is proposed for self-aware model managements, which can



iteratively build and combine surrogates to obtain suitable surrogate models for different problems. Second, a localized data generation (LDG) method is proposed to generate synthetic data to alleviate data shortage and increase data quantity, which is achieved by approximating fitness through data positions. By integrating the BS and the LDG, the BDDEA-LDG algorithm is able to improve model accuracy and data quantity at the same time automatically according to the problems at hand. Besides, a tradeoff is empirically considered to strike a better balance between the effectiveness of surrogates and the time cost for building them. The experimental results show that the proposed BDDEA-LDG algorithm can generally outperform both traditional methods without surrogates and other state-of-the-art DDEA on widely used benchmarks and an arterial traffic signal timing real-world optimization problem. Furthermore, the proposed BDDEA-LDG algorithm can use only about 2% computational budgets of traditional methods for producing competitive results. Read More

IEEE Transactions on Evolutionary Computation, Oct. 2020

Continual Learning of Recurrent Neural Networks by Locally Aligning Distributed Representations

Temporal models based on recurrent neural networks have proven to be quite powerful in a wide variety of applications, including language modeling and speech processing. However, training these models often relies on backpropagation through time (BPTT), which entails unfolding the network over many time steps, making the process of conducting credit assignment considerably more challenging. Furthermore, the nature of backpropagation itself does not permit the use of nondifferentiable activation functions and is inherently sequential, making parallelization of the underlying training process difficult. Here, we propose the parallel temporal neural coding network (P-TNCN), a biologically inspired model trained by the learning algorithm we call local representation alignment. It aims to resolve the difficulties and problems that plague recurrent networks trained by BPTT. The architecture requires neither unrolling in time nor the derivatives of its internal activation functions. We compare our model and learning procedure with other BPTT alternatives (which also tend to be computationally expensive), including real-time recurrent learning, echo state networks, and unbiased online recurrent optimization. We show that it outperforms these on-sequence modeling benchmarks such as Bouncing MNIST, a new benchmark we denote as Bouncing NotMNIST, and Penn Treebank. Notably, our approach can, in some instances, outperform full BPTT as well as variants such as sparse attentive backtracking. Significantly, the hidden unit correction phase of P-TNCN allows it to adapt to new data sets even if its synaptic weights are held fixed (zero-shot adaptation) and facilitates retention of prior generative knowledge when faced with a task sequence. We present results that show the P-TNCN's ability to conduct zero-shot adaptation and online continual sequence modeling. Read More

IEEE Transactions on Neural Networks and Learning Systems, Oct. 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.

Report on "Careers in Computational intelligence: How To Inspire Women Of All Ages" Held At WCCI 2020

The IEEE Women in Computational Intelligence (WIC) subcommittee held a virtual event called "Careers in Computational intelligence: How to inspire women of all ages" on 23 July at IEEE WCCI 2020. The 90-minute event consisted of several speakers and two breakout rooms allowing interaction and engagement from attendees. The event chaired by Prof. Keeley Crockett featured an overview of the IEEE Computational Intelligence Society by Prof. Bernadette Bouchon-Meunier (President of the IEEE Computational Intelligence Society). An inspiring talk by Dr Lisa Lazareck-Asunta -- the IEEE Women in Engineering Chair and the work of the IEEE Computational Intelligence High School Outreach Sub-committee by Prof. Julia Chung. Attendees were then invited to attend one of two virtual breakout rooms. The first focused on career journeys in Computational Intelligence and the second allowed attendees to share stories of Computational Intelligence focused STEM activities for girls that they had organized or participated in. Some great ideas were shared between the 63 virtual participants.

A survey following the event showed that 88% of participants felt that the virtual event provided a forum for promoting female researchers in the CIS area. 100% of participants who took part in the survey had gained more awareness of WIC and Women in Engineering (WIE) and 88% rated the event as very good or excellent. Positive comments included "It was a very friendly and open environment. The information was concise and helpful" and "warm and democratic environment." However, one person indicated that they felt virtual events were difficult for them. Things to improve include: a) make the event longer with more discussion panels b) ensure there is a follow-up c) more student involvement d) more publicity for events e) make slides available.

In a difficult challenging time, it was a great opportunity to meet some amazing people, hear about career journeys and get some good ideas for CI inspired STEM events. Watch this space for IEEE WCI's next virtual event at SSCI 2020 in December!

Educational Activities

IEEE Canberra Artificial Intelligence Summer School (CAISS) 2020

To bring AI to the broader technical and non-technical audience, we are organising a summer school under the title of the IEEE Canberra Artificial Intelligence Summer School -- and we are cordially inviting you to participate! We have secured high-calibre Australian and international AI experts, who will share their passion for both Artificial Intelligence (AI) and education.

As interaction is vital, we will "engineer" the breakout groups to maximise the diversity: each group will be composed of students, academics, industry, and members of the general public -- as well as facilitators.

Are you ready to be wowed by AI?

Website: http://canberraai.net/caiss2020/

We are going to use Discord to announce news and as a general chat platform: https://discord.gg/rcKuNm4 (free)

For the video conferences, we are going to use Zoom: https://zoom.us/download (free)

If interested in staying up-to-date, please join the Discord channel!

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 at https://cis.ieee.org/professional-development/research-grants

Technical Activities

Second IEEE-CIS Technical Challenge: Energy Prediction from Smart Meter Data

The IEEE Computational Intelligence Society (IEEE-CIS) presents its second technical challenge, this year on the topic of predicting monthly and yearly energy consumption for a number of households. We want to improve energy prediction based on smart meter data, while also improving the customer experience. IEEE-CIS works across a variety of Artificial Intelligence and machine learning areas, including deep neural networks, fuzzy systems, evolutionary computation, and swarm intelligence. Today we are partnering with one of the leading international energy providers, E.ON, seeking the best solutions for energy prediction using smart meters, and now you are invited to join the challenge. Winners will be invited to present their solution at the 2020 IEEE Symposium Series on Computational Intelligence (SSCI). https://ieee-dataport.org/competitions/ieee-cis-technical-challenge-energy-prediction-smart-meter-data

Prizes

- 1st prize: US$7,000
- 2nd prize: US$5,000
- 3rd prize: US$3,000
- 4th and 5th prizes: US$1,000

Important Dates

- 15 August 2020 – **Competition starts**
- 15 November 2020 – **Final submission deadline**
- 18 November 2020 – Shortlisting announcement
- 25 November 2020 – Deadline final description report
- 1 December 2020 – Shortlisted solution presentations at the 2020 IEEE Symposium Series on Computational Intelligence (SSCI). The conference will be held virtually and registration for the 5 shortlisted submissions will be covered
- 4 December 2020 – Awards ceremony Important links Submission platform Data description Submission guide Evaluation

Important links

- Submission platform
- Data description
- Submission guide
- Evaluation

Journal Special Issues

- IEEE TCDS Special Issue on Emerging Topics on Development and Learning (15 Jan 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)

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.

7th International Conference on Behavioural and Social Computing (BESC)
Bournemouth, UK
5-7 Nov. 2020

7th International Conference on Soft Computing and Machine Intelligence (ISCMI)
Stockholm, Sweden
14-15 Nov. 2020

2020 IEEE Symposium Series on Computational Intelligence (IEEE SSCI 2020)
Virtual Event
1-4 Dec. 2020

2020 IEEE Smart World Conference (SWC 2020)
Melbourne, Australia
8-10 Dec. 2020

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
Full paper submission deadline: 30 Nov. 2020

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 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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