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I – SCIENTIFIC ACTIVITY DURING YOUR FELLOWSHIP

We focus on exploring how emerging Industry 4.0 technologies for the sustainable supply chain management. Therefore, we analysed all relevant literature to provide one systematic literature review (SLR).

Our systematic literature review (SLR) aims to objectively summarize the contributions of Industry 4.0 (I4.0) technologies to sustainable supply chain management (SSCM) and bridge the gap between emerging I4.0 technologies and SSCM. Previous literature reviews have identified a lack of comprehensive studies on the specific benefits and challenges of adopting I4.0 technologies for SSCM and how these technologies can be effectively used to support sustainability goals.

Using Mendeley and Excel, and Gephi for data analysis, we analyzed the current state of research regarding I4.0 and SSCs. Our review identified key themes from popular definitions of SSCM, green supply chain management (GSCM), and closed-loop supply chain management (CLSCM). We also investigated the key technological barriers when implementing existing mature technologies in SSCM and provided the results of literature analysis, such as the top nine productive journals, methods used in publications, and most popular application areas in SSC.

In addition, our review systematically explores how emerging I4.0 technologies are used for SSCM to overcome existing technological barriers. We identified promising ideas for future research on I4.0 technologies and SSCM and proposed a research framework to guide future studies. Our review provides a comprehensive overview of the roles and applications of emerging I4.0 technologies in the SSCM context and identifies research gaps that can inform effective strategies for implementing these technologies to support the transition to more sustainable supply chain practices.

II – PUBLICATION(S) DURING YOUR FELLOWSHIP

1. Hui Han and Jingyue Li (2022). Tiny Machine Learning: A New Technique for AI Security. ERCIM NEWS 129, 16-17.

Abstract:

Tiny machine learning (TinyML) is the intersection of machine learning (ML) algorithms and embedded systems (hardware and software) in terms of low latency, low power, and small size. It allows data to be kept mainly on edge devices and to be processed and have ML tasks run directly in the device. Therefore, the TinyML paradigm is expected to preserve AI security and combat cybercrimes. In this study, we explore how TinyML, the cutting-edge of ML technologies, solves relevant AI security problems (including cybercrimes) from the AI lifecycle aspect: data engineering, model engineering and model deployment. Finally, we discuss the opportunities for future research.

Tiny machine learning (TinyML) is a fast-growing field of machine learning (ML) technologies and applications that include algorithms, hardware (dedicated integrated circuits), and software that can perform on-device sensors (vision, audio, inertial measurement unit, biomedical, etc.) data



analytics at extremely low power, typically in the order of milliwatts, enabling a variety of always-on machine learning use cases on battery-powered devices. TinyML will play an essential role in our daily interactions with ML in the near future.

2. Hui Han and Silvana Trimi (2023). Unsupervised Random Forest for Online Learning Platforms Analysis During the COVID-19 Pandemic. ISA Transactions. Under Review.

Abstract:

Cloud computing-based online education has served a crucial role in helping students continue their learning during the COVID-19 pandemic. This study used unsupervised random forest (RF) to analyze the real data involving 63 cloud computing-based educational platforms in the world during the pandemic. The analysis was performed to identify the important variables related to these platforms and gain insights into the underlying structure of cloud computing-based educational platforms. Specifically, Gini index, permutation importance, and Boruta were employed to determine important attributes for effectively operating online platforms of higher education. To compare RF with current machine learning techniques, WEKA software was implemented to calculate their accuracy. The results showed that RF reached high levels of precision (ZeroR 59.0909%, J48 77.2727% and RF 90.9091%). In conclusion, unsupervised RF can be an effective tool to solve problems in the online education area, which has not been fully explored by previous research.

3. Hui Han and Jingyue Li (2023). Emerging Industry 4.0 technologies for sustainable supply chain management: A systematic review. Draft finished.

Abstract:

Emerging Industry 4.0 (I4.0) technologies create new possibilities to overcome technical barriers in sustainable supply chain management (SSCM). However, there is a lack of comprehensive studies on the specific benefits and challenges of these technologies for SSCM and how they can be effectively used to support sustainability goals. To bridge these gaps, this study conducts a systematic review literature of 204 studies by using Mendeley and Excel, and Gephi for data analysis. The main research objectives are to analyze the current state of research, systematically explore how emerging I4.0 technologies are used for SSCM to overcome existing technological barriers and identify research gaps to guide future studies. The results of this review are summarized in an integrated framework, which provides valuable insights into the potential of I4.0 technologies for SSCM and informs strategies for effectively implementing these technologies to support the transition to more sustainable practices.

III – ATTENDED SEMINARS, WORKHOPS, CONFERENCES

- Work environment follow up meeting - (ARK), 12th May, Scandic Lerkendal.
- Exited seminar, 30th May – 2nd June 2022, IT-bygget, 454.
- Math meets Industry webinar, 3rd June 2022.
- Gary McGraw, guest lecture "Security Engineering for Machine Learning", 7th October 2022, auditorium S4.
- NorwAI meeting, 1st - 2nd November 2022, Scandic Nidelven.
- PLS Workshop, 8th – 9th February 2023, IT-bygget, 242.
- Pass Norwegian Language Level 1 (A2/B1)



IV – RESEARCH EXCHANGE PROGRAMME (REP)

- REP Host institute: RISE, Sweden
- Host supervisors: Dr. Thiemo Voigt and Dr. Joakim Eriksson
- Time Period: 9th Jan – 13th Jan 2023
- During REP: Dr. Thiemo Voigt and Dr. Joakim Eriksson introduce their research group and their current research. I attend their weekly unit meeting and give one presentation about my research focus “The Future of AI is Tiny Machine Learning (TinyML)”. During the REP, Dr. Thiemo Voigt and I have several talks to discuss on several details about the possible development of Tiny Machine Learning in real industry. At the same time, Dr. Joakim Eriksson introduces the functions of various Arduino devices and M5 camera (very competent device and runs a full Linux).