

& science

# RADIONICA

## Upravljanje otvorenim istraživačkim podacima za istraživače

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3: Institut tehničkih nauka SANU

# RADIONICA?

- Originalno, radionica je nastala sa ciljem uvođenja prakse otvorenih istraživačkih podataka u Republici Srbiji pod okriljem [RDA](#) organizacije (eng. *Research Data Alliance*) i u svom originalnom obliku je održana na [PSSOH](#) (Primena slobodnog softvera i otvorenog hardvera) konferenciji 2019. godine.
  - Više na Zenodo repozitorijumu, Miljković, Nadica, Lazarević B., Ljiljana, Vučkovac, Obrad, & Ševkušić, Milica. (2019, November 25). PSSOH workshop: Open research data practices for researchers. <http://doi.org/10.5281/zenodo.3529463>
- Prilagođenu radionicu smo održali i istraživačima u ITN SANU.
- A danas i u IBISS-u
  - N. Miljković, Otvoreni istraživački podaci
  - O. Vučkovac, Upravljanje istraživačkim podacima
  - M. Ševkušić, Metapodaci za istraživačke podatke

# O meni

- Nadica Miljković
  - Vanredni profesor na ETFu
  - Moja glavna oblast istraživanja je biomedicinsko inženjerstvo ... ali i otvoreni nastavni materijali, rodna ravnopravnost, otvoreni podaci, nauka o podacima ...
  - Imam >12 godina iskustva u Akademiji i >6 godina iskustva u industriji.
- 
- Veoma sam zahvalna Milici Ševkušić, Biljani Kosanović, Ljiljani B. Lazarević, Iris Žeželj, Danki Purić i drugima koji su me uveli u svet otvorene nauke i otvorenih podataka.



# Otvoreni istraživački podaci

Nadica Miljković

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URL: <https://bit.ly/2pvosx0>

# Moje iskustvo sa istraživačkim podacima

- Previše ponavljanja u elektrofiziološkim merenjima. Nedovoljna transparentnost u radu u istoj istraživačkoj instituciji. Nas par je merilo iste signale više puta ...
- Veliki troškovi. Gubitak vremena. Niska interoperabilnost.
- Dodatno, više ispitanika -> bolja analiza.
- Publikovali smo rezultate analize otvorenih istraživačkih podataka:
  - A. Aleksić, N. Miljković, M. B. Popović, *FastICA for extraction of fetal ECG*, Proceedings of the 7<sup>th</sup> International Symposium on Neurocardiology, pp. 87, October 16-17, 2015, Belgrade, Serbia, ISSN: 2069-0169, [PhysioNet](#)
  - N. Katić, N. Miljković, A. Marjanović, *Motor imagery classification using H2O machine learning platform*, Proceedings of the 2<sup>nd</sup> Belgrade Bioinformatics Conference BelBi, pp. 112, June 18-22, 2018, Belgrade, Serbia, ISSN: 2334-6590, doi (poster): [10.13140/RG.2.2.36530.50888](#), [PhysioNet](#)
  - M. S. Isaković, N. Miljković, M. B. Popović, *Classifying sEMG-based hand movements by means of principal component analysis*, Telfor Journal, vol. 7, no. 1, pp. 26-30, 2015, doi: [10.5937/telfor1501026I](#), [NinaPro](#)

# Moje iskustvo ...

- U nastavi na ETF-u koristim otvorene podatke:
  - [Metode analize elektrofizioloških signala](#) na akademskim osnovnim studijama
    - Uglavnom koristimo PhysioNet bazu (<https://physionet.org/>)
  - [Tehnike obrade biomedicinskih signala](#) na akademskim master studijama
- Na nekim predmetima smo otvorili podatke, ali ne na odgovarajući način
  - Na primer:  
[http://automatika.etf.rs/images/FAJLOVI\\_srpski/predmeti/izborni\\_kursevi\\_os/biomedicinsko\\_inzenjerstvo/TOBS/predavanja/50.txt](http://automatika.etf.rs/images/FAJLOVI_srpski/predmeti/izborni_kursevi_os/biomedicinsko_inzenjerstvo/TOBS/predavanja/50.txt) i  
[http://automatika.etf.rs/images/FAJLOVI\\_srpski/predmeti/izborni\\_kursevi\\_os/biomedicinsko\\_inzenjerstvo/TOBS/predavanja/EMG.txt](http://automatika.etf.rs/images/FAJLOVI_srpski/predmeti/izborni_kursevi_os/biomedicinsko_inzenjerstvo/TOBS/predavanja/EMG.txt).
- Onda smo nedavno podelili podatke za jedan rad u časopisu kao *supplementary material*. Koja greška!
  - N. B. Popović, N. Miljković, M. B. Popović, *Simple gastric motility assessment method with a single-channel electrogastrogram*, Biomedical Engineering / Biomedizinsche Technik, vol. 64, no. 2, pp. 177-185, April 2019, doi: [10.1515/bmt-2017-0218](https://doi.org/10.1515/bmt-2017-0218). Epub 2018.



# Kako smo korigovali grešku?

- Otvaranjem na odgovarajući način
- U repozitorijumu
- Sa odgovarajućim metapodacima, DOI-jem i licencom
- I sa GNU Octave kodom
- Kako citirati naše podatke?
  - Popović, N.B., Miljković, N. and Popović, M.B., 2020. Three-channel surface electrogastrogram (EGG) dataset recorded during fasting and post-prandial states in 20 healthy individuals [Data set]. *Zenodo*, doi: [10.5281/zenodo.3730617](https://doi.org/10.5281/zenodo.3730617).

June 5, 2020

Dataset Open Access

## Three-channel surface electrogastrogram (EGG) dataset recorded during fasting and post-prandial states in 20 healthy individuals

 Popović B., Nenad;  Miljković, Nadica; Popović B., Mirjana

This repository contains Electrogastrography signals termed Electrogastrograms (EGG) recorded with surface Ag/AgCl electrodes placed over stomach and pre-processed in 20 healthy individuals (8 Females and 12 Males). The method for EGG recording and pre-processing together with subjects' data can be found in [Popović et al. 2019](#).

For each subject, EGG was recorded from three locations before (fasting state) and after (postprandial state) a commercial oat meal (274 kcal). Two 20 minutes recordings (files) are obtained for each subject - fasting and postprandial.

Naming convention for files: **subjects ID \_ type of recording (fasting / postprandial)**.

192

 views

14

 downloads

[See more details...](#)

Indexed in

**OpenAIRE**

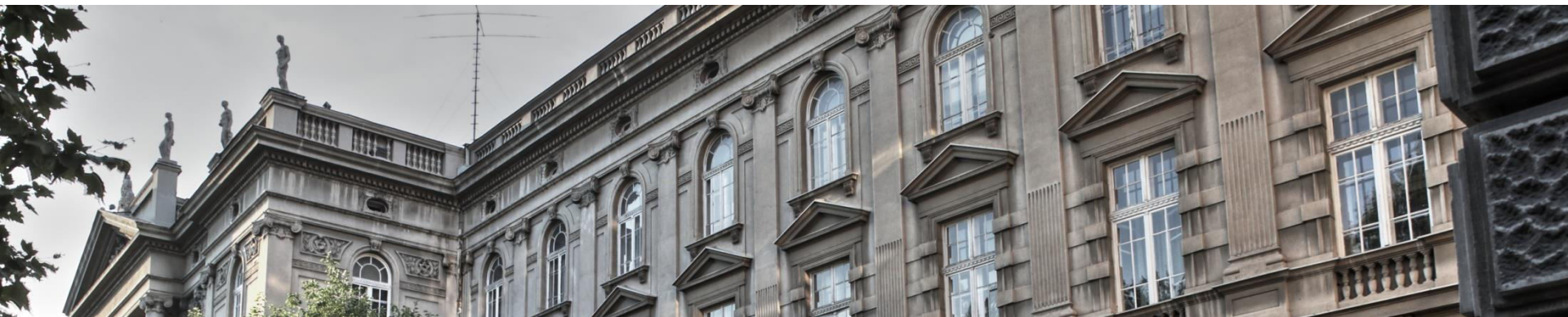
# Jesam li ja delila materijale?

- Otvoren elektronski udžbenik i zbirka zadataka
- Otvoreni materijali za predmete ([TOBS](#) posebno)
- Projektnu prijavu, MamoStat, [https://zenodo.org/record/3246564#.XvzrcOdS\\_IW](https://zenodo.org/record/3246564#.XvzrcOdS_IW)
- Signale, prezentacije, radove i kodove za predavanja po pozivu:
  - N. Miljković, *Digital biosignal processing with R*, satRday Conference in Belgrade, R Consortium, Belgrade, Serbia, October 27, 2018, [CD-ROM, Online], <https://github.com/NadicaSm/satRday-Belgrade-2018> Assessed November 13, 2018, and <https://belgrade2018.satrdays.org/>, Assessed on June 2019.
  - N. Miljković, *Otvoreni nastavni materijali: Interna iskustva* (in English: "Open educational resources: In-house experiences"), *Primena slobodnog softvera i otvorenog hardvera PSSOH*, pp. 16-19, October 13, 2018, Belgrade, Serbia, University of Belgrade - School of Electrical Engineering and Academic Mind, ISBN: 978-86-7466-748-4, doi: [10.5281/zenodo.1468045](https://zenodo.org/record/1468045), <https://github.com/pssoh/Electronic-textbooks-at-ETF-2018>.
- Kodove i kurseve:
  - Post-conference PSSOH course titled *R for Data Science*, <https://github.com/pssoh/R-for-Data-Science-PSSOH-2018>, 2018. (isti kurs je održan i za kolegice i kolege sa Filozofskog fakulteta Univerziteta u Beogradu 2019. godine).
  - *Arduino* workshop organized by EESTEC LC Belgrade, 2018, <https://github.com/NadicaSm/Arduino-workshop-EESTEC-Belgrade>.



# Da li mi je neko ukrao materijale?

- Ne da ja znam.
- U većini slučajeva sam otvarala da me ne bi pokrali.
- Važno napomenuti:
  - Ne treba sve otvarati.
  - Ne treba sve otvarati odjednom.
  - Otvorenost nije binarna osobina podataka. Postoje npr. 50% otvoreni podaci.
- Primer otvorenih podataka ->



Branch: master ▾

New pull request

Find file

Clone or download ▾



NadicaSm Merge pull request #1 from NadicaSm/add-license ...

Latest commit 6c936df on Oct 28, 2018

EMGpectoralis.txt	Add files via upload	15 months ago
LICENSE	Create LICENSE	15 months ago
NMiljkovicAbstractSatRday2018.pdf	Add files via upload	15 months ago
NMiljkovicPresentationSatRday2018.pdf	Add files via upload	15 months ago
README.md	Update README.md	15 months ago
codeSatRday2018NMiljkovic.R	Add files via upload	15 months ago

README.md

## satRday-Belgrade-2018

Code, slides, abstract and raw data for invited talk presented at the satRday Conference in Belgrade on October 27, 2018 (<https://belgrade2018.satrdays.org/>). File EMGpectoralis.txt contains raw sample data recorded for educational purposes at the [University of Belgrade - School of Electrical Engineering](#) and used for [TOBS course](#) with topics on biomedical data analysis with R programming. Additionally, EMGpectoralis.txt has header with info on electromyography (EMG) data.

Commits on Oct 28, 2018

Merge pull request #1 from NadicaSm/add-license ...

 NadicaSm committed on Oct 28, 2018

Verified



6c936df



Create LICENSE

 NadicaSm committed on Oct 28, 2018

Verified



260fceb



Add files via upload

 NadicaSm committed on Oct 28, 2018


Verified



6b4ca76



Update README.md

 NadicaSm committed on Oct 28, 2018

Verified



e3ec201



Update README.md

 NadicaSm committed on Oct 28, 2018

Verified



c786820



Add files via upload

 NadicaSm committed on Oct 28, 2018

Verified



5ef7d3b



Update README.md

 NadicaSm committed on Oct 28, 2018

Verified



da02183



Create README.md

 NadicaSm committed on Oct 28, 2018

Verified



0f9319d



DA POČNEMO ...

# Definicija

- Otvoreni istraživački podaci su podaci (informacija) koji nastaju kao rezultat istraživačkog procesa i koji su dostupni svima. (slobodna interpretacija)

## Primeri definicija

- “Open research data refers to the data underpinning scientific research results that has no restrictions on its access, enabling anyone to access it.”
  - Izvor: [https://ec.europa.eu/info/research-and-innovation/strategy/goals-research-and-innovation-policy/open-science/open-science-monitor/facts-and-figures-open-research-data\\_en](https://ec.europa.eu/info/research-and-innovation/strategy/goals-research-and-innovation-policy/open-science/open-science-monitor/facts-and-figures-open-research-data_en)
- “Research data refers to resources which the researcher produces or uses during the research process. It is needed to validate the research and it is meritorious in research if it is published. Open publication of research data is a component area of open science. Data can be stored in Finnish or international repositories. The degree of publicity can be regulated by different licenses (e.g. Creative Commons, CC).”
  - [https://uva.libguides.com/open\\_access/open\\_research\\_data](https://uva.libguides.com/open_access/open_research_data)

# Tipovi podataka

- Pored otvorenih i zatvorenih, podaci mogu biti primarni i sekundarni, <https://www.statisticshowto.datasciencecentral.com/primary-data-secondary/>
  - Primarni podaci su podaci koji su prikupljeni “iz prve ruke” korišćenjem naučnih metoda (upitnici, eksperimenti, merenja, intervjui) sa jasnim projektnim ciljem.
    - Posebna kategorija primarnih su sirovi (eng. *raw*) podaci – nekad i ista kategorija, [https://en.wikipedia.org/wiki/Raw\\_data](https://en.wikipedia.org/wiki/Raw_data)
  - Sekundarni podaci su podaci koji su prikupljeni iz studija koje su izveli drugi istraživači i sa drugim ciljem i koji se mogu ponovo koristiti (eng. *reuse*).
- Mogu biti i kvalitativni i kvantitativni. [https://en.wikibooks.org/wiki/Statistics/Different\\_Types\\_of\\_Data/PS](https://en.wikibooks.org/wiki/Statistics/Different_Types_of_Data/PS).
- Podaci mogu biti i delimično otvoreni (slika od <https://twitter.com/HeidiBaya/status/1217822464111267841>).

# Primeri istraživačkih podataka

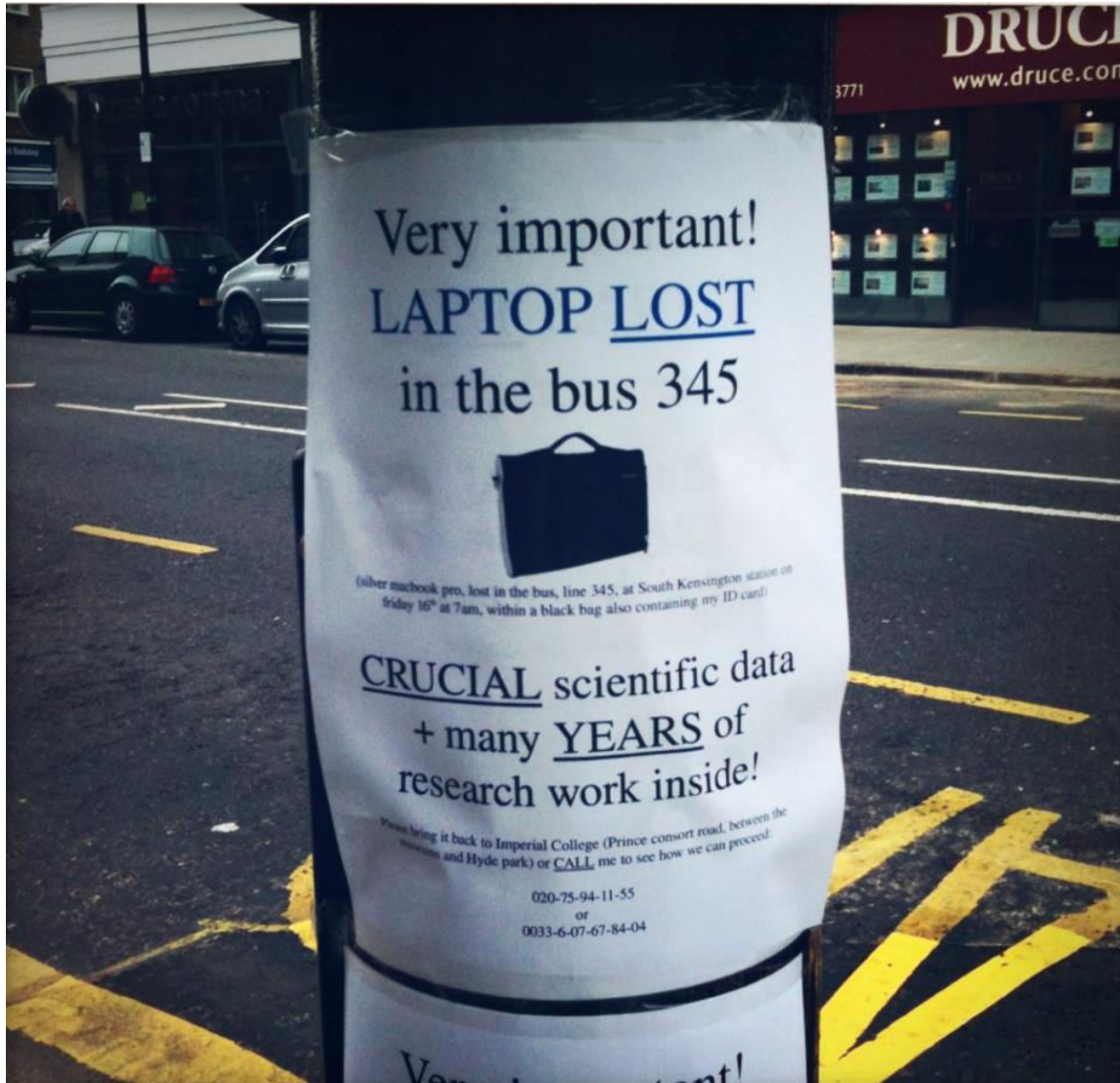
- Istraživački podaci uključuju:
  - rezultate eksperimenata,
  - merenja,
  - analize upitnika,
  - snimke intervjua,
  - fotografije i
  - dr.
- Kada se priča o otvorenim istraživačkim podacima, fokus je na njihovoj dostupnosti u digitalnoj formi, ali i na prpratnim elementima (metode, softver i sl).
  - Izvor: Sarah Jones (iz Digital Curation Centre, University of Glasgow), HORIZON 2020 Open Research Data Pilot “More information on the Open Research Data Pilot in H2020: who should participate and how to comply”, 2014, <https://www.fosteropenscience.eu/content/horizon-2020-open-research-data-pilot>

# Zašto delimo podatke?

- To je uslov za H2020 projekte. Jednostavno rečeno “Public money. Public data.” (po ugledu na kampanju “Public money. Public code.”, <https://publiccode.eu/>)
  - Više na: Sarah Jones (iz Digital Curation Centre, University of Glasgow), HORIZON 2020 Open Research Data Pilot “More information on the Open Research Data Pilot in H2020: who should participate and how to comply”, 2014, <https://www.fosteropenscience.eu/content/horizon-2020-open-research-data-pilot>
- Transparentno istraživanje
- Brži razvoj nauke kroz ponovnu upotrebu postojećih podataka
- Veća citiranost objavljenih istraživanja
- Provera objavljenih rezultata
- Zato što je etički, pogotovu ako se rade studije na životinjama
- Iznenadjujuće, ali istinito: da sačuvamo podatke



# “The personal pain of data loss”



Credit: Dave Hill, CC-BY-NC-SA 2.0 Generic.

<https://www.flickr.com/photos/dmh/650/4031607067/in/gallery-wlef70-72157633022909105/>. Slika takođe u prezentaciji Nielsen, Lars Holm. (2019, April). Zenodo: FAIR data in a generic data repository. Zenodo. <http://doi.org/10.5281/zenodo.2650088>.

# Deljeni podaci -> bolja nauka?

- Članak “How to collaborate more effectively: 5 tips for researchers” od Andrea Aguilar, 28. januar 2020, [https://www.natureindex.com/news-blog/how-to-collaborate-more-effectively-five-tips-for-researchers-science?utm\\_source=snSocial&utm\\_medium=social&utm\\_campaign=springerNatureSocial NatureMasterclassesCollaboration Jan2020&sf229283612=1](https://www.natureindex.com/news-blog/how-to-collaborate-more-effectively-five-tips-for-researchers-science?utm_source=snSocial&utm_medium=social&utm_campaign=springerNatureSocial%20NatureMasterclassesCollaboration%20Jan2020&sf229283612=1).
- Saveti:
  1. Strateško upravljanje vremenom (obećavajte koliko možete da ispunite i manje)
  2. Stavite dogovor(e) “na papir”
  3. Delite i uspehe i neuspehe (posebno važno “If you think you are over-communicating, you’re not.”)
  4. Vaš fokus treba da bude na sve istraživačke rezultate, ne samo na radove (Podaci? Sajt? Igre tj. aplikacije? Društvene mreže?)
  5. Budite timski igrači (dozvolite sebi da prihvatite nove ideje)
- Efektivnija saradnja kroz strateško deljenje podataka?

NISU SVI DELJENI PODACI ISTI

# FAIR podaci

- FAIR je skraćenica koja označava **Findable** (mogućnost pronalaženja), **Accessible** (dostupnost), **Interoperable** (interoperabilnost) i **Reusable** (ponovna upotrebljivost) podataka.
- U okviru radionice pod nazivom “Jointly Designing a Data Fairport” koja se održala u Lajdenu u Holandiji u 2014. godini definisani su FAIR principi koji važe i za ljude i za mašine. Tada je osnovana i FAIR radna grupa.
  - Ovoj radionici su prisustvovali i predstavnici akademije i industrije.
  - Radionica je organizovana jer postoji zajednički interes da se iskoristi maksimalno trud i sredstva koja ulažemo u istraživanja.



# PID je važan za FAIR podatke

- PID (eng. *Persistent Identifier*) je trajna referenca na dokument, fajl, internet stranicu ili druge objekte ([https://en.wikipedia.org/wiki/Persistent\\_identifier](https://en.wikipedia.org/wiki/Persistent_identifier)).
- “Truo” link ([https://en.wikipedia.org/wiki/Link\\_rot](https://en.wikipedia.org/wiki/Link_rot)) ili sahranjen link na internetu
  - Postoje studije koje su se bavile prebrojavanjem internet grobova tzv. “404” HTTP poruke greške ([https://en.wikipedia.org/wiki/HTTP\\_404](https://en.wikipedia.org/wiki/HTTP_404)). Podaci se kreću od ~25% do ~50%.



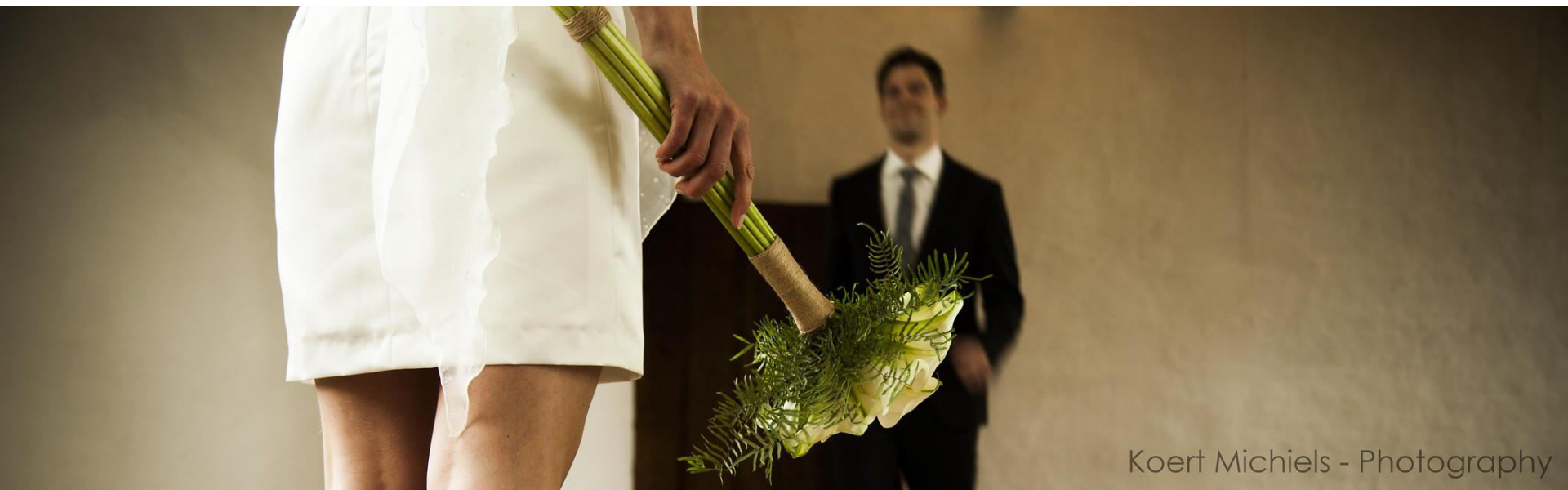
# A, da ih ipak ne podelimo?

- Nemamo vremena
- Nema nagrade
- Ako želimo da iskoristimo rezultate u komercijalne svrhe ili u okviru industrije
- Ako na taj način ugrožavamo poverljivost ili bezbednost
- Ako naše deljenje nije u skladu sa GDPRom (eng. *General Data Protection Regulation*, [https://en.wikipedia.org/wiki/General\\_Data\\_Protection\\_Regulation](https://en.wikipedia.org/wiki/General_Data_Protection_Regulation))
- Nekada samo privremeno ne želimo da delimo



# Šta kaže na to H2020 manual?

- Kompromis je “as open as possible, as closed as necessary”
  - [https://ec.europa.eu/research/participants/data/ref/h2020/grants\\_manual/hi/oa\\_pilot/h2020-hi-oa-data-mgt\\_en.pdf](https://ec.europa.eu/research/participants/data/ref/h2020/grants_manual/hi/oa_pilot/h2020-hi-oa-data-mgt_en.pdf)



Koert Michiels - Photography

# Moć podataka

- Postoje mnoga interdisciplinarna istraživanja koja ranije nisu bila moguća.
- Primer: Više noćnih poziva korišćenjem mobilnih telefona će uzrokovati veći broj HIV pozitivnih u određenim područjima Afrike (hvala Draganu Satariću što mi je rekao za ovu studiju)
  - Brdar, Sanja, et al. "Unveiling spatial epidemiology of HIV with mobile phone data." *Scientific reports* 6 (2016): 19342.

## SCIENTIFIC REPORTS



OPEN

### Unveiling Spatial Epidemiology of HIV with Mobile Phone Data

Sanja Brdar<sup>1,\*</sup>, Katarina Gavrić<sup>1,\*</sup>, Dubravko Čulibrk<sup>1,2</sup> & Vladimir Crnojević<sup>1,3</sup>



# DELJENJE I PRONALAZENJE PODATAKA

# Kako se dele istraživački podaci?

- Generalno, u tri koraka (prema Nielsen, Lars Holm. (2019, April). Zenodo: FAIR data in a generic data repository. Zenodo. <http://doi.org/10.5281/zenodo.2650088>)
  - *Upload* / Postaviti na repozitorijum
  - *Describe* / Opisati (uključuje i PID)
  - *Publish* / Objaviti
- Specifično, zavisi od situacije i od repozitorijuma na kom želimo da podelimo podatke.
- Neki postojeći repozitorijumi:
  - Repozitorijumi specifične namene: Genbank (<https://www.ncbi.nlm.nih.gov/genbank/>), Worldwide Protein Data Bank (<https://www.wwpdb.org/>), UniProt (<https://www.uniprot.org/>), Space Physics Data Facility (<https://spdf.gsfc.nasa.gov/>), ...
  - Repozitorijumi opšte namene: Dataverse (<https://dataverse.org/>), FigShare (<https://figshare.com/>), Dryad (<https://datadryad.org/stash>), Mendeley Data (<https://data.mendeley.com/>), Zenodo (<https://zenodo.org/>), DataHub (<https://datahub.io/>), DANS (<https://dans.knaw.nl/en>), ...

# Gde naći podatke?

- › Tip 1: Think about the data you need and why you need them.
- › Tip 2: Select the most appropriate resource.
- › Tip 3: Construct your query strategically.
- › Tip 4: Make the repository work for you.
- › Tip 5: Refine your search.
- › Tip 6: Assess data relevance and fitness -for -use.
- › Tip 7: Save your search and data- source details.
- › Tip 8: Look for data services, not just data.
- › Tip 9: Monitor the latest data.
- › Tip 10: Treat sensitive data responsibly.
- › Tip 11: Give back (cite and share data).

Ili primenom platformi i pretraživača: DataCite (<https://datacite.org/>), Google DatasetSearch (<https://toolbox.google.com/datasetsearch>) i druge.

Article Source: [Eleven quick tips for finding research data](#)

Gregory K, Khalsa SJ, Michener WK, Psomopoulos FE, de Waard A, et al. (2018) Eleven quick tips for finding research data. PLOS Computational Biology 14(4): e1006038.

<https://doi.org/10.1371/journal.pcbi.1006038>

# Google Dataset Search

- Pronaći na Google Dataset pretraživaču (<https://toolbox.google.com/datasetsearch> ) podatke za fetalni EKG koji je sniman neinvazivno na ljudima. Više o ovom alatu na:
  - Castelvecchi, Davide (2018-09-05). "[Google unveils search engine for open data](#)". Nature. **561** (7722): 161–162. [doi:10.1038/d41586-018-06201-x](#). [ISSN 0028-0836](#). [PMID 30206390](#).
- Da li postoje podaci u EDF+ formatu? Koji je to format?
- Da li su neki podaci deljeni kao .zip?

# Google Dataset Search: pretraga

The screenshot shows the Google Dataset Search interface. At the top left is the 'Google Dataset Search' logo. A search bar contains the query 'non-invasive fetal ecg' with a magnifying glass icon on the left and a close 'X' icon on the right. An 'About' link is visible in the top right corner. Below the search bar, it indicates '7 results found'. Three results are listed in a vertical list on the left side of the page. The first result is 'Non-Invasive Fetal ECG Database' from physionet.org, published on Sep 6, 2007. The second result is 'Non-Invasive Fetal ECG Arrhythmia Database' from physionet.org, published on Feb 19, 2019. The third result is 'Fetal ECG Synthetic Database' from datamed.org. On the right side, a detailed view of the 'Non-Invasive Fetal ECG Arrhythmia Database' is shown. It features a blue button labeled 'Explore at physionet.org'. Below this, the 'Unique identifier' is provided as a DOI link: <https://doi.org/10.13026/C2CT0S>. The 'Dataset published' date is Feb 19, 2019. The 'Authors' section lists Joachim Behar. The 'License' section specifies 'Open Data Commons Attribution License (ODC-By) v1.0' and notes that the license information was derived automatically. The 'Description' section begins with the text: 'Fetal cardiac arrhythmias are defined as any irregular fetal cardiac rhythm or regular rhythm at a rate outside'.

# Google Dataset Search: format

## Files









Total uncompressed size: 372.6 MB.

### Access the files

- [Download the ZIP file](#) (372.6 MB)
- Access the files using the Google Cloud Storage Browser [here](#). Login with a Google account is required.
- Access the data using Google Cloud "gsutil": `gsutil -m cp -r gs://nifecgdb-1.0.0.physionet.org DESTINATION`
- Download the files using your terminal: `wget -r -N -c -np https://physionet.org/files/nifecgdb/1.0.0/`

[Visualize waveforms](#)

Folder Navigation: <base>

Name		S
 <a href="#">ANNOTATORS</a>		2
 <a href="#">RECORDS</a>		71
 <a href="#">SHA256SUMS.txt</a>		8.7
 <a href="#">ecgca102.edf</a>		2.6

& science

# RADIONICA

## Upravljanje otvorenim istraživačkim podacima za istraživače

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