Reports for ProgPrakt II

Visualization of netJEN problem domains and results

Erich Eichberger Thomas Aschauer Thorsten Engl
Christian Zödl

March 29, 2000

1 1st. Protocol March 15, 2000

General

- *Present persons:*
  - DI Mag. Roland Schwaiger
  - Erich Eichberger
  - Thomas Aschauer
  - Thorsten Engl
  - Christian Zödl
- *Place:* DI Mag. Schwaigers Office
- *Time:* 16.00 - 16.30
- *Chief of protocol:* Erich Eichberger

General project definition

Theme: Visualisation of netJEN problem domains and results

The project is going to be a graphical tool, written in java, for the visualisation of netJEN problem domains. The aim is to show the pattern file[1] before and after netJEN evaluated it (they are called learning and result pattern). The pattern files are in the pattern file format of the SNNS [2]. Thus the program has to be able to read this files and display the information contained in a manner that depends on the problem domain. This, perhaps, could be an image from a satellite that should be classified or prognosis of tax courses.

Topics talked about

- Administrative details
- Sources for Information related to the topic
- Presentation of our group's web site
- The Neural Network Simulator netJEN and SNNS

[1]The data neural network simulators work with is called pattern
[2]Stuttgart Neural Network Simulator

- Problem domains, kinds of visualisation

Task list

- Pictures of group-members (for web site)
- Find problem domains for NNs [3]
- Find NN-applications and problems that are solved with NNs

[3] NN... short form of Neural Network

2 Results of the week (March 15th to March 22nd)

The goal of this week was to find the applications and problem domains of NNs. First we discuss the NN-Applications we found, and then we list the problem domains we found within these applications.

Applications for NNs

Manufacturing

- process optimizing
- process monitoring and controlling
- determining operational policies
- predictive control of quality
- flexible manufacturing scheduling

Chemical Industry

- sensor analysis
- spectroscopy
- molecular modeling
- data rectification for dynamic processes
- process modeling for fault detection
- statistical analysis

Medicine

- diagnosis of coronary artery disease
- structure analysis of virus proteins
- diagnosis of epilepsy
- rehabilitation of persons with incomplete spinal cord injury
- analysis and classification of EEG signals

Nuclear engineering

- spectral analysis
- signal prediction in nuclear power plants
- classification of energy levels
- alarm handling in nuclear power plants

Miscellaneous applications

- classification of satellite pictures
- sensor analysis
- optical character recognition
- voice recognition
- stock rate prognosis
- texture recognition
- temperature regulation
- sunspot evaluation
- business prognosis and optimization
- sale prognosis

Problem domains

- classification
- time series prediction
- parameter determination
- signal recognition
- signal analysis and prediction
- rule extraction
- optimization
- modeling

Ideas for possible visualisation

- picture data as bitmap
- classification as regions (graphs)
- bar chart
- line chart
- plain pattern text
- graphs
- text

3 2nd. Protocol March 22nd, 2000

General

- *Present persons:*
  - DI Mag. Roland Schwaiger
  - Erich Eichberger
  - Thomas Aschauer
  - Thorsten Engl
  - Christian Zödl
- *Place:* DI Mag. Schwaigers Office
- *Time:* 16.00 - 16.30
- *Chief of protocol:* Erich Eichberger

Topics talked about

- Results form last week
- Possible visualisation of problem domains
- Possible names of problem domains (like classifikation, ...)

Task list

- Adding bibliography information
- Finding problem domains, their possible visualisation and names
- Pictures of possible visualisation
- Grouping NN-Applications to problem domains
- Work into ArgoUML

4 Results of the week (March 22nd to March 28th)

Applications for NNs

Manufacturing

Literature: [CNC], [HeK96], [NNAb]

- process optimizing
  Visualisation: Graph
  Problem Domain: Optimization, Time series prediction, Parameter determination

- process monitoring and controlling
  Visualisation: 3D - Chart
  Problem Domain: Signal analysis and prediction

- determining operational policies
  Visualisation: Graph
  Problem Domain: Parameter determination

- predictive control of quality
  Visualisation: 2D - Chart
  Problem Domain: Signal analysis and prediction, Time series prediction

- flexible manufacturing scheduling
  Visualisation: Graph
  Problem Domain: Rule extraction, Time series prediction

Chemical Industry

Literature: [CNC], [NNAa]

- sensor analysis
  Visualisation: Line - Chart
  Problem Domain: Signal recognition

- spectroscopy
  Visualisation: Bar - Chart
  Problem Domain: Signal recognition, Classification

- molecular modeling
  Visualisation: 3d - Model
  Problem Domain: Modeling
- data rectification for dynamic processes
  Visualisation: 2D / 3D - Chart
  Problem Domain: Signal recognition, Time series prediction
- process modeling for fault detection
  Visualisation: Graph / 3D - Chart
  Problem Domain: Rule extraction, Optimization
- statistical analysis
  Visualisation: 2D / 3D - Chart
  Problem Domain: Time series prediction

Medicine

Literature: [CNC], [NNAc]

- diagnosis of coronary artery disease
  Visualisation: Graph / Chart
  Problem Domain: Classification
- structure analysis of virus proteins
  Visualisation: 3D - Model
  Problem Domain: Parameter determination
- diagnosis of epilepsy
  Visualisation: Graph / Chart
  Problem Domain: Classification
- rehabilitation of persons with incomplete spinal cord injury
  Visualisation: Graph
  Problem Domain: Optimization, Rule extraction
- analysis and classification of EEG signals
  Visualisation: Bar - Chart
  Problem Domain: Classification, Signal analysis and prediction

Nuclear engineering

Literature: [CNC], [NNAf]

- spectral analysis
  Visualisation: Bar - Chart
  Problem Domain: Signal recognition, Parameter determination

- signal prediction in nuclear power plants
  Visualisation: Line - Chart
  Problem Domain: Signal analysis and prediction, Time series prediction

- classification of energy levels
  Visualisation: Bar - Chart
  Problem Domain: Classification

- alarm handling in nuclear power plants
  Visualisation: Line - Chart
  Problem Domain: Signal analysis and prediction, Time series prediction

Miscellaneous applications

Literature: [CNC], [NNAg], [PDN], [NNAb], [NNAa], [NNAc], [NNAd], [NNAf], [NNAe], [HeK96]

- classification of satellite pictures
  Visualisation: Areas / 3D - Model
  Problem Domain: Classification

- sensor analysis
  Visualisation: 2D / 3D - Chart
  Problem Domain: Signal recognition

- optical character recognition
  Visualisation: Picture / Text
  Problem Domain: Classification, Signal recognition

- voice recognition
  Visualisation: Line / Bar - Chart / Text
  Problem Domain: Signal recognition, Classification

- stock rate prognosis
  Visualisation: Line - Chart
  Problem Domain: Time series prediction

- texture recognition
  Visualisation: Bar - Chart / Text
  Problem Domain: Classification

- temperature regulation
  Visualisation: Line - Chart
  Problem Domain: Signal analysis and prediction, Time series prediction, Rule extraction, Parameter determination

- sunspot evaluation
  Visualisation: 2D / 3D - Chart
  Problem Domain: Time series prediction, Classification, Rule extraction

- business prognosis and optimization
  Visualisation: Graph / 3D - Chart
  Problem Domain: Optimization, Time series prediction

- sale prognosis
  Visualisation: 2D / 3D - Chart / Graph
  Problem Domain: Time series prediction

Problem domains

- classification
- time series prediction
- parameter determination
- signal recognition
- signal analysis and prediction
- rule extraction
- optimization
- modeling

Possible visualisation

We found various ways to show the pattern and results:

- picture data as bitmap
  (see Figure 1)
- classification as areas
  (see Figure 2)
- Various charts: Bar, Line, Circle, ...
  (see Figures 3, 4, 5, 6, 7, 8, 9 and 10)
- 3D-graphics
  (see Figures 11, 12, 13 and 14)
- Frequency diagram
  (see Figure 15)
- graphs
  (see Figure 16)
- text
- plain pattern text

Here are some examples:

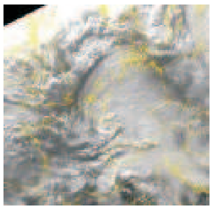

Figure 1: Example: Satellite bitmap

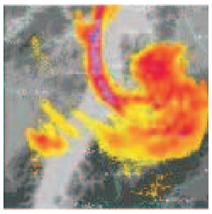

Figure 2: Example: Satellite bitmap with result areas

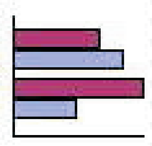

Figure 3: Example: Bar chart

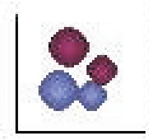

Figure 4: Example: Bubbles chart

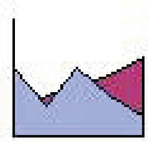

Figure 5: Example: Area chart

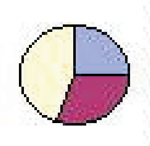

Figure 6: Example: Circle chart

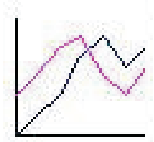

Figure 7: Example: Line chart

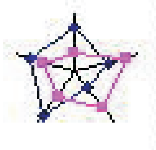

Figure 8: Example: Net chart

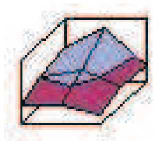

Figure 9: Example: Surface chart

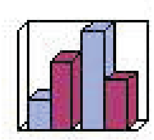

Figure 10: Example: Pillar chart

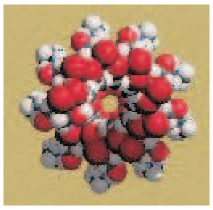

Figure 11: Example: Molecule

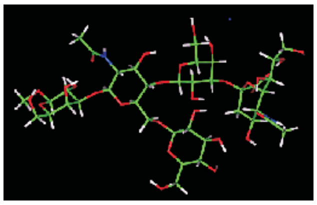

Figure 12: Example: Molecule Structure

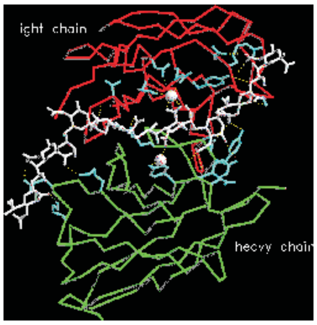

Figure 13: Example: Molecule Structure 2

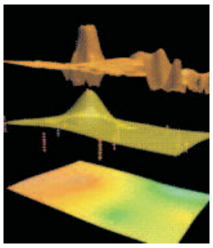

Figure 14: Example: Landscape

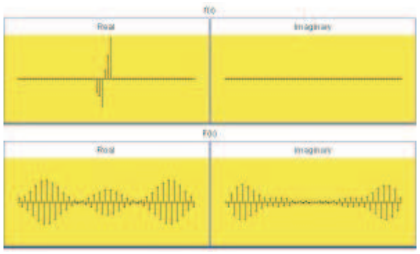

Figure 15: Example: Frequency diagram

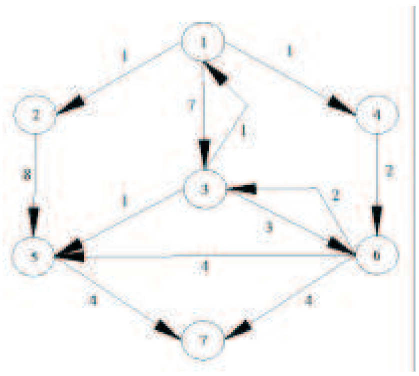

Figure 16: Example: Graph

References

[CNC] The centre for neural computing applications. http://www.brunel.ac.uk/research/cnca/links/related.html.

[HeK96] Einfuehrung in den stuttgarter neuronale netze simulator, 1996. http://www-i6.Informatik.RWTH-Aachen.de/Colleagues/HeKonn96/abstract/snns.html.

[NNAa] Neural network applications in chemistry. http://www.emsl.pnl.gov:2080/proj/neuron/neural/bib/chemistry.html.

[NNAb] Neural network applications in manufacturing. http://www.emsl.pnl.gov:2080/proj/neuron/neural/bib/manufacturing.html.

[NNAc] Neural network applications in medicine. http://www.emsl.pnl.gov:2080/proj/neuron/neural/bib/medicine.html.

[NNAd] Neural network applications in molecular modeling. http://www.emsl.pnl.gov:2080/proj/neuron/neural/bib/molecular.html.

[NNAe] Neural network applications in process control. http://www.emsl.pnl.gov:2080/proj/neuron/neural/bib/molecular.html.

[NNAf] Neural network applications in power plants. http://www.emsl.pnl.gov:2080/proj/neuron/neural/bib/power.html.

[NNAg] Nn-at gruppenprofile (8-apr-1997). http://www.ai.univie.ac.at/nn-at-97/gruppen.html.

[PDN] Problem domain. http://www.cis.hut.fi/ jhollmen/dippa/node36.html.