Chapter 2
Advanced Computational Intelligence for Climate Change Adaptation

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ABSTRACT

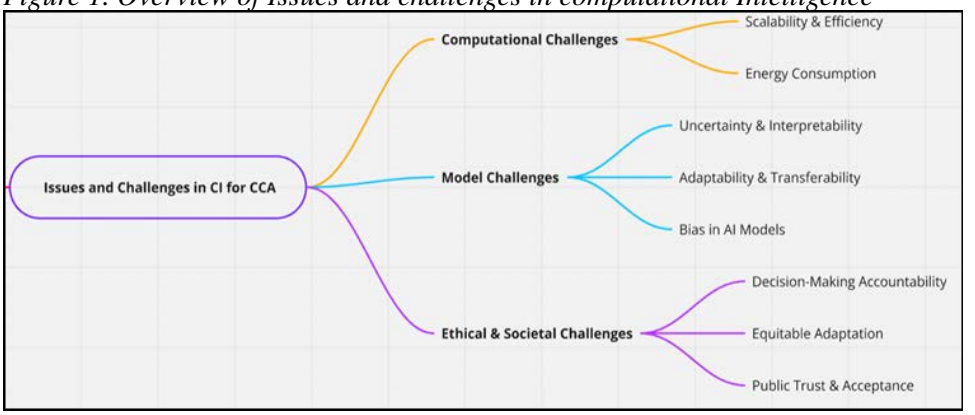
Climate change poses an unprecedented threat to ecosystems, human livelihoods, and global sustainability. Addressing this challenge requires innovative approaches that go beyond traditional methods. This chapter also focuses on the role of advanced Computational Intelligence encompassing Machine Learning, deep learning, evolutionary algorithms, and fuzzy systems in facilitating effective climate change adaptation strategies. By integrating large-scale climate data, environmental models, and socioeconomic parameters, ACI enables predictive analytics, risk assessment, and decision-support systems tailored to dynamic climate conditions. Furthermore, this chapter also highlights recent advancements from the past five years, showcasing how computational intelligence is being leveraged across disciplines to build resilience and support sustainable adaptation pathways. Challenges such as data uncertainty, model interpretability, and ethical considerations are discussed, along with future research directions.

DOI: 10.4018/979-8-3693-9132-7.ch002

INTRODUCTION

AI is an ambiguous phrase that has recently become widely used to describe a group of methods intended to use machines to approximate some human or animal cognition feature. AI comes in a variety of forms. It looks at climate change, which is a huge issue in and of itself and one field that is ready for greater artificial intelligence. Without action, the destabilising climate would bury towns, cause deadly natural disasters, and endanger vital food and water supplies, according to a federal circuit court(Bolton & Zanna, 2019; Callaghan et al., 2021). Carbon emissions "rose 1.7% last year and hit a new record" due to increased worldwide energy consumption, despite the strong and consistent scientific evidence that we need to limit our global carbon emissions. The United States only achieved short-term worldwide carbon reductions comparable to the 8% experts estimate is required annually to meet climate-change targets during a global pandemic and economic shutdown(Challinor et al., 2018). Water-related management concerns have drawn the greatest amount of research on the application of AI (Chernozhukov et al., 2018). According to the survey's findings, the strongest consensus was found on the potential of AI and digitisation to improve governance procedures and policy coherence in the context of climate change. The study's findings indicate that, with the right precautions, artificial intelligence (AI) can be a useful tool in the worldwide endeavour to better comprehend and manage the myriad issues related to climate change. Figure 1Overview of Issues and challenges in computational Intelligence.

Figure 1. Overview of Issues and challenges in computational Intelligence



It is widely acknowledged that disruptive technological advancements create new possibilities for automating repetitive and typically time-consuming tasks, provide opportunities to recognise patterns in substantial amounts of unstructured data, and