

Ontario Electricity Price Forecasting in the Day Ahead Market Using Bi-directional Long-Short Term Memory Network

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Abstract

All players, including generation companies as sellers and distribution companies as buyers, try to accurately forecast the electricity price to increase their benefits in the market. The players have been using various techniques to improve their forecasting accuracy because only a little modification can increase the profit significantly. Recently, the machine learning based techniques have been used for forecasting especially price forecasting. The Bi-directional Long-Short Term Memory (B-LSTM) network, as one of the advanced machine learning techniques, can accurately forecast the electricity price. In this paper, the Ontario electricity price data is analyzed firstly. The bad data is denoised and the refined data is used to train the network in the next step. In order to increase the accuracy of the process, the structure and parameters of the designed B-LSTM network are determined optimally. Finally, the designed network are tested in various scenarios both on working days and weekends. The ability of the designed network is investigated for hourly forecasting of the day ahead market especially for spike points prediction.

Keywords

Electricity Price, Forecasting, Machine Learning, B-LSTM Network, Electricity Market.

Biographies

Ali Ahmadian received his PhD Degree in Electrical Engineering in 2017. Currently, he is a Postdoctoral Research Fellow in the Department of Chemical Engineering at the University of Waterloo, Canada. He has been published more than 80 papers in journals and conference proceedings and one book in Springer. His main research interests include: transportation electrification, energy storage, energy and environment, smart cities, and machine learning applications in modern energy systems.

Hedia Fgaier is currently a Professor of Mathematics at Full Sail University. Prior to this she was a Lecturer at the University of Waterloo and an Assistant Professor of Applied Mathematics at Al-Ain University of Science & Technology. Dr. Fgaier holds a PhD and a Master degree in applied mathematics from the University of Guelph, ON, Canada. Her research interests lie in the areas of dynamical systems, computer simulation, parameter estimation, and optimal control with applications to biology and medicine. Dr. Fgaier envisions her research to be a blend of theoretical investigations, development of computational methods, and the building and analysis of mathematical models of nonlinear systems. She has published in peer review journals such as Journal of Theoretical Biology and Computers & Chemical Engineering. She has participated in national and international conferences and workshops.

Ali Elkamel is a Professor of Chemical Engineering. He is also cross appointed in Systems Design Engineering. Prof. Elkamel holds a BSc in Chemical Engineering and BSc in Mathematics from Colorado School of Mines, MS in Chemical Engineering from the University of Colorado-Boulder, and PhD in Chemical Engineering from Purdue University – West Lafayette, Indiana. His specific research interests are in computer-aided modelling, optimization and simulation with applications to energy production planning, carbon management, sustainable operations and product design. Professor Elkamel is currently focusing on research projects related to gas production and processing, integration of renewable energy in oil and gas operations, and the utilization of data analytics (Digitalization), machine learning, and Artificial Intelligence (AI) to improve process and enterprise-wide efficiency and profitability. Prof. Elkamel activities include supervising post doctorate and research associates, advising graduate/undergraduate students and participation in both university and professional societal activities.