ALISTAIR JOHNSON

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EDUCATION

University of Oxford *2009 - 2014*
DPhil (Ph.D.) in Healthcare Innovation *Oxford, UK*

Thesis title: Mortality prediction and acuity of illness in critical care

Advisors: Gari D. Clifford, Andrew A. Kramer

McMaster University *2005 - 2009*
BEng in Biomedical & Electrical Engineering *Hamilton, ON, Canada*

EXPERIENCE

Massachusetts Institute of Technology *2017 - Present*
Research Scientist *Cambridge, MA, USA*

- Produced eICU-CRD: the largest publicly available critical care dataset with over 200,000 stays
- Created a state of the art model for deidentification of free-text medical notes using bidirectional encoder representations from transformers combined with rule-based approaches
- Created MIMIC-CXR: the largest database of chest x-rays with deidentified free-text radiology reports, facilitating entirely new applications of medical computer vision and natural language understanding
- Demonstrated how heterogenous disease definitions in healthcare (e.g. sepsis) complicate the inferences of studies as patient populations are no longer comparable

Massachusetts Institute of Technology *2015 - 2017*
Postdoctoral Associate *Cambridge, MA, USA*

- Created MIMIC-III, a large publicly available deidentified critical care dataset used by more than 10,000 users and 800 publications
- Organized global workshops to stimulate research on clinically relevant problems and foster collaboration between clinicians and data scientists
- Developed a real-time mortality prediction model

Emory University *2013*
Visiting Researcher *Atlanta, GA*

- Researched measures for heart rate variability and their impact on mortality prediction models
- Improved algorithms which derived breathing rate from the electrocardiogram
- Developed new signal quality indices for breathing rate estimations from the electrocardiogram

Cerner Corporation *2010*
Visiting Researcher *Vienna, VA*

- Conceptualized initial approach for novel severity of illness optimization algorithm
- Worked with Cerner engineers to implement these approaches on a production system

SCHOLARSHIPS AND AWARDS

Design, Innovate, Impact Challenge 2019	Winner, Track 3
Forbes 30 under 30	Healthcare, 2018
SCCM 47th Annual Congress 2018	Star Research Award
SCCM 46th Annual Congress 2017	Star Research Award
PCinC 2014 Challenge on Multimodal peak detection	1st Prize
IET Healthcare Technologies Network	William James Award
PCinC 2012 Challenge on Mortality prediction	1st Prize
RCUK Digital Economy Programme	CDT Postgraduate Studentship

TEACHING EXPERIENCE

Harvard Medical School *2017 - Present*
Lecturer, Master of Medical Sciences in Clinical Investigation *Boston, MA, USA*

Lectured medical students on machine learning using tree-based approaches

Massachusetts Institute of Technology *2017 - Present*
Instructor, Collaborative Data Science in Medicine *Cambridge, MA, USA*

Organized a graduate level course focusing on data science in medicine

University of Oxford *2012 - 2014*
Instructor, Machine Learning *Oxford, UK*

Introduced first year PhD students to machine learning

University of Oxford *2012 - 2014*
Instructor, Signal Processing for Biomedical Signals *Oxford, UK*

Lectured first year PhD students on electrocardiogram processes

CONFERENCE PROCEEDINGS

1. **Johnson**, **AE**, Bulgarelli, L, and Pollard, TJ. Deidentification of free-text medical records using pre-trained bidirectional transformers. In: *Proceedings of the ACM Conference on Health, Inference, and Learning*. 2020:214–221.
2. **Johnson**, **AE**, Pollard, TJ, and Naumann, T. Generalizability of predictive models for intensive care unit patients. In: *Machine Learning for Health (ML4H) Workshop at NeurIPS 2018*. 2018.
3. Ren, O, **Johnson**, **AE**, Lehman, EP, et al. Predicting and Understanding Unexpected Respiratory Decompensation in Critical Care Using Sparse and Heterogeneous Clinical Data. In: *2018 IEEE International Conference on Healthcare Informatics (ICHI)*. IEEE. 2018:144–151.
4. **Johnson**, **AE** and Mark, RG. Real-time mortality prediction in the Intensive Care Unit. In: *AMIA Annual Symposium Proceedings*. Vol. 2017. American Medical Informatics Association. 2017:994.
5. **Johnson**, **AE**, Pollard, TJ, Celi, LA, and Mark, RG. Analyzing the eICU Collaborative Research Database. In: *Proceedings of the 8th ACM International Conference on Bioinformatics, Computational Biology, and Health Informatics*. ACM. 2017:631–631.
6. **Johnson**, **AE**, Pollard, TJ, and Mark, RG. Reproducibility in critical care: a mortality prediction case study. In: *Machine Learning for Healthcare Conference*. 2017:361–376.
7. Suresh, H, Hunt, N, **Johnson**, **AE**, Celi, LA, Szolovits, P, and Ghassemi, M. Clinical Intervention Prediction and Understanding with Deep Neural Networks. In: *Machine Learning for Healthcare Conference*. 2017:322–337.
8. **Johnson**, **AE**, Behar, J, Andreotti, F, Clifford, GD, and Oster, J. R-peak estimation using multimodal lead switching. In: *Computing in Cardiology Conference (CinC), 2014*. IEEE. 2014:281–284.

9. **Johnson**, **AE**, Burgess, J, Pimentel, MA, et al. Physiological trajectory of patients pre and post ICU discharge. In: *Engineering in Medicine and Biology Society (EMBC), 2014 36th Annual International Conference of the IEEE*. IEEE. 2014:3160–3163.
10. **Johnson**, **AE**, Kramer, AA, and Clifford, GD. Data preprocessing and mortality prediction: the Physionet/CinC 2012 challenge revisited. In: *Computing in Cardiology Conference*. 2014.
11. Behar, J, **Johnson**, **AE**, Oster, J, and Clifford, GD. An echo state neural network for foetal ECG extraction optimised by random search. In: *Machine Learning for Clinical Data Analysis and Healthcare NIPS Workshop*. 2013.
12. Colloca, R, **Johnson**, **AE**, Mainardi, L, and Clifford, GD. A support vector machine approach for reliable detection of atrial fibrillation events. In: *Computing in Cardiology Conference (CinC), 2013*. IEEE. 2013:1047–1050.
13. **Johnson**, **AE**, Cholleti, SR, Buchman, TG, and Clifford, GD. Improved respiration rate estimation using a Kalman filter and wavelet cross-coherence. In: *Computing in Cardiology Conference (CinC), 2013*. IEEE. 2013:791–794.
14. Zhu, T, **Johnson**, **AE**, Behar, J, and Clifford, GD. Bayesian voting of multiple annotators for improved QT interval estimation. In: *Computing in Cardiology Conference (CinC), 2013*. IEEE. 2013:659–662.
15. **Johnson**, **AE**, Dunkley, N, Mayaud, L, Tsanas, A, Kramer, A, and Clifford, G. Patient Specific Predictions in the Intensive Care Unit Using a Bayesian Ensemble. In: *Computing in Cardiology (CinC), 2012*. IEEE. 2012:249–252.
16. **Johnson**, **AE**, Kramer, AA, and Clifford, GD. Pre-processing methods for prognostic models. In: *Neural Information Processing Systems: Workshop on Machine Learning for Clinical Data Analysis and Healthcare*. 2012.

JOURNAL ARTICLES

1. Bulgarelli, L, Deliberato, RO, and **Johnson**, **AE**. Prediction on critically ill patients: The role of "big data". Journal of Critical Care 2020.
2. Cai, Z, Li, J, **Johnson**, **AE**, et al. Rule-based rough-refined two-step-procedure for real-time premature beat detection in single-lead ECG. Physiological Measurement 2020.
3. Bose, S, **Johnson**, **AE**, Moskowitz, A, Celi, LA, and Raffa, JD. Impact of intensive care unit discharge delays on patient outcomes: a retrospective cohort study. Journal of intensive care medicine 2019;34:924–929.
4. Deliberato, RO, Escudero, GG, ..., and **Johnson**, **AE**. SEVERITAS: An externally validated mortality prediction for critically ill patients in low and middle-income countries. International journal of medical informatics 2019;131:103959.
5. Deliberato, RO, Neto, AS, ..., and **Johnson**, **AE**. An evaluation of the influence of body mass index on severity scoring. Critical care medicine 2019;47:247–253.
6. **Johnson**, **AE**, Pollard, TJ, Berkowitz, SJ, et al. MIMIC-CXR, a de-identified publicly available database of chest radiographs with free-text reports. Scientific Data 2019;6.
7. Naik, GS, Waikar, SS, **Johnson**, **AE**, et al. Complex inter-relationship of body mass index, gender and serum creatinine on survival: exploring the obesity paradox in melanoma patients treated with checkpoint inhibition. Journal for immunotherapy of cancer 2019;7:89.
8. Neto, AS, Deliberato, RO, **Johnson**, **AE**, et al. Normalization of mechanical power to anthropometric indices: impact on its association with mortality in critically ill patients. Intensive care medicine 2019;45:1835–1837.
9. Bryant, C, **Johnson**, **AE**, Henson, K, Freeseman-Freeman, L, Stark, M, and Higgins, T. APACHE Outcomes Across Venues predicting inpatient mortality using electronic medical record data. Critical Care Medicine 2018;46:8.
10. **Johnson**, **AE**, Aboab, J, Raffa, JD, et al. A Comparative Analysis of Sepsis Identification Methods in an Electronic Database. Critical care medicine 2018;46:494–499.

11. Neto*, AS, Deliberato*, RO, **Johnson***, **AE**, et al. Mechanical power of ventilation is associated with mortality in critically ill patients: an analysis of patients in two observational cohorts. Intensive care medicine 2018:1–9.
12. O'Donoghue, S, Devanna, D, and **Johnson**, **AE**. Incidence and Risk Factors Associated with Hyperactive, Hypoactive, and Mixed Delirium. American Journal of Critical Care 2018;27:e6.
13. Pollard*, TJ, **Johnson***, **AE**, Raffa, JD, Celi, LA, Mark, RG, and Badawi, O. The eICU Collaborative Research Database, a freely available multi-center database for critical care research. Scientific data 2018;5.
14. Pollard, TJ, **Johnson**, **AE**, Raffa, JD, and Mark, RG. tableone: An open source Python package for producing summary statistics for research papers. JAMIA Open 2018.
15. Sandfort, V, **Johnson**, **AE**, Kunz, LM, Vargas, JD, and Rosing, DR. Prolonged elevated heart rate and 90-Day survival in acutely Ill patients: Data from the MIMIC-III database. Journal of intensive care medicine 2018.
16. Zhu, T, **Johnson**, **AE**, Yang, Y, Clifford, GD, and Clifton, DA. Bayesian fusion of physiological measurements using a signal quality extension. Physiological measurement 2018.
17. Chen, C, Lee, J, **Johnson**, **AE**, Mark, RG, Celi, LA, and Danziger, J. Right ventricular function, peripheral edema, and acute kidney injury in critical illness. Kidney International Reports 2017.
18. **Johnson**, **AE**, Stone, DJ, Celi, LA, and Pollard, TJ. The MIMIC Code Repository: enabling reproducibility in critical care research. Journal of the American Medical Informatics Association 2017;25:32–39.
19. Lehman, LW, **Johnson**, **AE**, Sudduth, C, Mark, R, and Nemati, S. Dynamics of multivariate vital sign time series and severe sepsis among patients in critical care. Journal of Critical Care 2017;38:365.
20. Li, AS, **Johnson**, **AE**, and Mark, RG. False arrhythmia alarm reduction in the intensive care unit. arXiv preprint arXiv:1709.03562 2017.
21. Neto*, AS, Deliberato*, RO, **Johnson***, **AE**, et al. Mechanical power during mechanical ventilation of critically ill patients. Journal of Critical Care 2017;42:392.
22. Pimentel, MA, **Johnson**, **AE**, Charlton, PH, et al. Toward a robust estimation of respiratory rate from pulse oximeters. IEEE Transactions on Biomedical Engineering 2017;64:1914–1923.
23. **Johnson**, **AE**, Celi, LA, Raffa, J, Pollard, T, and Stone, D. External Validation Of The Sepsis-3 Guidelines. Critical Care Medicine 2016;44:91.
24. **Johnson**, **AE**, Ghassemi, MM, Nemati, S, Niehaus, KE, Clifton, DA, and Clifford, GD. Machine learning and decision support in critical care. Proceedings of the IEEE 2016;104:444–466.
25. **Johnson**, **AE**, Pollard, TJ, Shen, L, et al. MIMIC-III, a freely accessible critical care database. Scientific data 2016;3:160035.
26. **Johnson**, **AE**, Behar, J, Andreotti, F, Clifford, GD, and Oster, J. Multimodal heart beat detection using signal quality indices. Physiological measurement 2015;36:1665.
27. Behar, J, **Johnson**, **AE**, Clifford, GD, and Oster, J. A comparison of single channel fetal ECG extraction methods. Annals of biomedical engineering 2014;42:1340–1353.
28. Zhu, T, **Johnson**, **AE**, Behar, J, and Clifford, GD. Crowd-sourced annotation of ECG signals using contextual information. Annals of biomedical engineering 2014;42:871–884.
29. **Johnson**, **AE** and Clifford, GD. Risk-adjustment of patient subpopulations in the intensive care unit using oasis, a novel severity score. Journal of Critical Care 2013;28:e20–e21.
30. **Johnson**, **AE**, Kramer, AA, and Clifford, GD. A new severity of illness scale using a subset of acute physiology and chronic health evaluation data elements shows comparable predictive accuracy. Critical care medicine 2013;41:1711–1718.