Aaron M. **Rosenfeld**

Bioinformatics Lead

Stellar-Chance Laboratories, 422 Curie Blvd., Philadelphia, Pennsylvania, 19104

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Skills

Languages	Python, JavaScript/ES6, SQL, Java, C, Bash
Web	Bottle, Flask, React, Vue
Scientific	Biopython, numpy, matplotlib, networkx, pandas, scipy
Other	Git, Docker, AWS

Experience

Human Immunology Core, Perelman School of Medicine, University of Pennsylvania

Philadelphia, Pennsylvania

Bioinformatics Lead

November, 2018 – Present

Tools: Python 2 & 3, Bottle, JavaScript/ES6, Vue, MySQL, numpy, pandas, scipy, Git, Docker

- Developed software and project-specific data analysis methods for human immune repertoire sequencing studies.
- Created easy-to-use tools on a per-project basis to aid investigators in understanding large-scale repertoire data.
- Developed computational methods for quantifying clonal expansion.

Systems Immunology Lab, School of Biomedical Engineering, Drexel University

Philadelphia, Pennsylvania

Bioinformatics Software Engineer

September, 2014 – November, 2018

Tools: Python 2 & 3, Bottle, Flask, JavaScript/ES6, React, MySQL, C, numpy, pandas, scipy, Git, Docker, AWS

- Created ImmuneDB, a Python & MySQL pipeline for identifying V and J genes in rearranged immunoglobulin heavy & light chains, clustering sequences into clones, and generating statistics.
- Developed a dynamic web frontend with React for viewing and analyzing high-throughput sequencing data served with Bottle.
- Maintained test suites, continuous integration systems, and Docker images for lab software.
- Compared and improved existing methods of clonal assignment for rearranged heavy chains in B-cells.
- Investigated B-cell repertoires across various tissues, donors, and diseases.
- Collaborated with physicians and laboratory technicians to determine future experimental designs.

Applied Informatics Group, Drexel University

Philadelphia, Pennsylvania

Research Assistant

March, 2011 – August, 2014

Tools: Java, Python 2, matplotlib, networkx, Git, C

- Developed the “Transport Engine” middleware which uses distributed decision making to dynamically select appropriate transport protocols and persistence algorithms.
- Developed and implemented anti-entropy algorithms to maintain data integrity across lossy, tactical, ad-hoc networks.
- Contributed to research papers as both a lead- and co-author.
- Analytically and experimentally evaluated the performance of gossip algorithms in challenged network conditions.
- Planned, prepared, and participated in military field experiments to test software on military radios.
- Collaborated with the Naval Research Laboratory to develop chat and persistence applications for use on the tactical edge.

Czech Technical University

Prague, Czech Republic

Visiting Scientist

January, 2011 – March, 2011

Tools: Java, Python 2, matplotlib, networkx, Git, C

- Selected for an international research exchange program between Drexel University and Czech Technical University.
- Developed AHOY, a simulation environment for comparing the effectiveness of sensor network deployments.
- Presented AHOY to university students and faculty for feedback and to identify possible collaboration points.

U.S. Naval Research Laboratory

Washington, District of Columbia

Student Researcher

March, 2010 – September, 2010

Tools: Java, Python 2, networkx, Git, C

- Used Naïve Bayesian Classifiers to improve the performance of existing anti-entropy protocols by dynamically adapting to changing network conditions.
- Studied the effects of tactical conditions on data propagation in mobile ad-hoc networks.
- Examined the performance of existing persistence and anti-entropy protocols under varying loads.
- Developed a mathematical model of data propagation in mobile wireless networks.

Institute for Applied Comment and Information Networking — *Camden, New Jersey*

Research Assistant — *September, 2010 – January, 2011*

Student Research Assistant — *April, 2009 – March, 2010*

Tools: Python 2, C++, networkx, Git, sqlite

- Used Naïve Bayesian Classifiers to improve the performance of existing anti-entropy protocols by dynamically adapting to changing network conditions.
- Studied the effects of tactical conditions on data propagation in mobile ad-hoc networks.
- Examined the performance of existing persistence and anti-entropy protocols under varying loads.
- Developed a mathematical model of data propagation in mobile wireless networks.

phillyBurbs.com — *Tullytown, Pennsylvania*

Web Developer — *April, 2008 – March, 2009*

Tools: PHP, MySQL, Typo3, Apache, SVN

- Created mass-mailing, contest, RSS reader, and news editor extensions for the PHP-based Typo3 content management system.
- Setup a new development server with Debian, the Apache web server, MySQL, and PHP (LAMP architecture).
- Maintained a Subversion (SVN) server for the development team and implemented backup solutions.

Education

Drexel University — *Philadelphia, Pennsylvania*

Master of Science, Computer Science — *April, 2014*

- *Thesis*: Dynamic Selection of Network Protocols for Group Communications in Mobile Ad-hoc Networks

Drexel University — *Philadelphia, Pennsylvania*

Bachelor of Science, Computer Science — *August, 2011*

- *Concentrations*: Artificial Intelligence & Operating System

Honors & Awards

Bioinformatics – Reviewer — *2015*

Reviewed paper submissions for the Oxford Bioinformatics journal.

MILCOM – Student Travel Grant — *2015*

Travel grant for a small number of selected student authors.

MILCOM – Reviewer — *2011 – 2014*

Reviewed paper submissions for the premiere military communications conference.

Upsilon Pi Epsilon – President — *2011 – 2012*

International honor society for computing and information disciplines.

Outstanding Senior Design Award — *2011*

For the AHOY sensor network simulator.

Drexel Undergraduate Student Research Award — *2011*

Awarded annually to one undergraduate Computer Science student for outstanding research contributions.

CRA Outstanding Undergraduate Research Award – Honorable Mention — *2010*

For showing outstanding potential in an area of computing research.

Maple Founders' Award — *2010*

Awarded annually to a student who shows potential for teaching or advanced work in computational or computer science.

U.S. Government SECRET Security Clearance — *2010*

Projects

ImmuneDB – A system for the analysis and exploration of high-throughput IGHV sequencing data

Lead Developer – `http://immunedb.com`

ImmuneDB is a Python system for the processing of IGHV sequencing data including V- and J-gene identification, clonal assignment, mutation analysis, and lineage construction. It is implemented as a suite of command line tools, uses MySQL to store all information, and provides a web interface, implemented in React, for visualization.

Transport Engine – A System for Dynamic Transport and Persistence Protocol Selection

Lead Developer – (Closed Source)

The Transport Engine is a Java middleware which allows applications to send information across a possibly disrupted network, while stipulating certain quality of service (QoS) needs. Based on network and data attributes, the Transport Engine dynamically selects combinations of

transport protocols and persistence algorithms to assure the desired level of QoS is achieved, and alleviates the need to select a protocol before deployment.

phpWatch – An open-source web service monitoring system

Lead Developer – `http://phpwatch.net`

phpWatch is a free, open-source, web-based service monitoring system written in PHP. It includes features to query web services in a number of different ways, and can notify specified individuals through various means when a service is determined to be offline or malfunctioning. phpWatch has a rich API, allowing developers to create custom query and notification methods.

AHOY – An Event-Based Simulation Environment for Networked Multi-Agent Systems

Co-developer – `https://github.com/di/ahoy`

AHOY is an event-based simulation environment designed to test networked multi-agent systems. Through user-defined, interchangeable component models, the effectiveness of different combinations of software agents, network configurations, and sensors can be tested in real-world environments. Scenario definitions specify a high-level model of a simulation's attributes, allowing for nondeterministic experiment progression. Real-time execution enables the integration of human interaction with the simulation. The distributed simulation engine provides the ability to run large-scale, complex experiments, reducing the cost of otherwise economically infeasible experiments.

Naïve Bayesian Classifier Taxonomic Webserver – A Job-Queueing System for Taxonomic Classification

Co-developer – `http://nbc.ece.drexel.edu`

The Naïve Bayesian Classifier Taxonomic Webserver provides a publicly available web interface for classifying heterogeneous taxonomic reads. This extended previous work by adding an intelligent job-queuing system, which allowed for parallel computation and prioritization

XOP – The XMPP Overlay Proxy

Co-developer – (Closed Source)

XOP is a serverless, cross-platform, asynchronous group messaging framework written in Java which seeks to enable group communications across tactical edge networks using the XMPP chat protocol. It provides the ability to gateway and bridge traffic between tactical edge and enterprise network environments, extending into mobile, disruption-prone, ad-hoc tactical MANETS and cellular networks.

Publications

1. Vander Heiden, J. A., Marquez, S., Marthandan, N., Bukhari, S. A. C., Busse, C. E., Corrie, B., Hershberg, U., Kleinstein, S. H., Matsen, F. A., Ralph, D. K., Rosenfeld, A. M., Schramm, C. A., Christley, S., and Laserson, U. **AIRR Community Standardized Representations for Annotated Immune Repertoires**. *Frontiers in Immunology* 9 (2018). doi:10.3389/fimmu.2018.02206. https://doi.org/10.3389/fimmu.2018.02206.

2. Rosenfeld, A. M., Meng, W., Luning Prak, E. T., and Hershberg, U. **ImmuneDB, a Novel Tool for the Analysis, Storage, and Dissemination of Immune Repertoire Sequencing Data**. *Frontiers in Immunology* 9 (2018). doi:10.3389/fimmu.2018.02107. https://doi.org/10.3389/fimmu.2018.02107.

3. Miron, M., Kumar, B. V., Meng, W., Granot, T., Carpenter, D. J., Senda, T., Chen, D., Rosenfeld, A. M., et al. **Human Lymph Nodes Maintain TCF-1^{hi} Memory T Cells with High Functional Potential and Clonal Diversity throughout Life**. *The Journal of Immunology*, 2018. doi:10.4049/jimmunol.1800716.

4. Rosenfeld, A. M., Meng, W., Chen, D. Y., Zhang, B., et al. **Computational Evaluation of B-Cell Clone Sizes in Bulk Populations**. *Frontiers in Immunology* 9 (2018). doi:10.3389/fimmu.2018.01472.

5. Rubelt, F., Busse, C. E., Bukhari, S. A. C., Bürckert, J.-P., Mariotti-Ferrandiz, E., Cowell, L. G., Watson, C. T., Marthandan, N., Faison, W. J., Hershberg, U., Laserson, U., Corrie, B. D., Davis, M. M., Peters, B., Lefranc, M.-P., Scott, J. K., Breden, F., The AIRR Community (including Rosenfeld, A. M.), Prak, E. T. L., and Kleinstein, S. H. **Adaptive Immune Receptor Repertoire Community recommendations for sharing immune-repertoire sequencing data**. *Nature Immunology* 18, no. 12 (2017): 1274–1278. doi:10.1038/ni.3873.

6. Meng, W., Zhang, B., Schwartz, G. W., Rosenfeld, A. M., et al. **An atlas of B-cell clonal distribution in the human body**. *Nature Biotechnology* 35, no. 9 (2017): 879–884. doi:10.1038/nbt.3942.

7. Yu-Chang, B. W., Rosenfeld, A. M., Upton, N., Dhariwal, J., et al. **Insight into Rhinovirus-Induced Asthma Exacerbation Using High-Throughput Immunosequencing of B-Cell Repertoires**. *Journal of Allergy and Clinical Immunology* 139, no. 2 (2017): AB80. doi:10.1016/j.jaci.2016.12.213.

8. Rosenfeld, A. M., Meng, W., Prak, E. T. L., and Hershberg, U. **ImmuneDB: a system for the analysis and exploration of high-throughput adaptive immune receptor sequencing data**. *Bioinformatics* 33, no. 2 (2016): 292–293. doi:10.1093/bioinformatics/btw593.

9. Toby, I. T., Levin, M. K., Salinas, E. A., Christley, S., Bhattacharya, S., Breden, F., Buntzman, A., Corrie, B., Fonner, J., Gupta, N. T., Hershberg, U., Marthandan, N., Rosenfeld, A. M., et al. **VDJML: a file format with tools for capturing the results of inferring immune receptor rearrangements**. *BMC Bioinformatics* 17, no. 13 (2016): 333. doi:10.1186/s12859-016-1214-3.

10. Brueffera, C., Antao, T., Cock, P., Talevich, E., Hoon, M. de, Arindrarto, W., Pritchard, L., Sharma, A., Rasche, E., Rosenfeld, A. M., et al. **Biopython Update 2016**. *Bioinformatics Open Source Conference*, 2016.

11. Rosenfeld, A. M., Lass, R. N., Regli, W. C., and Macker, J. P. **Dynamic Selection of Persistence and Transport Layer Protocols in Challenged Networks**. In *MILCOM*. IEEE, 2013. doi:10.1109/milcom.2013.248.

12. Rosenfeld, A. M., Lass, R. N., Ingram, D. S., Regli, W. C., et al. **A comparison of group-based data persistence techniques in MANETs**. In *MILCOM*. IEEE, 2012. doi:10.1109/milcom.2012.6415596.

13. Rosenfeld, A. M., Kusic, D., Kopena, J. B., and Regli, W. C. **A Gossip-based Synchronization Protocol for State Consistency in Distributed Applications**. *MobiHoc Tactical MANET Workshop*, 2011.

14. Rosen, G. L., Reichenberger, E. R., and Rosenfeld, A. M. **NBC: the Naïve Bayes Classification tool webserver for taxonomic classification of metagenomic reads**. *Bioinformatics* 27, no. 1 (2011): 127–129.

15. Rosenfeld, A. M. **Messaging the Web: Implementing an SMS System in PHP**. *php|architect* 7, no. 9 (2008).