Chapter 4

Concerning the Integration of Machine Learning Content in Mechatronics Curricula

Jörg Frochte Bochum University of Applied Science, Germany

Markus Lemmen Bochum University of Applied Science, Germany

Marco Schmidt Bochum University of Applied Science, Germany

ABSTRACT

Machine learning is becoming more and more important for mechatronic systems and will become an ordinary part of today's student life. Thus, it is obvious that machine learning should be part of today's student's curriculum. Unfortunately, machine learning seldomly is implemented into the curriculum in a substantial or linking manner, but rather offered as an elective course. This chapter provides an analysis of how machine learning can be integrated as a mandatory part of the curriculum of mechatronic degree courses. It is considered what the required minimal changes in fundamental courses should be and how traditional subjects like robotics, automation, and automotive engineering can profit most of this approach. As a case study, this chapter utilizes an existing German mechatronic degree course specialized on information technology, which covers most of the discussed aspects.

DOI: 10.4018/978-1-5225-7793-5.ch004

Copyright © 2020, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

INTRODUCTION

Mechatronics is a multidisciplinary field that includes mechanical engineering, electronics, and computer engineering. Typical application areas are industrial automation, robotics, and automotive engineering. Especially for the latter two, control theory has become an important topic.

Within mechatronic systems, software and intelligent systems play a crucial role as they are the key drivers for innovation and added value of modern mechatronic systems. Nowadays, also machine learning is a new major factor in this field, and very often it interacts closely with control theory. Some techniques will be or are already integrated into modern mechatronic systems as standard components, like e.g. image and speech recognition. Usually, these components are simply licensed and integrated from suppliers. Nevertheless, in many cases the integration of machine learning requires a deep understanding of the technical behavior of a mechatronic system. Therefore, engineers should have a basic understanding of common machine learning approaches. This is especially true for the field of robotics, flexible manufacturing, vehicles and logistics.

This demand in mechatronic engineering practice has a strong impact on mechatronics and computer science engineering curricula at universities: While machine learning is increasingly important for the mechatronic systems, the mechatronic degree courses at universities often lack integration of this subject, and usually the different curricula are not ready to integrate this subject into fundamental courses of a degree curriculum. We will show, that with minor changes in the curriculum, seamless integration of machine learning contents is achievable. In that way, a university can enhance the attractiveness of a degree course without additional expenses.

In the following sections of this paper, we analyze the requirements for integrating machine learning into mechatronic degree courses based on an existing (example) degree course. In order to be able to choose a proper approach to integrate machine learning, it is essential to understand, which part of machine learning offers the strongest connections to the courses under discussion and therefore candidates are to be integrated into the courses. Next, the interaction to control theory and simulation will be highlighted; both topics have already (classically) a big influence on mechatronic degree courses have to be considered, and which already established approaches and topics can be utilized for this purpose by slight re-arrangements, e.g. in control theory.

20 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: <u>www.igi-</u> <u>global.com/chapter/concerning-the-integration-of-machine-</u> <u>learning-content-in-mechatronics-curricula/237242</u>

Related Content

Evaluating the Visual Demand of In-Vehicle Information Systems: The Development of a New Method

Ainojie Alexander Irune (2013). *Developments in Technologies for Human-Centric Mobile Computing and Applications (pp. 1-21).* www.irma-international.org/chapter/evaluating-visual-demand-vehicle-information/69628

Nudge: A Bridge Between Choice and Desired Decision

Vikas Pujara, Bhavesh Prakash Joshiand Charu Virmani (2022). *International Journal of Applied Behavioral Economics (pp. 1-15).* www.irma-international.org/article/nudge/302140

Behavioral Challenges for Retirement Planning: A Study of Employees of the Information Technology Industry in Pune, Maharashtra

Ashlesha Khedekar-Swaminathanand Savita Kulkarni (2018). *International Journal of Applied Behavioral Economics (pp. 15-29).* www.irma-international.org/article/behavioral-challenges-for-retirement-planning/205533

The Impact of Co-Creating Through AR in Retail Stores on Purchase Intentions: The Mediating Role of Customer Trust and Risk

Saifeddin Alimamy, Juergen Gnothand Kenneth Richard Deans (2021). *International Journal of Technology and Human Interaction (pp. 16-33).* www.irma-international.org/article/the-impact-of-co-creating-through-ar-in-retail-stores-on-purchase-intentions/278696

Corporate Moral Agency and Artificial Intelligence

Alan E. Singer (2013). International Journal of Social and Organizational Dynamics in IT (pp. 1-13).

www.irma-international.org/article/corporate-moral-agency-artificial-intelligence/76944