Chapter 3
Securing Digital Ecosystems: Harnessing the Power of Intelligent Machines in a Secure and Sustainable Environment

Mario Casillo
University of Salerno, Italy

Francesco Colace
https://orcid.org/0000-0003-2798-5834
University of Salerno, Italy

Brij B. Gupta
Asia University, Taichung, Taiwan & Lebanese American University, Beirut, Lebanon

Francesco Marongiu
University of Salerno, Italy

Domenico Santaniello
https://orcid.org/0000-0002-5783-1847
University of Salerno, Italy

ABSTRACT

Industries are evolving towards an integral digitisation of their processes. In the face of ever-faster market demands and ever-increasing quality, information technology (IT) progress represents the only solution to these needs. Industry 4.0 was born with this focus, where cybernetic systems interact with each other to achieve, efficiently, a predetermined goal. The whole process takes place with minimal, or in some cases total, absence of human intervention, leaving the systems to interact in full autonomy. This approach commonly falls under the internet of things (IoT) paradigm, in which all objects, regardless of size and functionality, are connected in a standard network exchanging information. In this sense, objects acquire intelligence because they can modify their behaviours based on the data they receive and transmit.

DOI: 10.4018/978-1-6684-9999-3.ch003

Copyright © 2024, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

INTRODUCTION

In recent years, we are increasingly experiencing a rapid spread of so-called smart objects thanks to the steady growth of the Internet of Things (IoT). Smart objects are devices that can retrieve and transfer data and information via the Internet, enabling interaction with other objects and, thus, with people, improving the quality of life in cities, homes, workplaces, and public places (Melibari et al., 2023). IoT projects, with their own devices (sensors and actuators) and the data processed by them, can be managed through cloud platforms.

The Internet of Things (IoT) is an expression that emerged from the need to define the network of objects connected to the Internet. Objects represent embedded devices consisting of hardware and software (and possibly sensors/actuators) and network connectivity to enable connection and, thus, exchange of information with the network. Through the network infrastructure, IoT thus enables the remote sensing and control of objects, exploiting the immense potential of software in applications to solve real-world problems. Prominent examples are provided by the so-called Smart City project (Saadeh et al., 2018), aimed at improving the quality of life in the city, and that of Smart House, comfortable and technological homes(Syed et al., 2021).

The basic structure of the IoT architecture consists of five essential elements:

- sensors/actuators, i.e., the tangible and integrated components in the environments, the system terminals that continuously monitor and acquire data or perform actions based on received instructions.
- network, i.e., the connection structure.
- cloud, on which data is collected and stored.
- analytical component, consisting of the algorithms that have the fundamental role of carrying out the decision-making and computational processes to fulfil the system's objectives. This component is the core of the IoT framework.
- user interface, to allow the end user to view the state of the environment or make decisions.

In a more general view, the presented elements can be placed into three levels of operation. Sensors and actuators are part of the perceptual layer, which collects data and information from the physical world, taking advantage of various technologies, such as cameras, GPS, and wireless sensors. The application layer is responsible for showing analysis results to end users through an intuitive interface. On the other hand, data processing and transmission functions are performed by the network layer (Aboubakar et al., 2022). The network bridges the perceptual component and the application layer by relying on various wireless technologies (e.g., Wi-Fi, Bluetooth, RFID) and numerous communication protocols (such as IPV6, MQTT, and HTTP).

Given the large volume of networked devices and, thus, sensitive data inherent in users' privacy, security is paramount. There is a risk of losing control of what is communicated to the network; sensors, meters, and everyday objects capable of collecting and exchanging information can record information about habits or health status to resell to third parties (Yu et al., 2021).

In the rapidly evolving digital technology sphere, the convergence of intelligent machines and Internet of Things (IoT) systems is reshaping the dynamics of industries worldwide. As these technologies become increasingly intertwined in our everyday lives and business operations, the security of these systems represents a paramount concern for their proper functioning. The risks are myriad, and if man-

23 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the publisher's webpage:
www.igi-global.com/chapter/securing-digital-ecosystems/334468

Related Content

A Review on Time Series Motif Discovery Techniques an Application to ECG Signal Classification: ECG Signal Classification Using Time Series Motif Discovery Techniques
Ramanujam Elangovanand Padmavathi S. (2019). *International Journal of Artificial Intelligence and Machine Learning (pp. 39-56).*
www.irma-international.org/article/a-review-on-time-series-motif-discovery-techniques-an-application-to-ecg-signal-classification/238127

Machine Learning in UAV-Assisted Smart Farming
Simeon Okechukwu Ajakwe, Nkechi Faustina Esomonu, Opeyemi Deji-Oloruntoba, Ihunanya Udodiri Ajakwe, Jae-Min Leeand Dong Seong Kim (2024). *Applications of Machine Learning in UAV Networks (pp. 217-245).*
www.irma-international.org/chapter/machine-learning-in-uav-assisted-smart-farming/337256

Three-Layer Stacked Generalization Architecture With Simulated Annealing for Optimum Results in Data Mining
K. T. Sanvitha Kasthuriarachchiand Sidath R. Liyanage (2021). *International Journal of Artificial Intelligence and Machine Learning (pp. 1-27).*
www.irma-international.org/article/three-layer-stacked-generalization-architecture-with-simulated-annealing-for-optimum-results-in-data-mining/279277

On Swarm Intelligence and Its Integration With Internet of Things: Challenges and Applications
Gowthami J., Jeyauthmigha R. K.and Shanthi N. (2021). *Advanced Deep Learning Applications in Big Data Analytics (pp. 156-181).*
www.irma-international.org/chapter/on-swarm-intelligence-and-its-integration-with-internet-of-things/264554

Autoencoder Based Anomaly Detection for SCADA Networks
Sajid Nazir, Shushma Patelland Dilip Patel (2021). *International Journal of Artificial Intelligence and Machine Learning (pp. 83-99).*
www.irma-international.org/article/autoencoder-based-anomaly-detection-for-scada-networks/277436