SPRINGER LINK

三 Menu

Q Search

Cart



<u>International Conference on Signal Processing and Information</u> Communications

ICSPIC 2023: **6th International Conference on Signal Processing and Information Communications** pp 73–83

Home > 6th International Conference on Signal Processing and Information Communications
 Conference paper

Flood Forecasting Using Edge AI and LoRa Mesh Network

Conference paper | First Online: 11 November 2023

12 Accesses

Part of the <u>Signals and Communication Technology</u> book series (SCT)

Abstract

Remote flood forecasting has exponentially grown over the past decade together with the unprecedented expansion of Internet of Things (IoT) network. This is feasible with the use of long-range wireless communication technology such as LoRa. Ideally, each LoRa device shall process the sensor data locally and trigger warnings to the remote server based on prediction results.

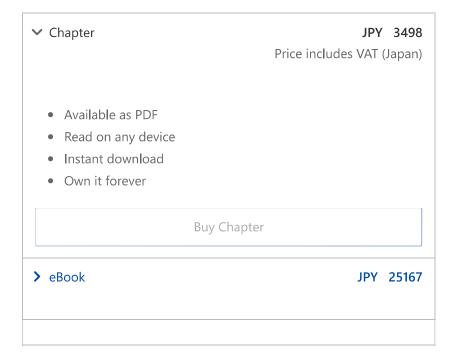
However, conventional prediction methods rely on highly computational artificial intelligence (AI) algorithms, which are not suitable for low-powered LoRa network. In this paper, the LoRa device is integrated with an edge AI model, which is based on long short-term memory (LSTM) neural network. OpenVINO is adopted to optimize the LSTM model before executing the solution on a Raspberry Pi 4 in combination with Intel Movidius Neural Computing Stick 2 (NCS2). Experimental results demonstrate the feasibility of deployment of the customized model on low-cost and power-efficient embedded hardware.

Keywords

Edge AI LSTM Flood forecasting

LoRa Mesh Network IoT

This is a preview of subscription content, <u>access via</u> <u>your institution</u>.



Tax calculation will be finalised at checkout

Purchases are for personal use only Learn about institutional subscriptions

References

- O.A. Kisi, A combined generalized regression neural network wavelet model for monthly streamflow prediction. KSCE J. Civ. Eng. 15, 1469–1479 (2011)
- Z.M. Yaseen et al., Artificial intelligence based models for stream-flow forecasting: 2000–2015.
 J. Hydrol. 530, 829–844 (2015)
- 3. S. Hochreiter, J. Schmidhuber, Long short-term memory. Neural Comput. **9**(8), 1735–1780 (1997)
- 4. K. Cho, B.V. Merrienboer, D. Bahdanau, Y. Bengio. On the properties of neural machine translation: Encoder-decoder approaches, in Proceedings of SSST-8, Eighth Workshop on Syntax, Semantics and Structure in Statistical Translation. Association for Computational Linguistics, Doha, Qatar (2014), pp. 103–111

- V. Mazzia, A. Khaliq, F. Salvetti, M. Chiaberge, Real-time apple detection system using embedded systems with hardware accelerators: An edge ai application. IEEE Access 8, 9102– 9114 (2020)
- 6. J.P. Queralta, T.N. Gia, H. Tenhunen, T. Westerlund. Edge-AI in LoRa-based health monitoring: Fall detection system with fog computing and LSTM recurrent neural networks, in Proceedings of 2019 42nd International Conference on Telecommunications and Signal Processing (TSP). IEEE, Budapest, Hungary (2019), pp. 601–604
- M. Inoue, Y. Owada, NerveNet architecture and its pilot test in Shirahama for resilient social infrastructure. IEICE Trans. Commun. 100(9), 1526–1537 (2017)
- 8. Ministry of Land, Infrastructure, Transport, and Tourism in Japan (MLIT Japan). Hydrology and Water Quality Database, http://www1.river.go.jp/. Last accessed 30 July 2022
- N. Kimura et al., Convolutional neural network coupled with a transfer-learning approach for time-series flood predictions. Water 12(96) (2020)

10. OpenVINO Toolkit.

https://software.intel.com/enus/openvinotoolk
it. Last accessed 01 July 2022

11. S. Yang, X. Yu, Y. Zhou. Lstm and gru neural network performance comparison study: Taking yelp review dataset as an example, in Proceedings of 2020 International Workshop on Electronic Communication and Artificial Intelligence (IWECAI). IEEE, Shanghai, China (2020), pp. 98–101

Acknowledgments

This work is the output of the ASEAN IVO (http://www.nict.go.jp/en/asean_ivo/index.html) project titled "Context-Aware Disaster Mitigation using Mobile Edge Computing and Wireless Mesh Network" and financially supported by NICT (http://www.nict.go.jp/en/index.html).

Author information

Authors and Affiliations

Department of Electrical and Electronic Engineering, Universiti Tunku Abdul Rahman, Kajang, Malaysia

Mau-Luen Tham, Xin Hao Ng & Rong-Chuan Leong

Resilient ICT Research Center, National Institute of Information and Communications Technology

(NICT), Tokyo, Japan

Yasunori Owada

Corresponding author

Correspondence to Mau-Luen Tham.

Editor information

Editors and Affiliations

National Sun Yat-sen University, Kaohsiung, Taiwan

Chua-Chin Wang

School of EE and Computer Science, Queen Mary University of London, London, UK

Arumugam Nallanathan

Rights and permissions

Reprints and Permissions

Copyright information

© 2024 The Author(s), under exclusive license to Springer Nature Switzerland AG

About this paper

Cite this paper

Tham, ML., Ng, X.H., Leong, RC., Owada, Y. (2024). Flood Forecasting Using Edge AI and LoRa Mesh Network. In: Wang, CC., Nallanathan, A. (eds) 6th International Conference on Signal Processing and Information Communications. ICSPIC 2023. Signals and Communication Technology. Springer, Cham. https://doi.org/10.1007/978-3-031-43781-6-7

<u>.RIS ♥ .ENW ♥ .BIB ♥</u>

DOI Published Publisher Name https://doi.org/10 11 November Springer, Cham

.1007/978-3-031- 2023

43781-6_7

Print ISBN Online ISBN eBook Packages

978-3-031- 978-3-031- <u>Engineering</u>

43780-9 43781-6 <u>Engineering (R0)</u>