Artificial Intelligence Techniques

Applications of Neural Networks

Example Applications

- Analysis of data
- Classifying in EEG
- Pattern recognition in ECG
- EMG disease detection.


- To produce a model of risk facts in heart disease.
- MLP used
- The accuracy was relatively good for cholestremia and triglyceremdia:
  - Training phase around 99%
  - Testing phase around 93%
- Not so good for HDL
Electroencephalography (EEG)
- Recordings of electrical activity from the brain.

Classifying operation
- Awake
- Drowsy
- Sleep

MLP
- 15-23-3
- Hidden layer - log-tanh function
- Output layer - log-sigmoid function
- Input is normalise to be within the range 0 to 1.
- Accuracy
  - 95% +/- 3% alert
  - 93% +/- 4% drowsy
  - 92 +/- 5% sleep
- Feature were extracted and form the input to the network, from wavelets.

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- ECG - electrocardiographs - electrical signals from the heart.
- Wavelets again.
- Classification of patterns
- Patterns were spotted

- EMG - Electromyography - muscle activity.
- Interference patterns are signals produce from various parts of a muscle-hard to see features.
- Applied neural network to EMG interference patterns.

- Classifying
  - Nerve disease
  - Muscle disease
  - Controls
- Applied various different ways of presenting the pattern to the ANN.
- Good for less serve cases, serve cases can often be see by the clinician.
Example Applications
- Wave prediction
- Controlling a vehicle
- Image processing
- Condition monitoring

Wave prediction
  - MLP used to predict storm waves.
  - 2:2:2 network
  - Good correlation between ANN model and another model
van de Ven P, Flanagan C, Toal D (in press) Neural network control of underwater vehicles *Engineering Applications of Artificial Intelligence*

- Semiautonomous vehicle
- Control using ANN
- ANN replaces a mathematical model of the system.

Fig. 10. Block schematic of the model predictive control scheme.

Fig. 12. Modified Elman architecture.

- Image recognition of part
- Deals with the shifting of the part

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- Modelling tool wear
- Combines ANN with other AI (Expert systems)
- Self-organising Maps (SOM) and ART2 investigated
- SOM better for extracting the required information.