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John P. Lalor

Research Interests

My research is in machine learning and natural language processing. I am particularly interested in model evaluation and quantifying uncertainty, as well as applications in biomedical informatics.

Education

2019 (expected) **Ph.D. Computer Science**, University of Massachusetts, Amherst, MA.
Advisor: Hong Yu

2015 **M.S. Computer Science**, DePaul University, Chicago, IL.
Graduated with Distinction

2011 **B.B.A. IT Management**, University of Notre Dame, South Bend, IN.
Minor: Irish Language and Literature Graduated Cum Laude

Professional Experience

2018 **Applied Scientist Intern**, Amazon Alexa, Cambridge, MA.
Supervisors: Bill Campbell and Eunah Cho
I investigated ways to incorporate paraphrases as training data for semi-supervised machine learning models. I developed an embedding model for customer utterances that embeds paraphrase information. Analysis of these embeddings showed that they could be used to identify training data in both semi-supervised and active learning frameworks.

2015 - present **Research Assistant**, BioNLP Group, Amherst, MA.
Supervisor: Hong Yu
In the BioNLP lab I conduct research on improving patient health literacy and Electronic Health Record (EHR) note understanding. I developed the ComprehENotes test, the first test of EHR note comprehension available. I have used the ComprehENotes test to validate previously self-reported results on improved EHR note comprehension when patients are given the NoteAid tool. I am also developing a machine learning model for identifying cases of hypoglycemia in patient secure messages with their health care providers. I also work on core machine learning problems in deep learning model evaluation, interpretability, and quantifying uncertainty. Using Item Response Theory I've shown that human-measured item difficulty impacts deep learning model performance, and that raw accuracy on test sets does not account for test set item difficulty.

2017 **Applied Scientist Intern**, Amazon Alexa, Cambridge, MA.
Supervisors: Imre Kiss and Francois Mairesse
I implemented a new internal metric to predict whether a customer request would be actioned correctly by Alexa. Using this metric I developed new regression tests for production model development, and developed a new semi-supervised technique for identifying apropriate unlabeled data for inclusion in training sets.

2016 **Intern**, ESPN Advanced Technology Group, Bristol, CT.
Supervisor: Zvi Topol
I developed a text summarization model to extract short summaries from ESPN articles that could be presented as smartphone notifications or social media posts.

2013 - 2015 **Software Developer**, Eze Software Group, Chicago, IL.
I designed and built a notification system to alert customers when trade orders are completed via email and text message. I also designed and built an administrative dashboard for our case management system that filtered and displayed case information for 1000+ cases across 30+ clients. I was the team lead for updating code and fixing bugs for internal case management, account management, and incident resolution systems.

2011 - 2013 **Advisory Sr. Associate**, KPMG, Philadelphia, PA, Chicago, IL.
I coordinated and performed General IT Control and application control testing for large and mid-size companies across various industries as part of IT Financial Statement Audit Support teams. I also developed an automated user access testing application to identify terminated employees across application access lists.

Honors and Awards

2018 UMass CICS Travel Grant recipient

2015 DePaul University Graduate Assistantship

2015 Inducted into the Upsilon Pi Epsilon computer science honor society, DePaul chapter

2007 - 2011 Dean's List 4 semesters at Notre Dame

Publications

Manuscripts Under Review

15 J. Chen, **J.P. Lalor**, W. Liu, E. Druhl, H. Yu. Detecting Hypoglycemia Incidents Reported in Patients' Secure Messages: Using Cost-sensitive Learning and Oversampling to Reduce Data Imbalance. *JMIR Preprints.* 21/08/2018:11990 DOI: 10.2196/preprints.11990

Journal and Conference Publications

14 **J.P. Lalor**, B. Woolf, H. Yu. Improving EHR Note Comprehension with NoteAid: A Randomized Trial of EHR Note Comprehension Interventions with Crowdsourced Workers. *J Med Internet Res (forthcoming).* doi:10.2196/10793.

13 **J.P. Lalor**, H. Wu, T. Munkhdalai, H. Yu. Understanding Deep Learning Performance through an Examination of Test Set Difficulty: A Psychometric Case Study. *EMNLP 2018: Conference on Empirical Methods in Natural Language Processing*, 2018.
Oral presentation, top 9.9% of submitted short papers

12 **J.P. Lalor**, H. Wu, L. Chen, K. Mazor, H. Yu. ComprehENotes, an Instrument for Assessing Patient Electronic Health Record Note Reading Comprehension: Development and Validation. *J Med Internet Res* 2018;20(4):e139. doi:10.2196/jmir.9380

11 T. Munkhdalai, **J.P. Lalor**, H. Yu. Citation Analysis with Neural Attention Models. *LOUHI 2016 : The Seventh International Workshop on Health Text Mining and Information Analysis*, Austin, TX, USA, November 2016.

10 **J.P. Lalor**, H. Wu, H. Yu. Building an Evaluation Scale using Item Response Theory. *EMNLP 2016: Conference on Empirical Methods in Natural Language Processing*, Austin, TX, USA, November 2016.

9 C. Miller, A. Settle, **J.P. Lalor**. Learning Object-Oriented Programming in Python: Towards an Inventory of Difficulties and Testing Pitfalls. *SIGITE 2015: The Special Interest Group for Information Technology Education Conference*, Chicago, IL, October 2015

8 A. Settle, **J.P. Lalor**, T. Steinbach. Evaluating a Linked-Courses Learning Community for Development Majors. *SIGITE 2015: The Special Interest Group for Information Technology Education Conference*, Chicago, IL, October 2015

7 A. Settle, **J.P. Lalor**, T. Steinbach. A Computer Science Linked-Courses Learning Community. *ITiCSE 2015: The 20th Annual Conference on Innovation and Technology in Computer Science Education*. Vilnius, Lithuania, July 2015

6 A. Settle, **J.P. Lalor**, T. Steinbach. Reconsidering the Impact of CS1 on Novice Attitudes. *SIGCSE 2015: The ACM Special Interest Group on Computer Science Education*. Kansas City, MO, March 2015

Workshop Papers, Posters, and Abstracts

5 J. Chen, **J.P. Lalor**, H. Yu. Detecting Hypoglycemia Incidents from Patients' Secure Messages. *American Medical Informatics Association (AMIA) Annual Symposium* Poster, 2018

4 **J.P. Lalor**, H. Wu, H. Yu. Soft Label Memorization-Generalization for Natural Language Inference. *Workshop on Uncertainty in Deep Learning. Uncertainty in Artificial Intelligence (UAI)*, 2018.

3 **J.P. Lalor**, H. Wu, H. Yu. Modeling Difficulty to Understand Deep Learning Performance. *Northern Lights Deep Learning Workshop (NLDL)*, 2018.

2 **J.P. Lalor**, H. Wu, H. Yu. CIFT: Crowd-Informed Fine-Tuning to Improve Machine Learning Ability. *Human Computation and Crowdsourcing (HCOMP)* Works-in-Progress, 2017.

1 **J.P. Lalor**, H. Wu, L. Chen, K. Mazor, H. Yu. Generating a Test of Electronic Health Record Narrative Comprehension with Item Response Theory. *American Medical Informatics Association (AMIA) Annual Symposium* Podium Abstract, 2017.

Tutorials and Invited Talks

11/2018 Evaluation and Interpretability in Deep Neural Networks. *American Medical Informatics Association (AMIA) Annual Symposium* Instructional Workshop, 2018. With A. Jagannatha and H. Yu.

10/2018 ComprehENotes: A New Test of EHR Note Comprehension. *University of Notre Dame Mendoza College of Business.*

09/2018 Leveraging Uncertainty for Better DNN Training and Evaluation. *UMass Lowell Data Science Lecture Series.*

09/2017 Building Better Evaluations using Item Response Theory. *University of Notre Dame Natural Language Processing Group.*

12/2016 Building Evaluation Scales for NLP using Item Response Theory. *UMass CICS Machine Learning and Friends Lunch series.*

Teaching and Mentoring Experience

Fall 2018 **Instructor**, UMass Lowell Data Science Lecture Series, University of Massachusetts Lowell.
Prepared and gave three lectures on evaluation and interpretability in deep neural networks

Fall 2018 **Instructor**, CICS First Year Seminar, University of Massachusetts Amherst.
Seminar for first year students on Artificial Intelligence in Healthcare. I am the sole instructor for this course, and designed the syllabus, lectures, and assignments.

2018 **Research Mentor**, Long Le, B.S. in Computer Science, University of Massachusetts Amherst.
Project: Analysis of Easy/Difficult Images for CNN Models

2018 **Research Mentor**, UMass CICS Industry Mentor Program.
Project: Analyzing Users within Organizations with NLP

2017-2018 **Research Mentor**, Nikhil Titus, M.S. in Computer Science, University of Massachusetts Amherst.
Project: Neural Question Generation

2015 **Teaching Assistant**, Introduction to Computer Science, Amherst College, Amherst, MA.
Professor: Crystal Valentine
As TA I held weekly office hours, assisted students during weekly lab session, and graded weekly lab programming asssignments. I also prepared and gave two lectures during the semester.

2014 - 2015 **Tutor**, DePaul University.
Tutor for masters and undergraduate students in Computer Science on courses involving Python, SQL, and HTML/CSS

Service

2018 - present **Co-organizer**, UMass CICS Machine Learning and Friends Lunch..

2018 **Reviewer**, American Journal of Preventative Medicine (AJPM), American Medical Informatics Association (AMIA) Annual Symposium, Journal of Medical Internet Research (JMIR).

2017 **Reviewer**, Journal of Medical Internet Research (JMIR).

2014 - 2015 **Graduate Ambassador**, DePaul University.
Spoke with prospective graduate students about DePaul and the MS program.