

Navigating the Landscape of Empathetic Dialogue Systems: Current Innovations and Future Developments

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Abstract

There has been a growing interest in empathetic dialogue systems (EDS) that demonstrate emotional and social intelligence within the natural language processing (NLP) community. The ability to recognize users' emotional states, sentiments, and behaviors and respond accordingly is crucial for effective communication. While this comes naturally to humans, embedding such human-like capabilities into conversational systems presents a formidable challenge. Since empathetic dialogue systems encompass a broad range of human characteristics, newcomers often find it challenging to begin. As a result, this tutorial aims to provide a comprehensive overview of empathetic dialogue systems. The tutorial's scope encompasses various aspects, including the historical context, development, available datasets, techniques (including cutting-edge approaches), methods for evaluation, and recent trends and challenges in empathetic dialogue systems. Lastly, it highlights some of the limitations and deficiencies in existing techniques to guide future research in this field.

1 Introduction

The primary aim of the development of dialogue systems is to replicate human communication in order to address users' concerns and requests effectively. In recent years, there has been a growing emphasis on incorporating empathy into conversational systems to promote prosocial behavior and enhance the establishment of social connections. This tutorial is designed to provide an overview of empathetic dialogue systems (EDS), which not only focus on responding to a variety of user requests but also aim to enhance the recognition and expression of emotional states and individual preferences. Within this tutorial, we will commence by introducing conceptual empathy models (Davis et al., 1980; Goleman, 1995) and briefly discuss

the significance of empathy in dialogue systems (McTear et al., 2016).

Subsequently, we delve into significant research endeavors concerning EDS. More specifically, our focus centers on the affective and social aspects of these empathetic dialogue systems. The recognition of emotions plays a pivotal role in enabling the selection of pertinent empathetic responses, as demonstrated in the work by (Rashkin et al., 2019). Several studies have also been dedicated to identifying sentiments within user messages for the purpose of crafting empathetic responses, exemplified by the contributions of (Chen and Nakamura, 2021) and (Lahoz-Beltra and López, 2021). Following emotion-based response generation, we succinctly synthesize the body of work that underscores the recognition of users' emotions and sentiments as an essential step toward generating empathetic responses in CAI systems, including works by (Zhou et al., 2018; Firdaus et al., 2021a,b; Zheng et al., 2021; Madasu et al., 2022; Majumder et al., 2022). Nevertheless, it is crucial to recognize that incorporating emotions and sentiments into the generated responses only constitutes a partial solution for empathetic response generation.

A more comprehensive EDS system should be equipped with access to additional contextual information, including the causes of emotions, user intent, persona, social etiquette (politeness), and external knowledge, to enhance the empathetic quality of the generated responses. Emotion cause facilitates understanding the underlying cause of a particular emotion for generating more relevant empathetic responses (Li et al., 2021; Gao et al., 2021). Recognizing the users' intent in conversational systems is essential for delivering the requisite information to the users (Xie and Pu, 2021). Persona is highly correlated with personality, which in turn influences empathy. A Persona-based Empathetic Conversation (PEC) dataset has been created in (Zhong et al., 2020). Several other studies have

utilized persona-aware techniques for enhancing the performance of empathetic response generation (Firdaus et al., 2020d; Saha and Ananiadou, 2022; Firdaus et al., 2022d). Likewise, politeness is also vital for developing a cordial and empathetic connection with the users (Mishra et al., 2022b). A few works have shown that the use of external knowledge sources in EDS research facilitates a more in-depth comprehension of the user’s feelings by deducing the implicit information inherent in the user’s responses. We extensively spotlight numerous influential works that delve into these facets, contributing to the advancement of superior EDS systems, as evidenced by the contributions of (Li et al., 2021; Gao et al., 2021; Xie and Pu, 2021; Zheng et al., 2021; Zhong et al., 2020; Firdaus et al., 2020d,c, 2022d; Golchha et al., 2019; Mishra et al., 2022b,a, 2023; Firdaus et al., 2022b,a; Yoo and Jeong, 2021; Sabour et al., 2022; Liu et al., 2022; Li et al., 2022). In particular, we delve into the datasets, methodologies, state-of-the-art (SOTA) approaches, and evaluation techniques presented within these works.

Recent developments in the field have also demonstrated the utility of multimodal information, which combines features from various modalities, including text, images, audio, and video, in enhancing emotion analysis within CAI systems, as exemplified by (Poria et al., 2018; Firdaus et al., 2020b). Consequently, we also explore studies that have integrated multimodal information into the framework of empathetic response generation, yielding significantly improved performance compared to models relying solely on unimodal information, as evidenced in works by (Tavabi et al., 2019; Firdaus et al., 2020a, 2022c).

Furthermore, a burgeoning line of research has shown that empathetic dialogue systems possess the capacity for social influence, wherein they can affect users’ emotional and cognitive responses, thereby contributing to shifts in their beliefs, attitudes, and behaviors through empathetic interactions. Notable social influence tasks include persuasion and psychotherapy, as documented in works by (Wang et al., 2019; Althoff et al., 2016). We provide a concise overview of the noteworthy study addressing this emerging trend in EDS systems, including contributions by (Samad et al., 2022; Mishra et al., 2022c; Sharma et al., 2020, 2021).

Lastly, in conclusion, we shed light on the limitations and shortcomings inherent in contemporary approaches. This serves to facilitate the progress

of research on EDS systems, particularly for those embarking on this field.

2 Target audience for the tutorial

We believe that the potential target audience could be the students at all levels (Doctorals, Masters, Bachelors), and anyone who is associated with e-commerce, customer care, & related application areas, and researchers.

We would assume an acquaintance with basic concepts about chatbots and neural networks, such as those included in most introductory Machine Learning (ML), Deep Learning (DL) and Natural Language Processing (NLP) courses.

3 Outline

This tutorial is organized as follows:

- Concepts of empathy and its need in dialogue systems
- Emotion, sentiment, emotion cause, intent, persona, and politeness in empathetic dialogue systems
- Relevance of external knowledge and multimodal information in empathetic dialogue systems
- Empathetic dialogue systems for social good applications - Persuasion and Therapy
- Conclusion and Future Directions

4 Presenters

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Brief CVs of all the presenters are attached to this proposal.

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A Appendix

A.1 Ethical Concerns

Dialogue systems are becoming ubiquitous in daily applications like healthcare and customer care, necessitating ethical considerations in development and usage. Key considerations include: (i) Knowledge-enhanced dialogue systems can collect sensitive user information, including personal and health data. To safeguard users' privacy, the data used in the research presented here has been anonymized, and personal details have been protected; (ii) In the context of knowledge-enhanced dialogue systems, user-centric design is essential, ensuring that users have control over the conversation and information sharing. Respecting user autonomy, these systems should offer options to conclude the conversation or seek further assistance. The datasets created for various research topics covered in this tutorial have been crafted to preserve user autonomy.

A.2 Relevant Publications from our group

1. Gitanjali Kumari, Pranali Shindey, Asif Ekbal. The Persuasive Memescape: Understanding Effectiveness and Societal Implications of Internet Memes. In the main conference AACL-IJCNLP 2023.
2. Mauajama Firdaus, Priyanshu Priya, Asif Ekbal. Mixing It Up: Inducing Empathy and Politeness using Multiple Behaviour-aware Generators for Conversational Systems. In Findings AACL-IJCNLP 2023.
3. Kshitij Mishra, Priyanshu Priya and Asif Ekbal (2023). PAL to Lend a Helping Hand: Towards Building an Emotion Adaptive Polite and Empathetic Counseling Conversational Agent. In Proceedings of the 61st Annual Meeting of the Association for Computational Linguistics, Canada Toronto.
4. Priyanshu Priya, Kshitij Mishra, Asif Ekbal (2023). PARTNER: A Persuasive Mental Health and Legal Counselling Dialogue System for Women and Children Crime Victims. In the 32nd International Joint Conference on Artificial Intelligence (AI for Social Good Track), Macao, S.A.R.
5. Kshitij Mishra, Priyanshu Priya, and Asif Ekbal (2023). *Help Me Heal*: A Reinforced Polite and Empathetic Mental Health and Legal Counseling Dialogue System for Crime Victims. In 37th AAAI Conference on Artificial Intelligence, February 7-14, USA.
6. Z. Ahmad, K. Mishra, and A. Ekbal (2023). RPTCS: A Reinforced Persona-aware Topic-guiding Conversational System. In 17th Conference of the European Chapter of the Association for Computational Linguistics (EACL), May 2-4, Croatia.
7. Soumitra Ghosh, Asif Ekbal, Pushpak Bhattacharyya (2023). VAD-assisted multitask transformer framework for emotion recognition and intensity prediction on suicide notes. In Information Processing & Management.
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9. M. Firdaus, A. Ekbal and P. Bhattacharyya (2022). PoliSe: Reinforcing Politeness using User Sentiment for Customer Care Response Generation. In 29th International Conference on Computational Linguistics (COLING), October 12-17, Korea.
10. K. Mishra, A. Samad, P. Totala and A. Ekbal (2022). PEPDS: A Polite and Empathetic Persuasive Dialogue System for Charity Donation. In 29th International Conference on Computational Linguistics (COLING), October 12-17, Korea.
11. D. Varshney, A. Prabhakar and A. Ekbal (2022). Commonsense and Named Entity Aware Knowledge Grounded Dialogue Generation. In Proceedings of NAACL-HLT 2022, 1322-1335, July 10-15, USA.
12. A. Samad, K. Mishra, M. Firdaus and A. Ekbal (2022). Empathetic Persuasion: Reinforcing Empathy and Persuasiveness in Dialogue Systems. In Proceedings of NAACL-HLT 2022 (Findings), 844-856, July 10-15, USA.
13. Zishan Ahmad, Asif Ekbal, Subhashish Sengupta, Pushpak Bhattacharyya (2022). Neural Response Generation for Task Completion using Conversational Knowledge Graph, PLoSOne, <https://doi.org/10.1371/journal.pone.0259238>.

14. M. Firdaus, N. Thangavelu, A. Ekbal and P. Bhattacharyya (2022). I enjoy writing and playing, do you?: A Personalized and Emotion Grounded Dialogue Agent using Generative Adversarial Network. In *IEEE Transaction on Affective Computing*, doi: 10.1109/TAFFC.2022.3155105.
15. Kshitij Mishra, Mauajama Firdaus and Asif Ekbal (2022). Please be Polite: Towards building a Politeness Adaptive Dialogue System for Goal-oriented Conversations, *Neurocomputing*, 94, 242-254, Elsevier.
16. K. Misra, M. Firdaus, A. Ekbal (2022). Predicting politeness variations in Goal-oriented Conversations. *IEEE Transaction on Computational Social System*, IEEE, doi: 10.1109/TCSS.2022.3156580.
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18. Mauajama Firdaus, Nidhi Thakur, Asif Ekbal (2022). Sentiment Guided Aspect Conditioned Dialogue Generation in a Multimodal System. In *Proc. of ECIR (1) 2022*: 199-214.
19. S. Ghosh, A. Ekbal, P. Bhattacharya (2022). Am i no good? towards detecting perceived burdensomeness and thwarted belongingness from suicide notes. In *IJCAI 2022*.
20. Soumitra Ghosh, Swarup Roy, Asif Ekbal, Pushpak Bhattacharyya (2022). CARES: CAUSE recognition for emotion in suicide notes. In *European Conference on Information Retrieval 2022*.
21. Soumitra Ghosh, Dharendra Kumar Maurya, Asif Ekbal, Pushpak Bhattacharyya (2022). EM-PERSONA: emotion-assisted deep neural framework for personality subtyping from suicide notes. In *Proceedings of the 29th International Conference on Computational Linguistics*.
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26. Mauajama Firdaus, Nidhi Thakur and Asif Ekbal (2021). Multi-Aspect Controlled Response Generation in a Multimodal Dialogue System using Hierarchical Transformer Network. In *Proc of 2021 International Joint Conference on Neural Networks (IJCNN)*.
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28. M Firdaus, N Thakur, A Ekbal (2021). Aspect-Aware Response Generation for Multimodal Dialogue System. In *ACM Transactions on Intelligent Systems and Technology (TIST)* 12 (2), 1-33. 1.
29. M. Firdaus, H. Chauhan, A. Ekbal and P. Bhattacharyya (2020). EmoSen: Generating Sentiment and Emotion Controlled Responses in a Multimodal Dialogue System (2020). *IEEE Transactions on Affective Computing*, 10.1109/TAFFC.2020.3015491.
30. Mauajama Firdaus, Nidhi Thakur, Asif Ekbal (2020). MultiDM-GCN: Aspect-Guided Response Generation in Multi-Domain Multimodal Dialogue System using Graph Convo-

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EDUCATION

- **Indian Institute of Technology Patna** 2020 - Present
PhD - Computer Science and Engineering
- **Central University of South Bihar** 2016-2018
M.Sc. - Computer Science
- **Patna Women's College** 2013-2016
B.Sc. in Computer Applications

EXPERIENCE

- **National Atmospheric Research Laboratory (NARL), Department of Space, Tirupati** January - May 2018
Intern - Machine Learning
Advisor: Dr. Vikas Singh, Scientist, NARL, Tirupati

PUBLICATIONS AND TUTORIALS

- Mauajama Firdaus*, **Priyanshu Priya***, Asif Ekbal. Mixing It Up: Inducing Empathy and Politeness using Multiple Behaviour-aware Generators for Conversational Systems. In Findings AACL-IJCNLP 2023.
- Kshitij Mishra*, **Priyanshu Priya*** and Asif Ekbal (2023). *PAL to Lend a Helping Hand: Towards Building an Emotion Adaptive Polite and Empathetic Counseling Conversational Agent*. In Proceedings of the 61st Annual Meeting of the Association for Computational Linguistics, Canada Toronto.
- Priyanshu Priya***, Kshitij Mishra*, Asif Ekbal (2023). *PARTNER: A Persuasive Mental Health and Legal Counselling Dialogue System for Women and Children Crime Victims*. In the 32nd International Joint Conference on Artificial Intelligence (AI for Social Good Track), Macao, S.A.R.
- Kshitij Mishra*, **Priyanshu Priya***, and Asif Ekbal (2023). *Help Me Heal: A Reinforced Polite and Empathetic Mental Health and Legal Counseling Dialogue System for Crime Victims*. In 37th AAAI Conference on Artificial Intelligence, February 7-14, USA.
- Gopendra Vikram Singh*, **Priyanshu Priya***, Mauajama Firdaus*, Asif Ekbal and Pushpak Bhattacharyya (2022). *EmoInHindi: A Multi-label Emotion and Intensity Annotated Dataset in Hindi for Emotion Recognition in Dialogues*. In LREC 2022.
- Priyanshu Priya**, Mauajama Firdaus, Asif Ekbal (2023). *A multi-task learning framework for politeness and emotion detection in dialogues for mental health counselling and legal aid*. In Expert Systems With Applications, Elsevier.

Note: * - The authors are jointly first authors

- Tutorial:** Priyanshu Priya, Mauajama Firdaus, Kshitij Mishra, and Asif Ekbal. *Empathetic Conversational Artificial Intelligence Systems: Recent Advances and New Frontiers*. In the 32nd International Joint Conference on Artificial Intelligence (AI for Social Good Track), Macao, S.A.R.

RESEARCH INTERESTS

Natural Language Processing, Conversational AI, Machine Learning, Deep Learning

TECHNICAL SKILLS

Programming Languages: Python, PyTorch, C, C++, Advanced JAVA

Web Technologies: HTML 5, PHP, JSP, Javascript

Databases: SQL, MySQL

TEACHING ASSISTANTSHIP

- CS349** Artificial Intelligence
- CS102** Programming and Data Structures
- CS112** Programming and Data Structures Laboratory
- CS271** Optimization Techniques
- CS358** Computer Networks
- CS359** Computer Networks Laboratory

ACHIEVEMENTS AND AWARDS

- DST-INSPIRE Fellowship** 2021
for pursuing PhD in Computer Science and Engineering at IIT Patna
- UGC-NET Junior Research Fellowship** December 2019
University Grants Commission
- UGC-NET Lectureship** July 2018, December 2018, June 2019
University Grants Commission
- Merit Scholarship** December 2016, June 2017
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- Merit Scholarship** 2016
Central University of South Bihar Entrance Test
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First Rank Holder, Patna Women's College

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Education

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Publications & Tutorial

Patent

2020 Harshawardhan Madhukar Wabgaonkar, Shubhashis Sengupta, Tirupal Rao Ravilla, Sumitraj Ganapat Patil, Poulami Debnath, GM Sushravya, Roshni Ramesh Ramnani, Gurudatta Mishra, Moushumi Mahato, **Maujama Firdaus**, et al. Spoken language understanding system and method using recurrent neural networks, June 9 2020. US Patent 10,679,613.

Tutorial

2023 **Priyanshu Priya, Maujama Firdaus, Kshitij Mishra and Asif Ekbal**, Empathetic Conversational Artificial Intelligence Systems: Recent Advance and New Frontiers, In The 32nd International Joint Conference on Artificial Intelligence (IJCAI), 2023.

Journal Articles

2023 **Maujama Firdaus**, Gopendra Vikram Singh, Asif Ekbal, and Pushpak Bhattacharyya. Affect-gcn: a multimodal graph convolutional network for multi-emotion with intensity recognition and sentiment analysis in dialogues. *Multimedia Tools and Applications*, pages 1–22. Springer, 2023.

2023 **Maujama Firdaus**, Avinash Madasu, and Asif Ekbal. A unified framework for slot based response generation in a multimodal dialogue system. *Multimedia Tools and Applications*. Springer, 2023.

2023 **Maujama Firdaus**, Asif Ekbal, and Erik Cambria. Multitask learning for multilingual intent detection and slot filling in dialogue systems. *Information Fusion*, volume 91, pages 299–315. Elsevier, 2023.

- 2023 Priyanshu Priya, **Mauajama Firdaus**, and Asif Ekbal. A multi-task learning framework for politeness and emotion detection in dialogues for mental health counseling and legal aid. *Expert Systems with Applications*, page 120025. Elsevier, 2023.
- 2023 Kshitij Mishra, **Mauajama Firdaus**, and Asif Ekbal. Genpads: Reinforcing politeness in an end-to-end dialogue system. *Plos One*, volume 18, page e0278323. Public Library of Science San Francisco, CA USA, 2023.
- 2022 **Mauajama Firdaus**, Naveen Thangavelu, Asif Ekbal, and Pushpak Bhattacharyya. I enjoy writing and playing, do you: A personalized and emotion grounded dialogue agent using generative adversarial network. *IEEE Transactions on Affective Computing*. IEEE, 2022.
- 2022 **Mauajama Firdaus**, Arunav Shandilya, Asif Ekbal, and Pushpak Bhattacharyya. Being polite: Modeling politeness variation in a personalized dialog agent. *IEEE Transactions on Computational Social Systems*. IEEE, 2022.
- 2022 Gopendra Vikram Singh, **Mauajama Firdaus**, Shambhavi, Shruti Mishra, and Asif Ekbal. Knowing what to say: Towards knowledge grounded code-mixed response generation for open-domain conversations. *Knowledge-Based Systems*, volume 249, page 108900. Elsevier, 2022.
- 2022 Gopendra Vikram Singh, **Mauajama Firdaus**, Asif Ekbal, and Pushpak Bhattacharyya. Unity in diversity: Multilabel emoji identification in tweets. *IEEE Transactions on Computational Social Systems*. IEEE, 2022.
- 2022 Gopendra Vikram Singh, **Mauajama Firdaus**, Asif Ekbal, and Pushpak Bhattacharyya. Emoint-trans: A multimodal transformer for identifying emotions and intents in social conversations. *IEEE/ACM Transactions on Audio, Speech, and Language Processing*, volume 31, pages 290–300. IEEE, 2022.
- 2022 Kshitij Mishra, **Mauajama Firdaus**, and Asif Ekbal. Predicting politeness variations in goal-oriented conversations. *IEEE Transactions on Computational Social Systems*. IEEE, 2022.
- 2022 Kshitij Mishra, **Mauajama Firdaus**, and Asif Ekbal. Please be polite: Towards building a politeness adaptive dialogue system for goal-oriented conversations. *Neurocomputing*. Elsevier, 2022.
- 2021 **Mauajama Firdaus**, Nidhi Thakur, and Asif Ekbal. Aspect-aware response generation for multimodal dialogue system. *ACM Transactions on Intelligent Systems and Technology (TIST)*, volume 12, pages 1–33. ACM New York, NY, USA, 2021.
- 2020 **Mauajama Firdaus**, Arunav Pratap Shandeelya, and Asif Ekbal. More to diverse: Generating diversified responses in a task oriented multimodal dialog system. *PloS one*, volume 15, page e0241271. Public Library of Science San Francisco, CA USA, 2020.
- 2020 **Mauajama Firdaus**, Hitesh Golchha, Asif Ekbal, and Pushpak Bhattacharyya. A deep multi-task model for dialogue act classification, intent detection and slot filling. *Cognitive Computation*, pages 1–20. Springer, 2020.
- 2020 **Mauajama Firdaus**, Hardik Chauhan, Asif Ekbal, and Pushpak Bhattacharyya. Emosen: Generating sentiment and emotion controlled responses in a multimodal dialogue system. *IEEE Transactions on Affective Computing*. IEEE, 2020.
- 2019 **Mauajama Firdaus**, Ankit Kumar, Asif Ekbal, and Pushpak Bhattacharyya. A multi-task hierarchical approach for intent detection and slot filling. *Knowledge-Based Systems*, volume 183, page 104846. Elsevier, 2019.

In Conference Proceedings

- 2023 Zijun Wu, Zi Xuan Zhang, Atharva Naik, Zhijian Mei, **Mauajama Firdaus**, and Lili Mou. Weakly supervised explainable phrasal reasoning with neural fuzzy logic. In *Proceedings of the Eleventh International Conference on Learning Representations (ICLR)*, 2023.

- 2022 **Mauajama Firdaus**, Nidhi Thakur, and Asif Ekbal. Sentiment guided aspect conditioned dialogue generation in a multimodal system. In *European Conference on Information Retrieval*, pages 199–214. Springer, 2022.
- 2022 **Mauajama Firdaus**, Asif Ekbal, and Pushpak Bhattacharyya. Polise: Reinforcing politeness using user sentiment for customer care response generation. In *Proceedings of the 29th International Conference on Computational Linguistics (COLING)*, pages 6165–6175, 2022.
- 2022 Gopendra Vikram Singh, Priyanshu Priya, **Mauajama Firdaus**, Asif Ekbal, and Pushpak Bhattacharyya. Emoinhindi: A multi-label emotion and intensity annotated dataset in hindi for emotion recognition in dialogues. *LREC*, 2022.
- 2022 Azlaan Mustafa Samad, Kshitij Mishra, **Mauajama Firdaus**, and Asif Ekbal. Empathetic persuasion: Reinforcing empathy and persuasiveness in dialogue systems. In *Findings of the Association for Computational Linguistics: NAACL 2022*, pages 844–856, 2022.
- 2021 **Mauajama Firdaus**, Nidhi Thakur, and Asif Ekbal. Multi-aspect controlled response generation in a multimodal dialogue system using hierarchical transformer network. In *2021 International Joint Conference on Neural Networks (IJCNN)*, pages 1–8. IEEE, 2021.
- 2021 **Mauajama Firdaus**, Arunav Pratap Shandilya, Sthita Pragyana Pujari, and Asif Ekbal. Attribute centered multimodal response generation in a dialogue system. In *2021 International Joint Conference on Neural Networks (IJCNN)*, pages 1–8. IEEE, 2021.
- 2021 **Mauajama Firdaus**, Umang Jain, Asif Ekbal, and Pushpak Bhattacharyya. Seprg: Sentiment aware emotion controlled personalized response generation. In *Proceedings of the 14th International Conference on Natural Language Generation*, pages 353–363, 2021.
- 2021 **Mauajama Firdaus**, Hardik Chauhan, Asif Ekbal, and Pushpak Bhattacharyya. More the merrier: Towards multi-emotion and intensity controllable response generation. In *Proceedings of the AAAI Conference on Artificial Intelligence*, volume 35, pages 12821–12829, 2021.
- 2020 **Mauajama Firdaus**, Naveen Thangavelu, Asif Ekba, and Pushpak Bhattacharyya. Persona aware response generation with emotions. In *2020 International Joint Conference on Neural Networks (IJCNN)*, pages 1–8. IEEE, 2020.
- 2020 **Mauajama Firdaus**, Nidhi Thakur, and Asif Ekbal. Multidm-gcn: Aspect-guided response generation in multi-domain multi-modal dialogue system using graph convolution network. In *Proceedings of the 2020 Conference on Empirical Methods in Natural Language Processing: Findings*, pages 2318–2328, 2020.
- 2020 **Mauajama Firdaus**, Asif Ekbal, and Pushpak Bhattacharyya. Incorporating politeness across languages in customer care responses: Towards building a multi-lingual empathetic dialogue agent. In *Proceedings of The 12th Language Resources and Evaluation Conference*, pages 4172–4182, 2020.
- 2020 **Mauajama Firdaus**, Hardik Chauhan, Asif Ekbal, and Pushpak Bhattacharyya. Meisd: A multimodal multi-label emotion, intensity and sentiment dialogue dataset for emotion recognition and sentiment analysis in conversations. In *Proceedings of the 28th International Conference on Computational Linguistics*, pages 4441–4453, 2020.
- 2019 Tulika Saha, Saurabh Srivastava, **Mauajama Firdaus**, Sriparna Saha, Asif Ekbal, and Pushpak Bhattacharyya. Exploring machine learning and deep learning frameworks for task-oriented dialogue act classification. In *2019 International Joint Conference on Neural Networks (IJCNN)*, pages 1–8. IEEE, 2019.
- 2019 Hitesh Golchha, **Mauajama Firdaus**, Asif Ekbal, and Pushpak Bhattacharyya. Courteously yours: Inducing courteous behavior in customer care responses using reinforced pointer generator network. In *Proceedings of the 2019 Conference of the North American Chapter of the Association for Computational Linguistics: Human Language Technologies, Volume 1 (Long and Short Papers)*, pages 851–860, 2019.

- 2019 Hardik Chauhan, **Mauajama Firdaus**, Asif Ekbal, and Pushpak Bhattacharyya. Ordinal and attribute aware response generation in a multimodal dialogue system. In *Proceedings of the 57th Annual Meeting of the Association for Computational Linguistics*, pages 5437–5447, 2019.
- 2018 **Mauajama Firdaus**, Shobhit Bhatnagar, Asif Ekbal, and Pushpak Bhattacharyya. Intent detection for spoken language understanding using a deep ensemble model. In *Pacific Rim international conference on artificial intelligence*, pages 629–642. Springer, 2018.
- 2018 **Mauajama Firdaus**, Shobhit Bhatnagar, Asif Ekbal, and Pushpak Bhattacharyya. A deep learning based multi-task ensemble model for intent detection and slot filling in spoken language understanding. In *International Conference on Neural Information Processing*, pages 647–658. Springer, 2018.

Accepted Publications

- 2023 **Mauajama Firdaus**, **Gopendra Vikram Singh**, **Asif Ekbal**, and **Pushpak Bhattacharyya**, Multi-step Prompting for Few-shot Emotion-Grounded Conversations, In Proceedings of The 32nd ACM International Conference on Information and Knowledge Management (CIKM), 2023.
- 2023 **Mauajama Firdaus**, **Priyanshu Priya**, **Asif Ekbal**, Mixing It Up: Inducing Empathy and Politeness using Multiple Behaviour-aware Generators for Conversational Systems, Findings of IJCNLP-AAACL 2023.

Research Experience

Indian Institute of Technology, Patna

- December,2020 – 2021 ***Modeling Politeness Variation in a Personalized Dialogue Agent.***
 Developing a novel Polite Personalized Dialogue Generation (PoPe-DG) framework that employs a reinforced deliberation network for generating polite personalized dialogue responses in accordance with the user profile and consistent with the conversational history.
 Advisor : **Dr. Asif Ekbal**, Associate Professor, Computer Science & Engineering, IIT Patna & **Prof. Pushpak Bhattacharyya**, Professor, Computer Science & Engineering, IIT Bombay
- July,2019 – October,2020 ***Aspect-aware Response Generation for Multimodal Dialogue System.***
 In our current work, we focus on the task of aspect controlled response generation in a multimodal task-oriented dialog system. As there was no readily available data for building such multimodal systems, we create a Multi-Domain Multi-Modal Dialog (MDMMD++) dataset. The dataset comprises of the conversations having both text and images belonging to the four different domains, such as hotels, restaurants, electronics and furniture.
 Advisor : **Dr. Asif Ekbal**, Associate Professor, Department of Computer Science & Engineering, IIT Patna
- February,2019 – September,2020 ***Emotion and Sentiment controlled Dialogue Systems.***
 Proposed an approach for sentiment and emotion controlled dialogue generation. Creation of large-scale emotion and sentiment controlled dialogue dataset. In addition, we introduce the task of multi-emotion controllable response generation with the ability to express different emotions with varying levels of intensity in an open-domain dialogue system.
 Advisor : **Dr. Asif Ekbal**, Associate Professor, Computer Science & Engineering, IIT Patna & **Prof. Pushpak Bhattacharyya**, Professor, Computer Science & Engineering, IIT Bombay
- June,2018 – December,2018 ***Inducing courteous phrases in Customer care Responses.***
 In this work, we propose an effective deep learning framework for inducing courteous behavior in customer care responses. Our technique is based on a reinforced pointer-generator model for the sequence to sequence task. The model is also conditioned on a hierarchically encoded and emotionally aware conversational context. We use real interactions on Twitter between customer care professionals and aggrieved customers to create a large conversational dataset.
 Advisor : **Dr. Asif Ekbal**, Associate Professor, Computer Science & Engineering, IIT Patna & **Prof. Pushpak Bhattacharyya**, Professor, Computer Science & Engineering, IIT Bombay

- January,2017 **Multi-task framework for Natural Language Understanding.**
 – May,2018 Proposed an end-to-end hierarchical multi-task framework that can jointly perform both intent detection (ID) and slot filling (SF) tasks for the datasets of varying domains. Besides, we also propose a multi-task network that in addition to ID and SF also performs Dialogue Act Classification (DAC).
 Advisor : **Dr. Asif Ekbal**, Associate Professor, Computer Science & Engineering, IIT Patna & **Prof. Pushpak Bhattacharyya**, Professor, Computer Science & Engineering, IIT Bombay
[National Institute of Technology, Durgapur](#)
- July,2015 – **Constraint specification in Multi Agent System.**
 May,2016 This work proposes formal analysis method for defining and specifying properties, resources, knowledge and related constraints of an agent in a Multi Agent System (MAS).
 Advisor : **Dr. Rajiv Kumar Chatterjee**, Assistant Professor, Department of Computer Science & Engineering, NIT Durgapur

Fellowships & Awards

- 2019 Receipt of **Microsoft Travel Grant** to attend the **17th Annual Conference of the North American Chapter of the Association for Computational Linguistics: Human Language Technologies (NAACL-HLT), 2019** in Minneapolis, United States.
- 2019 Receipt of **Microsoft Travel Grant** to attend the **57th Annual Meeting of the Association for Computational Linguistics (ACL), 2019** in Florence, Italy.
- 2019 Receipt of the **ACM India-IARCS travel grant** to attend **57th Annual Meeting of the Association for Computational Linguistics(ACL), 2020** in Florence, Italy.

Computer skills

Programming Languages	Python, PyTorch, Keras, Tensorflow, C, C++, Advanced JAVA
Web Technologies	HTML 5, PHP, JSP, Javascript
Database	SQL, MySQL, Apache, Neo4j

Teaching Assistantship

- Fall, 2020 : **CS571: Artificial Intelligence**, IIT Patna.
 Spring, 2020 : **CS563: Natural Language Processing**, IIT Patna.
 Fall, 2019 : **CS571: Artificial Intelligence**, IIT Patna.
 Spring, 2019 : **CS564: Foundations of Machine Learning**, IIT Patna.
 Fall, 2018 : **CS342: Operating System Lab**, IIT Patna.
 Spring, 2018 : **CS101: Introduction to Computing**, IIT Patna.
 Spring, 2017 : **CS101: Introduction to Computing**, IIT Patna.

Referees

Dr. Asif Ekbal

*Associate Professor, Department of
Computer Science & Engineering
Indian Institute of Technology Patna*
✉ asif.ekbal@gmail.com

Dr. Shubhashis Sengupta

*Managing Director and Head of Research
Accenture Labs, India*
✉ shubhashis.sengupta@accenture.com

Prof. Pushpak Bhattacharyya

*Professor, Department of
Computer Science & Engineering
Indian Institute of Technology Bombay*
✉ pushpakbh@gmail.com

Dr. Lili Mou

*Assistant Professor, Department of
Computing Science
University of Alberta, Canada*
✉ lmou@ualberta.ca

GOPENDRA VIKRAM SINGH

PhD. Scholar

@ gopendra.99@gmail.com
@ 1921cs15@iitp.ac.in

✉ AI-NLP-ML Lab, 5th FLOOR, BLOCK-3, IIT PATNA
in gopendra singh

📍 Bihta, Bihar, INDIA

EXPERIENCE

Ph.D. Scholar

Indian Institute of Technology, Patna

📅 January 2019 – Ongoing 📍 Bihta, Bihar, India

- Working on the project *Ministry of Home Affairs project for Women and Child Safety*- Dec 2017 - Jan 2020.

M.Tech. Student.

National Institute of Technology, Sikkim

📅 Aug 2016 – June 2018 📍 Sikkim, India

- Worked as a researcher on thesis topic of *Quantum Inspired Genetic Algorithm for Relay Node Placement*.
- Performed TA duties in 3 subjects viz. Operating System, Machine Learning, Object Oriented Programming.

ACADEMIC RESPONSIBILITIES

Teaching Assistant

Project Research Scholar

Workshop Organizer

Teaching

Mentoring Interns, Undergraduates and Postgraduates

OTHER ACTIVITIES

Conducted tutorial on *Word Embedding and NLG with GPT-2* in GIAN Workshop on **Deep Learning Techniques for Conversational Artificial Intelligence**

Indian Institute of Technology Patna

📅 13 – 24 Apr 2022

Conducted tutorial and demo on *Encode-Decoder models in deep learning* in **Faculty Development Program (FDP)**

National Institute of Technology, Patna

📅 16–18 Feb 2022

Conducted tutorial on *Mono-lingual and Multi-lingual word representation in Deep Learning* in CEP course on **Deep Learning for NLP**

Indian Institute of Technology Patna

📅 10 – 23 Jan 2020

Organizer of CEP course on **Deep Learning for NLP**

Indian Institute of Technology Patna

📅 10 – 23 Jan 2020

Program Committee member for *The 29th International Conference on Neural Information Processing (ICONIP 2022)*

New Delhi India

ACHIEVEMENTS



GATE Scholarship by Govt. of India
to pursue M.Tech.

SKILLS

Coding

Python

C

PHP

Frameworks and Platforms

Pytorch

Scikitlearn

Huggingface

Keras

RESEARCH INTERESTS

Natural Language Processing

Emotion and Sentiment Analysis

Conversational AI

Machine Learning

Deep Learning

Text Generation

Information Extraction

STRENGTHS

Hard-working

Collaborative

Ready to learn

Quick learner

LANGUAGES

English

Hindi



REFEREES

Dr. Asif Ekbal

@ Indian Institute of Technology Patna

✉ asif.ekbal@gmail.com; asif@iitp.ac.in

https://www.asifekbal.com/

Prof. Pushpak Bhattacharyys

@ Indian Institute of Technology Bombay

✉ pushpakbh@gmail.com; pb@cse.iitb.ac.in

Dr. Pratyay Kuila

@ National Institute of Technology, Sikkim

✉ pratyay_kuila@nitsikkim.ac.in

📅 22 – 26 Nov 2022

Program Committee member and reviewer for *The 17th International Conference on Natural Language Processing*, Bihar, India

[Indian Institute of Technology Patna](#)

📅 18–21 Dec 2022

Regular reviewer of journals like *Sādhanā*, *PLOS One*, *ACM TALLIP*, *Expert Systems With Applications*, and Conferences like *ICON*, *ICONIP*.

Secondary reviewer for core rank A*/A conferences like *ACL* and *JCDL*

EDUCATION

Ph.D. in Computer Science and Engineering

[Indian Institute of Technology Patna](#)

📅 January 2019 - Ongoing

- CPI: 8.0
- Research Area: Natural Language Processing.
- Ph.D. Research Topic: Emoji Prediction, Knowledge, Sentiment, and Text Generation, Sarcasm Detection.

M.Tech.in Computer Science and Engineering

[National Institute of Technology, Patna](#)

📅 Aug 2016 - June 2018

- CGPA: 8.68
- Research Area: Natural Language Processing
- M.Tech. Thesis Topic: Quantum Inspired Genetic Algorithm

RESEARCH PAPER WORKS

Published

1. **Singh GV**, Ghosh S., Ekbal A. Promoting Gender Equality through Gender-biased Language Analysis in Social Media. *International Joint Conference on Artificial Intelligence 2023 (IJCAI)*.
2. **Singh GV**, Firdaus M, Mishra S, Ekbal A. Knowing What to Say: Towards knowledge grounded code-mixed response generation for open-domain conversations. *Knowledge-Based Systems*. 2022 Aug 5;249:108900.
3. **Singh GV**, Ghosh S, Ekbal A, Bhattacharyya P. DeCoDE: Detection of Cognitive Distortion and Emotion Cause Extraction in Clinical Conversations. In *Advances in Information Retrieval: 45th European Conference on Information Retrieval, ECIR 2023, Dublin, Ireland, April 2–6, 2023, Proceedings, Part II 2023 Mar 17* (pp. 156-171). Cham: Springer Nature Switzerland.
4. **Singh GV**, Firdaus M, Ekbal A, Bhattacharyya P. EmoInt-Trans: A Multimodal Transformer for Identifying Emotions and Intents in Social Conversations. *IEEE/ACM Transactions on Audio, Speech, and Language Processing*. 2022 Nov 23;31:290-300.
5. **Singh GV**, Firdaus M, Ekbal A, Bhattacharyya P. Affect-GCN: A Multimodal Graph Convolutional Network for Multi-Emotion with Intensity Recognition and Sentiment Analysis in Dialogues. *Multimedia and Tools*. 2022 Nov 5;249:108900.

6. **Singh GV**, Firdaus M, Ekbal A, Bhattacharyya P. Unity in Diversity: Multilabel Emoji Identification in Tweets. *IEEE Transactions on Computational Social Systems*. 2022 Apr 13.
7. **Singh GV**, Priya P, Firdaus M, Ekbal A, Bhattacharyya P. Emoln-Hindi: A Multi-label Emotion and Intensity Annotated Dataset in Hindi for Emotion Recognition in Dialogues. *arXiv preprint arXiv:2205.13908*. 2022 May 27. (Accepted in Lrec 22 paper id 1297)
8. **Singh GV**, Chauhan DS, Firdaus M, Ekbal A, Bhattacharyya P. Are Emoji, Sentiment, and Emotion Friends? A Multi-task Learning for Emoji, Sentiment, and Emotion Analysis. (Accepted in Pacific Asia Conference 22 Paper id 55)
9. **Singh GV**, Harizan S, Kuila P. Quantum Inspired Genetic Algorithm for Relay Node Placement in Cluster Based Wireless Sensor Networks. *International Conference on Computational Intelligence, Communications, and Business Analytics 2018 Jul 27* (pp. 381-391). Springer, Singapore.
10. Ghosh S, **Singh GV**, Ekbal A, Bhattacharyya P. COMMA-DEER: Common-sense aware Multimodal Multitask Approach for Detection of Emotion and Emotional Reasoning in Conversations.(Coling 22)
11. Chauhan DS, **Singh GV**, Majumder N, Zadeh A, Ekbal A, Bhattacharyya P, Morency LP, Poria S. M2H2: A Multimodal Multiparty Hindi Dataset For Humor Recognition in Conversations. *Proceedings of the 2021 International Conference on Multimodal Interaction 2021 Oct 18* (pp. 773-777).
12. Chauhan DS, **Singh GV**, Arora A, Ekbal A, Bhattacharyya P. Mhadig: A Multilingual Humor-Aided Multiparty Dialogue Generation in Multimodal Conversational Setting. *Knowledge-Based Systems*. 2023 July 26:109924.
13. Chauhan DS, **Singh GV**, Arora A, Ekbal A, Bhattacharyya P. An emoji-aware multitask framework for multimodal sarcasm detection. *Knowledge-Based Systems*. 2022 Sep 26:109924.
14. Chauhan DS, **Singh GV**, Arora A, Ekbal A, Bhattacharyya P. A Sentiment and Emotion aware Multimodal Multiparty Humor Recognition in Multilingual Conversational Setting.(Accepted in Coling 22)
In paper 10,11,12,13,14 First two Authors contributed equally and jointly the first author.

Curriculum Vitae of Dr. Asif Ekbal

Office Address:

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Indian Institute of Technology (IIT) Patna
Patna 801106, India

Webpage: <http://www.iitp.ac.in/~asif/>

Google Scholar: https://scholar.google.co.in/citations?user=IAL_F04AAAAJ&hl=en

DBLP: <https://dblp.uni-trier.de/pers/hd/e/Ekbal:A>

Semantic Scholar: <https://www.semanticscholar.org/author/Asif-Ekbal/1734904>

Nationality: Indian

Current Status:

Associate Professor, Department of Computer Science and Engineering, IIT Patna,
India-800013

Research Areas

Artificial Intelligence, Natural Language Processing, Information Extraction, Machine Translation, Sentiment Analysis, Text Mining, Machine Learning Applications, and Dialogue Systems

Asif Ekbal is currently an Associate Professor in the Department of Computer Science and Engineering, IIT Patna. Prior to joining as an Assistant Professor in the same department in January 2011, he spent approximately 2 years as a Postdoctoral Research Fellow in Heidelberg University, Germany and University of Trento, Italy. He has been pursuing research in Natural Language Processing (NLP), Information Extraction, Text Mining and Machine Learning (ML) for the last 13 years, and has made significant contributions in these areas. He has authored around 230 papers in top-tier conferences like AAI, IJCAI, ACL, EMNLP, COLING, NAACL, and journals like PLOS One, ACM Transactions, IEEE Transaction on Affective Computing etc. Asif has been involved in several sponsored research projects, funded by the different private agencies, such as Elsevier, Accenture, ezDI, LG, Skymap, Samsung, Flipkart; and Govt. agencies such as MeITY, Govt. of India, MHRD, Govt. of India, and SERB, Govt. of India etc.

He has recently served as PC Chair, ICONIP-2022; has served as an Area Chair of Language Resources, EACL 2021; NAACL-19's area chair on QA; as the Senior PC member of IJACI-2019, 2020; AAI 2020, 2021. He regularly serves in the PC and/review committee of conferences like ACL, EMNLP, CoNLL, IJCNLP, COLING, NAACL, AAI, IJCAI etc. He is serving as an Associate Editor of ACM Transaction on Asian and Low-resource Language Information Processing (ACM TALLIP), ACM; Editorial Board member of Computer Speech and Language, Elsevier; Editorial Board member, Plosone; Action Editor, Neural Networks, Elsevier; Associate Editor, Sadhana, Springer; Springer Nature CS, Springer. He has served as an Editorial Board Member, Machine Translation, Springer.

He is an awardee of the "Best Innovative Project Award from the Indian National Academy of Engineering", Govt. of India, "JSPS Invitation Fellowship" from Govt of

Japan and "Visvesvaraya Young Faculty Research Fellowship Award" of the Govt. of India.

Google Scholar Citation which is the benchmark for Computer Science and Engineering shows **8918 career citations** to Dr. Asif's papers. His **h-index: 46** and **i-10 index: 204**.

Professional Experience

- Serving as an Associate Professor in the Department of Computer Science and Engineering, IIT Patna, India since March 29, 2017
- Served as an Assistant Professor in the Department of Computer Science and Engineering, IIT Patna, India from January 27th, 2011 to March 28, 2017.
- Postdoctoral Research Fellow, Department of Information Engineering and Computer Science, University of Trento, Italy, September, 2010-January, 2011 and May-July, 2011
- Postdoctoral Research Fellow, Department of Computational Linguistics, Heidelberg University, September, 2009-June, 2010.

Visiting Positions

- Visiting Scientist (JSPS Fellow), Kyoto University, Japan, March, 2018-August, 2018
- Visiting Professor, University of Hamburg, Germany, May-July, 2017.
- Visiting Professor, Language Technology Group, Darmstadt University, Germany, May-July, 2016.
- Visiting Professor, University of Caen, France, May-June, 2016.
- Visiting Research Scientist, University of Caen, France, December, 2014
- Visiting Research Scientist, University of Caen, France, June-July, 2014

Background (Projects, tutorials, publications, patents)

- No of Sponsored Projects in conversational AI: 5 (*Industry as well as Govt Sponsored*)
- No. of PhD scholars supervising (in conversational AI): 7 (ongoing) + 2 (completed)
- No Masters thesis guided (in Conversational AI): 13
- No of keynotes/invited talks: 32 (e.g. Accenture, Microsoft, Huawei, LG Soft etc)
- Tutorial in IJCAI 2023
 - *Empathetic Conversational Artificial Intelligence Systems: Recent Advances and New Frontiers*
- Tutorial in IJCAI-2019
 - *Concept to Code: Aspect Sentiment Classification with Deep Learning*
- **Patents**
 - A Question Answering Mechanism in Restricted Domain, US Patent filed (with Accenture)
 - Generating Knowledge Graph from Conversations, US Patent Filed (with Accenture)

Total Publications: Journals: 101; Conferences: 196; Others: 55)

Complete List can be found here:

GoogleScholar: https://scholar.google.co.in/citations?user=IAL_F04AAAAJ&hl=en

DBLP: <https://dblp.uni-trier.de/pers/hd/e/Ekbal:Asif>

Semantic Scholar: <https://www.semanticscholar.org/author/Asif-Ekbal/1734904>

Publications (Conversational AI)

1. K. Mishra, P. Priya and A. Ekbal (2023). PAL to Lend a Helping Hand: Towards Building an Emotion Adaptive Polite and Empathetic Counseling Conversational Agent. In *Proceedings of the 61st Annual Meeting of the Association for Computational Linguistics (ACL)*, pp. 12254-12271, Canada Toronto.
2. P. Priya, K. Mishra, A. Ekbal (2023). PARTNER: A Persuasive Mental Health and Legal Counseling Dialogue System for Women and Children Crime Victims. In the *32nd International Joint Conference on Artificial Intelligence (IJCAI)*, AI for Social Good Track, pp. 6183-6191 Macao, S.A.R.
3. Zishan Ahmad, Kshitij Mishra, Asif Ekbal, Pushpak Bhattacharyya (2023). RPTCS: A Reinforced Persona-aware Topic-guiding Conversational System. In *Proc. of EACL 2023*: 3464-3476
4. D. Varshney, A. Zafar, N. Behera, and Asif Ekbal (2023). Knowledge Graph Assisted End-to-End Medical Dialog Generation. In *Artificial Intelligence in Medicine*, Elsevier, 139, 102535 (IF- (IF-7.011) (*an outcome of Wipro collaboration*))
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6. D. Varshney, A. Singh and A. Ekbal (2023). Aspect-level Sentiment-Controlled Knowledge Grounded Multimodal Dialog Generation using Generative Models for Reviews. *Multimedia Tools and Application*, Springer, <https://doi.org/10.1007/s11042-023-16720-z>.
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9. M. Firdaus, A. Ekbal and P. Bhattacharyya (2022). PoliSe: Reinforcing Politeness using User Sentiment for Customer Care Response Generation. In *29th International Conference on Computational Linguistics (COLING)*, 6165-6175, October 12-17, Korea.
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11. A. Samad, K. Mishra, M. Firdaus and A. Ekbal (2022). Empathetic Persuasion: Reinforcing Empathy and Persuasiveness in Dialogue Systems. In *Proceedings of NAACL-HLT 2022 (Findings)*, 844-856, July 10-15, USA.
12. Zishan Ahmad, Asif Ekbal, Subhashish Sengupta , Pushpak Bhattacharyya (2022). Neural Response Generation for Task Completion using Conversational Knowledge Graph,

PlosOne, <https://doi.org/10.1371/journal.pone.0259238> (IF-3.752; h5 index: 180) (*in collaboration with Accenture*)

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14. Kshitij Mishra, Mauajama Firdaus and Asif Ekbal (2022). Please be Polite: Towards building a Politeness Adaptive Dialogue System for Goal-oriented Conversations, *Neurocomputing*, 94, 242-254, Elsevier (IF-5.719; h5 index: 123).
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18. Mauajama Firdaus, Nidhi Thakur, Asif Ekbal (2022). Sentiment Guided Aspect Conditioned Dialogue Generation in a Multimodal System. In *Proc. of ECIR (1) 2022*: 199-214.
19. S. Ghosh, G. Singh, A. Ekbal and P. Bhattacharyya (2022). COMMA-DEER: Common-sense aware Multimodal Multitask Approach for Detection of Emotion and Emotional Reasoning in Conversations. In *the 29th International Conference on Computational Linguistics (COLING)*, 6978-6990 October 12-17, Korea
20. Firdaus, H. Chauhan, A. Ekbal and P. Bhattacharyya (2021). More the Merrier: Towards Multi-Emotion and Intensity Controllable Response Generation. In *Proceedings of AAI 2021*, PP. 12821-12829.
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22. M. Firdaus, U. Jain, A. Ekbal and P. Bhattacharyya (2021). SEPRG: Sentiment aware Emotion controlled Personalized Response Generation. In *Proc. of the 14th International Conference on Natural Language Generation (INLG)*, 353-363.
23. Mauajama Firdaus, Hitesh Golchha, Asif Ekbal, Pushpak Bhattacharyya (2021). A Deep Multi-task Model for Dialogue Act Classification, Intent Detection and Slot Filling. *Cognitive Computation* 13(3): 626-645 (2021), Springer (h5 index: 43; IF-5.418)
24. Mauajama Firdaus, Nidhi Thakur and Asif Ekbal (2021). Multi-Aspect Controlled Response Generation in a Multimodal Dialogue System using Hierarchical Transformer Network. In *Proc of 2021 International Joint Conference on Neural Networks (IJCNN)*. (h5-index:63)
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27. M. Firdaus, H. Chauhan, A. Ekbal and P. Bhattacharyya (2020). EmoSen: Generating Sentiment and Emotion Controlled Responses in a Multimodal Dialogue System (2020). *IEEE Transactions on Affective Computing*, 10.1109/TAFFC.2020.3015491. (Impact factor- 10.305)

28. Mauajama Firdaus, Nidhi Thakur, Asif Ekbal (2020). MultiDM-GCN: Aspect-Guided Response Generation in Multi-Domain Multi-Modal Dialogue System using Graph Convolution Network. *In Proc. of EMNLP (Findings) 2020*: 2318-2328.
29. M. Firdaus, A.P Shandilya and A. Ekbal (2020). More to Diverse: Generating Diversified Responses in a Task Oriented Multimodal Dialog System. PLoS ONE, <https://doi.org/10.1371/journal.pone.0241271>. (IF-3.752; h5 index: 180)
30. Mauajama Firdaus, Asif Ekbal, Pushpak Bhattacharyya (2020). Incorporating Politeness across Languages in Customer Care Responses: Towards building a Multilingual Empathetic Dialogue Agent. In *Proceedings of The 12th Language Resources and Evaluation Conference (LREC)*, pp. 4171-4182. (h5 index: 49)
31. Hardik Chauhan, Mauajama Firdaus, Asif Ekbal and Pushpak Bhattacharyya (2019). Ordinal and Attribute Aware Response Generation in a Multimodal Dialogue System. In *Proceedings of Association for Computational Linguistics (ACL)*, pp. 5437-5447.
32. M. Firdaus, H. Chauhan, A. Ekbal and P. Bhattacharyya (2020). MEISD: A Multimodal Multi-Label Emotion, Intensity and Sentiment Dialogue Dataset for Emotion Recognition and Sentiment Analysis in Conversations. *Proceedings of COLING 2020*, pp. 4441-4453.
33. Zishan Ahmad, Asif Ekbal, Shubhashis Sengupta, Anutosh Mitra, Roshni R. Rammani, Pushpak Bhattacharyya (2020). Active Learning Based Relation Classification for Knowledge Graph Construction from Conversation Data. In *Proceedings of ICONIP (4) 2020*: 617-625. (Core-A in 2020) (*with Accenture*)
34. M. Firdaus, N. Thangavelu, A. Ekbal and P. Bhattacharyya (2020). Persona aware Response Generation with Emotions. In *the 2020 International Joint Conference on Neural Networks (IJCNN)*, Glasgow, UK, July 2020. (h5 index: 63).
35. M. Firdaus, A. Kumar, A. Ekbal and P. Bhattacharyya (2019). A Multi-task Hierarchical Approach for Intent Detection and Slot Filling. *Knowledge based Systems*, Elsevier, <https://doi.org/10.1016/j.knosys.2019.07.017>. (IF-8.038; h5 index: 107).
36. Hitesh Golchha, Mauajama Firdaus, Asif Ekbal, and Pushpak Bhattacharyya (2019). Courteously Yours: Inducing courteous behavior in Customer Care responses using Reinforced Pointer Generator Network. In *Proceedings of the 2019 Conference of the North American Chapter of the Association for Computational Linguistics: Human Language Technologies (NAACL-HLT)*, pp. 851-860. 2019. .

Awards / Recognitions

- Listed in top-2% scientists published by Stanford University (2021, 2022)
- Ranked in top Computer Science researcher list, published by Research.com (2022, 2023)
- Outstanding paper award from IEEE CIS for Year 2023
- Japanese Society for the Promotion of Science (JSPS) Invitation Fellowship, Japan, 2017 Japan.
- Visvesvaraya Young Faculty Research Fellowship, MeITY, Govt. of India, 2017.
- Best Innovative Project Award, Indian National Academy of Engineering (INAE), 2000.
- European Union Fellowship for visiting Scientist, Dublin City University, Ireland (2019)
- European Union Fellowships for Postdoctoral Research at University of Heidelberg, Germany and University of Trento, Italy.
- Best Papers, COLING 2016 CLINICAL NLP Workshop; ICACCI 2012
- Most downloadable article, Data and Knowledge Engineering Journal, Elsevier
- AFNLP Nagao Fund Award for attending ACL 2006
- Travel support from AFNLP, Microsoft, NLP AI etc.

Sponsored R&D Projects involved (relevant to the tutorial)

1. Sevak- An Intelligent Indian Language Chatbot, Sponsored by Imprint2A, SERB, Govt of India, Value: INR 98 Lacs (\$140473.20)- (*Role: PI*). (*The target is to build a Chatbot in English, Indian languages, and Code-mixed Languages in three important domains like Railways, Judiciary and Healthcare*).
2. An Empathetic Knowledge Grounded Conversational System for Mental Health Counseling and Legal Assistance, Sponsored by IHUB Anubhuti, TIH, IIIT Delhi, Value: 30 Lacs (\$40802) (ongoing) (*Role: PI*). (*The objective of this project is to build a dialogue agent to assist the victims for mental health counseling and legal assistance. Important attributes such as empathy and politeness are being incorporated*).
3. Percuro-A Holistic Solution for Clinical Text Mining, Sponsored by Wipro Ltd, Value: INR 39 Lakhs (\$53042.38) [**only for IIT Patna**] (Consortium partner: University of South Carolina, USA) (ongoing) (*Role: PI*) (*The target is to build question answering system with knowledge graph for the medical domain*)
4. Knowledge Grounded Conversational System, Sponsored by Accenture, India, Value: 2232375.00 (\$30000) (completed) (*Role: PI*) (*It aimed at integrating external common sense knowledge to improve the quality of dialogue generation*)
5. Dynamic Knowledge Natural Language Generation, Sponsored by Samsung Research, Value: 18 Lacs (\$24191) (ongoing) (*Role: PI*) (*This project aimed at integrating external unstructured knowledge for dialogue generation*)
6. HELIOS - Hate, Hyperpartisan, and Hyperpluralism Elicitation and Observer System, Sponsored by Wipro Ltd, India, Value: INR 42 Lacs (\$55229) [**only for IIT Patna**] (Ongoing) (Consortium partners: UT Austin, USA; and IIIT Delhi, India) (*Role: PI*)
7. IITP Centre of Excellence in Cyber Crime Prevention against Women and Children- AI based Tools for Women and Children Safety, Sponsored by MHA, Govt of India, 284 Lakhs (\$2113230459.69)- With other faculty members of IIT Patna (ongoing) (*Role: Joint-PI*)
8. Sentiment, Emotion, Sarcasm and Hate Speech Detection (SESH), Sponsored by CDOT, Value: 40 Lacs (\$ 48131.00) (ongoing) (*Role: PI*)
9. Centre of Excellence for Natural Language Processing-IITP, Sponsored by Elsevier, Value: Rs. 213 Lacs (\$ 295403.00) (Completed)
10. ATL IIT AI Lab (QA, Dialogue Systems), Sponsored by Accenture Pvt. Limited, Value: Rs. 65 Lac (\$ 90146.00) (Completed) (*Role: Co-PI*)

Industry Collaboration

Elsevier, Flipkart, Wipro, Samsung Research, Accenture, ezDI

Industry consultancies:

- Neural Network and Application Training, TCS, 2019-2020, Rs. 540000 (Ongoing)
- Data Science Training on NLP, TCS, March-2014- Rs. 120,000.00 - completed
- Information Extraction, 2017, LG Soft Ltd, Rs. 750,000.00-Completed
- Machine Learning for Blackout Prediction, Bosch, Rs. 750,000.00 -completed
- Restaurant Recommendation System, LG Soft, 13.5 Lacs-completed

Student Guidance:

- Ph.D. Students Supervision (as sole or joint-supervisor): 16 (*ongoing*) (**Degree awarded/Thesis Completed-19**)

lution Network. In Proc. of EMNLP (Findings) 2020: 2318-2328.

- Masters' theses guidance- 42 (completed), 3 (on-going) [*Six received DAAD-IIT Master Sandwich Fellowships; 5 received Chairman's Gold Medal; 5 received Best MTech Thesis Award*]
- Undergraduate project guidance- 65 (completed), 4 (on-going) [*Two received the best BTech project award; 1 received President Gold Medal; 1 received Kedar Nath Memorial Award; 1 received Director's Gold Medal for all round performance*]

Teaching

Have been teaching for the last 13 years.

Some of the courses that I have taught include the following:

Artificial Intelligence, Natural Language Processing, Foundations of Machine Learning, Advanced Machine Learning, Formal Language and Automata Theory, Theoretical Computer Science, Compilers, Fuzzy Sets and Artificial Intelligence

Outreach and Other Academic Responsibilities:

- Secretary, NLP Association of India
- Member, AI Standardization, Govt of India
- Co-Chair, The 29th International Conference on Neural Information Processing (ICONIP-2022), Nov 22-26, 2022
- Action Editor, Neural Network, Elsevier
- Associate Editor, ACM TALLIP, ACM
- Editorial Board Member, Computer Speech and Language, Elsevier
- Academic Editor, PlosOne
- Associate Editor, Sadhana, Springer; Machine Translation (now Language Resources and Evaluation), Springer; Springer Nature CS, Springer
- Chair-EACL 2021 Language Resources and Evaluation Track, NAACL 2019 QA Track
- Senior PC member: IJACI 2019, 2020, 2021; AAAI 2019, 2020, 2021, 2022
- Program Committee Member and/or Reviewer: ACL, EMNLP, IJCAI, AAAI, COLING, NAACL, LREC etc
- Journal Reviewer: IEEE Intelligent System, Artificial Intelligence, Language Resources and Evaluation, Bioinformatics, Information Systems, Knowledge based Systems etc.