Revision

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Lecture Outline

- Overview of course material

Introduction to AI

- Artificial / Computational Intelligence
- CI models

Data Transformation

- Statistical operations on Data
- Data transformations
  - The objectives of a data transform
  - Linear versus non-linear transformations
  - Transformations for pre-processing of data
  - DFT and FFT Transformations
  - Wavelet Transformations

Rule Based Systems

- Production systems
- Facts & Templates
- Production rules
- The inference process
- Advantages of production systems
- Disadvantages of production systems
- Expert systems

Fuzzy Sets and Fuzzification

- Crisp sets
- Fuzzy sets
- Fuzzy membership functions
- Fuzzification
- Fuzzy logic

Fuzzy Rules, Inference and Defuzzification

- Fuzzy rules
- Fuzzy inference
- Defuzzification

Fuzzy Systems

- Fuzzy systems
- Developing fuzzy systems
- Advantages of fuzzy systems
- Disadvantages of fuzzy systems

Applications of Fuzzy Systems

- Advantages of fuzzy systems
- Pattern recognition / Classification
- Fuzzy control
- Decision making

Biological and Artificial Neurons

- Biological Neurons
- Biological Neural Networks
- Artificial Neurons
- Artificial Neural Networks

Perceptrons

- Perceptron architecture
- Perceptron learning
- Problems with perceptrons

Multi-Layer Perceptrons

- Multi-Layer Perceptrons
- Terminology
- Advantages
- Problems

Backpropagation Training

- Backpropagation training
- Error calculation
- Error surface
- Pattern vs. Batch mode training
- Restrictions of backprop
- Problems with backprop

Kohonen Self Organising Maps

- Vector Quantisation
- Unsupervised learning
- Kohonen Self Organising Topological Maps

Applying Neural Networks

- When to use an ANN
- Preparing the data
- Apportioning data
- What kind of ANN to use
- Training ANN

Evolution

- What is evolution?
- What evolution is not
- Lamarckian evolution
- Mendellian genetics
- Darwinian evolution

Genetic Algorithms

- Genetic algorithms
- Jargon
- Advantages of GAs
- Disadvantages of GAs
- Simple genetic algorithm
- Encoding schemata
- Fitness evaluation

Genetic Algorithms

- Selection
- Creating new solutions
- Crossover
- Mutation
- Replacement strategies
- Word matching example

Evolution Strategies
Evolutionary Programming
Genetic Programming

- Evolution Strategies
- Evolutionary Programming
- Genetic Programming

Applications of Evolutionary Algorithms

- Advantages of EA
- EA Application areas
- Scheduling
- Load balancing
- Engineering
- Path Planning

Evolutionary Algorithms and Neural Networks

- Problems with ANN
- EA and ANNs
- ANN Topology Selection by EA
- Initial Weight Selection
- Selecting Control Parameters
- EA Training

Evolutionary Algorithms and Fuzzy Systems

- Advantages of fuzzy systems
- Problems with fuzzy systems
- Applying EA to fuzzy systems
  - Optimisation of MF
  - Optimisation of rules
  - Optimisation of fuzzy systems

IIS for Speech Processing

- Speech Production
- Speech Segments
- Speech Data Capture
- Representing Speech Data
- Speech Processing
- Speech Recognition

IIS for Bioinformatics

- What is bioinformatics?
- What is DNA?
- How is it processed in cells?
- What is DNA data?
- How is DNA data represented?
- How can IS be applied to DNA data?

IIS for Finance

- Economic data
- Applications
- Why is it hard?
- Methods to use
- Applications of IIS

IIS for Image Processing

- What are images?
- Why process them?
- What is Image Processing/Recognition?