Chapter 14
Machine Learning–Based Approach for Modelling Soil–Structure Interaction Effects on Reinforced Concrete Structures Subjected to Earthquake Excitations

Hemaraju Pollayi
GITAM University, India

Prathyusha Bandaru
GITAM University, India

Praveena Rao
https://orcid.org/0000-0003-2325-6300
GITAM University, India

ABSTRACT

In the chapter, the authors develop a machine learning (ML)-based model that has the potential to make rapid predictions for seismic responses with SSI effects and determine the seismic performance levels. The authors select several input parameters for training, validation, and testing of the present model. The present high speed and accurate data generation methods can be incorporated as a tool for safe seismic assessment and design of sustainable earthquake resistant structures. Finally, the authors will test the soil-pile model experimentally on a shake table (with strain gauges and accelerometers) when subjected to harmonic load with varying frequencies in the range 3Hz to 12Hz and base acceleration ranging from 0.05g to 0.3g. The present approach shall provide substantial information for design of piles and the response of piles subjected to earthquake excitations.

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INTRODUCTION

Artificial Intelligence (AI) is advancing in leaps and bounds and expected to increase global competition over the decades to come which shall have certain strategic advantage to its early adopters. Over the past few decades different nations have been competing globally based on their capital derived from human, physical, financial and intellectual means. But, in the years to come, there shall be competition amongst the nations with increasing Digital Capital.

AI IN WORLD: INITIATIVES

Currently, facial recognition, traffic management, biometric identification, criminal investigation, crowd management, and digital agriculture, etc. are some of sectors where the government of India has successfully implemented AI. Several International organizations and National governments have leveraged the deployment of AI in targeted policies for achieving its maximum benefits. It has been found that the US had invested around $6 million for research in AI and projects in the year 2021. Whereas, Europe has been spending increasingly on AI by 33% in past three years. India has harnessed its enormous digital capital by investing for bottom-up and inclusive AI-driven development projects. Also the Indian market has the largest community of developers on a global level with great opportunities for start-ups, as well as a thriving ecosystem for scientific and engineering research. The Indian government has embarked on its journey through this revolution by collaborating with several organizations such as DRDO, MeitY, and NASSCOM that have been ahead in field of AI in the country. The Centre for Artificial Intelligence and Robotics (CAIR) was set up for exclusive research, development and projects in AI and since then its Digital India initiative has progressed exceptionally well.

The US-India AI Initiative

The US-India Artificial Intelligence Initiative was instituted on the 18th March 2021 by the Indo-US Science and Technology Forum (IUSSTF) as a flagship program for fostering and sharing of ideas. The major role of this program is to create more opportunities and promote further innovation in AI by bringing the stake holders of India and the USA together in bilateral collaboration.

AI Centres of Excellence

There is a National Centre for Transformation AI which is essentially working towards application-based research in AI. As the application of AI in daily life has received immense appreciation and demand, whether its AI for locating places on the maps to online food ordering.

Thus it is aiming at working towards enabling AI into central and state government decision making structures and systems.

MCA 3.0

It is the latest newer version 3.0 portal of The Ministry of Corporate Affairs (MCA), which was launched in May 2021. Latest technologies including AI, ML, and data analytics have been vastly implemented