

IEEE ETFA 2020

Title: Hands-on Deep Learning Workshop for Industrial Applications

8 September 2020

9:00 AM – 12:00 PM

Presenters:

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Summary of the workshop:

Deep learning is gradually becoming a mature artificial intelligence paradigm in both research and practice. Supported by a substantial evidence base, it demonstrates increasing potential for industrial applications in factory automation, energy, manufacturing, transport, communication and human engagement. This workshop aims to develop essential knowledge of deep learning with hands-on exercises in Python, using Google Collaboratory and Jupyter Notebooks. The workshop will begin by exploring the structural elements of deep learning models, hyper-parameters, and comparison to standard machine learning algorithms, followed by the theory and application of deep neural networks (classification), convolutional neural networks (image processing), and recurrent neural networks (time-series prediction). Participants will conduct hands-on experiments of each technique using benchmark and real datasets, for training, testing and evaluation. Each technique will be demonstrated in the context of real-world projects in Industrial Informatics. The learning outcomes of this workshop are; the theoretical foundations of deep learning - when to use and in which settings, the design and development of deep learning models, rapid prototyping, evaluation and deployment using Python.

Requirements: Participants will access Google Collaboratory using a Gmail account. A laptop with an Internet browser and a stable Internet connection are mandatory.

Schedule:

Time	Topic	Content
9.00 – 9.50 AM	Theoretical Foundations of Deep Learning	<ul style="list-style-type: none"> • Transition from AI to ML to DL • Basic structure of DL model • Deep Learning model architecture and hyper-parameters
9.50 – 10.10 AM	Practical implementation of DNN	<ul style="list-style-type: none"> • Developing a DL model • Hands-on implementation using a benchmark dataset
10.10 – 10.20 AM	Break	
10.20 – 11.00 AM	Theoretical foundation of RNN and CNN	<ul style="list-style-type: none"> • Sequence modelling with RNN • Variants of RNN • Inspiration and intuition behind CNN • Components of CNN
11.00 – 11.40 AM	Practical implementation of CNN and RNN	<ul style="list-style-type: none"> • Developing a CNN and RNN models • Hands-on implementation using a benchmark dataset and real-world case-study dataset
11.40 – 12.00 PM	Questions and Discussion	Demonstration of further projects and scenarios.

Combined CV of Presenters:

Daswin is Deputy Director of the Research Centre for Data Analytics and Cognition (CDAC) at La Trobe University, Australia. Daswin's research interests are incremental machine learning, information fusion, deep learning, auto ML, with applications in energy, smart cities, and human emotions. He's an associate editor of the IEEE Transactions of Industrial Informatics.

Rashmika and Achini are Technical Leads in the same Research Centre (CDAC). Rashmika leads the image, video analysis capability with applications in transport while Achini leads the human sentiment and emotions analysis with applications in digital health and social media. Besides academic pursuits, as part of CDAC strategic initiatives, all three presenters are actively involved in industry engagement, solving real-world AI problems and working with both analytics technology providers and consultants.

Relevant publications:

De Silva, D., Sierla, S., Alahakoon, D., Osipov, E., Yu, X. and Vyatkin, V., 2020. Toward Intelligent Industrial Informatics: A Review of Current Developments and Future

Directions of Artificial Intelligence in Industrial Applications. IEEE Industrial Electronics Magazine, 14(2), pp.57-72.

Nawaratne R, Alahakoon D, **De Silva D**, Kumara H, Yu X. Hierarchical Two-Stream Growing Self-Organizing Maps with Transience for Human Activity Recognition. IEEE Transactions on Industrial Informatics. 2019 Dec 4.

Nallaperuma D, **Nawaratne R**, Bandaragoda T, **Adikari A**, Nguyen S, Kempitiya T, **De Silva D**, Alahakoon D, Pothuhera D. Online incremental machine learning platform for big data-driven smart traffic management. IEEE Transactions on Intelligent Transportation Systems. 2019 Jul 11;20(12):4679-90.

Jayarathne M, **de Silva D**, Alahakoon D. Unsupervised Machine Learning Based Scalable Fusion for Active Perception. IEEE Transactions on Automation Science and Engineering. 2019 May 15;16(4):1653-63.

De Silva D, Ranasinghe W, Bandaragoda T, Adikari A, Mills N, Iddamalgoda L, Alahakoon D, Lawrentschuk N, Persad R, Osipov E, Gray R. Machine learning to support social media empowered patients in cancer care and cancer treatment decisions. PloS one. 2018;13(10).

Nawaratne R, Alahakoon D, **De Silva D**, Chhetri P, Chilamkurti N. Self-evolving intelligent algorithms for facilitating data interoperability in IoT environments. Future Generation Computer Systems. 2018 Sep 1;86:421-32.