Cranfield UNIVERSITY

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Some Practical Applications of Neural Networks in the Electricity Industry

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Some Practical Applications of Neural Networks in the Electricity Industry

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ABSTRACT

The development of an optimising model predictive controller for domestic storage radiators was the ultimate goal of this research project. Neural networks are used to create empirical models that are used to predict the likely temperature response of a room to the charging of a storage radiator. The charging strategy can then be optimised based on the real-time price of electricity.

Neural network modelling is investigated by looking at the load forecasting problem. It is shown how accurate neural models can be created and demonstrated exactly how they process the data. Very specific rules are extracted from the neural network that can model the load to a reasonable accuracy.

An efficient optimisation technique is sought by optimising the charging of a domestic hot water tank based on actual consumption data and the pool price of electricity. Initially genetic algorithms were tried but their weaknesses are demonstrated. A stochastic hill climbing method was found to be more suitable. Monetary saving of 40% over the existing E7 tariff was common.

The modelling and optimisation are brought together in a storage radiator simulation. There are improvements in cost and electricity consumption over E7 primarily due to the ability to look ahead and avoid overheating.

A prototype neural controller is developed and tested in a real house. The results are very encouraging.

Declaration

All work in this thesis and the resulting publications are the sole work of the author unless otherwise stated

To my Grandparents

> We've got to keep it tight at the back, pick up the spare man, use the width of the park and let the ball do the work. Hopefully, at the end of the ninety minutes we'll come away with some sort of result.

Tommy Brown, Fulchester United Supremo

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