

# Rick Farouni | Curriculum Vitae

ETH Zurich - Department of Biosystems Science and Engineering (D-BSSE)  
Basel – Switzerland

📞 +41 79 723 9098 • ✉ rfarouni@gmail.com  
🌐 <http://rfarouni.github.io/>

I am an applied statistician and data scientist with expertise in Bayesian statistics, generalized linear mixed models, machine and deep learning, and the bioinformatics analysis of genomics, AAV evolution, and CRISPR editing data.

## Experience

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### Bioinformatics Scientist.....

- **The Swiss Federal Institute of Technology in Zurich (ETH Zurich)** **Basel, Switzerland**  
*Research Lab of Dr. Platt, Department of Biosystems Science and Engineering 10/2020-Present*
  - Statistical consulting, advising, and collaboration with graduate and post-doctoral students.
  - Analysis of transcriptional recording data.
  - Analysis of single nucleus RNA-seq in vivo CRISPR perturbation screens.
  - Development of a sequencing databases mining pipeline to discover uncharacterized Cas1-RT fusion proteins.
  - Design and analysis of base and prime editing CRISPR screens.
  - Statistical modeling of in vivo and invitro CRISPRi screens.
  - Development of target sequence extraction pipeline that matches the sequencing read into a given template and partitions it into specified parts. [https://github.com/plattlab/quantify\\_target\\_sequence](https://github.com/plattlab/quantify_target_sequence) (private repo currently)
  - Analysis and modeling of AAV directed evolution experimental data for gene therapy applications.
  - Analysis of Deep Mutational Scans (DMS) screen data.

### Postdoctoral Researcher.....

- **McGill University-Génomique Québec Innovation Centre** **Quebec, Canada**  
*Research Lab of Dr. Najafabadi, Department of Human Genetics 06/2018-09/2020*
  - Published two first author/coauthor papers and one middle author paper.
  - **PhantomPurgeR**: A probabilistic model for the estimation, and remediation of sample index hopping in multiplexed droplet-based single-cell RNA-seq data.
  - **Transcriptional reprogramming of muscle cells**: A collaboration in which I was responsible for the computational analysis of the data generated by bulk RNA-seq and the single-cell RNA-seq assays.

- Massachusetts General Hospital-Harvard Medical School**

Research Lab of Dr. Pinello, Molecular Pathology Unit

- The Broad Institute of MIT and Harvard (Affiliated Member)

**Massachusetts, USA**

06/2017-05/2018

Published two first author/coauthor papers and three middle author papers.

  - **AmpUMI**: Mathematical derivation of a closed-form analytical solution for determining the collision probabilities of biological molecules in deep amplicon sequencing.
  - **haystack\_bio**: A python pipeline to determine epigenetic variability, cross-cell-type plasticity of chromatin states, and transcription factors (TFs) motifs aimed at providing mechanistic insights into chromatin structure, cellular identity and gene regulation.
  - **Histone Code**: Deep generative modeling (i.e. a Variational Autoencoder ) of chromatin signal data across multiple cell types and histone marks with the goal of learning a latent representation of a continuous histone code. Slides: [https://docs.google.com/presentation/d/1MTAGBvQtS\\_LI17pGrsFeF-PtpEeiB3w15E3J5ELNqck/edit#slide=id.p3](https://docs.google.com/presentation/d/1MTAGBvQtS_LI17pGrsFeF-PtpEeiB3w15E3J5ELNqck/edit#slide=id.p3)

## Research Intern.....

- Department of Biomedical Informatics Summer Internship Program**

Research Lab of Dr. Ewy Mathè, The Ohio State University

**Ohio, USA**

05/2016-08/2016

Published one first author/coauthor paper.

  - **ALTRE**: An R package and a Shiny app for the analysis of data generated from genome-wide chromatin accessibility assays such as ATAC-seq and DNase-seq with the goal of identifying regulatory elements involved in the cancer epigenetic landscape.

## University Teaching Assistant.....

- The Ohio State University**

Graduate Teaching Associate (Statistics)

**Ohio, USA**

2013-2017

Served as a Teaching Assistant for three courses:

  - Repeated Measures Models
  - Covariance Structure Models
  - Data Analysis in Psychology

## Education

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### Academic Qualifications.....

- PhD in Quantitative Psychology (i.e. Applied Statistics)**

The Ohio State University

**Ohio, USA**

2015-2017

Dissertation Topic: 'Application of Deep Latent Generative Models to the Unsupervised Learning of Chromatin States'
- Master of Science in Mathematical Statistics**

The Ohio State University

**Ohio, USA**

2012-2015
- Master's Degree in Psychometrics**

The Ohio State University

**Ohio, USA**

2012-2014

## Publications

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### Journal Papers (first author/co-author).....

- Lazure, F.<sup>†</sup>, **Farouni, R.<sup>†</sup>**, Sahinyan, K., Blackburn, D.M., Hernández-Corchado, A., Perron, G., Lu, T., Osakwe, A., Ragoussis, J., Crist, C. and Perkins, T.J., Jahani-Asl, A., Najafabadi, H.S., & Soleimani, V.D. (2023). Transcriptional reprogramming of skeletal muscle stem cells by the niche environment. *Nature Communications*, 14(1), 535. Paper available at <https://www.nature.com/articles/s41467-023-36265-x>. Website: [https://csglab.github.io/transcriptional\\_reprogramming\\_muscle\\_cells/](https://csglab.github.io/transcriptional_reprogramming_muscle_cells/).
- **Farouni, R.**, Djambazian, H., Ferri, L. E., Ragoussis, J., & Najafabadi, H. S. (2020). Model-based analysis of sample index hopping reveals its widespread artifacts in multiplexed single-cell RNA-sequencing. *Nature Communications*. Paper available at <https://www.nature.com/articles/s41467-020-16522-z>. Website: <https://csglab.github.io/PhantomPurgeR/>.
- Clement, K.<sup>†</sup>, **Farouni, R.<sup>†</sup>**, Bauer, D. E., & Pinello, L. (2018). Design and analysis of unique molecular identifiers for deep amplicon sequencing. *Bioinformatics*. <https://doi.org/10.1093/bioinformatics/bty264>. Preprint available at <https://www.biorxiv.org/content/biorxiv/early/2018/03/23/288118.full.pdf>
- Pinello, L.<sup>†</sup>, **Farouni, R.<sup>†</sup>**, & Yuan, G-C. (2018). Haystack: systematic analysis of the variation of epigenetic states and cell-type specific regulatory elements. *Bioinformatics*. <https://doi.org/10.1093/bioinformatics/bty031>. Preprint available at <https://doi.org/10.1101/199067>
- Baskin, E.<sup>†</sup>, **Farouni, R.<sup>†</sup>**, & Mathè, E. (2017). ALTRE: workflow for defining ALTERed Regulatory Elements using chromatin accessibility data. *Bioinformatics*. <https://doi.org/10.1093/bioinformatics/btx386>. Preprint available at <http://www.biorxiv.org/content/early/2016/10/14/080564.full.pdf+html>

### Journal Papers (middle author).....

- Belli, O., Karava, K., **Farouni, R.**, & Platt, R. J. (2024). Multimodal mutational scanning with base and prime editing. *Under review*.
- Santinha, A. J., Klingler, E., Kuhn, M., **Farouni, R.**, Lagler, S., Kalamakis, G., Lischetti, U., Jabaudon, D., & Platt, R. J. (2023). Transcriptional linkage analysis with in vivo AAV-Perturb-seq. *Nature*, 622(7982), 367-375. <https://www.nature.com/articles/s41586-023-06570-y>
- Schmidt, F., Zimmermann, J., Tanna, T., **Farouni, R.**, Conway, T., Macpherson, A.J., & Platt, R.J. (2022). Noninvasive assessment of gut function using transcriptional recording sentinel cells. *Science*, 376(6594), p.eabm6038. <https://www.science.org/doi/abs/10.1126/science>.

abm6038

- Anderson-Trocmé, L., **Farouni, R.**, Bourgey, M., Kamatani, Y., Higasa, K., Seo, J., Kim, C., Matsuda, F., & Gravel, S. (2019). Legacy Data Confounds Genomics Studies. ***Molecular Biology and Evolution***. <https://doi.org/10.1093/molbev/msz201>
- Seruggia, D., Oti, M., Tripathi, P., Canver, M. C., LeBlanc, L., Di Giammartino, D. C., Bullen, M.J., Nefzger C.M., Sun, Y.B.Y., **Farouni, R.**, Polo, J.M., Pinello, L., Apostolou, E., Kim J., Orkin, S.H., & Das, P.P. (2019). TAF5L and TAF6L Maintain Self-Renewal of Embryonic Stem Cells via the MYC Regulatory Network. ***Molecular Cell***.
- Clement K., Rees H., Canver, M.C., Gehrke J. M., **Farouni, R.**, Hsu, J.Y., Cole, M., Liu D.R., Joung J.K., Bauer, D.E., & Pinello, L. (2019). CRISPResso2 provides accurate and rapid genome editing sequence analysis. ***Nature Biotechnology***.
- Hsu, J. Y., Fulco, C.P., Cole, M., Canver, M.C., Pellin D., Sher, F, **Farouni, R.**, Clement K., Biasco L., Engreitz, J.M., Lander, E.S., Joung J.K., Bauer, D.E., & Pinello, L. (2018). CRISPR-SURF: Exploratory and interactive software for analyzing CRISPR-based tiling screens. ***Nature Methods***.

#### Consortium Journal Papers (contributor).....

- Grüning, B., Dale, R., Sjödin, A., Rowe, J., Chapman, B. A., Tomkins-Tinch, C. H., The Bioconda Team, & Köster, J.(2018). Bioconda: A sustainable and comprehensive software distribution for the life sciences. ***Nature Methods***. (Bioconda team member contributor, ranked 94 in the consortium author list). .

#### Preprints.....

- **Farouni, R.** (2017). A Contemporary Overview of Probabilistic Latent Variable Models. ***arXiv preprint***. Preprint available at <https://arxiv.org/abs/1706.08137>

#### Dissertation and Thesis.....

- **Farouni, R.** (2017). Application of Deep Latent Generative Models to the Unsupervised Learning of Chromatin States. *PhD Dissertation*. Manuscript available at [https://etd.ohiolink.edu/!etd.send\\_file?accession=osu1492189894812539&disposition=inline](https://etd.ohiolink.edu/!etd.send_file?accession=osu1492189894812539&disposition=inline)
- **Farouni, R.** (2014). Latent Variable Models of Categorical Responses in the Bayesian and Frequentist Frameworks. *Masters Thesis*. Manuscript available at [https://etd.ohiolink.edu/!etd.send\\_file?accession=osu1412374136&disposition=inline](https://etd.ohiolink.edu/!etd.send_file?accession=osu1412374136&disposition=inline)

#### Conference Presentations.....

- **Joint Statistical Meetings** **Seattle**  
*Poster Presentation* **2015**  
**Poster Title:** Across-Subject Predictive Modeling of fMRI BOLD Responses to Faces using a sparse Bayesian Group Factor Analysis Model (available at <https://rfarouni.github.io/assets/posters/jsm2015.pdf>).

## Software Development

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- PhantomPurgeR: The optimal purging of phantom molecules by the robust estimation of the sample index hopping rate in multiplexed droplet-based single-cell RNA-seq data. GitHub Repo: <https://csglab.github.io/PhantomPurgeR/>.
- Haystack: A Python bioinformatics pipeline for the identification of genomic regions of epigenetic variability across different cell-types, cell-type specific cis-regulatory elements, and their associated transcription factors. GitHub Repo: [https://github.com/pinellolab/haystack\\_bio](https://github.com/pinellolab/haystack_bio).
- ALTRE: A Workflow for Identifying ALTered Regulatory Elements using Chromatin Accessibility Data. GitHub Repo: <https://github.com/Mathelab/ALTRE>.

## Awards and Fellowships

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- **Graduate Student Conference Presentation Award**  
*The Ohio State University* 2015
- **The Center for Cognitive and Brain Sciences Summer Graduate Fellowship**  
*The Ohio State University* 2015  
**Project Proposal:** 'Decoding the Pixels of the Face Image from the Voxels of fMRI BOLD Activity Patterns'
- **The Social and Behavioral Sciences Summer Fellowship**  
*The Ohio State University* 2014
- **University Fellowship**  
*The Ohio State University* 2012

## Technical Skill Set

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- **Statistics and Machine Learning**
  - **Scientific Programming Languages:** Proficient in and comfortable transitioning between *R* and *Python* depending on computing goals. Familiar with *Julia*.
  - **Deep Learning Frameworks:** Experienced in using Pytorch, Tensorflow, and Keras.
  - **Probabilistic Programming Languages:** Proficient in Stan, familiar with Edward.
- **Bioinformatics:**
  - **Analysis of sequencing data:** scRNAseq, RNAseq, ChIPseq, ATACseq, Deep Mutational Scans (DMS), CRISPR screens, Alternative Splicing, Amplicon Sequencing, PacBio sequencing.
  - **Workflow development:** Development of custom workflows using R's Bioconductor core package, large database protein mining pipelines. Good knowledge of running bioinformatics analysis pipelines on super-computing clusters.
  - **Established tools:** STAR, Bowtie2, bedtools, samtools, PEAR, Prokka, etc.
- **Web and Software Development Tools:**  $\LaTeX$ , Linux OS, Git, Docker, and Bash. Basic knowledge in website development tools such as HTML, CSS, and Jekyll.

## Personal Details

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- **Country of Current Residence:** Switzerland
- **Countries of Previous Residence:** Canada, USA, Russia, Jordan
- **Languages Spoken:** English, Arabic, Russian, French (B1), Spanish (B1), German (A1)