

# Ashok Rajaraman

## Experience

- January 2016– **Postdoctoral Research Associate**, *Carnegie Mellon University, School of Computer Science.*
- Designing statistical inference models and algorithms for problems in structural genomics.
  - Developed a convex optimization scheme for improved graphical representations of cancer genomes.
  - Analysing correlations between combinatorial structures in graphical representations of genomes and functional characteristics.
- May 2015– **Postdoctoral Research Associate**, *University of Illinois at Urbana-Champaign, College of Engineering*.
- December 2015
- Developed a convex optimization algorithm for multiresolution reconstruction of ancestral genomes.
- January 2011– **Research Assistant**, *Simon Fraser University, Department of Mathematics.*
- August 2012
- Devised a semidefinite approximation for vertex ordering in hypergraphs.
  - Developed polynomial time and fixed parameter tractable algorithms for generalizations of the consecutive ones property.
  - Implemented models and algorithms for ancestral genome reconstruction and phylogenetics.
  - Used combinatorial techniques to reconstruct the genome of the ancestral Black Death bacterium.

## Published software

- 2016 **MultiRes**, *Inferring ancestral gene orders using extant gene and syntenic orders, with Jian Ma.*  
MultiRes is a heuristic convex optimization method for improved consensus ancestral reconstruction.
- 2015 **DeClone**, *Predicting and sampling ancestral adjacency evolution in reconciled gene trees, with Cédric Chauve, Yann Ponty and João Zannetti.*  
DeClone is an integrated method for sampling solutions to a phylogenetic problem, and for parameter inference.
- 2013 **FPSAC**, *Fast Phylogenetic Scaffolding of Ancient Contigs, with Cédric Chauve and Eric Tannier.*  
FPSAC is a pipeline for scaffolding ancestral genomes using extant genomic data.
- 2012 **ANGES**, *Reconstructing ANcestral GENomeS maps, with Cédric Chauve, Bradley Jones and Eric Tannier.*  
ANGES is a suite of combinatorial and spectral algorithms for ancestral genome reconstruction.

## Skills

**Research expertise**, Convex and combinatorial optimization, statistical inference models, machine learning, graph algorithms, data representation.

**Programming expertise.**

**Highly experienced**

- Python
- C++
- L<sup>A</sup>T<sub>E</sub>X

**Extensively used**

- Shell script
- MATLAB

**Familiar**

- Perl
- R

**Toolkit:** Numpy/Scipy, Scikit-Learn, TensorFlow, Pandas, Matplotlib, Git, SVN, Docker.

## Education

- 2015 **Doctor of Philosophy in Mathematics**, *Simon Fraser University, Burnaby, BC.*  
Supervisor Cédric Chauve  
Thesis title *Variants of the Consecutive Ones Property: Algorithms, Computational Complexity and Applications in Genomics.*
- 2009 **Bachelor of Technology in Metallurgical and Materials Engineering**, *Indian Institute of Technology Roorkee, Roorkee, Uttarakhand, India.*

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## Publications

### Google Scholar profile.

- 2017 **Rajaraman, A.** and Ma, J. Towards recovering allele-specific cancer genome graphs. In S.C. Sahinalp, editor, *Research in Computational Molecular Biology: 21st Annual International Conference, RECOMB 2017, Hong Kong, China, May 3-7, 2017, Proceedings*, pages 224–240. Springer International Publishing, Cham, 2017. ISBN 978-3-319-56970-3.
- 2016 **Rajaraman, A.** and Ma, J. Reconstructing ancestral gene orders with duplications guided by synteny level genome reconstruction. *BMC Bioinformatics*, 17(14):201–212, 2016. ISSN 1471-2105.
- Rajaraman, A.**, Zanetti, J.P.P., Mañuch, J., and Chauve, C. Algorithms and complexity results for genome mapping problems. *IEEE/ACM Transactions on Computational Biology and Bioinformatics*, PP(99):1–1, 2016. ISSN 1545-5963.
- 2015 **Rajaraman, A.**, Chauve, C., and Ponty, Y. Assessing the robustness of parsimonious predictions for gene neighborhoods from reconciled phylogenies. In *Bioinformatics Research and Applications - 11th International Symposium, ISBRA 2015, Norfolk, VA, USA, June 7-10, 2015 Proceedings*, pages 260–271. 2015.
- Neafsey, D.E., Waterhouse, R.M. et al. Highly evolvable malaria vectors: The genomes of 16 anopheles mosquitoes. *Science*, 347(6217), 2015.
- 2013 **Rajaraman, A.**, Tannier, E., and Chauve, C. FPSAC: Fast Phylogenetic Scaffolding of Ancient Contigs. *Bioinformatics*, 29(23):2987–2994, 2013.
- Chauve, C., Patterson, M., and **Rajaraman, A.**. Hypergraph covering problems motivated by genome assembly questions. In *Combinatorial Algorithms - 24th International Workshop, IWOCA 2013, Rouen, France, July 10-12, 2013, Revised Selected Papers*, pages 428–432. 2013.
- 2012 Jones, B.R., **Rajaraman, A.**, Tannier, E., and Chauve, C. ANGES: Reconstructing ANcestral GEnomeS maps. *Bioinformatics*, 28(18):2388–2390, 2012.

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## Invited Talks

- 2015 **PIMS Discrete Mathematics Seminar, Simon Fraser University, Burnaby, British Columbia.**  
Vertex ordering problems for hypergraphs: Connections to the consecutive ones property.
- 2014 **Centre for Systems Genomics, Pennsylvania State University, State College, Pennsylvania.**  
A simple scaffolding pipeline, with application to ancient genomes.
- 2013 **PIMS IGTC in Mathematical Biology Summit, Banff, Alberta.**  
Scaffolding the genome of the Black Death agent.

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## Academic Honours

- Michael Stevenson Graduate Scholarship (2014–2015)
- SFU President’s PhD Scholarship (Spring 2014)
- PIMS International Graduate Training Centre Fellowship in Mathematical Biology (2012–2014)
- Faculty of Science Graduate Fellowship (Summers 2010, 2012–2014)
- Travel and Minor Research Award (Fall 2011, 2012)

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## References

On request.