SPECIAL ISSUE ON

COMPUTATIONAL INTELLIGENCE ON META LEARNING FOR SMART HEALTHCARE

Aims and Scope

Computational intelligence (CI) includes ideas, paradigms, algorithms, and implementations for practical adaptation and self-organization that allow or promote appropriate behaviors (intelligent behavior) in complex and changing situations. Typical machine learning models are normally built from scratch for a given challenge utilizing a defined learning algorithm. Deep learning-based methods have provided considerable success in a range of domains; however, there are certain drawbacks, for example, deep learning requires a ton of data to train.

This can pose a major challenge for domains ranging from supervised medical image processing to reinforcement learning where real-world data collection poses a major logistical challenge. Meta-learning offers a potential solution to this problem: by learning to learn across data from many previous tasks, and by discovering the structure among tasks to enable fast learning of new tasks. A meta-learning strategy moves the emphasis in the whole CI field from individual learning algorithms to a higher level of learning how to learn.

A successful meta-learning model should be trained in a range of learning tasks and tailored for best results in the distribution of tasks, including theoretically unseen tasks. As a sub-field of the CI research, meta learning algorithms are added to machine learning experiment metadata. Instead of traditional machine learning methods that only learn a certain task from a single mass dataset, meta-learning is a high-level machine learning method that studies other tasks together. As a consequence, this method involves a hierarchical system that learns to learn a new challenge with distributed hierarchically organized metadata.

The growing number of chronic patients and ageing population make disease prevention a compulsory necessity. Prevention is characterized not only as a means of keeping a healthy lifestyle (physical exercise, diet, intermittent preventive checks, etc.), but also as a means of preventing chronic problems from becoming worse. A rising number of chronic conditions and the shortage of medical services to fulfill patient care demands should have to be tackled by the potential healthcare industry. A smart healthcare framework includes different components such as Internet of Things (IoT), intelligent sensors, medical systems using artificial intelligence (AI) and machine learning, edge and cloud computing, and next-generation wireless network. Most of the medical data are resource-scarce, confidential, and private. Therefore, meta

learning plays a crucial role in smart healthcare. For example, meta learning can be used in smart healthcare to reduce the training overhead and complexity for communication systems, to generate fast adaptive task offloading in edge computing, to develop an effective energy dispatch mechanism for self-powered wireless networks with edge computing, to connect the fragmented healthcare data sources with privacy-preservation, to predict clinical risk with limited patient electronic health records, to classify resource-limited medical images, and for domain adaptation for medical image segmentation and analysis.

There are several publicly available databases for meta learning experiments. Researchers can compare the performance of their novel meta learning-based systems using these databases. Some examples of such databases are Omniglot (B. M. Lake, R. Salakhutdinov, and J. B Tenenbaum, “Human-level concept learning through probabilistic program induction,” Science, 350(6266):1332–1338, 2015.), mini-ImageNet (O. Vinyals, et al., “Matching networks for one shot learning,” In Advances in Neural Information Processing Systems, pp. 3630–3638, 2016.), and META-DATASET (E. Triantafillou, et al., Meta-Dataset: A Dataset of Datasets for Learning to Learn from Few Examples, International Conference on Learning Representations, Addis Ababa, 2020).

This special issue (SI) focuses on recent advancements of meta learning paradigm in smart healthcare. In particular, the SI seeks novel contributions in the field of meta learning such as convolutional Siamese neural network, matching networks (k-shot classification), relation network, prototypical networks, memory-augmented neural networks, meta networks, long-short term memory (LSTM) meta-learner, and model-agnostic meta-learning (MAML). The contribution should be explicit, in detail, and easily understood by general readers. The manuscript should be original, unpublished, and should not be accepted or under review in any journals or magazines. Manuscripts will be peer-reviewed by at least three independent reviewers and will be chosen based on contributions including their originality, scientific quality as well as their suitability to this SI.

Topics

This special issue is targeted on general readership articles about design and application of CI technologies. Topics of interest include, but are not limited to:

- Clinical risk prediction using meta learning
- Genomic survival analysis for disease prediction using meta learning
- Explainable meta-reinforcement learning (xMRL) for smart healthcare
- Secure collaborative few-shot learning framework
- Brain-computer interface applications using meta learning
- Meta learning-based affective computing
- Security and privacy issues of smart healthcare using meta learning

- Time-series analysis of medical signals using meta learning
- Meta learning for medical robots
- Edge computing based on meta reinforcement learning for smart healthcare
- Meta learning for connected living

Submission

The IEEE Computational Intelligence Magazine (CIM) publishes peer-reviewed high-quality articles. All manuscripts must be submitted electronically in PDF format. Manuscripts must be in standard IEEE two-column/single space format and adhere to a length of 10 pages (including figures and references) for regular papers. A mandatory page charge is imposed on all papers exceeding 10 pages in length.

More information on manuscript details and submission guidelines can be found at the following websites:

- Special Issue website: https://sites.google.com/ccis.edu.sa/special-issue-on-meta-learning/home
- IEEE CIM website: https://cis.ieee.org/publications/ci-magazine/cim-information-for-authors

Important Dates

- Manuscript Due: **30 October, 2021**
- First Notification: 01 January, 2022
- Revision Due: 15 February, 2022
- Final Notification: 15 April, 2022

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