Mohammed VI Polytechnic University (UM6P)
International Artificial Intelligence Center of Morocco (Ai movement)

Promoting building energy efficiency using edge-based transfer learning

Amal El Fallah Seghrouchni, Omar Elharrouss

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1 Research Motivation

The use of deep learning (DL) models for endorsing energy efficiency in buildings is booming as they are excelled in performing different tasks, such as load forecasting, anomaly and fault detection and diagnosis, energy usage optimization, etc. However, DL algorithms require vast amounts of data in the training process, which is not always possible due to data shortage. Investigating deep transfer learning to utilize knowledge learned from other domains or other buildings data can alleviate this issue and improve the accuracy of DL models in performing different tasks.

2 Problem Statement

The use of energy has been increasing exponentially through the last few years around the world. Specifically, the building sector alone consumes more than 40% of the global energy produced worldwide [1].This consumption is expected to increase by 1.3% per year on average from 2018 to 2050 in organization for economic cooperation and development (OECD) countries (e.g. USA, Europe, Australia, etc.), while this rate will be more than 2% for non-OECD countries (e.g. Middle East, China, Russia, etc.) . Therefore, experts naturally assume that the rise of population and quality of life in various regions will result in a growing need for electricity-consuming devices and individualized equipment, and hence, an increasing energy consumption rate [2].In order to alleviate this issue, recent research and development projects and initiatives have been focused on developing nearly zero energy buildings (nZEB) in the last decade, which incorporate renewable and sustainable energy resources and energy management systems .However, these kind of measures could not be supported in all countriesaround the globe due to its high deployment cost [3]. Consequently,finding other cost-effective or no-cost energy saving solutions becamethe core of interest for the building energy community, especiallythose based on the use of information and communication technolo-gies (ICT) [4].

3 Research Scope

This thesis focuses first on developing effective deep transfer learning models using long short-term memory (LSTM), adversarial neural network (DANN) and other new DL models [5]. Moreover, as the implementation of DL-based energy efficiency solutions on the cloud could have some issues, e.g. the data latency and bandwidth limits and cost of the cloud services, it is worthy to investigate the implementation of these solutions on the edge. The latter moves the intelligence and computing tasks to the edge, which increases network speed, reduces latency and therefore supports real-time applications. In this regard, the second part of this thesis concentrates on the implementation of the above-mentioned deep transfer learning models on edge devices.

4 Admission Criteria

The PhD position is proposed by the International Center of Artificial Intelligence of Morocco, of the Mohammed VI Polytechnic University. Applicants with excellent cursus must be holders of a Master's, an engineering or an equivalent recognized degree in Computer Science or Applied Mathematics. In addition, they should have skills in Programming (Python and deep learning techniques) and good communication skills in English. Particular attention will be given to the suitability of this research project with the applicant's background.

References

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