R & I

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Hello world!

- My name is Nadica Miljković.
- I am Assist. Prof. of Biomed. Eng. at the ETF.
- I have 10 yrs. long experience in Academia and 6 yrs. in industry.
- For a long time (> decade) I used Matlab mainly.
- Prof. Predrag Pejović introduced me with:
  - free software and
  - R.
- I searched for R. No results. Tried “R programming” instead.

Predrag Pejovic

tnt.etf.rs/~peja/

Dr. Predrag Pejović

Professor

Faculty of Electrical Engineering
University of Belgrade

E-mail: peja@etf.rs

Google Scholar Profile

ORCID ID: 0000-0003-4064-6204

TEACHING | LIST OF PUBLICATIONS | PERSONAL

Undergraduate Courses

- Electrical Measurements (13E042EM)
- Analog Electronics (13E043AE)
- Power Electronics 1 (13E043EE)
- Software Tools in Electronics (13E042PSA)
- Electronics Lab 2 (13E043LVE2)

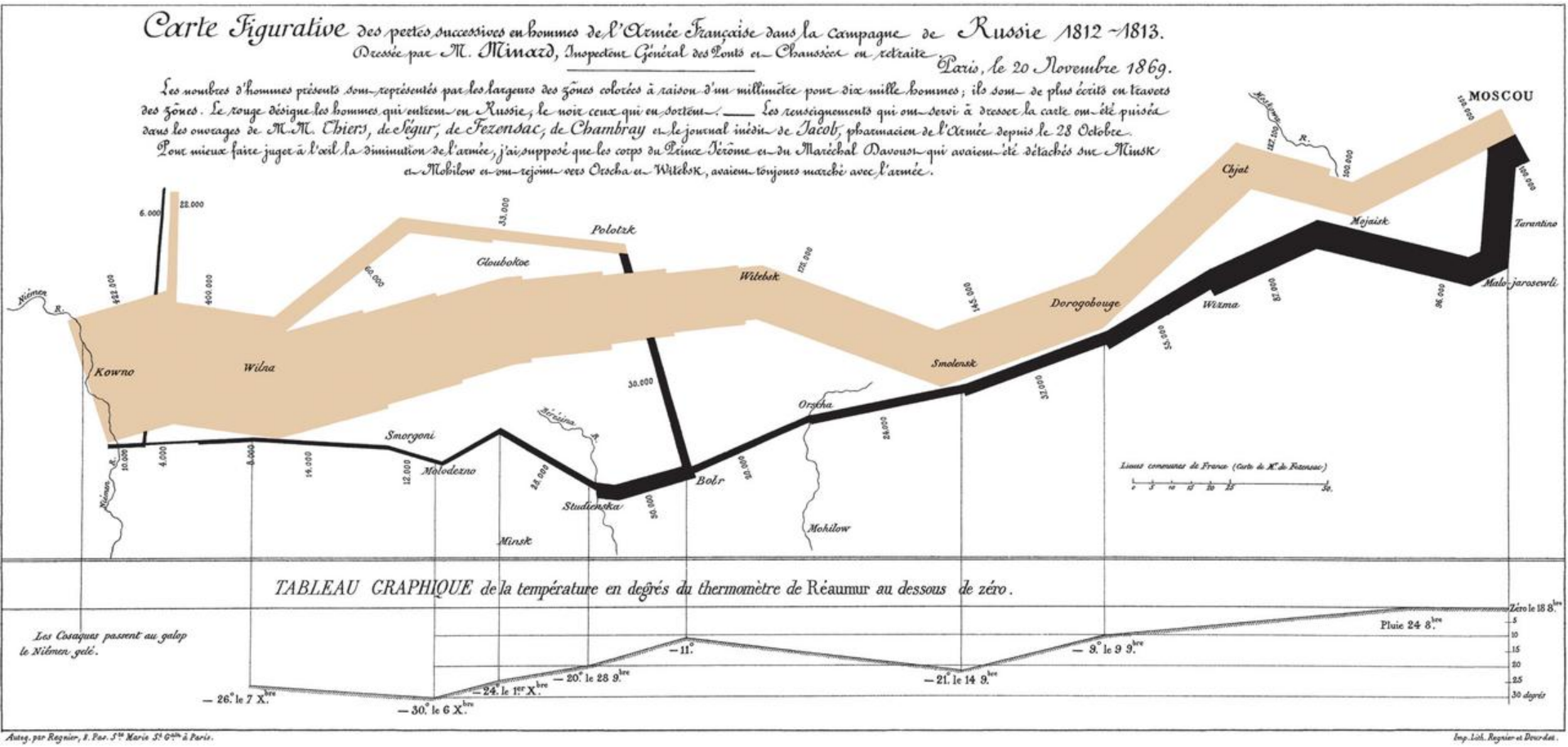
Hvala!

Graduate Courses

Why oh why?

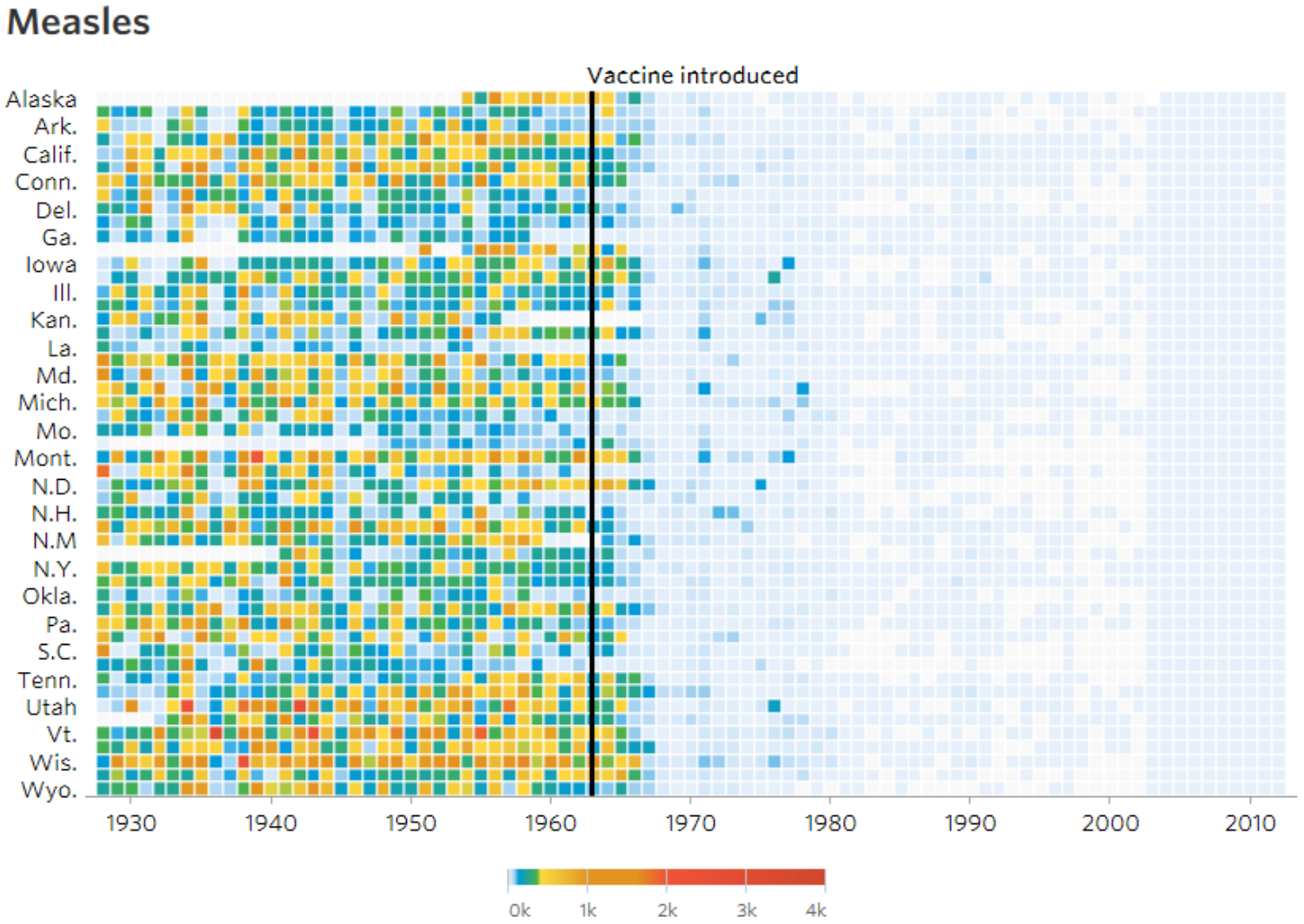
- Two features catched my eye:
  - data cleaning tools (namely **dplyr** package)
  - data visualization tools (namely **ggplot** package)
- And I wasn't in the industry any more… more free time!
- I decided to learn R.

Minard's map



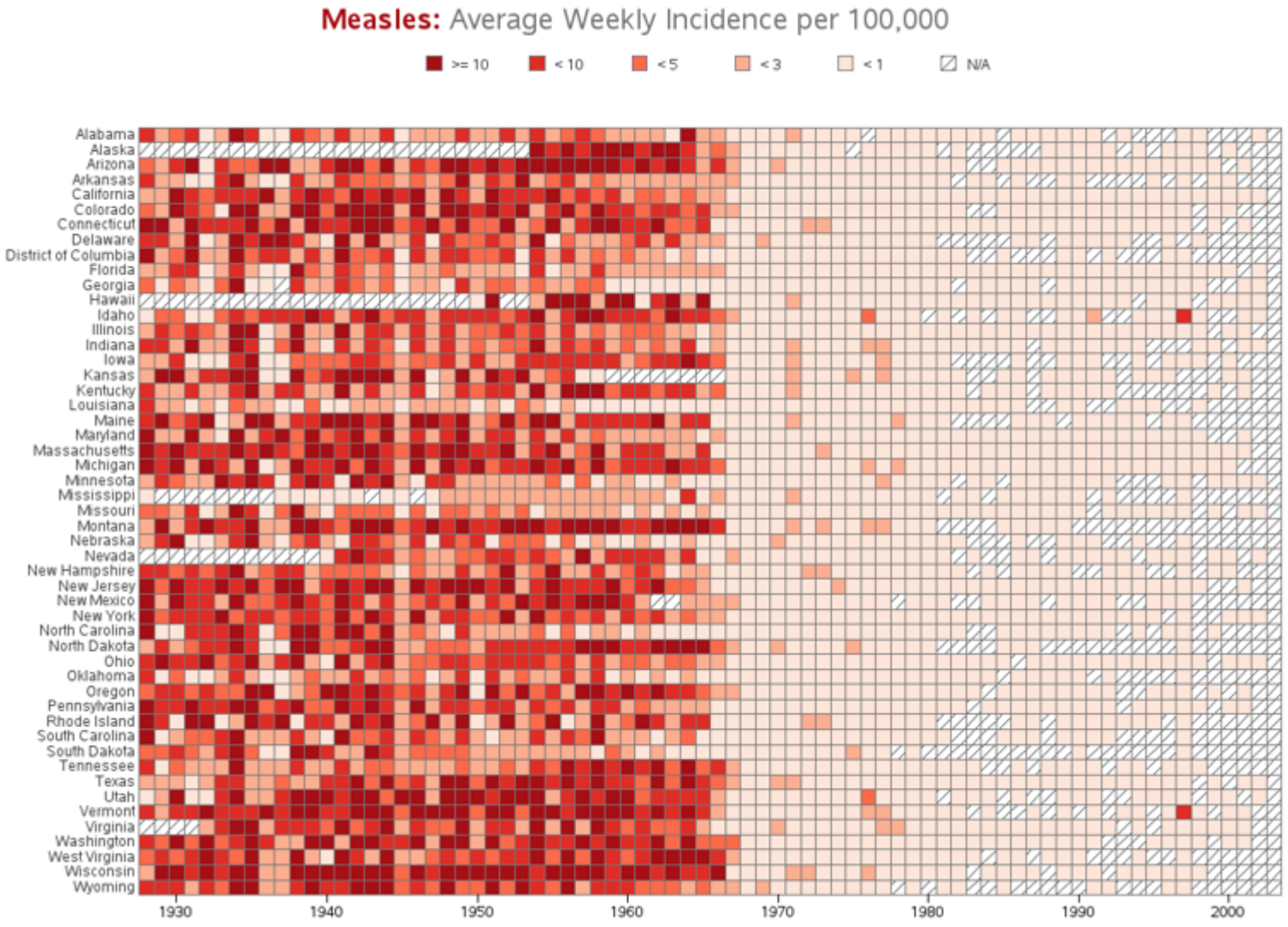
By Charles Minard (1781-1870) - see upload log, Public Domain, https://commons.wikimedia.org/w/index.php?curid=297925.

Other visualizations?



graphics.wsj.com/infectious-diseases-and-vaccines/

Improved visualizations?



https://blogs.sas.com/content/sastraining/2015/02/17/how-to-make-infectious-diseases-look-better/

Hello R!

- I learnt a lot from :
  - edX (courses tought by prof. Rafael Irizarry, Harvard University) and
  - Coursera (courses tought by prof. Rodger Peng, John Hopkins University).
- Then, I searched for tutorials, books, blogs, forums, and various online resources.
- Last, but not least I coded.

R book (for learning R)

R Programming for Data Science

Roger D. Peng

This book brings the fundamentals of R programming to you, using the same material developed as part of the industry-leading Johns Hopkins Data Science Specialization. The skills taught in this book will lay the foundation for you to begin your journey learning data science. Printed copies of this book are available through Lulu.

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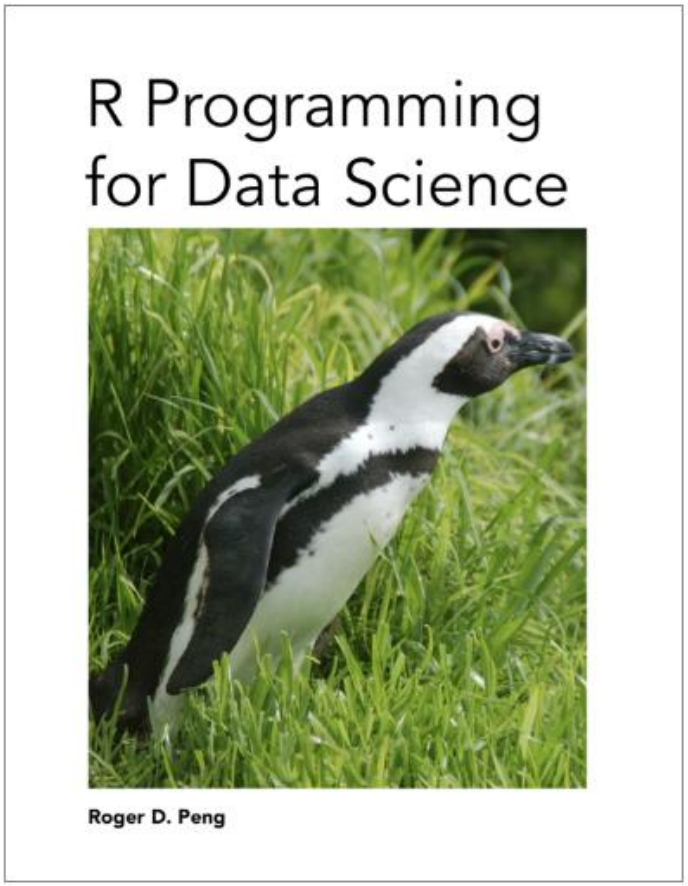

LAST UPDATED ON 2016-12-22

- Peng R. D. R programming for data science, Leanpub book, 2014-2016.
- https://leanpub.com/rprogramming.

R book (for understanding R)

Data Analysis for the Life Sciences

Rafael A Irizarry and Michael I Love

Data analysis is now part of practically every research project in the life sciences. In this book we use data and computer code to teach the necessary statistical concepts and programming skills to become a data analyst. Instead of showing theory first and then applying it to toy examples, we start with actual applications and describe the...

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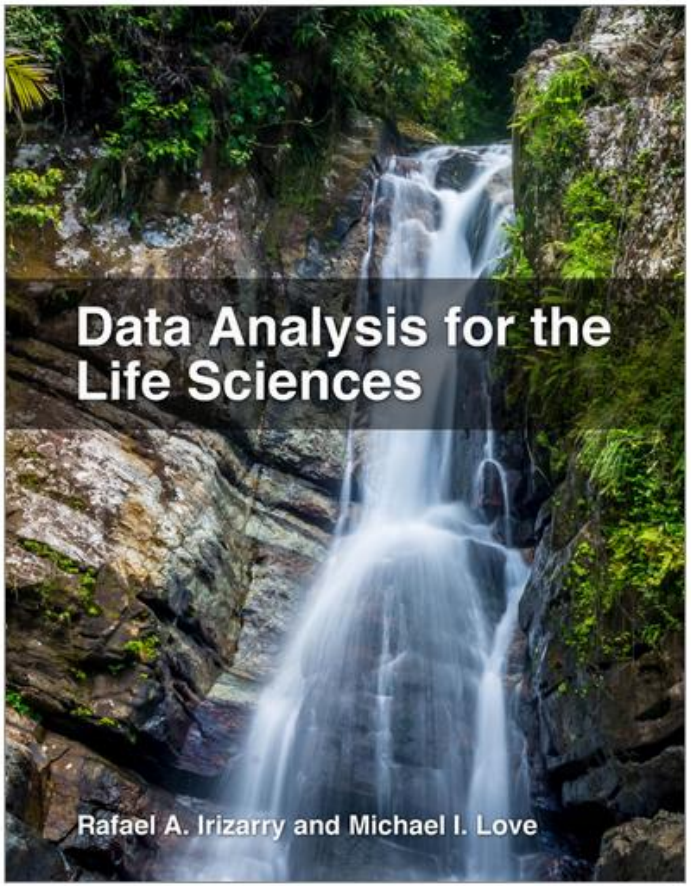


This book is 100% complete

COMPLETED ON 2015-09-23

- Irizarry R. and Love M. I. Data analysis for the life sciences, Leanpub book, 2015.
- https://leanpub.com/dataanalysisforthelifesciences.

Meanwhile…

- I heated R, I loved R, I was overwhelmed with R, I missed R, I missed Matlab, I wanted to do something else, ...
- In the end, I learnt it.
- Exhausted, but happy, I wanted to share my enthusiasm with students.
- And collegues, cosins, neightbours, others.


Then, I decided to propose course on R!

R at the ETF

- I proposed new electoral master course with the aim to teach students to analyze biosignals in R.
- Had to change course title ... Politics ...
- Final title: “Biomedical signal processing techniques” or “Tehnike obrade biomedicinskih signala” in Serbian (yes!, it’s TOBS, but not the baseball one).
- And the course began.

http://www.acme.com/heartmaker/heartmaker.cgi

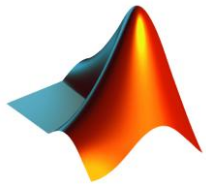
TOBS

- 4 h (2 h of lectures and 2 h of computer coding) a week for 14 weeks students learnt about R.
- Although I prepared all in advance, I had to change course materials, mostly to enhance:
  - automatic reporting (**R markdown** package) and
  - development of web based applications and interactive reporting (**Shiny** and **plotly** packages).

Hard R

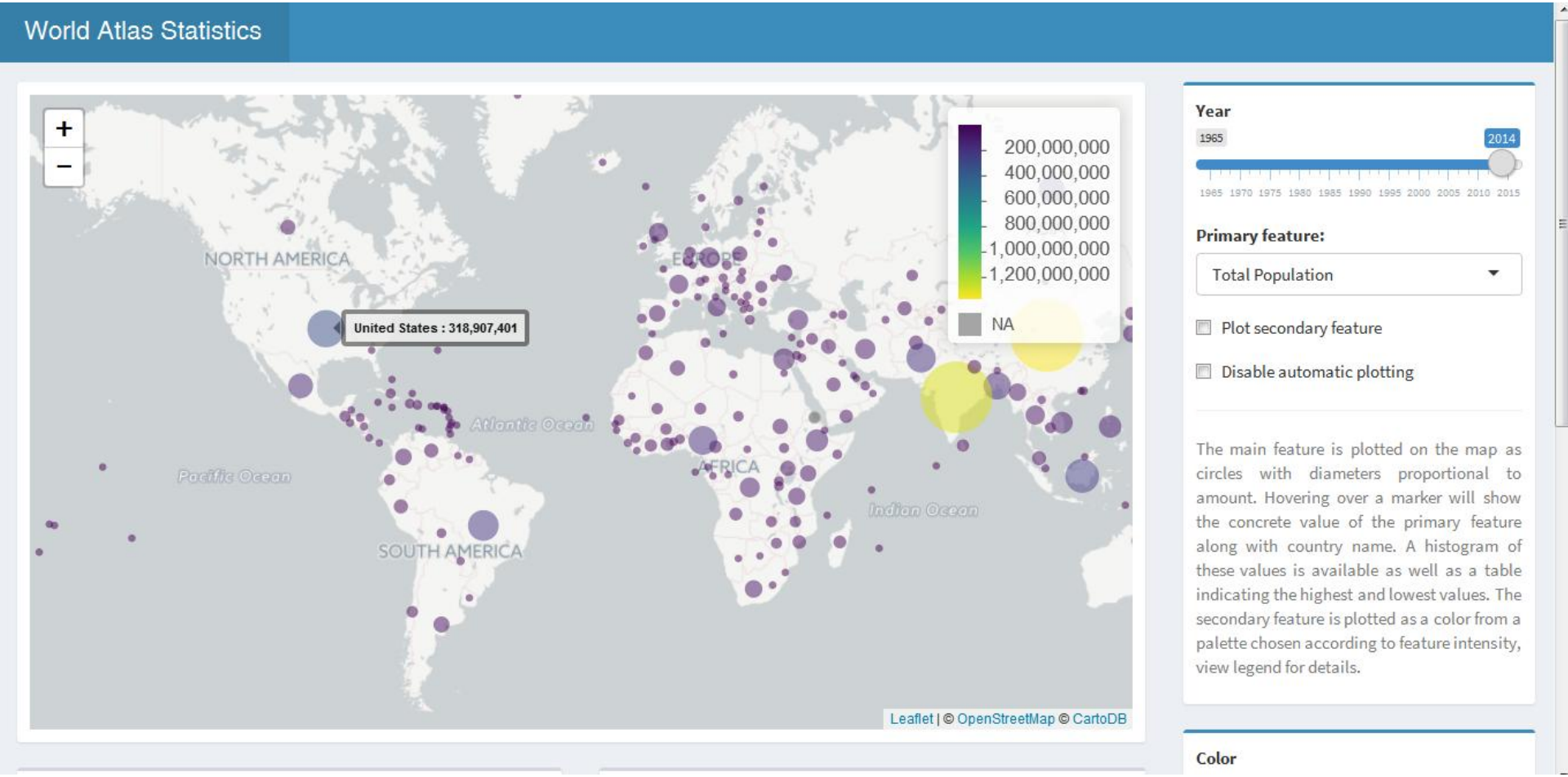
- The first code was simple
- The second code was harder
- The third code looked like this sentence: “Meni tutto mixed up y ahora Я не могу mehr zu tun ...”
- ...
- The same for students!
- But, the 100th code, was different!

Why bother at all?


- Why not stick to Matlab?
  - There are methods for signal analysis and visualization that are not available in Matlab (*vice versa* applies too) or someone has to pay for them.
  - R is free software and there is a large user's community (https://directory.fsf.org/wiki/R)
  - R is relatively simple
  - R has over 12000 packages (14th June, 2018, https://cran.r-project.org/web/packages/index.html)
  - All projects are written in more than one programming language.
  - R is a must in the curriculum at the most prestigious Universities.
  - There is an ongoing debate which programming language to use!
- Who knows more languages knows more! If you ask me…
- For those who know Matlab and learn R (and *vice versa*), I recommend: *R and MATLAB*, Chapman and Hall / CRC, 2015, ISBN 9781466568389.
- Maybe true debate is Matlab *vs*. GNU Octave not R *vs*. Matlab. Right?

Selected TOBS2017 projects 1/3



Jovan Rnjak, 2016/2017, Shiny + Leaflet + plotly + ggplot

Selected TOBS2017 projects 2/3

eegkit paket | Uvod | eegcap | eegica | eegsmooth temporal | eegsmooth spatial | Literatura

Spatial smoothing signal sa jednog kanala

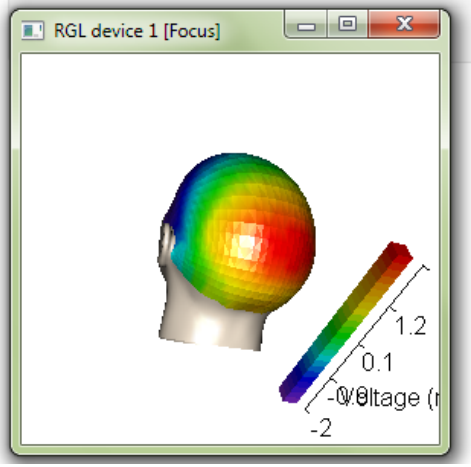
Funkcija eegsmooth može da smooth-uje signale sa jednog ili više kanala u vremenu ili prostoru.

Ovde je prikazana raspodela potencijala u prostoru u određenom vremenskom trenutku. Ova funkcija je odlična za vizuelizaciju EEG podataka na 2D i 3D mapama.

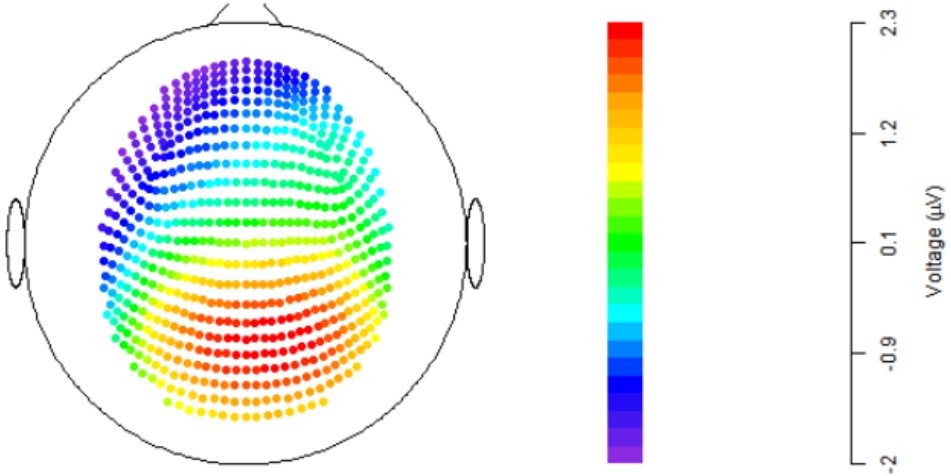
Odaberite željeni trenutak:

0 65 256

0 26 52 78 104 130 156 182 208 234 256

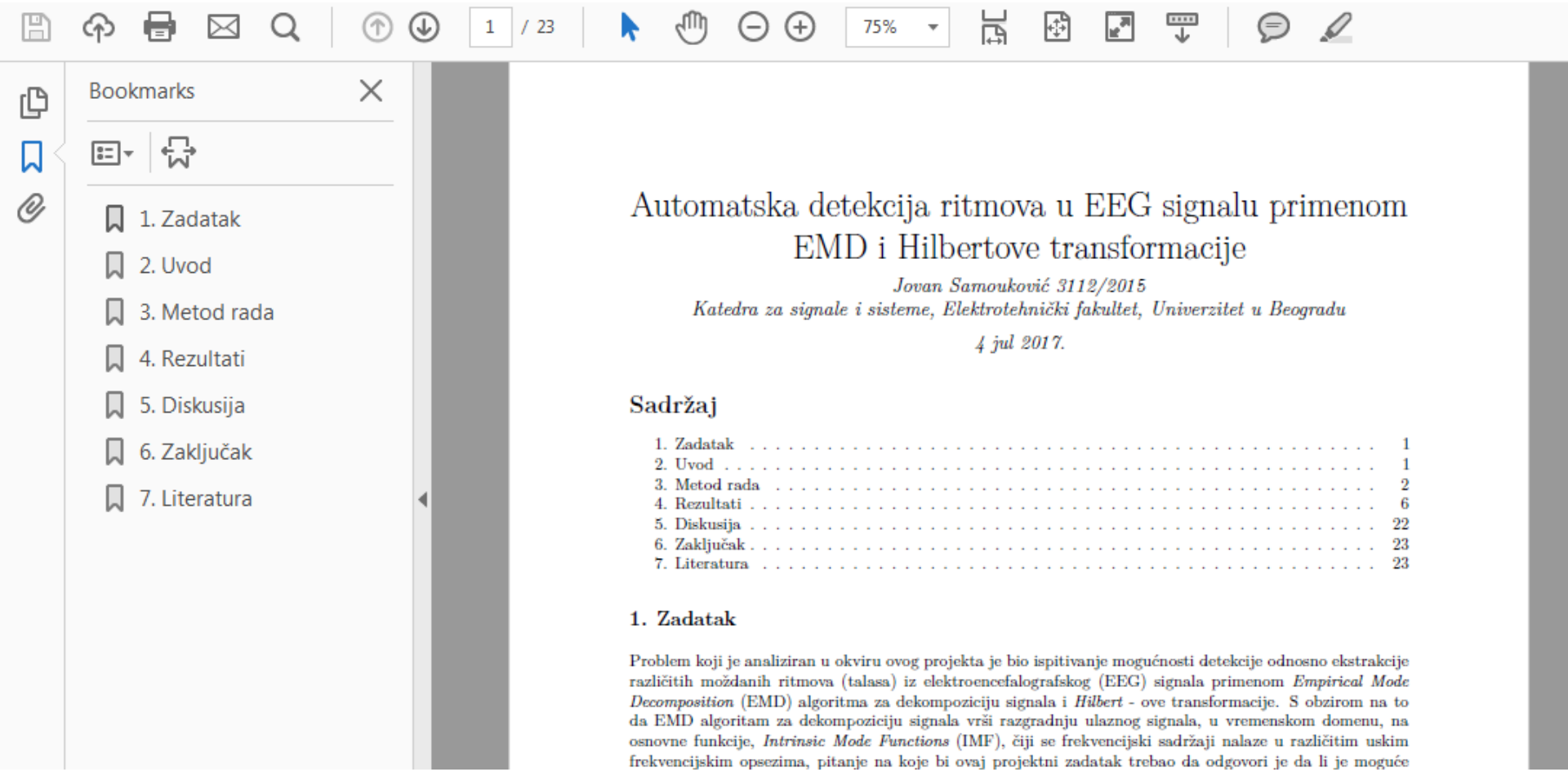


2d mapa u određenom vremeskom trenutku (vreme je izraženo u ms):



Bojana Mihajlović, 2016/2017, Shiny + eegkit + eegkitdata

Selected TOBS2017 projects 3/3



Jovan Samouković, 2016/2017, signal + EMD + markdown

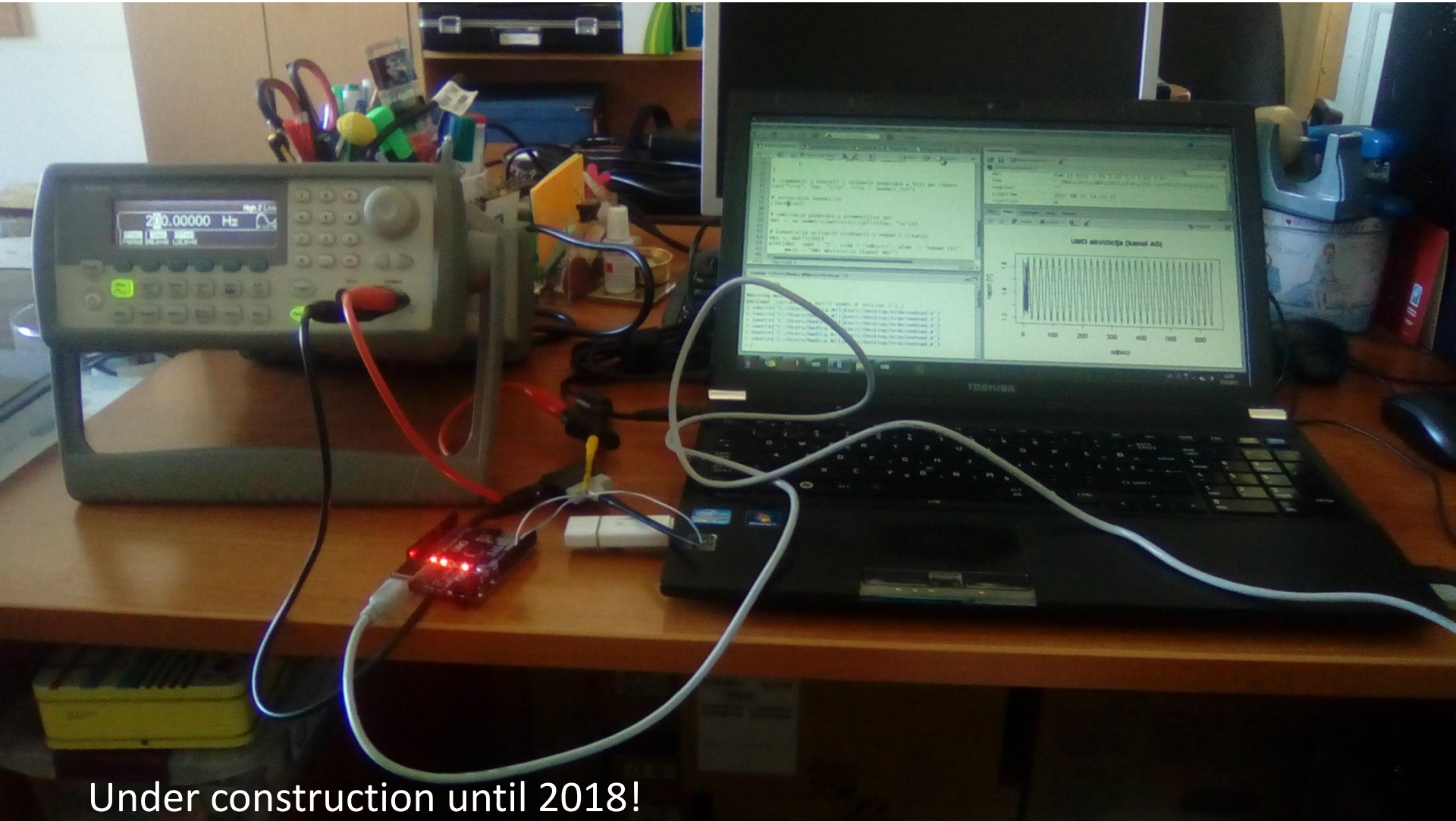
Students about R

- “More course promotion is needed.”
- “ggplot is interesting, but it is so different and hard to learn”
- “This is the most useful master course. Projects were so interesting, and we learnt a lot…”
- “Tell us in advance that the computer practices are obligatory, we have bad habits not to come.”
- “It is hard to choose the project during the semester, since we did not learn all we should.”

Me about students & R

- Very inspiring and motivated environment.
- Hard working students made any assignment (including advanced) easy. Setting limits even higher seems as a good idea.
- We had rich and joyfull discussions, with students heavily involved, about Bioethics and Data Ethics. I would like to spend more time on that.
- They liked examples of practical implementation.
- More ggplot definately!

Scientific research and R



Under construction until 2018!

Until May 2018 (ZINC Conference)

Two simple capacitance sensing solutions: Microcontroller-based measurements

Nadica Miljković and Milan Bjelica
University of Belgrade – School of Electrical Enigneering

Introduction

The main goals of the presented study are:

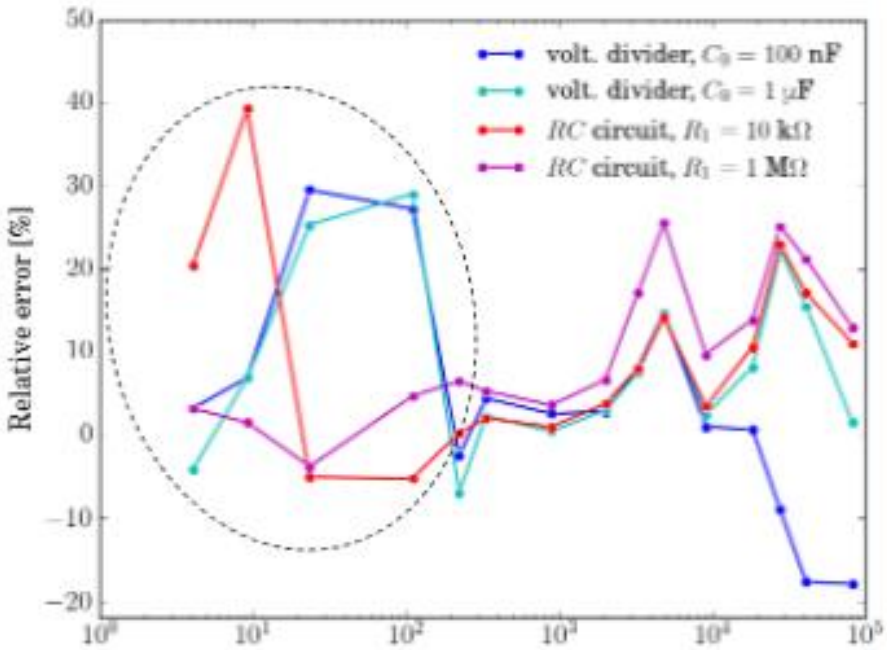
1. To design & test two systems for capacitance measurements that are: a) simple and low-cost and b) based on application of microcontrollers, open software, open hardware, and free software.
2. For undergraduate courses in electrical measurements and biomedical engineering.
3. To discuss application for healthcare solutions.

http://www.ti.com/tool/MSP-EXP430G2#1

Electronicians Co., https://www.aliexpress.com/

Results & Discussion

Relative errors from both methods (voltage divider and RC method) are presented in figure below (ceramic capacitors are presented within the dashed circle):



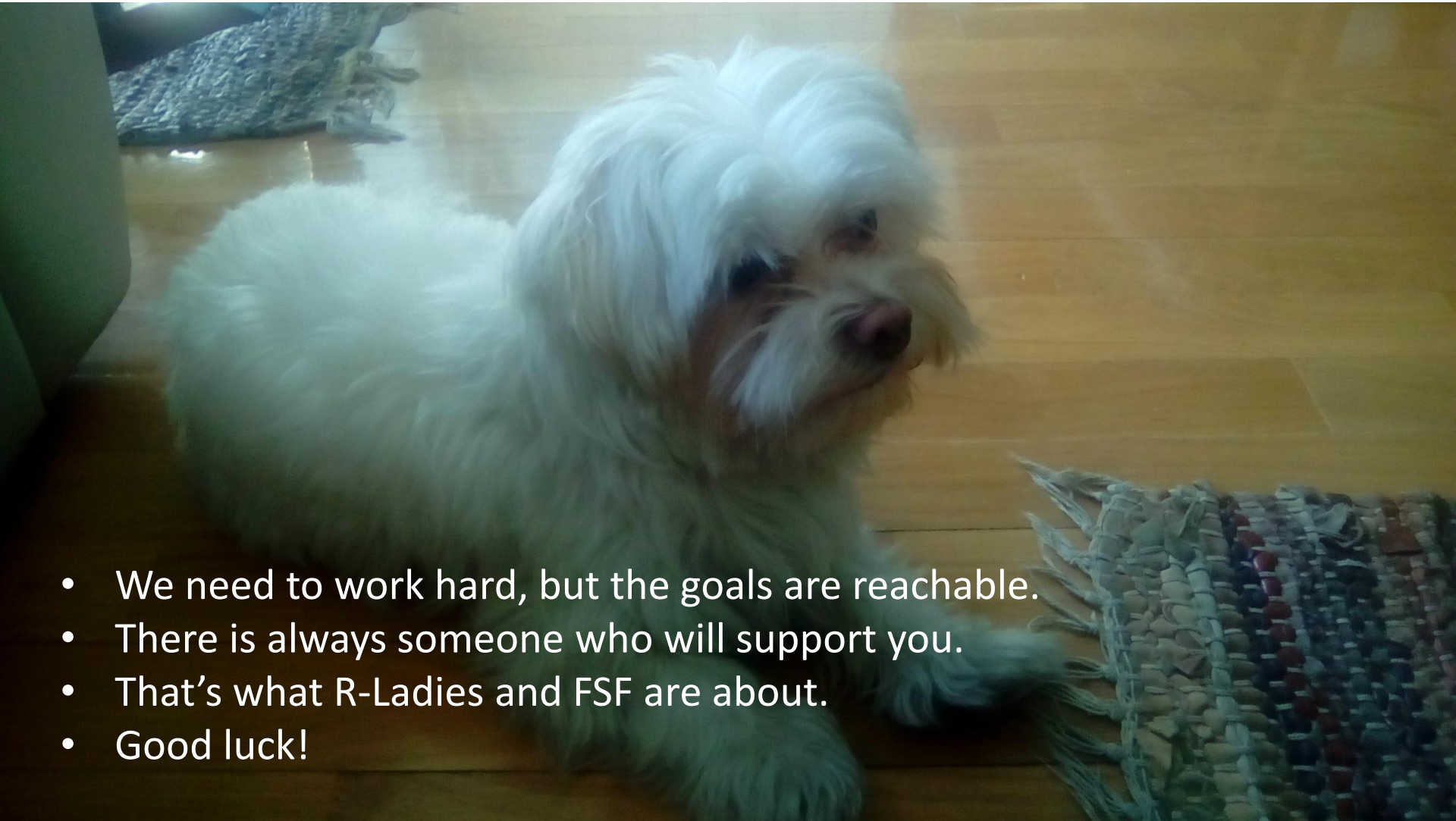
Or June 2018 (Belbi Conference)

Motor Imagery Classification using H2O Machine Learning Platform

NATALIJA KATIĆ, DR NADICA MILJKOVIĆ,
DR ALEKSANDRA MARJANOVIĆ

FACULTY OF ELECTRICAL ENGINEERING
UNIVERSITY OF BELGRADE
BELGRADE, SERBIA

Take-home messages



- We need to work hard, but the goals are reachable.
- There is always someone who will support you.
- That’s what R-Ladies and FSF are about.
- Good luck!

PH.D. NADICA MILJKOVIĆ » R-LADIES COMPLETE LIST

- Go back to directory.
- Add to Address Book.

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BIOGRAPHICAL INFO

- **Interests**: biomedical engineering, biosignal analysis, data visualization, free software.

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SOCIAL ACCOUNTS BY CHAPTER

- @RLADIESGLOBAL -

Assist. Prof. Nadica Miljković

Slides will be available at: https://bit.ly/2Mo6VR1
Or shared via @NadicaSm

Nadica Miljković, PhD

Assist. Prof. of Biomedical Engineering

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office 68, Building of Technical Faculties

Nadica Miljković finished Bachelor, Master and PhD studies at the School of Electrical Engineering, University of Belgrade (ETF). Her main research focus is related to Biomedical Engineering. She published papers related to Biomedical Signal Processing and Electrophysiological Signal Acquisition. Her main scientific contribution is multi-array electrode application in both measurement and electrical stimulation, and application of novel assessment methods based on electrophysiological signals analysis. She started to work at ETF at 2008. as Research and Teaching Associate, and since 2015. she works as Assistant Professor.