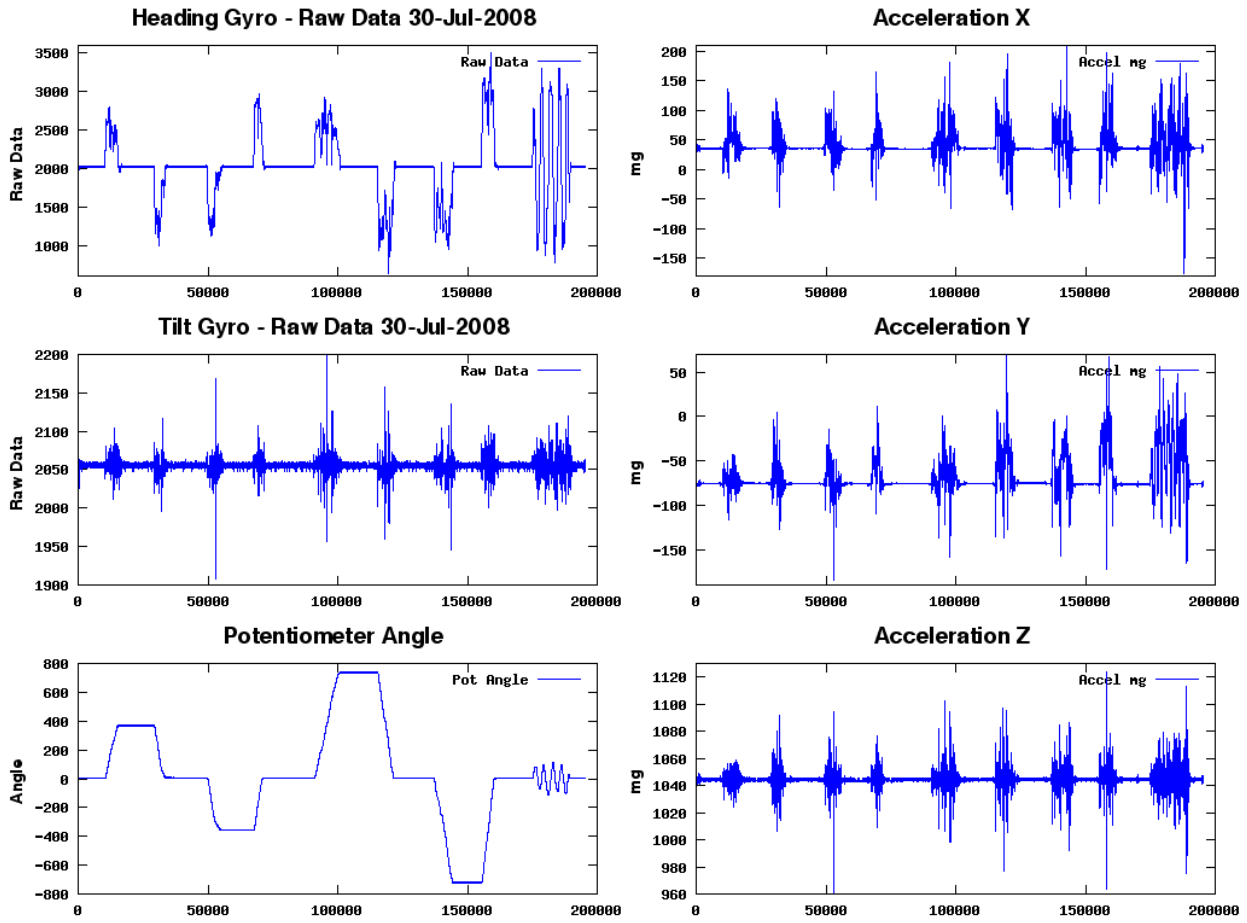
Introduction to Data Processing



Overview

- Introduction
- General Tips
- Some of my tools
  - Set of commandline tools (zsh, git, mvim …)
  - matlab, mathematica
  - ipython, R
- Case Study: Workshop Scenario

Disclaimer

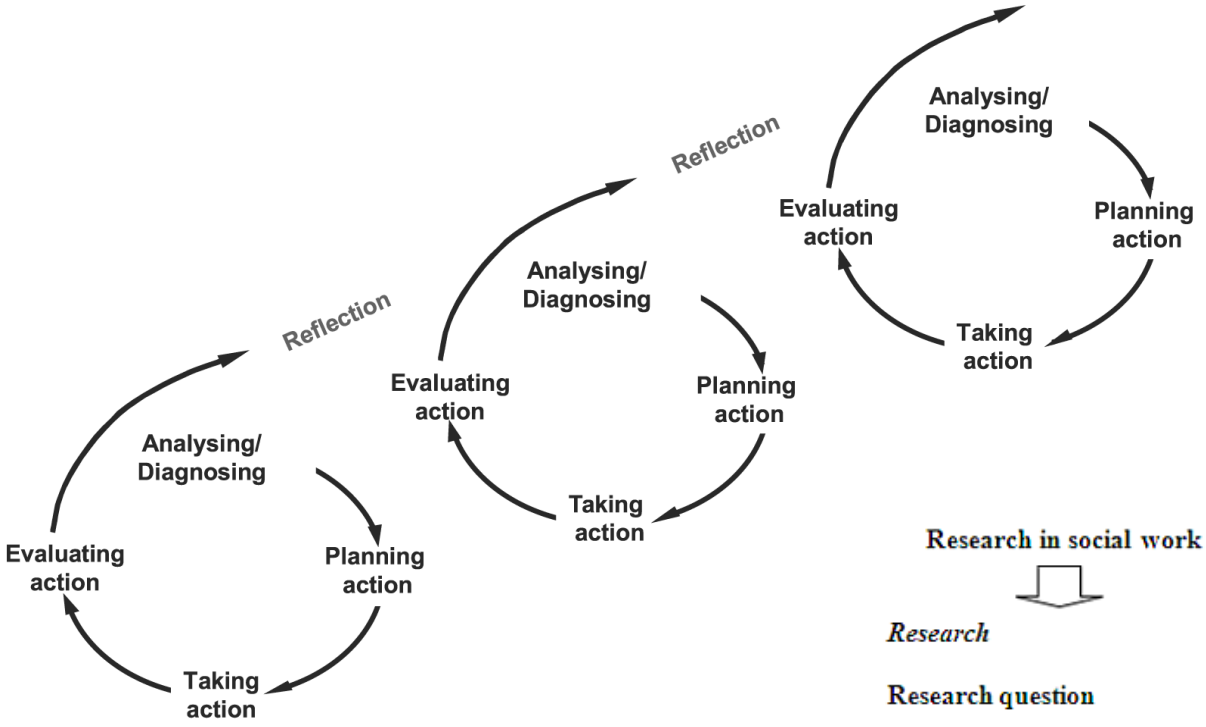
- Data analysis/processing is a very broad term
  - A lot of different definitions
  - A lot of different tools
- In this tutorial I show you what works for me:
  - The methodology
  - Some useful tools

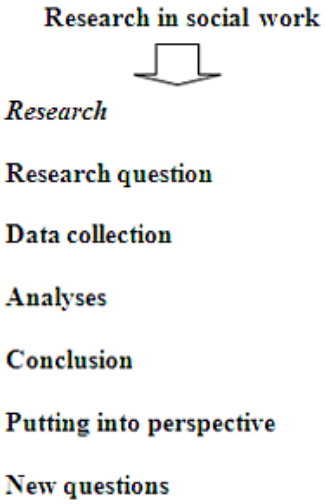
- Most important:
  - Have fun playing with data!

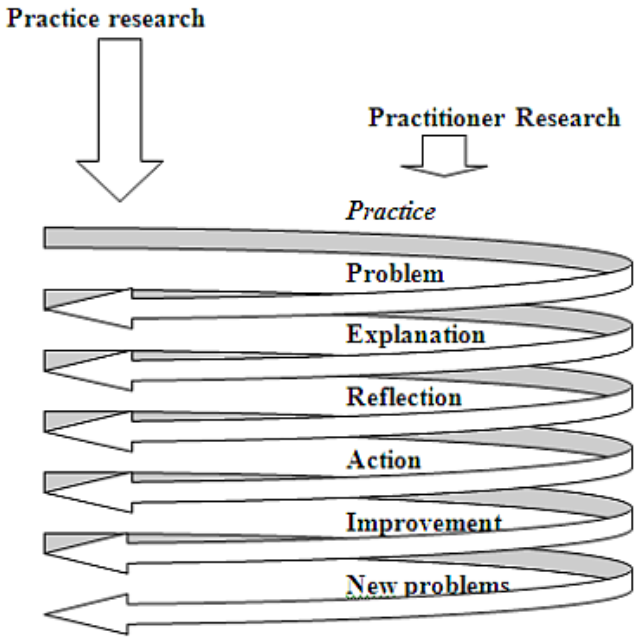
Research

- As researcher your product is not data or code … your product is **knowledge**
- Empirical science uses data and code to obtain knowledge
- good research is about reproducibility

Research “life” cycle







Getting data …

- Standard datasets
  - http://contextdb.org
- Own Experimental Design
  - Difficult !! Don't underestimate the design
  - Some good starting points (for UI design experiments, yet also valid for other designs)
  - http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-831-user-interface-design-and-implementation-spring-2011/lecture-notes/MIT6_831S11_lec14.pdf
  - http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-831-user-interface-design-and-implementation-spring-2011/lecture-notes/MIT6_831S11_lec15.pdf

How I handle data …

- Separate code from data
  - One data set, multiple types of analysis
- Have separate directories for data
  - Suggestion: input, working, output
  - input: never changes!
  - working: calculated features, processing steps
  - output: classification results etc.
- NEVER change the raw data directly
- NEVER do changes by hand to the data …

Sample Project directory

- My_project
  - data
    - Working
    - Input
    - Output
  - Code
    - Matlab
    - Python
    - C
  - README.md
- My_Data
  - EEG
    - Working
    - Input
    - Output
  - Face_rec
- My_EEG_project
  - papers
  - code
  - demo
  - test
  - README.md

Use Source Control (for code, docs …)

- Use a distributed version control system
  - My favorite: git
- I use it for everything … (except DATA)
  - papers
  - My website
  - Every text file

- Text files are your friends ☺
- Don’t use git for data (use .gitignore file to exclude it)

Save frequently and backup

- Save everything to disk frequently
  - Features you calculated
  - Data preprocessing steps
  - Your models, your results
- Disk-space is cheap, use it
- Use naming conventions:
  - For example one of my working directories:
    - Working/2012-12-02-features-accel-sw100.mat
- Dropbox is nice
  - if the data is not too large and sensitive (privacy!!)
  - works for code

On tests, timing …

- Test the data + code as early and often as possible
  - Work with input /output files
  - General tests used for:
    - Prototyping language (perl, python …)
    - Demo implementation in faster language (C, C++ …)
- Estimate the timing of your methods
  - Paper deadline driven

Tips

- Use folder structures (with docs, tests)
- Use Version Control
- Save everything frequently (intermediate steps)
- Easy to execute part of the analysis (modular setup)

Pick the right tool for the right purpose …

- Remember we want to produce knowledge
- There are a lot of data processing/ analysis software out there:
  - Matlab, mathematica, maple, S, Strata
  - Octave, Sage, R
  - Libraries in c, java, pyhton, ruby, javascript, perl

- Every software comes with advantages and disadvantages!

Tools I use …

- Commandline tools
  - screen, cat, grep, head, awk, find, xargs, sort, wc …
  - I use YADR (for mac):
    - http://skwp.github.com/dotfiles/
  - Zsh, mvim
- For the initial data processing
  - Matlab, python (ipython, scipy …) http://www.enthought.com
- For most plots: R
- For demos, production code:
  - Depends, whatever does the job
  - A good knowledge of C is very helpful ☺

Case Study: Workshop Scenario

Plotting in R

Rapid prototyping for demos …

- Processing
- java
- Node.js /ruby on rails
- Javascript:
  - d3.js (for http://contextdb.org)
  - http://square.github.com/cubism/

Further References

Data analysis, machine learning, dsp

https://class.coursera.org/dataanalysis-001/

https://www.coursera.org/course/dsp

https://www.coursera.org/course/ml

Visualization

http://cs171.org

Help

http://stackoverflow.com

http://stats.stackexchange.com