IEEE Transactions on Neural Networks and Learning Systems (IEEE TNNLS)

Special Issue on *Explainable Representation Learning-based Intelligent Inspection and Maintenance of Complex Systems*

Introduction

With the significantly increasing level of integration and intelligence in industry and commodity solutions, automation systems are facing a growing complexity. Moreover, these advanced systems are equipped with a plethora of sensors and heterogeneous data-stream sources (including digital measurements, images, videos, non-parametric logs, etc.) that provide a huge amount of data to process to make educated inference. It emerges that the complexity poses challenges to model- and expert knowledge-based systems in achieving the requested performance and interpretability in terms of explainable representations as latent features are closely related to system operation performance. In this direction, over the past decade, representation learning has received particular attention in the intelligent inspection and maintenance of complex systems thanks to its overwhelming advantages in discovering and mining hidden representations. For instance, neural networks have shown immense benefits when dealing with images and videos that provide alternative knowledge representations of digital measurements in performing inspection and maintenance. Therefore, representation learning has become particularly important in the field of intelligent inspection and maintenance of complex systems. The room for in-depth investigations of representation learning-related topics remains open. The following aspects enumerate several challenges of representation learning when applied to intelligent inspection and maintenance of complex systems. 1) What are the main differences between handcrafted features-based and representation learning? What are the distinct roles they play in intelligent inspection and maintenance? 2) What makes one learning representation achieve better performance of inspection and maintenance than the other? Interpretability is a premise as a good representation contains the posterior knowledge of the underlying explanatory factors. 3) Why do the layer-wise unsupervised pre-training procedures help a supervised learner sometimes?

Alongside these challenges, more instructive guidance about selection of both a suitable neural architecture complexity and the training-sample size is also of great interest when designing the intelligent inspection and maintenance methods, where the acquisition of supervised information has a cost.

Scope of the Special Issue

We invite submissions on all topics of Explainable Representation Learning-based Intelligent Inspection and Maintenance of Complex Systems, including but not limited to:

- Infrastructure planning of complex systems with representation learning
- Operation and scheduling of complex systems with representation learning
- Performance evaluation of complex systems with representation learning
- Life cycle management of complex systems with representation learning
- Fault diagnosis and fault-tolerant control for complex systems with representation learning
- Safety and reliability of complex systems with representation learning
- Computer vision-based online monitoring and performance recovery
- Statistical learning-aided inspection and monitoring for complex systems
- Transfer learning- and reinforcement learning-inspired deep neural networks with application in complex systems
- Deep neural network-based designs for dynamic complex systems

Timeline:

- Submission deadline: Sep. 1, 2022
- Notification of first review: Dec. 1, 2022
- Submission of revised manuscript: Mar. 1, 2023
- Notification of final decision: May 1, 2023

Guest Editors:

- Prof. Zhigang Liu (Tongji University, Southwest Jiaotong University, China)
- Prof. Cesare Alippi (Università della Svizzera italiana, Switzerland and Politecnico di Milano, Italy)
- Dr. Hongtian Chen (University of Alberta, Canada)
- Prof. Derong Liu (University of Illinois at Chicago, USA)

Submission Instructions

- Read the Information for Authors at http://cis.ieee.org/tnnls
- Submit your manuscript at the TNNLS webpage (http://mc.manuscriptcentral.com/tnnls) and follow the submission procedure. Include the following instructions in the header of the first page of your manuscript and cover letter: “Please submit the manuscript to the Special Issue on Explainable Representation Learning-based Intelligent Inspection and Maintenance of Complex Systems”.