

Curriculum Vitae

Education

PhD

Deakin University: September 2016 to July 2020

Graduated with a Doctor of Philosophy, with a thesis titled “Understanding sequencing data as compositions”

MD

SUNY Upstate Medical University: August 2011 to May 2016

Graduated with a Medicinae Doctor, with credited research hours in bioinformatics and medical genomics

BS

SUNY New Paltz: August 2009 to May 2011

Graduated *summa cum laude*, obtaining a Bachelor’s Degree in Biology with a concentration in biotechnology

AS

SUNY Orange: January 2007 to May 2009

Graduated *summa cum laude*, obtaining an Associate’s Degree in Science with a concentration in biology

Open source software

R packages which I designed and maintain,

balance | CRAN Balances have become a cornerstone of compositional data analysis. However, conceptualizing balances is difficult, especially for high-dimensional data. Most often, investigators visualize balances with “balance dendrograms”. However, this visualization tool does not scale well for large data. This package provides an alternative scheme for visualizing balances, described in [Quinn (2018)]. This package also provides a method for principal balance analysis.

exprso | CRAN Supervised machine learning has an increasingly important role in data analysis. This package introduces a framework for rapidly building and deploying supervised machine learning in a high-throughput manner. This package provides a user-friendly interface that empowers investigators to execute state-of-the-art binary and multi-class classification, as well as regression, with minimal programming experience necessary.

peakRAM | CRAN When working with big data sets, RAM conservation is critically important. However, it is not always enough to just monitor the size of the objects created. So-called “copy-on-modify” behavior, characteristic of R, means that some expressions or functions may require an unexpectedly large amount of RAM overhead. For example, replacing a single value in a matrix duplicates that matrix in the back-end, making this task require twice as much RAM as that used by the matrix itself. This package makes it easy to monitor the total and peak RAM used so that developers can quickly identify and eliminate RAM hungry code.

propr | CRAN The bioinformatic evaluation of gene co-expression often begins with correlation-based analyses. However, correlation lacks validity when applied to relative data, including count data generated by next-generation sequencing. This package implements several metrics for proportionality, including phi [Lovell et al (2015)] and rho [Erb and Notredame (2016)]. This package also implements several metrics for differential proportionality. Unlike correlation, these measures give the same result for both relative and absolute data.

R packages to which I contributed,

ALDEx2 | Bioconductor This package performs a differential abundance analysis of biological count data using log-ratio transformations.

catmap | CRAN This package conducts a meta-analysis on combined case-control and family-based (TDT) genetic data.

Professional experience

In industry,

Transport Accident Commission: October 2022 to present Employed as a **Data Scientist**.

In research,

Deakin University: March 2021 to October 2022 Employed as an **Alfred Deakin Postdoctoral Fellow** in the Applied Artificial Intelligence Institute (A2I2) lab under Dr. Svetha Venkatesh to study interpretable deep models of RNA splicing.

Deakin University: October 2019 to March 2021 Employed as an **Associate Research Fellow** in the Applied Artificial Intelligence Institute (A2I2) lab under Dr. Svetha Venkatesh to study XAI for health applications. This role involved close collaboration with computer science experts to design and implement neural network architectures that enable the interpretable analysis of high-dimensional genomic data.

Deakin University: January 2018 to August 2019 Employed as a **Casual Research Fellow** in the Pattern Recognition and Data Analysis (PRaDA) lab under Dr. Svetha Venkatesh to study autism spectrum disorder and cancer genomics. This role involved pre-processing genomic data, building and deploying classifiers based on gene expression signatures, and supervising a research assistant.

SUNY Upstate Medical University: August 2012 to May 2016 Employed as a **Student Research Assistant** in the Psychiatric Genetic Epidemiology and Neurobiology (PsychGENe) lab under Dr. Stephen Glatt to study the molecular underpinnings of psychiatric disorders. This role involved the development of bioinformatic tools for the analysis of single nucleotide polymorphisms and microarray-based gene expression data. Extensive time devoted to the implementation machine learning for the classification of autism spectrum disorder.

SUNY New Paltz: September 2009 to August 2010 Employed as a **Student Research Assistant** in an organic chemistry lab under Dr. Frantz Folmer-Andersen to study synthetic diamine macrocycles which have the capability to distinguish between mirror image molecules.

SUNY Purchase: May 2009 to July 2009 Employed as a **Student Research Assistant** in an environmental science lab under Dr. Kristopher Baker to study the impact of anthropogenic input on the biodiversity of the Hudson River estuary.

In education,

Deakin University: March 2017 to May 2019 Employed as a **Graduate Assistant** for two courses titled, *Principles of Pharmacology* (x3) and *Therapeutic Development* (x2).

Coursera: September 2016 to October 2016 Employed as a **Graduate Assistant** for an online course titled, *Big Data, Genes, and Medicine*.

SUNY New Paltz: September 2009 to May 2011 Employed as a **Teaching Assistant** for an undergraduate organic chemistry laboratory class.

SUNY Orange: September 2008 to August 2009 Employed as a **Tutor** in a university math learning center.

Community engagement

NAR Genomics and Bioinformatics: December 2020 to October 2021 Served as associate editor for several deep learning and bioinformatics articles.

ABACBS 2020: October 2020 Reviewed abstracts as part of the ABACBS 2020 Program Committee.

NAR Genomics and Bioinformatics: December 2019 to December 2020 Served as guest editor for special issue on compositional data analysis.

COMBINE 2018: October 2018 Reviewed abstracts as part of the COMBINE 2018 Program Committee.

Geelong Hacky Hour: October 2017 to October 2019 Co-founder of the Geelong Hacky Hour chapter where researchers help other researchers learn to program.

Awards and scholarships

2020 Shortlisted for Alfred Deakin Medal for Doctoral Thesis
2019 People’s Choice Award for Outstanding Talk at Joint GIW/ABACBS 2019
2017 Travel Award to Winter School in Mathematical & Computational Biology
2016 Travel Award to 2nd Bioconductor Asia-Pacific Developers’ Meeting
2014 Student Research Celebration Presenter Research Project Award
2010 New Paltz Student Undergraduate Research Experience (SURE) stipend
2009 Purchase Bridges to Baccalaureate Program stipend
2009 Outgoing Faculty Annual Scholarship awarded by SUNY Orange
2009 Outgoing William F. Ehlers Jr. Memorial Scholarship for excellence in anthropology awarded by SUNY Orange
2009 Outgoing Dr. Cortland R. Mapes Scholarship for excellence in biology awarded by SUNY Orange
2008 American Chemical Society award for excellence in chemistry
2007-2009 Recipient of President’s Scholarship for Outstanding Academic Achievement at SUNY Orange

Presentations

Quinn TP. April 2021. Appropriate statistics and data transformations for compositional data. Invited talk presented at Australasian Human Microbiome Research Network Virtual Conference (online delivery).

Quinn TP. December 2020. Deep learning: The quest for interpretability. Invited talk presented at Centre for Genomic Regulation in Barcelona, Spain (online delivery).

Quinn TP. November 2020. Deep learning: The quest for interpretability. Invited talk presented at WEHI ML Interest Group Seminar Series in Melbourne, Australia (online delivery).

Quinn TP. November 2020. HyperXPair: Learning distance-dependent motif interactions. Accepted talk presented at ABACBS 2020 Virtual Conference (online delivery).

Quinn TP. September 2020. Risk Prediction: An Introduction. Invited talk presented at Victoria University Bioinformatics Seminar in Melbourne, Australia (online delivery).

Quinn TP. July 2020. DeepCoDA: Personalized Interpretability for Compositional Health Data. Accepted talk presented at ICML 2020 in Vienna, Austria (online delivery).

Quinn TP. July 2020. On Compositions and Deep Learning. Invited talk presented at Monash Bioinformatics Seminar Series in Melbourne, Australia (online delivery).

Quinn TP. June 2020. DeepCoDA: Personalized Interpretability for Compositional Health Data. Invited talk presented at Gen(e)quality “Demystifying ‘omic’ Risk Scores” workshop in Geelong, Australia (online delivery).

Quinn TP. June 2020. Risk Prediction: An Introduction. Invited talk presented at Gen(e)quality “Demystifying ‘omic’ Risk Scores” workshop in Geelong, Australia (online delivery).

Quinn TP. May 2020. The microbiome as compositions: a methodological survey. Invited talk presented at San Diego State University in San Diego, California (online delivery).

Quinn TP. December 2019. Deep in the Bowel: Highly Interpretable Neural Encoder-Decoder Networks Predict Gut Metabolites from Gut Microbiome. Accepted talk presented at Joint GIW/ABACBS 2019 in Sydney, Australia.

Quinn TP. December 2019. DeepTRIAGE: Interpretable and Individualised Biomarker Scores using Attention Mechanism for the Classification of Breast Cancer Sub-types. Accepted talk presented at Joint GIW/ABACBS 2019 in Sydney, Australia.

Quinn TP. June 2019. Using balances to engineer features for the classification of health biomarkers: a new approach to balance selection. Accepted talk presented at CoDaWork 2019 in Terrassa, Spain.

Quinn TP. March 2019. A practical guide to (supervised) machine learning using the exprso R package. Invited talk presented at Deakin University in Geelong, Victoria.

Quinn TP. October 2018. Understanding sequencing data as compositions: theory and application. Invited talk presented at Centre for Genomic Regulation in Barcelona, Spain.

Quinn TP. October 2017. A compositionally valid pipeline for any-omics data. Accepted talk presented at Australasian Genomic Technologies Association in Hobart, Tasmania.

Peer-review contributions

Publons

Wellcome Trust

Statistical Methods in Medical Research

PeerJ

American Journal of Medical Genetics B Neuropsychiatric Genetics

Bioinformatics

Applied Computing and Geosciences

NAR Genomics and Bioinformatics

PLoS Computational Biology

BMC Genomics

Science Engineering Ethics

Frontiers in Genetics

Patterns

Lead Author Publications

Quinn TP+, Hess JL+, et al., & Glatt SJ. 2022. Signal from Noise: Using Machine Learning to Distil Knowledge from Data in Biological Psychiatry. PsyArXiv. <https://psyarxiv.com/dz7gt>.

Quinn TP, Jacobs S, Senadeera M, Le V, & Coghlan S. 2021. The three ghosts of medical AI: Can the black-box present deliver? Artificial Intelligence in Medicine. <https://doi.org/10.1016/j.artmed.2021.102158>.

Quinn TP. 2021. Stool Studies Don't Pass the Sniff Test: A Systematic Review of Human Gut Microbiome Research Suggests Widespread Misuse of Machine Learning. arXiv. <https://arxiv.org/abs/2107.03611>.

Quinn TP, Gordon-Rodriguez E, & Erb I. 2021. A Critique of Differential Abundance Analysis, and Advocacy for an Alternative. arXiv. <https://arxiv.org/abs/2104.07266>.

Quinn TP, Nguyen D, Gupta S, & Venkatesh S. 2021. A Neural Model of RNA Splicing: Learning Motif Distances with Self-Attention and Toeplitz Max Pooling. bioRxiv 445518. <https://doi.org/10.1101/2021.05.24.445518>.

Quinn TP & Erb I. 2021. Examining microbe-metabolite correlations by linear methods. Nature Methods 18:37-39. <https://doi.org/10.1038/s41592-020-01006-1>.

- Quinn TP**, Le V, & Cardilini APA. 2021. Test Set Verification Is An Essential Step in Model Building. *Methods in Ecology and Evolution* 12(1). Forum Article. <https://doi.org/10.1111/2041-210X.13495>.
- Harikumar H+, **Quinn TP**+, Rana S, Gupta S, & Venkatesh S. 2021. Personalized single-cell networks: a framework to predict the response of any gene to any drug for any patient. *BioData Mining* 14(37). <https://doi.org/10.1186/s13040-021-00263-w>.
- Quinn TP**, Senadeera M, Jacobs S, Coghlan S, & Le V. 2020. Trust and Medical AI: The challenges we face and the expertise needed to overcome them. *JAMIA*. Online ahead of print. <https://doi.org/10.1093/jamia/ocaa268>.
- Quinn TP** & Erb I. 2020. Amalgams: data-driven amalgamation for the dimensionality reduction of compositional data. *NAR Genomics and Bioinformatics* 2(4). <https://doi.org/10.1093/nargab/lqaa076>.
- Le V+, **Quinn TP**+, Tran T, & Venkatesh S. 2020. Deep in the Bowel: Highly Interpretable Neural Encoder-Decoder Networks Predict Gut Metabolites from Gut Microbiome. *BMC Genomics* 21(256). <https://doi.org/10.1186/s12864-020-6652-7>.
- Quinn TP**, Nguyen D, Nguyen P, Gupta S, & Venkatesh S. 2020. Learning distance-dependent motif interactions: an interpretable CNN model of genomic events. *bioRxiv* 270967. <https://doi.org/10.1101/2020.08.27.270967>.
- Quinn TP**+, Nguyen D+, Rana S, Gupta S, & Venkatesh S. 2020. DeepCoDA: personalized interpretability for compositional health data. *ICML 2020 (A* conference, acceptance rate = 21.8%)*. <https://arxiv.org/abs/2006.01392>.
- Loughman A+, **Quinn TP**+, et al., & Tang ML. 2020. Infant microbiota in colic: predictive associations with problem crying and subsequent child behavior. *Journal of Developmental Origins of Health and Disease*. Online ahead of print. <https://doi.org/10.1017/S2040174420000227>.
- Quinn TP** & Erb I. 2020. Interpretable Log Contrasts for the Classification of Health Biomarkers: a New Approach to Balance Selection. *mSystems* 5(2). <https://doi.org/10.1128/mSystems.00230-19>.
- Beykikhoshk A+, **Quinn TP**+, Lee SC, Tran T, & Venkatesh S. 2020. DeepTRIAGE: Interpretable and Individualised Biomarker Scores using Attention Mechanism for the Classification of Breast Cancer Subtypes. *BMC Medical Genomics* 13(20). <https://doi.org/10.1186/s12920-020-0658-5>.
- Quinn TP**, Erb I, Gloor G, Notredame C, Richardson MF, & Crowley TM. 2019. A field guide for the compositional analysis of any-omics data. *GigaScience* giz107. <https://doi.org/10.1093/gigascience/giz107>.
- Lee SC+, Quinn A, Nguyen T, Venkatesh S, & **Quinn TP**+. 2019. A cross-cancer metastasis signature in the microRNA-mRNA axis of paired tissue samples. *Molecular Biology Reports*. <https://doi.org/10.1007/s11033-019-05025-w>.
- Quinn TP**, Nguyen T, Lee SC, & Venkatesh S. 2019. Cancer as a tissue anomaly: classifying tumor transcriptomes based only on healthy data. *Frontiers in Genetics* 10:599. <https://doi.org/10.3389/fgene.2019.00599>.
- Quinn TP**+, Lee SC+, Venkatesh S, & Nguyen T. 2019. Improving the classification of neuropsychiatric conditions using gene ontology terms as features. *American Journal of Medical Genetics B Neuropsychiatric Genetics* 180(7):508-18. <https://doi.org/10.1002/ajmg.b.32727>.
- Lee SC+, **Quinn TP**+, et al., & Nguyen T. 2018. Solving for X: evidence for sex-specific autism biomarkers across multiple transcriptomic studies. *American Journal of Medical Genetics B Neuropsychiatric Genetics* 180(6):377-89. <https://doi.org/10.1002/ajmg.b.32701>.
- Quinn TP**. 2018. Visualizing Balances of Compositional Data: A New Alternative to Balance Dendrograms [version 1; referees: 2 approved]. *F1000Research* 7:1278. <https://doi.org/10.12688/f1000research.15858.1>.
- Quinn TP**, Crowley TM, & Richardson MF. 2018. Benchmarking differential expression analysis tools for RNA-Seq: normalization-based vs. log-ratio transformation-based methods. *BMC Bioinformatics* 19(1). <https://doi.org/10.1186/s12859-018-2261-8>.

Quinn TP, Erb I, Richardson MF, & Crowley TM. 2018. Understanding sequencing data as compositions: an outlook and review. *Bioinformatics* 34(16). <https://doi.org/10.1093/bioinformatics/bty175>.

Quinn T, Richardson MF, Lovell D, & Crowley T. 2017. propr: An R-package for Identifying Proportionally Abundant Features Using Compositional Data Analysis. *Scientific Reports* 7:16252. <https://dx.doi.org/10.1038/s41598-017-16520-0>.

Quinn T, Tylee D, & Glatt S. 2017. exprso: an R-package for the rapid implementation of machine learning algorithms [version 2; referees: 2 approved]. *F1000Research* 5:2588. <https://dx.doi.org/10.12688/f1000research.9893.2>.

Quinn TP, Atwood PD, Tanski JM, Moore TF, & Folmer-Andersen J. 2011. Aza-crown macrocycles as chiral solvating agents for mandelic acid derivatives. *Journal of Organic Chemistry* 76(24):10020-30. <https://dx.doi.org/10.1021/jo2018203>.

Other Publications

Greenacre M, Grunsky E, Bacon-Shone J, Erb I, & **Quinn T**. 2022. Aitchison’s Compositional Data Analysis 40 Years On: A Reappraisal. *arXiv*. <https://arxiv.org/abs/2201.05197>.

Gordon-Rodriguez E, **Quinn TP**, & Cunningham JP. 2022. Data Augmentation for Compositional Data: Advancing Predictive Models of the Microbiome. *arXiv*. <https://arxiv.org/abs/2205.09906>.

Nguyen TM, **Quinn TP**, Nguyen T, & Tran T. 2022. Explaining Black Box Drug Target Prediction through Model Agnostic Counterfactual Samples. *IEEE/ACM Transactions on Computational Biology and Bioinformatics*. <https://doi.org/10.1109/TCBB.2022.3190266>.

Gordon-Rodriguez E, **Quinn TP**, & Cunningham JP. 2021. Learning sparse log-ratios for high-throughput sequencing data. *Bioinformatics*. <https://doi.org/10.1093/bioinformatics/btab645>.

Aslam H, et al., **Quinn TP**, et al., & Loughman A. 2021. Gut Microbiome Diversity and Composition Are Associated with Habitual Dairy Intakes: A Cross-Sectional Study in Men. *The Journal of Nutrition*. <https://doi.org/10.1093/jn/nxab252>.

Gao Y, et al., **Quinn TP**, et al., & Vuillermin P. 2021. The maternal gut microbiome during pregnancy and offspring allergy and asthma. *Journal of Allergy and Clinical Immunology*. Online ahead of print. <https://doi.org/10.1016/j.jaci.2021.07.011>.

Nguyen T, Lee SC, **Quinn TP**, et al., & Le TD. 2021. PAN: Personalized Annotation-based Networks for the Prediction of Breast Cancer Relapse. *IEEE/ACM Transactions on Computational Biology and Bioinformatics*. <https://doi.org/10.1109/TCBB.2021.3076422>.

Erb I, Gloor GB, & **Quinn TP**. 2020. Editorial: Compositional data analysis and related methods applied to genomics—a first special issue from NAR Genomics and Bioinformatics. *NAR Genomics and Bioinformatics* 2(4). <https://doi.org/10.1093/nargab/lqaa103>.

Nguyen T, Le H, **Quinn TP**, Le TD, & Venkatesh S. 2020. GraphDTA: Predicting drug–target binding affinity with graph neural networks. *Bioinformatics*. Online ahead of print. <https://doi.org/10.1093/bioinformatics/btaa921>.

Hess JL, Chen S, **Quinn TP**, et al., & Glatt SJ. 2020. BrainGENIE: The Brain Gene Expression and Network Imputation Engine. *bioRxiv* 356766. <https://doi.org/10.1101/2020.10.27.356766>.

Bruxel EM, Moreira-Maia CR, Akutagava-Martins GC, **Quinn TP**, et al., & Hutz MH. 2020. Meta-analysis and systematic review of ADGRL3 (LPHN3) polymorphisms in ADHD susceptibility. *Molecular Psychiatry* (2020). <https://doi.org/10.1038/s41380-020-0673-0>.

Allnutt TR, Wade B, **Quinn TP**, Richardson MF, & Crowley TM. 2018. Shortlisting Aptamer Candidates from HT-SELEX data. *Aptamers* 2. <https://japtamers.co.uk/shortlisting-aptamer-candidates-from-ht-selex-data>.

Erb I, **Quinn T**, Lovell D, & Notredame C. 2017. Differential Proportionality - A Normalization-Free Approach To Differential Gene Expression. Proceedings of CoDaWork 2017, The 7th Compositional Data Analysis Workshop; available under bioRxiv 134536. <https://dx.doi.org/10.1101/134536>.

Tylee DS, Kikinis Z, **Quinn TP**, et al., & Makris N. 2017. Machine-learning classification of 22q11.2 deletion syndrome: A diffusion tensor imaging study. *NeuroImage: Clinical* 15(1):832-42. <https://dx.doi.org/10.1016/j.nicl.2017.04.029>.

Englebert C, **Quinn T**, & Bichindaritz I. 2017. Feature selection for survival analysis in bioinformatics. *CEUR Workshop Proceedings* 1942:30-35. <https://ceur-ws.org/Vol-1942/paper5.pdf>.

Tylee DS, Hess JL, **Quinn TP**, et al., & Glatt SJ. 2016. Blood transcriptomic comparison of individuals with and without autism spectrum disorder: A combined-samples mega-analysis. *American Journal of Medical Genetics B Neuropsychiatric Genetics* 174(3):181-201. <https://dx.doi.org/10.1002/ajmg.b.32511>.

Bichindaritz IB, Cole E, et al., & **Quinn TP**. 2016. Machine Learning Based Automatic Multilevel Stress Detection from ECG Signals. *IJCAI 2016: Workshop on Knowledge Discovery in Healthcare Data*. <https://sites.google.com/site/ijcai2016kdhealth/accepted-papers>.

Hess JL, **Quinn TP**, Akbarian S, & Glatt SJ. 2015. Bioinformatic analyses and conceptual synthesis of evidence linking ZNF804A to risk for schizophrenia and bipolar disorder. *American Journal of Medical Genetics B Neuropsychiatric Genetics* 168(1):14-35. <https://dx.doi.org/10.1002/ajmg.b.32284>.

Funding

Project: “An Interpretable Deep Learning Model of RNA Splicing”. Year: 2021. Provisioner: Alfred Deakin Postdoctoral Fellowship. Award: \$203,994. Role: Awardee. Contribution: Project lead.

Project: “The Pregnancy Research and Translation Ecosystem (PRT-E)”. Year: 2021. Provisioner: Western Alliance Flagship Research Program. Award: \$200,000. Role: CI. Contribution: Design of data collection and clinical translation methodology.

Project: “Optimising treatments in mental health using AI”. Year: 2020. Provisioner: MRFF Applied Artificial Intelligence Research in Health Fund. Award: \$4,995,434. Role: CI. Contribution: Design and implementation of trial analysis protocol.

Project: “How does the gut microbiome contribute to individual responses to psychobiotics?”. Year: 2020. Provisioner: Deakin IMPACT Seed Fund. Award: \$15,000. Role: AI. Contribution: Design and implementation of statistical and machine learning analyses.