Java Mind Reader

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Overview

- Brief overview of existing BCI hardware and software
- Demo & HowTo –

  NeuroSky BCI using Neuroph
- Open source frameworks & tools
- GoodOldAI Framework

Brain Computer Interface Technology

How BCI works: read brain brain waves (EEG), classify/recognize them and map to actions

Available hardware

- Emotiv Epoc http://www.emotiv.com/
- NeuroSky MindWave http://www.neurosky.com/
- Open EEG http://openeeg.sourceforge.net/doc/

NeuroSky MindWave

- Single dry sensor, easy to use
- Cheap and available
- More relevant details about NeuroSky...
- http://www.neurosky.com/

BCI & Neural Networks

- Neural networks are brain inspired machine learning technique used for classification, approximation, recognition and modeling problems
- BCI is a typical neural network use case: unreliable, unkown model, noisy data, requires learning & generalisation

- Example of using Emotiv Epoc with Multi Layer Perceptron with Backpropagation:

http://www.slideshare.net/psycllone/emotiv-epoceegbci

Source Code

- How to read from NeuroSky MindWave
- How to use neural net for classification
- BCI Plugin for neuroph?
- How to use it from GOAI Classifer

Demo

- Record data
- Prepare data
- Build classifier
- Test classifier
- Evaluate classifier, compare to others
- Notes about training process (training data, dest data, need for genralization)

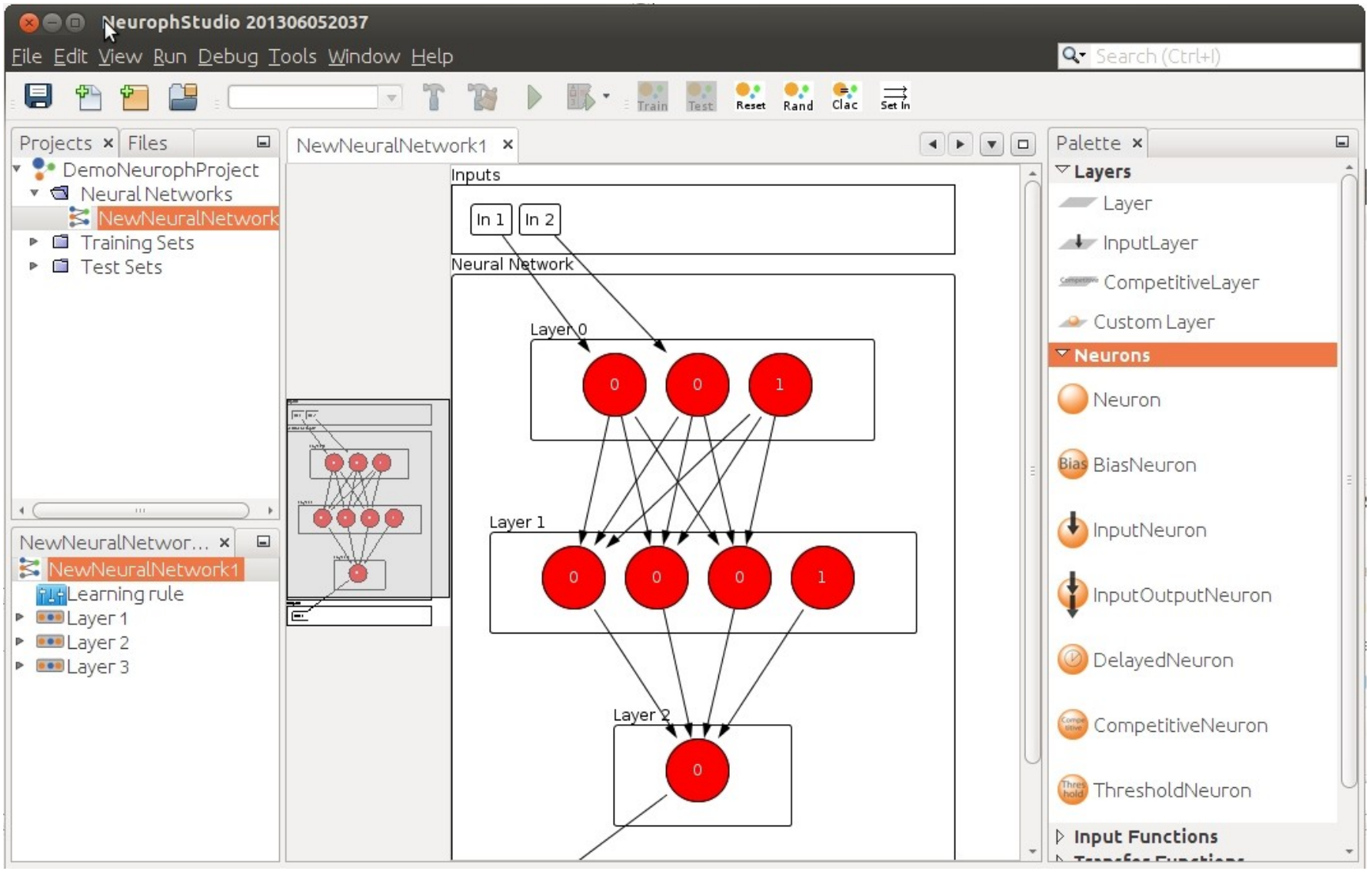
Notes on Signal Processing

- PCI (Principal Component Analysis)
- ICA (Indipendent Component Analysis)
- FFT (Fast Fourier Transform)
- Data normalization
- Sampling (select Beta waves – consciounes thoughts)

BCI for your app – how to

- Define actions you need for your app
- Collect brainwave data
- Build classifier based on brainwave data

Neuroph & Neuroph Studio



Java Open Source Frameworks & Tools

- Neural Networks
  - Neuroph
  - Encog
- Machine Learning:
  - Weka,
  - Java ML
  - Rapid Miner
- Visualization
  - Visualzation Scientific packages Jhep works, jscience, 2d jfree chart, 3d jzy3d,
  - for real time graphs reuse Visual VM
- Open EEG
- NeuroSky related projects on GIT
- GOAI Framework

GoodOldAI Framework

- Wrap all frameworks previous with same API
- Task and application oriented Java API – right measure of Abstraction to make it meaningfull and usefull
- Used as Classification API in BCI
- Benchmarking of different frameworks
- Benefits of using it: easy to compare different frameworks, and change undrlying framework in future
- Why it is important: makes development more productive, easier to develop, maintain, evolve and reuse AI software

GoodOldAI Framework Design

- Basic classses and runtime container
- Class diagram – 3rd party framework wrapper
- GOAI Component
- Task oriented interface (eg. Classifier)
- RuntimeContainer

GoodOldAI Team

- Laboratory of Artificial Intelligence
- Open Source Software Development Center
- University of Belgrade
- AI researchers and software engineers working together