



Contribution ID: 102

Type: not specified

Long short-term memory neural network for statistical process control of autocorrelated multiple stream process with an application to HVAC systems in passenger rail vehicles

Tuesday, 14 September 2021 11:40 (20 minutes)

Rail transport demand in Europe has increased over the last few years, and passenger thermal comfort has been playing a key role in the fierce competition among different transportation companies. Furthermore, European standards settle operational requirements of passenger rail coaches in terms of air quality and comfort level. To meet these standards and the increasing passenger thermal comfort demand, data from on-board heating, ventilation and air conditioning (HVAC) systems have been collected by railway companies to improve maintenance programs in the industry 4.0 scenario. Usually, a train consists of several coaches equipped with a dedicated HVAC system, and the sensor signals coming from each HVAC system produce multiple data streams. This setting can thus be regarded as a multiple stream process (MSP). Unfortunately, the massive amounts of data collected at high rates makes each stream more likely to be autocorrelated. This scenario calls for a new methodology capable of overcoming the simplifying assumptions on which traditional MSP models are based. This work is intended to propose a new control charting procedure based on a long short-term memory neural network trained to solve the binary classification problem of detecting whether the MSP is in control or out of control, i.e., to recognize mean shifts in autocorrelated MSPs. A simulation study is performed to assess the performance of the proposed approach and its practical applicability is illustrated by an application to the monitoring of HVAC system data, made available by the rail transport company Hitachi Rail based in Italy.

Keywords

Statistical process control, Multiple stream process, Long short-term memory neural network

Special/invited session

Primary authors: Mr GIANNINI, Giuseppe (Head of Operation Service and Maintenance Product Evolution, Hitachi Rail Group); Prof. LEPORE, Antonio (Department of Industrial Engineering, University of Naples Federico II); Prof. PALUMBO, Biagio (Department of Industrial Engineering, University of Naples Federico II); Mr SPOSITO, Gianluca (Department of Industrial Engineering, University of Naples Federico II)

Presenter: Mr SPOSITO, Gianluca (Department of Industrial Engineering, University of Naples Federico II)

Session Classification: Quality 1

Track Classification: Quality