Novel Image Based Method Using V-I Curves with Aggregate Energy Data for Non-Intrusive Load Monitoring Applications

P.M.L. Liyanage[1], G.M. Herath[2], M.H. Liyanage[2], and T.D. Thilakanayake[3]

[1]Dept. of Electrical and Electronics, Curtin University, Australia.
[2]Dept. of Mechanical Engineering, Sri Lanka Institute of Information Technology, Sri Lanka.
[3]Dept. of Electrical and Electronics, Sri Lanka Institute of Information Technology, Sri Lanka.
liyanagepasindu.96@gmail.com, madhawa.h@sliit.lk, migara.l@sliit.lk, thakshila.t@sliit.lk

Abstract

The emerging energy crises allow consumers to be concerned with the energy consumption of their appliances. Consumption data of individual appliances as opposed to the entire house are therefore in high demand. Non-intrusive load monitoring (NILM) is a way of producing individual appliance consumption data without using meters at individual appliances. Most studies have used signal features in steady state for device identification. However, many studies have not explored transient state signal characteristics for NILM. The voltage-current (V-I) trajectories during the transient state provide a unique way of representing the energy consumption of appliances. Although appliance-vise V-I characteristics have been considered in past studies, none has used aggregate V-I characteristics for appliance classification. Hence, using the V-I features of the aggregate data in an innovative manner for appliance classification has been explored in this work. The publicly available Plug-Level Appliance Identification Dataset (PLAID) was used to conduct this work. A Convolutional Neural Network (CNN) has been designed for device identification with 3 convolutional layers, a flatten layer and 4 fully connected layers. The results confirmed the possibility of using aggregate V-I trajectories for appliance classification with accuracies of up to 92% while retaining the full non-intrusive flavor of the study.

Keywords

Non-Intrusive, Load Monitoring, V-I, Trajectories, CNN, Aggregate, Classification