Anirban Laha

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⚯ **Google Scholar**   Citations: 451   h-index: 9   i10-index: 9

Interests

Deep Learning (NLP), Natural Language Generation, Model Interpretability, Systematic Generalization.

Highlights

- Received IBM Research India **Distinguished Paper Awards** in **2017** (for paper at ACL 2017) and **2018** (paper at NeurIPS 2018).
- Delivered **half-day tutorial at ACL 2019 conference** on Natural Language Generation from Structured Data.
- Part of IBM Project Debater team - Received news coverage for **live machine vs human debates** (Nature | SciAm | VB | NYT | Verge).
- Contributions in data-to-text NLG successfully deployed to provide match insights and commentary in the US Open 2020.
- **PC member** of ICLR 2022, ACL Rolling 2021-22, ICML 2020, AAAI 2020, NeurIPS 2019,21-22, ACL 2018-20, EMNLP 2019, COLING 2018.

Work Experience

Google Research India *Bangalore, India*
SENIOR RESEARCH SOFTWARE ENGINEER *Jul. 2022 - Present*
- *Research Projects*: Natural Language Generation for Advertising Sciences team.

Montreal Institute for Learning Algorithms (Mila) *Montreal, Canada*
GRADUATE RESEARCH PROGRAM   (PROF. AARON COURVILLE) *Sep. 2019 - Apr. 2022*
- *Research Projects*: Systematic Generalization in Neural Networks, Multi-Agent Reinforcement Learning for Co-operation between Agents.

IBM Research India Labs *Bangalore, India*
RESEARCH SOFTWARE ENGINEER   (BRIEFLY AS TECHNICAL LEAD) *Nov. 2015 - Aug. 2019*
- *Research Projects*: Natural Language Generation (NLG), IBM Project Debater, Interpretability in DL, Machine Learning for Creativity.

Microsoft India Bing Ads Division *Bangalore, India*
APPLIED SCIENTIST *Aug. 2013 - Nov. 2015*
- *Project*: Experimentation of new Click Prediction models for Ads Optimization in Microsoft Bing Ads for US and INTL Markets.

Amazon Development Center India Pvt. Ltd. *Chennai, India*
SOFTWARE DEVELOPMENT ENGINEER *May. 2010 - Jul. 2011*
- *Project*: Development of automated real-time scalable Pricing System for Amazon Kindle eBooks for markets like US, UK and DE.

Education

Indian Institute of Science (IISc), Bangalore *Jul. 2011 - Aug. 2013*
M.SC. (ENGG.) COMPUTER SCIENCE AND AUTOMATION *CGPA - 6.52/8.0*

Jadavpur University, Kolkata *Jul. 2006 - Apr. 2010*
B.E. COMPUTER SCIENCE AND ENGINEERING *CGPA - 9.05/10.0*

Selected Publications

1. Laha A.[†], Jain P.[†], Mishra A.[†], Sankaranarayanan K. (2019). *Scalable Micro-planned Generation of Discourse from Structured Data*, **Computational Linguistics** journal 2019.   [†]Equal Contribution.

2. Surya, S., Mishra, A., Laha, A., Jain, P., Sankaranarayanan, K. (2019). *Unsupervised Neural Text Simplification*, **ACL 2019**.

3. Laha A.[†], Ahmed S.[†], Agrawal P., Khapra M., S.K., Ramaswamy H.G. *On Controllable Sparse Alternatives to Softmax*, **NeurIPS 2018**.

4. Nema P., Shetty S., Jain P., Laha A., Sankaranarayanan K. and Khapra M. (2018). *Generating Descriptions from Structured Data Using a Bifocal Attention Mechanism and Gated Orthogonalization*. In **NAACL-HLT, 2018**.

5. Jain P., Laha A., Sankaranarayanan K., Nema P., Khapra M. and Shetty S. (2018). *A Mixed Hierarchical Attention based Encoder-Decoder Approach for Standard Table Summarization*. In **NAACL-HLT** (Short), **2018**.

6. Nema P., Khapra M., Laha A., Ravindran B. *Diversity driven Attention Model for Query-based Abstractive Summarization*, **ACL 2017**.

7. Pahuja V.[†], Laha A.[†], Mirkin S., Raykar V., Kotlerman L., Lev G. (2017). *Joint Learning of Correlated Sequence Labelling Tasks Using Bidirectional Recurrent Neural Networks*, **INTERSPEECH 2017**.

8. Jain P., Agrawal P., Mishra A., Sukhwani M., Laha A., Sankaranarayanan K. (2017). *Story Generation from Sequence of Independent Short Descriptions*. In **SIGKDD Workshop on Machine Learning for Creativity (ML4Creativity), 2017**.

9. Laha A., Raykar V. *An Empirical Evaluation of various Deep Learning Architectures for Bi-Sequence Classification Tasks*, **COLING 2016**.

Talks and Tutorials

- [*24 Aug, 2021*] Tutorial titled **Approaches towards explaining model predictions in NLP** organized at IIT, Madras. Link.
- [*28 Jul, 2019*] **Half-day Tutorial at ACL 2019** titled **Storytelling From Structured Data and Knowledge Graphs: An NLG Perspective**. Venue: Association for Computational Linguistics (ACL) 2019 in Florence, Italy. Details: Link.
- [*07 Mar, 2018*] **Generating Natural Language Descriptions from Structured Data**. Venue: IBM Research-IISc Workshop on Knowledge and Learning on March 07, 2018 organised at IISc. Details: Link.
- [*20 Jan, 2018*] **Tutorial on Natural Language Processing and Generation**. Venue: Technical Talk on the broader theme of 'Cognitive Analytics and NLP' as part of the annual science and cultural fest at IISc, Bangalore.

Skills

Programming Languages	Python, Java, C++, C#, C
ML/DL/NLP Frameworks	PyTorch, Jax, Flax, Tensorflow, HuggingFace, Numpy, MATLAB
Spoken Languages	English (fluent), Bengali (native tongue), Hindi (fluent), French (beginner)

Leadership and Organizational

- **Technical Lead** during the inception of the Natural Language Generation project at IBM Research: Led the efforts for formulation of team goals and **research agenda from scratch**.
- **Mentored Master's and PhD students (IIT Madras)** towards successful publications at ACL 2017 and NAACL 2018.
- **Mentored research engineers** at IBM Research towards successful publications at INTERSPEECH 2017 and NAACL 2018.
- Mentored two students of McGill University for course project titled "**Interpretability for NLP classification models**".
- **Co-organizer** of TagMe 2014, a nation-wide Machine Learning Contest (organized by IISc Bangalore and Microsoft).
- **Lead Organizer** of TwitMiner 2013, a nation-wide Machine Learning Contest (organized by IISc Bangalore and Amazon.com).

Research Projects

- **Systematic Generalization in Neural Networks**: Neural Networks are known to not generalize well when test data distribution varies compared to training data. For language processing, there is thus a need for systematicity, where test setting may see instances with similar atomic components (words/phrases) but novel composition of them compared to training. We investigate a distant supervised progressively iterative approach for the grounded instruction following task with encouraging initial results [**Ongoing**].
- **Opponent Shaping in Differentiable Multi-player Games**: We conducted a survey of optimization algorithms for multi-player differentiable games, where each player has their own objective which is also influenced by the non-stationarity of other players. We did a comparison of these algorithms for opponent shaping in 2-player game settings like Iterated Prisoner's Dilemma, Iterated Matching Pennies, Tandem and Iterated Dixit Game. Many of these algorithms achieve the Nash Equilibrium which leads to cooperation among players. These games characterize the dilemma between cooperation and competition among players. Project Report.
- **Match Insights and Commentary Generation at US Open 2020**: We developed a modular, interpretable data-to-text system which can generate natural language descriptions for structured tabular content. This system performs canonicalization of various structured input into triples, which is then operated by a morphology-aware triple-to-text model to generate text which can be stitched together by a discourse generation module. This modular approach is scalable and is domain-independent. This system helped generated match insights and commentary from match tabular data at the **US Open 2020**. CL '19.
- **IBM Project Debater**: This project helped garner a lot of interest in the field of argumentation mining. As a grand challenge, the goal was to develop a system which performs a live debate against professional human debaters. The main challenges involved identifying and understanding the debate topic, ranking relevant documents which contain claims and evidences either in supportive or opposite polarities towards the topic, perform speech recognition of human debate speech, and finally serve the relevant claims with evidence stitched together in a convincing way. My contributions were two-fold: (1) Using RNN-based conditional text classification to improve performance of context-dependent claim and evidence detection. (2) Applying multi-task based approach for sequence labelling with RNNs to perform punctuation prediction in unformatted human speech text. COLING '16, INTERSPEECH '17.
- **Interpretability of Natural Language Classification Models**: We study different approaches for interpretability like LIME, Integrated Gradients, Right for Right Reasons in the tasks of Sentiment Classification, Textual Entailment (classification) as well as POS Tagging and Neural Machine Translation. Our work proposes using ground truth explanations (say from SentiWordNet for sentiment classification) as a feedback for correction of the classification model. For the Sentiment Classification, we also create a challenge dataset based on adversarial perturbations, which will be released soon. [**Under Review**].
- **Controllable Sparse Alternatives to Softmax**: We study techniques for converting a real vector to a probability distribution. We propose a unified framework which leads to understanding of existing approaches incl. softmax. Our framework also enables providing explicit controls to vary sparsity of the output distribution. Our proposed convex loss functions enable achievement of greater sparsity for multi-label classification task. We also show encouraging results for sparse attention in NLG tasks. NeurIPS '18 Paper.
- **Structured Data to Text Generation**: This can be categorized into two paradigms - (a) Supervised End-to-end attention based seq2seq approaches for summarization of tabular data (NAACL '18 Paper 1, Paper 2), and (b) Unsupervised coherent description generation from tabular data, in a way that is scalable and adaptable to newer domains and does not require parallel data CL '19.

- **Query-based Abstractive Summarization**: In this work, we propose a model for the query-based summarization task based on the encode-attend-decode paradigm with two key additions (i) a query attention model (in addition to document attention model) which learns to focus on different portions of the query at different time steps (instead of using a static representation for the query) and (ii) a new diversity based attention model which aims to alleviate the problem of repeating phrases in the summary. ACL '17 Paper.
- **Sequence classification used for claim and evidence detection in argument mining**: We empirically evaluated multiple RNN and CNN architectures for bi-sequence classification and applied them for context-based claim and evidence detection. COLING '16 Paper.
- **Punctuation and Case prediction for ASR output**: Automatic Speech Recognition (ASR) engines are good at recognizing words from human speech; however, the output from ASR needs to be formatted with punctuation and case to be useful for downstream NLP tasks. In this work, we employed a multi-task approach to simultaneously produce punctuation and casing labels for a stream of words. This solution enabled mining of claims and evidences from human debate recordings. INTERSPEECH '17 Paper.
- **Unsupervised Neural Text Simplification**: We proposed an unsupervised approach towards text simplification using a shared encoder and attentional-decoders crucially assisted by discrimination-based losses and denoising. This approach was competitive with supervised approaches and surpassed viable unsupervised baselines. ACL '19 Paper.
- **Story generation from incoherent descriptions**: We proposed the new task of generating a coherent story from disconnected text snippets. For this, we implement an RNN based encoder-decoder solution to produce comprehensive coherent story. Paper.
- **ML Framework for evaluating creativity**: We identified important metrics for measuring creativity and proposed a regression-based learning framework for computing these metrics and combining them to produce a creativity score for an artifact. Paper.
- **Gene Prioritization from Heterogeneous Data Sources**: In this work, we use graph-based learning-to-rank methods to learn a ranking of genes from each individual data source represented as a graph, and then apply rank aggregation methods to aggregate these rankings into a single ranking over the genes. | *Advisor*: Dr. Shivani Agarwal. MS Thesis.
- **Investigation of the incentive compatible scoring rules for prediction markets**: We applied Prediction Markets in IISc Prediction League (to predict winners of DLF Indian Premier League 2012), an IISc-wide web application based on open-source Zocalo framework | *Advisor:* Prof. Y. Narahari. Project Report.

Patents

- **Object storage and retrieval based upon context** (US10713485B2).
- **Displaying dynamic content on multiple devices** (US10664217B1).
- **Generation of variable natural language descriptions from structured data** (US10776579B2).
- **Cognitive Assistant for Co-Generating Creative Content** (US20200134089A1).
- **Structured article generation** (US11194816B2).
- **Real-time assessment of text consistency** (US11194964B2).
- **Script modification** (US10891437B2).

References

1. Dr. **Karthik Sankaranarayanan** (Principal Scientist, Microsoft), karthiksa@microsoft.com.
2. Prof. **Mitesh M. Khapra** (Associate Professor, CSE, Indian Institute of Technology (IIT), Madras), miteshk@cse.iitm.ac.in.
3. Prof. **Aaron Courville** (Associate Professor, University of Montreal), aaron.courville@gmail.com.
4. Dr. **Pradeep Shenoy** (Researcher, Google Research India), pshenoy@cs.washington.edu.