NEURAL NETWORKS

Lecture 2

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Why neural networks?

- Intelligent processing without predefined model or algorithm. Only based on data about behaviour of some system

- Learning capability

- Wide range of applications

- Very efficent in solving complex problems hard to solve by using algorithmic approach

WHEN TO USE ANN

- When there is no clear mathematical model or other solution
- When the data is noisy, error prone and incomplete
- When adaptive learning is requirement
- High dimensional problems
- When NN provide better results than alternative solutions (faster response in real time, error tolerance)

MOST IMPORTANT ANN PROPERTIES

1. Learning capability
2. Generalization
3. Noise and error resistant

TYPES OF PROBLEMS

- Classification
- Recognition (image, speech, feature vectors...)
- Approximation
- Optimization
- Signal processing
- System modelling
- Prediction
- Controll

Training Procedure

- Gathering and preparing data
- Network training
- Network testing
- Choosing optimal parameters experimentaly (neuron number, layer number, learning rule parameters)

Preparing data

- Filtering

- Normalization

- Dimensionality reduction (PCA)

- Success depends on training data

- Data must provide good representation of the problem

Applications

- Classification
- Recognition
- Prediction
- Approximation
- Association
- Optimisation
- Intelligent signal processing and control

Network Training

- Determine network parameters

number of hidden layers and neurons

- Learning rate and momentum
- Validation with validation set
- Trening and test set
- Overfiting and generalization

PROBLEMS WITH NN APPLICATIONS

- No semantics in structure

- Is some problem solvable with neural networks at all?

- Determining architecture and learning rule setting

- Plasticity / stability

Solutions – advanced neural networks

- Sinergy of neural networks, fyzzy systems and genetic algortihms – computational intelligence

- Fuzzy logic brings semantics into structure

- Gen. algorithms improve learning by tweaking all posible settings

Application examples

- Stock market prediction

- Radar object recognition

- Face, character, fingerprint recognition

- Diagnostics in medicine

- Noise filtering

- Predict component failure

- Detect cancer, diagnose heart attacks

- Brain modelling

JAVA NEURAL NETWORK FRAMEWORK NEUROPH

http://neuroph.sourceforge.net