

## Chapter 7

# Urban Life and Artificial Intelligence, Machine Learning, Deep Learning, and Ambient Learning in Smart Cities

### ABSTRACT

*The purpose of this chapter is to explore evolving understandings of artificial intelligence (AI) in smart cities as well as machine learning, deep learning, and ambient learning. A review of the research literature is conducted in the context of smart cities. Issues, controversies, and problems emerging from the literature review are highlighted, contributing to formulation of a conceptual framework for artificial intelligence in urban life and the ambient in smart cities. Using an exploratory case study approach combined with an explanatory correlational design, variables of interest are identified, such as collaborating and creative opportunities, along with assessments of the nature of the relationship. Through the lens of emerging manifestations of artificial intelligence, machine learning, and deep learning, efforts are made to inform understandings of the ambient in smart cities, and more particularly ambient learning, while pointing to directions for future research.*

### 1. INTRODUCTION

Marzano (2006) describes concepts such as artificial intelligence (AI) as “terms that trigger the imagination.” Cugurullo (2020) provides an exploration of “how the development of AI intersects with the development of the city” both in theory and in practice. For Cugurullo (2020), urban artificial intelligence takes the form of “artifacts operating in cities, which are capable of acquiring and making sense of information on the surrounding urban environment, eventually using the acquired knowledge to act rationally according to pre-defined goals, in complex urban situations when some information might be missing or incomplete.” As such, Cugurullo (2020) argues that an inquiry of a philosophical and multi-disciplinary nature is needed that is “proactive” to “inform the development of AI, as it now intersects

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with the development of the city.” Zhang and He (2020) highlight the importance of a sustainable future incorporating both humanity and nature using “life-oriented approaches.” Wu, Ji, Yu, Zeng, Wu, and Shidujaman (2021) focus on the creativity potential of people and AI interactivities with the notion of AI creativity while advancing the Human-AI co-creation model with an emphasis on collaboration. In response, the work in this chapter is significant in that it considers that human capabilities are not static in that creativity, innovation, and discoveries are emergent and ongoing and as such, builds on the range of perspectives in the research literature on AI to explore urban life and the ambient in the context of smart cities giving rise to the motivation for this with the following objectives.

**Objectives:** The main objectives of this chapter are to a) explore urban life and the ambient in relation to artificial intelligence (AI), machine learning (ML), deep learning (DL), and ambient learning in the context of smart cities; b) formulate a conceptual framework for artificial intelligence (AI) for urban life and the ambient in smart cities; and c) explore the nature of the relationship between AI and smart cities as a way of learning more about ambient learning. These objectives give rise to the main research question under exploration in this chapter – *How and why does artificial intelligence, including machine learning and deep learning, manifest in urban life and the ambient in smart cities?*

## **2. BACKGROUND**

Mialhe and Hodes (2017) provide an overview of the emergence and history of artificial intelligence (AI), describing artificial narrow intelligence (ANI) as ‘weak’ where machines “operate strictly within the confine of the scenarios for which they are programmed” and artificial general intelligence (AGI) as “strong” as in “an autonomous machine’s ability to perform any intellectual tasks that a human can perform.” Accordingly, current AI capabilities are said to be of the ANI type involving machine learning algorithms, excluding AGI capability and Artificial Super Intelligence (ASI) that are both said to be in the near to distant future (Mialhe and Hodes, 2017). Amabile (2020), an influential creativity researcher in the management domain argues for the study of “AI and computer-assisted human intelligence” by organizational researchers focused on creativity and innovation to determine “the ways in which they may yield creative breakthroughs” as well as “how those innovations might impact—and be impacted by—workers, consumers, organizations, and society.” Shneiderman (2022) envisions an integration of AI (artificial intelligence) with HCI (Human-computer interaction) approaches so as “to amplify, augment, and enhance human abilities” in support of creativity and much more.

### **2.1 Definitions**

Definitions from the research literature are provided for key terms used in this chapter.

- **Ambient Learning:** Bick, Kummer, Pawlowski, and Veith (2007) articulate the notion of ambient learning in terms of mobile learning in digital environments in support of “contextualized, personalized knowledge for learners” dynamically, anywhere, anytime.
- **Artificial Intelligence (AI):** According to the National Artificial Intelligence Initiative Act of 2020 (Division E, Sec. 5001) of the United States (NAII, 2021), artificial intelligence refers to “a machine-based system that can, for a given set of human-defined objectives, make prediction, recommendations or decisions influencing real or virtual environments.”

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