

An Investigation into the implementation of Neural Networks in Digital Signal Processing and Control Applications

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Description of a Neural Network

A Neural Network(NN), in the sense of Digital Signal Processing, is either a feed-forward or recurrent network which maps a series of inputs, to a series of outputs. A Neural Network is capable, to a limited extent, of being taught behaviour and correcting errors through learning techniques, such as back propagation. This enables a NN to better cope with poorly defined problems or data sets.

Context of Neural Network Technology

Neural Networks(NN) are a developing technology derived from initial attempts to replicate “human-like” processing flexibility in computers, namely Artificial Intelligence. This technology is current being developed in a diverse range of fields encompassing both Control and Telecommunications. Adaptive Control and Pattern Recognition shall be discussed as examples of applications which benefit from the implementation of NN technology.

Technical Aspects and Relevant Theory

To understand the many of the fundamental concepts of NN operation will require the presentation of significant mathematical concepts, including some algebra. Also, to comprehend the context of NNs in modern technology will also require the presentation of previous alternatives, such a Finite State Machines (FSM).

Project Tasks and Outcomes

The Project Tasks listed below shall be attempted in the prescribed order. The project aims to give a general overview of both the technical workings of NN technology and its applications to various fields in Engineering.

- 1.Introduction to Neural Networks:** The basic concepts of Neural Networks shall be discussed, whilst introducing the any mathematical concepts required for latter sections. This introduction will most likely include material about FSMs and related Automata Theory.
- 2.Evolution of Neural Nets:** The historical evolution of Neural Networks from initial concepts till modern implementation shall be discussed.
- 3.Adaptive Control:** Several applications of NN's to the field of Adaptive Control shall be presented. Particular focus will be placed upon the role which digital signal processing techniques play in the operation of a NN.
- 4.Pattern Recognition/Communications:** Another practical application of a NN will be detailed, most likely from the area of Image Recognition.
- 5.MATLAB or C Example:** An attempt shall be made at producing a working example of using a NN to play scissors-paper-rock using MATLAB or C programming environments.

The Tasks described above shall be divided evenly amongst the group members.