Title:

Neural network-based imitation of model predictive control for power converters

Authors: Pere Izquierdo, Cristina Roche, Aitor Teran

Abstract:

Machine learning and neural networks have been at the forefront of many technological breakthroughs in recent years. This study aims to make use of these techniques to implement the control scheme of power converters, imitating the more widespread model predictive control methods. Model predictive control (MPC) has been shown to offer great advantages compared to more traditional techniques, but it has an important drawback in its high computational requirements. By predicting the behavior of the system for longer periods of time, performance can be improved at the cost of an exponentially increasing computational time. This can be potentially overcome by imitating such a method using a neural network, which can greatly reduce computational cost. Training data is collected using an accurate simulation model of conventional model predictive control schemes, for a wide range of parameters. This data is used to train an artificial neural network using the Python implementation of Tensorflow, which allows for a highly flexible neural network structure. The trained neural network is then to be experimentally verified by implementing it in a laboratory environment.

Keywords:

Artificial neural networks, supervised imitation learning, finite-set model predictive control, control design, DC-AC converters.