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NTU-NLP Group
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RESEARCH INTERESTS

- Natural Language Processing
 - NLP tools (Syntactic/Semantic/Discourse Parsing, Coherence models, Topic models)
 - Multi-lingual NLP (Machine Translation, Cross-lingual tasks)
 - Robust/adversarial NLP
 - NLP Applications (Question answering, Summarization, Dialogue systems)
 - Multi-modal NLP (Image/Video Captioning)
- Machine Learning & Data Science
 - Deep learning, Representation learning
 - Probabilistic graphical models
 - Reinforcement learning

PROFESSIONAL EMPLOYMENTS

Assistant Professor 2017-present
Nanyang Technological University (NTU), Singapore
Founder of NTU-NLP Group

Senior Manager 2019-present
Salesforce AI Research, Singapore
Founding member of the new lab

Research Scientist 2014-2017
Qatar Computing Research Institute, Doha, Qatar

Research & Teaching Assistant <i>University of British Columbia</i> <i>University of Lethbridge</i>	2006-2013
Research Intern <i>Microsoft Research</i>	2010
Lecturer <i>Islamic University of Technology, Dhaka, Bangladesh</i>	2005-2006

EDUCATION

Ph.D. (Computer science) <i>University of British Columbia (UBC), Vancouver, Canada</i> “Discourse analysis of asynchronous conversations” Thesis advisors: Giuseppe Carenini & Raymond T. Ng Internal committee members: Nando de Freitas (now at Oxford/DeepMind) & Rachel Pottinger External committee members: Carolyn P. Rosé (CMU) & Amanda Stent (Yahoo! Research)	2008-2013
M.Sc. (Computer science) <i>University of Lethbridge (UofL), Alberta, Canada</i> “Answer Extraction for Simple and Complex Questions” Thesis advisor: Yllias Chali Other committee members: Sajjad Zahir, Howard Cheng & Giuseppe Carenini (external)	2006-2008
B.Sc. (Computer science) <i>Islamic University of Technology (IUT), Dhaka, Bangladesh</i> CGPA: 4.97/5.00 (2nd in the class)	2001-2005

MAJOR HONORS AND AWARDS

- [NSERC Alexander Graham Bell Canada Graduate Scholarship¹](#) (CGS-D)
2010 – 2012 \$35,000 CAD/Year
- [Four Year Fellowship \(UBC\)](#)
2010 – 2013 \$18,000 CAD/Year
- [Faculty of Science Graduate Studies Award \(UBC\)](#)
2010 – 2013 \$7,200 CAD/Year
- [Nominated for MIT Technology Review’s Innovators Under 35 \(Asia\)](#) 2017 – 2018
- Microsoft Research Excellent Intern, 2010
- Nomination for Governor General Gold Medal for Best MSc. Thesis (UofL), 2008
- David R. Cheriton Scholarship, University of Waterloo, 2008 [Declined]

¹This award is given only to the top-ranked PhD students across Canada.

- FS Chia Ph.D. Scholarship, University of Alberta, 2008 [Declined]
- First class 2nd in BSc, 5th in higher secondary (HSC) & 11th in secondary (SSC) merit lists

TEACHING EXPERIENCE

Instructor, Nanyang Technological University (NTU) 2017-

- **Year 2019 - 2020:**
 - (i) CE-7455 (PhD level): *Deep Learning for NLP* (*new offer*)
- **Year 2018 - 2019:**
 - (i) Term 1: CZ3005: Artificial Intelligence (Lec, Lab, Tut), Data Structures (Tut. & Lab)
 - (ii) Term 2: CZ3005: Artificial Intelligence (Lec, Lab, Tut)
- **Year 2017 - 2018:**
 - (i) Term 1: Data Structures (Tutorial & Lab)
 - (ii) Term 2: Ugrad CZ3005: Artificial Intelligence (Lecture, Lab, & Tutorial)

Machine Learning & Data Mining Tutorial ([link to the lectures](#)) 2015-2016

- Gave 12 lectures to the scientists at QCRI on ML models: simple discriminative/generative models, latent variable models, directed/undirected graphical models, deep neural networks.

Teaching Assistant, University of British Columbia 2008-2013

- Courses TAed: Grad NLP, Grad/Ugrad AI, Object Oriented Programming, Intro. to Comp.

Teaching Assistant, University of Lethbridge 2006-2008

- Courses TAed: Introduction to Computers.

Lecturer, Islamic University of Technology 2005-2006

- Courses Taught: Theory of computation, UNIX prog., Systems prog., OOP.

PATENTS

1. Samson Tan and **Shafiq Joty**., “Adversarial Finetuning for Greater Robustness to Inflectional Disturbances”, *A4657PROV 70689.104PV01 U.S. US Patent*, (2020).
2. Yifan Gao, Chu Hong Hoi, **Shafiq Joty** and Chien-Sheng Wu., “Explicit Memory Tracker with Coarse-to-Fine Reasoning for Conversational Machine Reading.”, *A4664PROV 70689.107PV01 U.S. US Patent*, (2020).
3. Yue Wang, Chu Hong Hoi, and **Shafiq Joty**., “VD-BERT: Vision and Dialog Transformer with BERT for Visual Dialog.”, *A4727PROV 70689.111PV01 U.S. US Patent*, (2020).

4. Karan Aggarwal, Swaraj Khadanga, **Shafiq Joty**, Louis Kazaglis, and Jaideep Srivastava ., “Sleep Staging For Monitoring Sleep Apnea Patients On CPAP Therapy.”, *NTU REF: 2019-074 US Patent*, (2020).
5. Karan Aggarwal, Swaraj Khadanga, **Shafiq Joty**, and Jaideep Srivastava ., “Using Clinical Notes With Time Series Data For ICU Management”, *NTU REF: 2019-374 US Patent*, (2020).
6. Weishi Wang, **Shafiq Joty**, and Chu Hong Hoi., “Response Selection in Multi-Party Conversations with Dynamic Topic Tracking ”, *A4861PROV US Patent*, (2020).
7. Xuan-Phi Nguyen, **Shafiq Joty**, and Chu Hong Hoi., “Tree-Transformer: Improved Transformer With Tree-based Attention”, *A4441US 70689.89US01. US Patent*, (2019).

IMPACT AND VISIBILITY

** Most of the codes of my papers can be found in the [NTU-NLP](#) group page

PEER-REVIEWED JOURNAL PAPERS

1. Tasnim Mohiuddin and **Shafiq Joty**, “[Unsupervised Word Translation with Adversarial Autoencoder](#)”, *Computational Linguistics* **46:2**, (presented at ACL-2020) (Jun, 2020).
2. Jing Ma, Wei Gao, **Shafiq Joty**, and Kam-Fai Wong, “[An Attention-based Rumor Detection Model with Tree-structured Recursive Neural Networks](#)”, *ACM Transactions on Intelligent Systems and Technology (TIST)* **11:04**, (42) (2020).
3. Lorainne Car, Dhakshenya Dhinakaran, Bhone Kyaw, Tobias Kowatsch, **Shafiq Joty**, Yin Theng, and Rifat Atun, “[Conversational agents in healthcare: a scoping review and conceptual analysis](#)”, *Journal of Medical Internet Research (JMIR)* , (forthcoming) (Jun, 2020).
4. **Shafiq Joty** and Tasnim Mohiuddin, “[Modeling Speech Acts in Asynchronous Conversations: A Neural-CRF Approach.](#)”, *Computational Linguistics (Special Issue on Language in Social Media)* **44:4**, 859 - 894 (2018).
5. **Shafiq Joty**, Francisco Guzmán, Lluís Màrquez, and Preslav Nakov., “[Discourse Structure in Machine Translation Evaluation.](#)”, *Computational Linguistics.* **43:4**, 683–722 (Dec, 2017).
6. **Shafiq Joty**, Nadir Durrani, Hassan Sajjad, and Ahmed Abdelali., “[Domain Adaptation Using Neural Network Joint Model.](#)”, *Journal of Computer Speech and Language (Special Issue on Deep Learning for Machine Translation).* **45:C**; **csl.2016.12.006**, 161–179 (Sep, 2017).
7. Francisco Guzmán, **Shafiq Joty**, Lluís Màrquez, and Preslav Nakov., “[Machine Translation Evaluation with Neural Networks.](#)”, *Journal of Computer Speech and Language (Special Issue on Deep Learning for Machine Translation).* **45:C**; **csl.2016.12.005**, 180–200 (Sep, 2017).
8. Aarti Sathyanarayana, **Shafiq Joty**, Luis Fernandez-Luque, Ferda Ofli, Jaideep Srivastava, Ahmed Elmagarmid, Shahradd Taheri, and Teresa Arora., “[Sleep Quality Prediction From Wearable Data Using Deep Learning](#)”, *JMIR Mhealth Uhealth (JMU)* **(4(4):e125)**, JMIR (2016).

9. **Shafiq Joty**, Giuseppe Carenini and Raymond Ng, “[CODRA: A Novel Discriminative Framework for Rhetorical Analysis](#).”, *Computational Linguistics*. **41:3**, 385–435, MIT press (2015).
10. **Shafiq Joty**, Giuseppe Carenini and Raymond Ng, “[Topic Segmentation and Labeling in Asynchronous Conversations](#).”, *Journal of AI Research*. **47**, 521-573 (2013).
11. Yllias Chali, Sadid Hasan and **Shafiq Joty**, “[Improving graph-based random walks for complex question answering using syntactic, shallow semantic and extended string subsequence kernels](#).”, *Information Processing and Management*. **47:6**, 843–855, Elsevier (2011).
12. Yllias Chali, **Shafiq Joty** and Sadid Hasan, “[Complex Question Answering: Unsupervised Learning Approaches and Experiments](#).”, *Journal of AI Research*. **35**, 1-47 (2009). (I was a co-lead author of this paper.)

PEER-REVIEWED CONFERENCE PAPERS [BY YEAR]

2020

1. Xuan-Phi Nguyen, **Shafiq Joty**, Steven Hoi, and Richard Socher., “[Tree-Structured Attention with Hierarchical Accumulation](#).”, *In International Conference on Learning Representations (ICLR-2020)*, Addis Ababa, Ethiopia (2020).
2. Samson Tan, **Shafiq Joty**, Min-Yen Kan, and Richard Socher., “[It’s Morphin’ Time! Combating Linguistic Discrimination with Inflectional Perturbations](#).”, *In Proceedings of the 58th Annual Meeting of the Association for Computational Linguistics (ACL-2020)*, Seattle, USA (2020).
3. Yifan Gao, Chien-Sheng Wu, **Shafiq Joty**, Caiming Xiong, Richard Socher, Irwin King, Michael Lyu, and Steven C.H., “[Explicit Memory Tracker with Coarse-to-Fine Reasoning for Conversational Machine Reading](#).”, *In Proceedings of the 58th Annual Meeting of the Association for Computational Linguistics (ACL-2020)*, Seattle, USA (2020).
4. Thanh-Tung Nguyen, Xuan-Phi Nguyen, **Shafiq Joty**, and Xiaoli Li., “[Efficient Constituency Parsing by Pointing](#).”, *In Proceedings of the 58th Annual Meeting of the Association for Computational Linguistics (ACL-2020)*, Seattle, USA (2020).
5. Thanh-Tung Nguyen, Xuan-Phi Nguyen, **Shafiq Joty**, and Xiaoli Li., “[Differentiable Window for Dynamic Local Attention](#).”, *In Proceedings of the 58th Annual Meeting of the Association for Computational Linguistics (ACL-2020)*, Seattle, USA (2020).
6. Tasnim Mohiuddin, M Saiful Bari, and **Shafiq Joty**, “[LNMap: Departures from Isomorphic Assumption in Bilingual Lexicon Induction Through Non-Linear Mapping in Latent Space](#).”, *In Proceedings of the 2020 Conference on Empirical Methods in Natural Language Processing (EMNLP-2020)*, Virtual (2020).
7. Prathyusha Jwalapuram, **Shafiq Joty** and Youlin Shen, “[Pronoun-Targeted Finetuning for NMT with Hybrid Losses](#).”, *In Proceedings of the 2020 Conference on Empirical Methods in Natural Language Processing (EMNLP-2020)*, Virtual (2020).

8. Samson Tan, **Shafiq Joty**, Lav R., and Min-Yen Kan., “[Mind Your Inflections! Improving NLP for Non-Standard English with Base-Inflection Encoding.](#)”, In *Proceedings of the 2020 Conference on Empirical Methods in Natural Language Processing (EMNLP-2020)*, Virtual (2020).
9. Weishi Wang, **Shafiq Joty**, Steven C.H., “Response Selection for Multi-Party Conversations with Dynamic Topic Tracking.”, In *Proceedings of the 2020 Conference on Empirical Methods in Natural Language Processing (EMNLP-2020)*, Virtual (2020).
10. Tao Yu and **Shafiq Joty**, “Online Conversation Disentanglement with Pointer Networks.”, In *Proceedings of the 2020 Conference on Empirical Methods in Natural Language Processing (EMNLP-2020)*, Virtual (2020).
11. Yue Wang, **Shafiq Joty**, Michael R., Irwin King, Caiming Xiong, and Steven C.H., “[VD-BERT: A Unified Vision and Dialog Transformer with BERT.](#)”, In *Proceedings of the 2020 Conference on Empirical Methods in Natural Language Processing (EMNLP-2020)*, Virtual (2020).
12. Yifan Gao, Chien-Sheng Wu, Jingjing Li, **Shafiq Joty**, Steven C.H., Caiming Xiong, Irwin King, and Michael Lyu. , “Discern: Discourse-Aware Entailment Reasoning Network for Conversational Machine Reading.”, In *Proceedings of the 2020 Conference on Empirical Methods in Natural Language Processing (EMNLP-2020)*, Virtual (2020).
13. Bosheng Ding, Linlin Liu, Lidong Bing, Canasai Kruengkrai, Thien Hai, **Shafiq Joty**, Luo Si, and Chunyan Miao., “An Effective Data Augmentation Method for Low-resource Tagging Tasks.”, In *Proceedings of the 2020 Conference on Empirical Methods in Natural Language Processing (EMNLP-2020)*, Virtual (2020).
14. Xiangxi Shi, Xu Yang, Jiuxiang Gu, **Shafiq Joty**, and Jianfei Cai, “[Finding It at Another Side: A Viewpoint-Adapted Matching Encoder for Change Captioning](#)”, In *Proceedings of the European Conference on Computer Vision (ECCV’20)*, Online (2020).
15. Saiful Bari, **Shafiq Joty**, and Prathyusha Jwalapuram., “[Zero-Resource Cross-Lingual Named Entity Recognition.](#)”, In *Thirty-Fourth AAAI Conference on Artificial Intelligence (AAAI-2020)*, New York, USA (2020).
16. Yingzhu Zhao, Chongjia Ni, Cheung-Chi LEUNG, **Shafiq Joty**, Eng Siong, and Bin Ma., “Universal Speech Transformer.”, In *21st Annual Conference of the International Speech Communication Association (Interspeech-2020)*, Shanghai, China (2020).
17. Yingzhu Zhao, Chongjia Ni, Cheung-Chi LEUNG, **Shafiq Joty**, Eng Siong, and Bin Ma., “Speech Transformer with Speaker Aware Persistent Memory.”, In *21st Annual Conference of the International Speech Communication Association (Interspeech-2020)*, Shanghai, China (2020).
18. Yingzhu Zhao, Chongjia Ni, Cheung-Chi LEUNG, **Shafiq Joty**, Eng Siong, and Bin Ma., “Cross Attention with Monotonic Alignment for Speech Transformer.”, In *21st Annual Conference of the International Speech Communication Association (Interspeech-2020)*, Shanghai, China (2020).

1. Linlin Liu*, Xiang Lin*, **Shafiq Joty**, Simeng Han, and Lidong Bing., “[Hierarchical Pointer Net Parsing](#).”, *In Proceedings of the Conference on Empirical Methods in Natural Language Processing (EMNLP-2019)*, pages x-x, Hong Kong, China (2019).
2. Han-Cheol Moon*, Tasnim Mohiuddin*, **Shafiq Joty***, and Chi Xu., “[A Unified Neural Coherence Model](#).”, *In Proceedings of the Conference on Empirical Methods in Natural Language Processing (EMNLP-2019)*, pages x-x, Hong Kong, China (2019).
3. Prathyusha Jwalapuram, **Shafiq Joty**, Irina Temnikova, and Preslav Nakov., “[Evaluating Pronominal Anaphora in Machine Translation: An Evaluation Measure and a Test Suite](#).”, *In Proceedings of the Conference on Empirical Methods in Natural Language Processing (EMNLP-2019)*, pages x-x, Hong Kong, China (2019).
4. Swaraj Khadanga, Karan Aggarwal, **Shafiq Joty**, and Jaideep Srivastava., “[Using Clinical Notes with Multimodal Learning for ICU Management](#).”, *In Proceedings of the Conference on Empirical Methods in Natural Language Processing (EMNLP-2019)*, pages x-x, Hong Kong, China (2019).
5. Jiuxiang Gu, **Shafiq Joty**, Jianfei Cai, Handong Zhao, Xu Yang, and Gang Wang, “[Unpaired Image Captioning via Scene Graph Alignments](#)”, *In Proceedings of the International Conference on Computer Vision (ICCV’19)*, Seoul, Korea (2019).
6. Xiangxi Shi, Jianfei Cai, **Shafiq Joty**, and Jiuxiang Gu, “Watch It Twice: Video Captioning with a Refocused Video Encoder”, *In Proceedings of the 27th ACM International Conference on Multimedia (ACMMM’19)*, Nice, France (2019).
7. Xiang Lin*, **Shafiq Joty***, Prathyusha Jwalapuram and M Saiful Bari, “[A Unified Linear-Time Framework for Sentence-Level Discourse Parsing](#)”, *In Proceedings of the 57th Annual Meeting of the Association for Computational Linguistics (ACL’19)*, Florence, Italy (2019).
8. Jing Ma, Wei Gao, **Shafiq Joty**, and Kam-Fai Wong, “[Sentence-Level Evidence Embedding for End-to-End Claim Verification with Hierarchical Attention Networks](#)”, *In Proceedings of the 57th Annual Meeting of the Association for Computational Linguistics (ACL’19)*, Florence, Italy (2019).
9. **Shafiq Joty**, Giuseppe Carenini, Raymond Ng, and Gabriel Murray., “[Discourse Processing and Its Applications](#)”, *In Proceedings of the 57th Annual Meeting of the Association for Computational Linguistics: Tutorial (ACL-2019 Tutorial)*, Florence, Italy (2019).
10. Tasnim Mohiuddin and **Shafiq Joty**, “[Revisiting Adversarial Autoencoder for Unsupervised Word Translation with Cycle Consistency and Improved Training](#)”, *In Proceedings of the North American Chapter of the Association for Computational Linguistics: Human Language Technologies (NAACL-19)*, Minneapolis, USA (2019).
11. Tasnim Mohiuddin, Thanh-Tung Nguyen and **Shafiq Joty** (Equal Contributions), “[Adaptation of Hierarchical Structured Models for Speech Act Recognition in Asynchronous Conversation](#)”, *In Proceedings of the North American Chapter of the Association for Computational Linguistics: Human Language Technologies (NAACL-19)*, Minneapolis, USA (2019).
12. Karan Aggarwal, **Shafiq Joty**, Luis Fernandez-Luque, and Jaideep Srivastava., “[Adversarial Unsupervised Representation Learning for Activity Time-Series](#)”, *In Thirty-Third AAAI Conference on Artificial Intelligence (AAAI-2019)*, Honolulu, Hawaii (2019).

13. Sameer Khurana, **Shafiq Joty**, Ahmed Ali, and James Glass, “[A Factorial Deep Markov Model For Unsupervised Disentangled Representation Learning From Speech](#)”, In *International Conference on Acoustics, Speech, and Signal Processing (ICASSP-2019)*, Brighton, UK (2019).
14. Siyuan Liu, Sourav S Bhowmick, Wanlu Zhang, Shu Wang, Wanyi Huang, and **Shafiq Joty**, “[NEURON: Query Execution Plan Meets Natural Language Processing For Augmenting DB Education](#)”, In *Proceedings of 45th ACM SIGMOD International Conference on Management of Data (SIGMOD-2019 Demo)*, Amsterdam, NL (2019).

2018

1. **Shafiq Joty**, Giuseppe Carenini, Raymond Ng, and Gabriel Murray., “[Discourse Processing and Its Applications in Text Mining](#)”, In *18th IEEE International Conference on Data Mining: Tutorial (ICDM-2018 Tutorial)*, Singapore (2018).
2. Gabriel Murray, **Shafiq Joty**, and Giuseppe Carenini., “[NLP for Conversations: Sentiment, Summarization, and Group Dynamics.](#)”, In *Proceedings of the 27th International Conference on Computational Linguistics: Tutorial Abstracts (COLING-2018 Tutorial)*, pages 1-4, Santa Fe, New Mexico, USA (2018).
3. **Shafiq Joty**, Lluís Màrquez and Preslav Nakov., “[Joint Multitask Learning for Community Question Answering Using Task-Specific Embeddings.](#)”, In *Proceedings of the Conference on Empirical Methods in Natural Language Processing (EMNLP-2018)*, pages x-x, Brussels, Belgium (2018).
4. **Shafiq Joty**, Tasnim Mohiuddin, and Dat Nguyen (equal contributions), “[Coherence Modeling of Asynchronous Conversations: A Neural Entity Grid Approach](#)”, In *Proceedings of the 56th Annual Meeting of the Association for Computational Linguistics (ACL’18)*, Melbourne, Australia (2018).
5. Firoj Alam, **Shafiq Joty**, and Muhammad Imran., “[Domain Adaptation with Adversarial Training and Graph Embeddings](#)”, In *Proceedings of the 56th Annual Meeting of the Association for Computational Linguistics (ACL’18)*, Melbourne, Australia (2018).
6. Jiuxiang Gu, **Shafiq Joty**, Jianfei Cai, and Gang Wang, “[Unpaired Image Captioning by Language Pivoting](#)”, In *Proceedings of the European Conference on Computer Vision (ECCV-2018)*, Munich, Germany (2018).
7. Qing Li, Qingyi Tao, **Shafiq Joty**, Jianfei Cai and Jiebo Luo, “[VQA-E: Explaining, Elaborating, and Enhancing Your Answers for Visual Questions](#)”, In *Proceedings of the VQA-E: Explaining, Elaborating, and Enhancing Your Answers for Visual Questions (ECCV-2018)*, Munich, Germany (2018).
8. Jiuxiang Gu, Jianfei Cai, **Shafiq Joty**, Li Niu, and Gang Wang, “[Look, Imagine and Match: Improving Textual-Visual Cross-Modal Retrieval with Generative Models](#)”, In *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition (CVPR-2018)*, Salt Lake City, Utah, United States (2018).
9. Chin Yao, Kaiqi Zhao, **Shafiq Joty**, and Gao Cong, “[Aspect-based Neural Recommender](#)”, In *Proceedings of the 27th ACM International Conference on Information and Knowledge Management (CIKM-2018)*, Turin, Italy (2018).

10. Jing Li, Aixin Sun, and **Shafiq Joty**, “[SegBot: A Generic Neural Text Segmentation Model with Pointer Network](#)”, In *Proceedings of the 27th International Joint Conference on Artificial Intelligence and the 23rd European Conference on Artificial Intelligence (IJCAI-ECAI-2018)*, Stockholm, Sweden (2018).
11. Karan Aggarwal, Swaraj Khadanga, **Shafiq Joty**, Louis Kazaglis, and Jaideep Srivastava, “[A Structured Learning Approach with Neural Conditional Random Fields for Sleep Staging](#)”, In *Proceedings of the IEEE Big Data Conference 2018 (IEEE Big Data-2018)*, Seattle, USA (2018).
12. Muhammad Ebraheem, Saravanan Thirumuruganathan, **Shafiq Joty**, Mourad Ouzzani and Nan Tang, “[Distributed Representations of Tuples for Entity Resolution](#)”, In *Proceedings of the Forty-fourth International Conference on Very Large Data Bases (VLDB-2018)*, Rio de Janeiro, Brazil (2018).
13. Firoj Alam, **Shafiq Joty**, and Muhammad Imran, “[Graph Based Semi-supervised Learning with Convolutional Neural Networks to Classify Crisis Related Tweets](#)”, In *Proceedings of the Twelfth International Conference on Web and Social Media (ICWSM-2018)*, Stanford, United States (2018).

2017

1. Tanay Kumar Saha, **Shafiq Joty** and Mohammad Al Hasan., “[CON-S2V: A Generic Framework for Incorporating Extra-Sentential Context into Sen2Vec.](#)”, In *Proceedings of the European Conference on Machine Learning and practice of knowledge discovery in databases (ECML-PKDD-2017)*, Macedonia, Skopje (2017).
2. Tanay Kumar Saha, **Shafiq Joty**, Naeemul Hassan, and Mohammad Al Hasan., “[Regularized and Retrofitted models for Learning Sentence Representation with Context.](#)”, In *Proceedings of the 26th ACM International Conference on Information and Knowledge Management (CIKM-2017)*, Singapore (2017).
3. Dat Tien Nguyen and **Shafiq Joty** (co-lead author), “[A Neural Local Coherence Model.](#)”, In *Proceedings of the 55th Annual Meeting of the Association for Computational Linguistics (ACL-2017)*, pages 1320-1330, Vancouver, Canada (2017).
4. **Shafiq Joty**, Preslav Nakov and Lluís Màrquez, “[Cross-language Learning with Adversarial Neural Networks.](#)”, In *Proceedings of The SIGNLL Conference on Computational Natural Language Learning (CoNLL-2017)*, pages 226-237, Vancouver, Canada (2017).
5. Enamul Hoque, **Shafiq Joty**, Lluís Màrquez, and Giuseppe Carenini., “[CQAVis: Visual Text Analytics for Community Question Answering.](#)”, In *Proceedings of the 22nd annual meeting of the intelligent user interfaces (IUI-2017)*, pages 161-172, Limassol, Cyprus (2017).
6. Giovanni Da San Martino, Salvatore Romeo, Alberto Barron-Cedeno, Shafiq Joty, Lluís Màrquez, Alessandro Moschitti and Preslav Nakov., “[Cross-Language Question Re-ranking.](#)”, In *Proceedings of the 40th International ACM SIGIR Conference on Research and Development in Information Retrieval (SIGIR-2017)*, pages 1145-1148, Tokyo, Japan (2017).
7. Dat Tien Nguyen, Kamla Al-Mannai, **Shafiq Joty**, Hassan Sajjad, Muhammad Imran and Prasenjit Mitra., “[Robust Classification of Crisis-Related Data on Social Networks using Convolutional Neural Networks.](#)”, In *Proceedings of the 11-th International AAAI Conference on Weblogs and Social Media (ICWSM-2017)*, pages 632-635, Montreal, Canada (2017).

2016

1. **Shafiq Joty** and Enamul Hoque., “[Speech Act Modeling of Written Asynchronous Conversations with Task-Specific Embeddings and Conditional Structured Models.](#)”, *In Proceedings of the 54th Annual Meeting of the Association for Computational Linguistics (ACL-2016)*, pages 1746-1756, Berlin, Germany (2016).
2. **Shafiq Joty**, Lluís Màrquez and Preslav Nakov., “[Joint Learning with Global Inference for Comment Classification in Community Question Answering.](#)”, *In Proceedings of the North American Chapter of the Association for Computational Linguistics: Human Language Technologies (NAACL-2016)*, pages 703-713, San Diego, USA (2016).
3. Nadir Durrani, Hassan Sajjad, **Shafiq Joty**, and Ahmed Abdelali., “[A Deep Fusion Model for Domain Adaptation in Phrase-based MT.](#)”, *In Proceedings of the 26th International Conference on Computational Linguistics (COLING-2016)*, pages 3177–3187, Osaka, Japan (2016).
4. Enamul Hoque, **Shafiq Joty**, Lluís Màrquez, Alberto Barrón-Cedeño, Alessandro Moschitti, Giovanni Da San Martino, Preslav Nakov, Salvatore Romeo and Giuseppe Carenini., “[An Interactive System for Exploring Community Question Answering Forums.](#)”, *In Proceedings of the 26th International Conference on Computational Linguistics (COLING-2016)*, pages 1-5, Osaka, Japan (2016).

2015

1. **Shafiq Joty**, Hassan Sajjad, Nadir Durrani, Kamla Al-Mannai, Ahmed Abdelali and Stephan Vogel., “[How to Avoid Unwanted Pregnancies: Domain Adaptation using Neural Network Models.](#)”, *In Proceedings of the Conference on Empirical Methods in Natural Language Processing (EMNLP-2015)*, pages 1259-1270, Lisbon, Portugal (2015).
2. **Shafiq Joty**, Alberto Barrón-Cedeño, Giovanni Da San Martino, Alessandro Moschitti, Lluís Màrquez and Preslav Nakov., “[Global Thread-level Inference for Comment Classification in Community Question Answering.](#)”, *In Proceedings of the Conference on Empirical Methods in Natural Language Processing (EMNLP-2015)*, pages 573-578, Lisbon, Portugal (2015).
3. Pengfei Liu, **Shafiq Joty**, and Helen Meng., “[Fine-grained Opinion Mining with Recurrent Neural Networks and Word Embeddings.](#)”, *In Proceedings of the Conference on Empirical Methods in Natural Language Processing (EMNLP-2015)*, pages 1433-1443, Lisbon, Portugal (2015).
4. Francisco Guzmán, **Shafiq Joty**, Lluís Màrquez, and Preslav Nakov., “[Pairwise Neural Machine Translation Evaluation.](#)”, *In Proceedings of the 53rd annual meeting of the Association for Computational Linguistics (ACL-2015)*, pages 805 -814, Beijing, China (2015).
5. Alberto Barrón-Cedeño, Simone Filice, Giovanni Da San Martino, **Shafiq Joty**, Lluís Màrquez, Preslav Nakov and Alessandro Moschitti., “[Thread-level Information for Comment Classification in Community Question Answering.](#)”, *In Proceedings of the 53rd annual meeting of the Association for Computational Linguistics (ACL-2015)*, pages 687-693, Beijing, China (2015).
6. Nadir Durrani, Hassan Sajjad, **Shafiq Joty**, Ahmed Abdelali and Stephan Vogel., “[Using Joint Models for Domain Adaptation in Statistical Machine Translation.](#)”, *In Proceedings of the Association for Machine Translation in the Americas (AMTA-2015)*, Miami, USA (2015).

2014

1. **Shafiq Joty**, Alessandro Moschitti., “[Discriminative Reranking of Discourse Parses Using Tree Kernels](#).”, *In Proceedings of the Conference on Empirical Methods in Natural Language Processing (EMNLP-2014)*, pages 2049-2060, Doha, Qatar (2014).
2. Francisco Guzmán, **Shafiq Joty**, Lluís Màrquez, Alessandro Moschitti, Preslav Nakov and Massimo Nicosia., “[Learning to Differentiate Better from Worse Translations](#).”, *In Proceedings of the Conference on Empirical Methods in Natural Language Processing (EMNLP-2014)*, pages 214-220, Doha, Qatar (2014).
3. Iman Saleh, Alessandro Moschitti, Preslav Nakov, Lluís Màrquez and **Shafiq Joty**., “[Semantic Kernels for Semantic Parsing](#).”, *In Proceedings of the Conference on Empirical Methods in Natural Language Processing (EMNLP-2014)*, pages 436-442, Doha, Qatar (2014).
4. Francisco Guzmán, **Shafiq Joty**, Lluís Màrquez, and Preslav Nakov., “[Using Discourse Structure Improves Machine Translation Evaluation](#).”, *In Proceedings of the 52nd annual meeting of the Association for Computational Linguistics (ACL-2014)*, pages 687-698, Baltimore, USA (2014).
5. Iman Saleh, **Shafiq Joty**, Lluís Màrquez, Alessandro Moschitti, Preslav Nakov, Scott Cyphers and Jim Glass., “[A Study of Using Syntactic and Semantic Structures for Concept Segmentation and Labeling](#).”, *In Proceedings of the 25th International Conference on Computational Linguistics (COLING-2014)*, pages 193-202, Dublin, Ireland (2014).

2013

1. **Shafiq Joty**, Giuseppe Carenini, Raymond Ng and Yashar Mehdad., “[Combining Intra- and Multi-sentential Rhetorical Parsing for Document-level Discourse Analysis](#).”, *In Proceedings of the 51st Annual Meeting of the Association for Computational Linguistics. (ACL-2013)*, pages 486-496, Sofia, Bulgaria (2013).
2. Yashar Mehdad, Giuseppe Carenini, Raymond Ng and **Shafiq Joty**., “[Towards Topic Labeling with Phrase Entailment and Aggregation](#).”, *In Proceedings of the North American Chapter of the Association for Computational Linguistics: Human Language Technologies. (NAACL-2013)*, pages 179-189, Atlanta, USA (2013).
3. Maryam Tavafi, Yashar Mehdad, **Shafiq Joty**, Giuseppe Carenini, Raymond Ng., “[Dialogue Act Recognition in Synchronous and Asynchronous Conversations](#).”, *In Proceedings of the 14th Annual Meeting of the Special Interest Group on Discourse and Dialogue. (SIGDIAL-2013)*, pages 117-121, Metz, France. (2013).

2012

1. **Shafiq Joty**, Giuseppe Carenini and Raymond Ng., “[A Novel Discriminative Framework for Sentence-Level Discourse Analysis](#).”, *In Proceedings of the Conference on Empirical Methods in Natural Language Processing and the Conference on Natural Language Learning. (EMNLP-2012)*, pages 904-915, Jeju, Korea (2012).

2011

1. **Shafiq Joty**, Giuseppe Carenini and Chin-Yew Lin., “[Unsupervised Modeling of Dialog Acts in Asynchronous Conversations.](#)”, In *Proceedings of the twenty second International Joint Conference on Artificial Intelligence. (IJCAI-2011)*, pages 1807-1813, Barcelona, Spain (2011).
2. **Shafiq Joty**, Giuseppe Carenini, Gabriel Murray and Raymond Ng., “[Supervised Topic Segmentation of Email Conversations.](#)”, In *Fifth International AAAI Conference on Weblogs and Social Media. (ICWSM-2011)*, pages 530-533, Barcelona, Spain (2011).
3. Nicholas FitzGerald, Giuseppe Carenini, Gabriel Murray and **Shafiq Joty.**, “[Exploiting Conversational Features to Detect High-Quality Blog Comments.](#)”, In *Proceedings of the Canadian Conference on Artificial Intelligence (CAI-2011)*, pages 122-127, St. Johns, Newfoundland (2011).

2010

1. **Shafiq Joty**, Giuseppe Carenini, Gabriel Murray and Raymond Ng., “[Exploiting Conversation Structure in Unsupervised Topic Segmentation for Emails.](#)”, In *Proceedings of the Conference on Empirical Methods in Natural Language Processing and the Conference on Natural Language Learning. (EMNLP-2010)*, pages 388-398, Massachusetts, USA. (2010).

2009

1. Yllias Chali, Sadid Hasan and **Shafiq Joty.**, “[Do Automatic Annotation Techniques Have Any Impact on Supervised Complex Question Answering?](#)”, In *Proceedings of the ACL-IJCNLP 2009 Conference. (ACL-2009)*, pages 329-332, Suntec, Singapore. (2009).
2. Yllias Chali, Sadid Hasan and **Shafiq Joty.**, “[A SVM-Based Ensemble Approach to Multi-Document Summarization.](#)”, In *Proceedings of the 22nd Canadian Conference on Artificial Intelligence (CAI-2009)*, pages 329-332, Kelowna, Canada. (2009).
3. Yllias Chali, Sadid Hasan and **Shafiq Joty.**, “[Supervised Approaches to Complex Question Answering.](#)”, In *Proceedings of Conference of the Pacific Association for Computational Linguistics (PACLING-2009)*, pages 121-126, Sapporo, Japan. (2009).

2008

1. Yllias Chali and **Shafiq Joty.**, “[Selecting Sentences for Answering Complex Questions.](#)”, In *Proceedings of the Conference on Empirical Methods in Natural Language Processing (EMNLP-2008)*, pages 304-313, Hawaii, USA. (2008). (I was a co-lead author.)
2. Yllias Chali and **Shafiq Joty.**, “[Improving the Performance of the Random Walk Model for Answering Complex Questions.](#)”, In *Proceedings of the 46th Annual Meeting of the Association for Computational Linguistics: Human Language Technologies (ACL-2008)*, pages 9-12, OH, USA. (2008). (I was a co-lead author.)
3. Yllias Chali and **Shafiq Joty.**, “[Exploiting Syntactic and Shallow Semantic Kernels to Improve Random Walks for Complex Question Answering.](#)”, In *Proceedings of the 20th IEEE Int'l Conference on Tools with Artificial Intelligence (ICTAI-2008)*, pages 123-130, OH, USA. (2008). (I was a co-lead author.)
4. Yllias Chali and **Shafiq Joty.**, “[Answering Complex Questions Using Query-focused Summarization Technique.](#)”, In *Proceedings of the 20th IEEE Int'l Conference on Tools with Artificial Intelligence (ICTAI-2008)*, pages 131-134, OH, USA. (2008). (I was a co-lead author.)

5. Yllias Chali and **Shafiq Joty**., “[Unsupervised Approach for Selecting Sentences in Query-based Summarization.](#)”, In *Proceedings of the 21st FLAIRS conference (FLAIRS-2007)*, pages 47-52, Florida, USA. (2008). (I was a co-lead author.)
6. Gabriel Murray, **Shafiq Joty**, Giuseppe Carenini and Raymond Ng., “[The University of British Columbia at TAC 2008.](#)”, In *Proceedings of the Text Analysis Conference (TAC-2008)*, Rochester, USA. (2008).

2007

1. Yllias Chali and **Shafiq Joty**., “[University of Lethbridge’s Participation in DUC-2007 Main Task.](#)”, In *Proceedings of the Document Understanding Conference (DUC-2007)*, Rochester, USA. (2007). (I was a co-lead author.)
2. Yllias Chali and **Shafiq Joty**., “[University of Lethbridge’s Participation in TREC-2007 Main Task.](#)”, In *Proceedings of the Sixteenth Text REtrieval Conference (TREC-2007)*, Gaithersburg, USA. (2007). (I was a co-lead author.)
3. **Shafiq Joty** and Sadid Hasan., “[Advances in Focused Retrieval: A General Review.](#)”, In *Proceedings of the 10th IEEE International Conference on Computer and Information Technology (ICCIT-2007)*, pages 1-5, Dhaka, Bangladesh. (2007).

PEER-REVIEWED WORKSHOP PAPERS

1. Dat Nguyen, **Shafiq Joty**, Basma Boussaha, and Maarten de Rijke., “[Thread Reconstruction in Conversational Data using Neural Coherence Models.](#)”, In *Proceedings of the Neu-IR 2017 SIGIR Workshop on Neural Information Retrieval (NeuIR’17)*, Tokyo, Japan (2017).
2. Alberto Barrón-Cedeño, Giovanni Da San Martino, **Shafiq Joty**, Alessandro Moschitti, Fahad Al-Obaidli, Salvatore Romeo, Kateryna Tymoshenko and Antonio Uva., “[ConvKN at SemEval-2016 Task 3: Answer and Question Selection for Question Answering on Arabic and English Fora.](#)”, In *Proceedings of the 10th International Workshop on Semantic Evaluation. (SemEval 2016)*, San Diego, USA (2016). (*2nd place in both English & Arabic subtasks of Task 3*)
3. Dat Tien Nguyen, **Shafiq Joty**, Muhammad Imran, Hassan Sajjad, and Prasenjit Mitra., “[Applications of Online Deep Learning for Crisis Response Using Social Media Information.](#)”, In *the 4th International Workshop on Social Web for Disaster Management (co-located with CIKM 2016), (SWDM 2016)*, Indianapolis, USA (2016).
4. Massimo Nicosia, Simone Filice, Alberto Barrón-Cedeño, Iman Saleh, Hamdy Mubarak, Wei Gao, Preslav Nakov, Giovanni Da San Martino, Alessandro Moschitti, Kareem Darwish, Lluís Màrquez, **Shafiq Joty** and Walid Magdy., “[QCRI: Answer Selection for Community Question Answering - Experiments for Arabic and English.](#)”, In *Proceedings of the 9th International Workshop on Semantic Evaluation. (SemEval-2015)*, pages 203-209, Denver, USA (2015). (*Winner in Arabic and 3rd place in English subtask of Task 3*)
5. **Shafiq Joty**, Francisco Guzman, Lluís Marquez and Preslav Nakov., “[DiscoTK: Using Discourse Structure for Machine Translation Evaluation.](#)”, In *Proceedings of the Ninth Workshop on Statistical Machine Translation (WMT-2014)*, pages 402-408, Baltimore, USA (2014). (*Winner of the metric task.*)

6. Enamul Hoque, Giuseppe Carenini and **Shafiq Joty**., “[Interactive Exploration of Asynchronous Conversations: Applying a User-centered Approach to Design a Visual Text Analytic System.](#)”, *In Proceedings of the Workshop on Interactive Language Learning, Visualization, and Interfaces (ILLVI-2014)*, pages 45-52, Baltimore, USA. (2014).
7. Wei Jin, **Shafiq Joty**, Giuseppe Carenini and Raymond Ng., “[Detecting Informative Blog Comments using Tree Structured Conditional Random Fields.](#)”, *The Pacific Northwest Regional NLP Workshop (NWNLP-2012)*, Microsoft Research, Redmond, USA. (2012).
8. **Shafiq Joty**, Giuseppe Carenini, Gabriel Murray and Raymond Ng., “[Finding Topics in Emails: Is LDA enough?](#)”, *NIPS-2009 workshop on applications for topic models: text and beyond. (NIPS-2009)*, Whistler, Canada (2009).
9. Yllias Chali and **Shafiq Joty**., “[Word Sense Disambiguation Using Lexical Cohesion.](#)”, *In Proceedings of the 4th International Conference on Semantic Evaluations (SemEval-2007)*, pages 476-479, Prague, Czech Republic. (2007).

RESEARCH GRANTS

1. AI-supported collaborative activity design., “AISG 100 Experiments”, (Apr, 2020 – Sep, 2021).
2. Customised Tamil-English Translation Engine., “Joint Project with A-star”, (Sep, 2019 – Feb, 2021).
3. Knowledge Graph Mining for Educational Domain., “Delta-NTU-NRF”, (Jan, 2020 – Dec, 2022).
4. Language Understanding and Generation with Deep Neural Networks., “Start Up-Grant (NTU, Singapore)”, (Jul, 2017 – Jul, 2020).
5. A Malay-English Translation System., “SCSE demo fund (NTU, Singapore)”, (Jan, 2018 – Jun, 2018).
6. Multilingual Language Processing Using Generative Adversarial Autoencoders., “Tier-1 program (NTU, Singapore)”, (Mar, 2018 - Aug, 2019).

TUTORIALS AT INTERNATIONAL CONFERENCES

1. [Discourse Analysis and Its Applications](#), **Shafiq Joty**, Giuseppe Carenini, Raymond Ng, and Gabriel Murray, **ACL-2019**, Florence, Italy. ([Slides](#))
2. [Discourse Processing and Its Applications in Text Mining](#), **Shafiq Joty**, Giuseppe Carenini, Raymond Ng, and Gabriel Murray, **ICDM-2018**, Singapore. ([Slides](#))
3. [NLP for Conversations: Sentiment, Summarization, and Group Dynamics](#), Gabriel Murray, **Shafiq Joty**, and Giuseppe Carenini., **COLING-2018**, Santa Fe, New Mexico. ([Slides](#))

INVITED TALKS

1. “Discourse Analysis with Deep Learning” , TU-Darmstadt, Germany, July. 2019
2. “Structured Models for Discourse Analysis and NLP Applications ”, Alibaba, Singapore, Jan. 2019
3. [“Deep Structured Models for Natural Language Processing”](#), NTU-SenseTime Research Seminar, NTU, Singapore, Nov. 2018
4. “Deep Structured Models for Natural Language Processing ”, Salesforce AI Research, Palo Alto, USA, Oct. 2018
5. “Deep Learning for Multilingual and Multimodal Processing”, DSO National Laboratories, Singapore, Oct. 2018
6. [“Deep Learning for Multilingual and Multimodal Processing”](#), Industry-NTU Dialogue: AI Research, Innovation and Talent, NTU, Singapore, Sep. 2018
7. “Discourse Analysis and Its Applications”, Gwangju Institute of Science and Technology (GIST), South Korea, Dec. 2017
8. “How Computational Linguistics can help Computational History”, Johannesburg Institute for Advanced Study (JIAS), Johannesburg, South Africa, Nov. 2017
9. “Discourse Analysis and Its Applications”, National University of Singapore (NUS), Singapore, Oct. 2017
10. “Discourse Analysis and Its Applications”, Institute for Infocomm Research A*Star, Singapore, Sep. 2017
11. [“Structured Predictions for Discourse Analysis and Applications in Natural Language Processing”](#), Singapore University of Technology and Design (SUTD), Singapore, Sep. 2017
12. “Structured Predictions for Discourse Analysis and Applications in Natural Language Processing”, University of Calgary, Calgary, Canada, Mar. 2017
13. “Structured Predictions for Discourse Analysis and Applications in Natural Language Processing”, University of Waterloo, Waterloo, Canada, Feb. 2017
14. “Structured Predictions for Discourse Analysis and Applications in Natural Language Processing”, Nanyang Technological University (NTU), Singapore, Nov. 2016
15. “Introduction to Machine Learning”, Global Entrepreneurship Week, Doha, Nov. 2015
16. “Discourse Analysis & its Applications”, Chinese University of Hong Kong., Oct. 2015
17. “CODRA: A Complete Discriminative Framework for Rhetorical Analysis”, Universite Paul Sabatier, Toulouse, France., Sep. 2014
18. “Discourse Analysis of Asynchronous Conversations”, University of British Columbia, Vancouver, Canada., Dec. 2013
19. “Intra- and Multi-sentential Rhetorical Parsing for Document-level Discourse Analysis”, NSERC Business Intelligence Network AGM, IBM Software Labs, Canada., Nov. 2012

20. “A Novel Discriminative Framework for Sentence-Level Discourse Analysis”, NW-NLP workshop, Microsoft Research Redmond., May, 2012
21. “Discourse Analysis of Asynchronous Conversations (e.g., emails, blogs)”, Business Intelligence (BI) Workshop-NSERC BIN Watson, IBM Watson center, Feb, 2012
22. “Discourse Analysis of Asynchronous Conversations (e.g., emails, blogs)”, UBC Social Network Group, Feb, 2012
23. “Unsupervised Modeling of Dialog Acts in Asynchronous Conversations”, UBC Laboratory for Computational Intelligence (LCI) Forum Talk, Apr, 2011
24. “Topic and Dialog Act Modeling of Asynchronous Conversations”, Microsoft Research Asia, Nov, 2010
25. “What are they talking about?” Finding Topics in Email Conversations”, UBC Laboratory for Computational Intelligence Forum (LCI) Talk, Feb, 2010
26. “Answering Simple and Complex Questions”, University of Alberta NLP Group, Jan, 2008

SERVICE

1. Area chair for [ACL-2020 \(Discourse track\)](#), [ACL-2019 \(QA track\)](#), [EMNLP-2019 \(Discourse Track\)](#)
2. Associate editor for ACM Transactions on Asian and Low Resource Language Resource language Processing (TALLIP)
3. Senior Program Committee member for [IJCAI-2019](#)
4. Grant Proposal Reviewing: [NSERC Canada Discovery Grant](#) [2018].
5. Reviewing: TACL [2015-2019], ACL/EMNLP/SigDial/*SEM/NAACL/IJCAI/IUI/KDD.
6. Associate VP position in the Bangladesh Students’ Association, UBC (2009-2010).
7. Organizing committee member of EMNLP-2014, ICCIT-2005.

PROFESSIONAL MEMBERSHIP

- ACL, SIGDAT, SIGGEN, SIGSEM, ACM, IEEE.

CURRENT PHD STUDENTS

1. [Tasnim Mohiuddin](#) [Jan, 2018 - Present]
2. Prathyusha Jwalapuram [Aug, 2018 - Present]
3. Nguyen Thanh Tung [Aug, 2018 - Present] [Co-supervision with Xiaoli (A-star)]
4. [Saiful Bari](#) [Jan, 2019 - Present]
5. Han-Cheol Moon [Jan, 2019 - Present]

6. [Lin Xiang](#) [Jan, 2019 - Present]
7. Linlin Liu [Jan, 2019 - Present] [Co-supervision with Lidong Bing (Alibaba)]
8. Xuan Phi Nguyen [Aug, 2019 - Present] [Co-supervision with Wu Kui (A-star)]
9. Wang Weishi [Aug, 2019 - Present] [Co-supervision with Steven Hoi (Salesforce)]
10. Ding Bosheng [Aug, 2019 - Present] [Co-supervision with Lidong Bing (Alibaba)]
11. Tao Yu [Jan, 2020 - Present] [Part-time PhD]

PREVIOUSLY MENTORED STUDENTS

1. [Sameer Khurana](#) [May, 2018 - Aug, 2018]. (Now PhD student at MIT-CSAIL, USA)
2. [Jing MA](#) [Dec, 2018 - Aug, 2019]. (Now PhD student at CUHK, Hong Kong)
3. [Enamul Hoque](#) [Feb, 2016 - May, 2016] (Now Asst. Prof. at York Univ, Canada)
4. [Aarti Sathyanarayana](#) [July, 2016 - Dec, 2016] (Now Postdoc at Harvard Medical, USA)

REFERENCES

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