

# Ashish Mittal

ADVISORY RESEARCH ENGINEER

IBM Research, Bangalore, India

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## About Me

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I am working as an advisory research engineer in the AI-Tech department at IBM Research, Bangalore. I am working on the AI systems that use natural language processing and machine learning to solve real-world problems. I am part of the team that is building a platform which enables seamless interaction of the data to the user through conversation in natural language.

I completed my Masters in Computer Science from IIT Bombay in 2015. My M.Tech thesis titled "Numerical Relation Extraction with Minimal Supervision" was done under the guidance of Prof. Sunita Sarawagi, Prof. Ganesh Ramakrishnan and Prof. Mausam (IIT Delhi).

My research interests are machine learning, natural language processing, and recently deep learning. In my spare time, I read. I am interested in sports and play football, badminton and many more.

## Work Experience

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### IBM Research

ADVISORY RESEARCH ENGINEER

Bangalore, India

July 2019 - Present

- Research in fundamentals of natural language understanding and semantic parsing for low resource domains.
- Present research is in the understanding of Indian languages and more complex chatbots.

### IBM Research

RESEARCH SOFTWARE ENGINEER

Bangalore, India

July 2015 - June 2019

- Focused on building an end-to-end chatbot system which helps in analyzing vast amount of data using natural language queries.
- Developed end-to-end solution to be deployed across various IBM products.

### Tata Research Design and Development Centre

INTERNSHIP

Pune, India

Dec 2011 - Mar 2012

- Problem Statement: To provide a solution to handle the preprocessing directives while refactoring C++ code.
- Designed and implemented an efficient and novel solution of the problem using annotations of preprocessor directives in the abstract syntax trees.

## Education

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### M.Tech, Computer Science

IIT BOMBAY

Mumbai, India

July 2013 - May 2015

- *Advisors:* Prof. Sunita Sarawagi, Prof. Ganesh Ramakrishnan - IIT Bombay, Prof. Mausam (IIT Delhi)
- *Dissertation:* Number Relation Extraction with Minimal Supervision
- Designed two extraction systems that require minimal human supervision per relation: (1) NumberRule, a rule based extractor, and (2) NumberTron, a probabilistic graphical model.
- CGPA: 9.7/10.0

### B.E., Computer Science

DHARMSINH DESAI UNIVERSITY

Nadiad, India

July 2008 - May 2012

- Percentage: 84.79

## Publications

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### Unified Semantic Parsing with Weak Supervision.

PRİYANKA AGRAWAL, PARAG JAIN, AYUSHI DALMIA, ABHISHEK BANSAL, **ASHISH MITTAL**, KARTHIK SANKARANARAYANAN

ACL 2019

July 2019, Florence, Italy

### Natural Language Querying of Complex Business Intelligence Queries.

JAYDEEP SEN, FATMA ÖZCAN, ABDUL QUAMAR, GREG STAGER, **ASHISH MITTAL**, MANASA JAMMI, CHUAN LEI, DIPTIKALYAN SAHA, KARTHIK SANKARANARAYANAN

ACM SIGMOD 2019

June 2019, Amsterdam, The Netherlands

### Ontology-Based Natural Language Query Interfaces for Data Exploration.

CHUAN LEI, FATMA ÖZCAN, ABDUL QUAMAR, **ASHISH MITTAL**, JAYDEEP SEN, DIPTIKALYAN SAHA, KARTHIK SANKARANARAYANAN

IEEE Data Engineering Bulletin, 2018

Volume 41, Number 3.

## Tooling Framework for Instantiating Natural Language Querying System.

MANASA JAMMI, JAYDEEP SEN, **ASHISH MITTAL**, SAGAR VERMA, VARDAAN PAHUJA, REMA ANANTHANARAYANAN, PRANAY LOHIA, HIMA KARANAM, DIPTIKALYAN SAHA, KARTHIK SANKARANARAYANAN

*VLDB 2018*

*August 2018, Rio De Janeiro, Brazil*

## Functional Partitioning of Ontologies for Natural Language Query Completion in Question Answering Systems.

JAYDEEP SEN, **ASHISH MITTAL**, DIPTIKALYAN SAHA, KARTHIK SANKARANARAYANAN

*IJCAI 2018*

*July 2018, Stockholm, Sweden*

## An Ontology based Dialog Interface to Database.

**ASHISH MITTAL**, JAYDEEP SEN, DIPTIKALYAN SAHA, KARTHIK SANKARANARAYANAN

*ACM SIGMOD 2018*

*June 2018, Houston, United States*

## Creation and Interaction with Large-scale Domain-Specific Knowledge Bases.

Laura Chiticariu, Marina Danilevsky, Samved Divekar, Arnaldo C. F., Mauricio Hernandez, Howard Ho, Salil Joshi, Hima Karanam, Saravanan Krishnan, Rajashekhar K., Yunyao Li, **ASHISH MITTAL**, Fatma Özcan, Abdul Quamar, Diptikalyan Saha, Karthik S., Jaydeep Sen

*VLDB 2017*

*August 2017, Munich, Germany*

## ATHENA: an ontology-driven system for natural language querying over relational data stores.

Diptikalyan Saha, Avriela Floratou, Karthik Sankaranarayanan, Umar Farooq Minhas, **ASHISH R. MITTAL**, and Fatma Özcan.

*VLDB 2016*

*Sept 2016, New Delhi, India*

## Numerical Relation Extraction with Minimal Supervision.

Aman Madaan, **ASHISH MITTAL**, Mausam, Ganesh Ramakrishnan, and Sunita Sarawagi

*AAAI 2016*

*Feb 2016, Phoenix, United States*

## Patents Filed

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### Multi-agent conversational agent framework

**ASHISH MITTAL**, Priyanka Agrawal, Manasa JammI, Diptikalyan Saha

*P201810043US01*

*August 2019, USPTO*

### Natural Language interface databases

Jaydeep Sen, **ASHISH MITTAL**, Manasa JammI, Diptikalyan Saha

*P201802079US01*

*April 2019, USPTO*

### Automated generation of test cases for analyzing natural language interfaces to database systems

Jaydeep Sen, Diptikalyan Saha, Manasa JammI, **ASHISH MITTAL**

*P201706906US01*

*August 2018, USPTO*

### Ontology-based automatic bootstrapping of state based dialog systems

Diptikalyan Saha, **ASHISH MITTAL**, Jaydeep Sen, Parag Jain

*IN820161771US01*

*Jan 2018, USPTO*

### Ontology refinement based on query inputs

Jaydeep Sen, **ASHISH MITTAL**, Diptikalyan Saha, Karthik Sankaranarayanan

*IN820161530US01*

*Nov 2017, USPTO*

### Ontology Based Query Suggestion using Eye Tracking

**ASHISH MITTAL**, Jaydeep Sen, Diptikalyan Saha, Karthik Sankaranarayanan

*IN820161590US01*

*Sept 2017, USPTO*

### A System for Dialog in Natural Language using an Ontology

**ASHISH MITTAL**, Jaydeep Sen, Diptikalyan Saha, Karthik Sankaranarayanan

*IN920170003US1*

*March 2017, USPTO*

### Translating Structured Languages to Natural Language using Domain-specific Ontology

**ASHISH MITTAL**, Diptikalyan Saha, Karthik Sankaranarayanan

*US10169336B2, (Granted)*

*Jan 2017, USPTO*

### System, Method and Computer Program Product for Packing

Ruhi Sharma Mittal, **ASHISH MITTAL**, Vijay E, Y Shrinivasan

*US10304348B2, (Granted)*

*April 2016, USPTO*

## Key Projects

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### Multilingual Indic language support for IBM Watson Assistant based chatbot

ADVISORY RESEARCH ENGINEER

*Bangalore, India*

*Jan 2019 - Present*

- The aim of this project is to provide multilingual support (especially Indian languages) for IBM Watson Assistant. The aim was to provide speech interface to the chatbot using state-of-the-art NLP techniques.
- Working with experts in speech technologies and linguists to come up with solution using minimal amount of supervision which can work across multiple domains.

## Bootstrapping Chatbots automatically for Relational data stores using Domain specific

### Ontology

Bangalore, India

LEAD DEVELOPER

May 2018 - Dec 2018

- The aim of this project is to bootstrap chatbot using IBM's Watson Assistant framework for relational data stores using domain specific Ontologies. The goal was to automatically create meaningful intents and their natural language variations, entities along with the dialog flow.
- Worked with business partners from IBM's other divisions on getting the querying capability for their flagship products using Watson Assistant.

## Enabling Conversations over Relational data stores using Domain specific Ontology

Bangalore, India

PROJECT LEAD

July 2017 - Apr 2018

- The aim of this project is to enable natural language conversations over relational data stores using domain specific Ontologies. Typical user requirements span multiple queries and these rely on the context provided by the previous queries. Such a system allows an end-user to form contextual queries which can be executed over Relational data stores.
- Came with the idea of enabling contextual querying over the existing solution by relying on key linguistic features of contextual queries and their effect on underlying SQL queries.
- This work led to a paper in ACM SIGMOD 2018, lab-wide presentation as well as 2 manager's choice awards.

## Multilingual Natural Language Querying over relational data stores using Domain specific Ontology

Bangalore, India

RESEARCH SOFTWARE ENGINEER

May 2016 - June 2017

- The focus of this project is to develop a holistic multilingual natural language querying system over relational data stores. The aim was to use semantic parsing to understand the underlying meaning of the query and interpret it in a language agnostic way to support querying over multiple languages.
- Worked with the team in IBM Research, Almaden on adapting the previous work to support multiple languages by modifying the semantic parser to use universal proposition banks.

## Natural Language Querying over relational data stores using Domain specific Ontology

Bangalore, India

RESEARCH SOFTWARE ENGINEER

July 2015 - May 2016

- The main objective of this project was to provide an ontology-driven system for natural language querying of complex relational database. Developed system with unique two-stage approach, where the input natural language query is first translated into an intermediate query language over the ontology, called OQL, and subsequently translated into SQL. The two-stage approach allows to decouple the physical layout of the data in the relational store from the semantics of the query, providing physical independence.
- Worked with a remote team from IBM Research, Almaden on the project. Contributed to the core technology on the NLP aspects of the project.
- From the work, the team published a paper in VLDB titled 'ATHENA: an ontology-driven system for natural language querying over relational data stores' which won the distinguished paper award in 2018.

## Delic - Demystifying Licences

Mumbai, India

HACKATHON TEAM

Spring 2014

- The objective was to bring out the essence(summary) of the end user license agreements and highlight the important points. Implemented an end-to-end solution using NLP techniques to find out the relevant clusters of information and then rank them.
- Worked in a Team of 5, in building the NLP module to identify and summarize key important points in the EULA.

## Devnagari(Hindi) Character Recognition

Mumbai, India

FOR AI COURSE @IIT BOMBAY

Autumn 2013

- The objective of the project was to classify the image of a devnagari character from set of possible devnagari characters. Implemented an Artificial Neural Network (ANN) and trained the network using handcrafted training images.
- Lead the team of 2, created the ANN model from scratch in python and successfully showed the system working in real-time through a web app.

## Honors & Awards

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2019	<b>Research Division Award</b> , Recipient of IBM Research Division Award for my work in Natural language querying technology for Aditya Birla Retail (ABFRL) client win. This is an individual award which is given to select researchers who have made impact for IBM.	IBM Research
2019	<b>Eminence and Excellence Award</b> , Recipient of IBM Research's Eminence and Excellence cash award on demonstrating exemplary teamwork towards the NLQ for Retail Accomplishment.	IBM Research
2019	<b>Manager's choice award</b> , Won the award 4 times since joining IBM Research. The award is given for taking research initiatives, client deliveries and leadership.	IBM Research
2018	<b>Stock Award</b> , Recipient of IBM Stock Award for showing leadership in taking ideas to Impact, and creatively coming up with new research ideas and opportunities. This is an individual award which is given to a very less number of people globally every year, chosen by the CEO of IBM.	IBM Research
2017	<b>Distinguished Paper Award</b> , Recipient of IBM India Research Lab's Distinguish Paper Award for our paper published in VLDB 2016. This award is given to the research contributions that have shown significant progress and contributing to IBM's AI strategy.	IBM Research
2014	<b>Winner</b> , Won the AngelHack Hackathon held in Mumbai out of 38 teams. Selected for the finals and accepted at HACKcelerator program with office space, mentorship and \$5000 worth of Amazon AWS credits (declined).	IIT Bombay

## MISCELLANEOUS

- 2019 **Runner Up**, Lead the team of 3 to 2nd position in the hackathon(out of 18 teams). Our idea was to build an seamless end-to-end multilingual chatbot that can converse in multiple Indian languages. *IBM Research*
- 2015 **Rank 2**, Obtained Department Rank 2 out of 120 students in M.Tech CSE at IIT Bombay. *IIT Bombay*
- 2013 **All India Rank 11**, Obtained All India Rank 11 out of 2,24,160 students in the entrance exam for post graduate admissions(GATE) in India. *India*
- 2012 **All India Rank 115**, Obtained All India Rank 115 out of 1,56,780 students in the entrance exam for post graduate admissions(GATE) in India. *India*
- 2012 **Certificate of Excellence, Top Ranker**, Awarded Certificate of Excellence, Top Ranker 2012 from Nasscom for being a top ranker in Department of Computer Engineering at Dharmsinh Desai University. *Nadiad, India*
- 2010 **Eklavya Scholarship of Excellence**, Awarded Eklavya Scholarship of Excellence for first position in the Department of Computer Engineering at Dharmsinh Desai University *Nadiad, India*

## Mentorship

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- 2019 **Saneem C. G, Kevin Patel, Kushal Chauhan**, Mentored the team on building a chatbot for automating and collaboratively managing the process of training deep learning models using natural language. The team won the first position in the hackathon. *IBM Research Hackathon*
- 2019 **Aditya Jadhav, Sunanda Rao, Niresh R.**, Creating chatbot from medical ontology using API composition. *IBM Extreme Blue Internship*

## Academic Services

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- 2019 **Program Committee Member**, The Thirty-Fourth AAAI Conference on Artificial Intelligence (AAAI 2020) *New York, United States*
- 2019 **Program Committee Member**, ACM India Joint International Conference on Data Science & Management of Data, 2020 *Hyderabad, India*
- 2018 **Program Committee Member, Industry Track**, ACM India Joint International Conference on Data Science & Management of Data, 2019 *Kolkata, India*
- 2015 **Teaching Assistant**, CS 725, Foundations for Machine Learning, Prof. Saketha Nath *IIT Bombay*

## Invited Talks

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### IBM Research-IISc Workshop on Knowledge and Learning

*IISc Bangalore*

EXTERNAL TALK

*March 7 2018*

- Gave a talk on our work in the area around natural language querying over relational data stores using Ontology.
- <https://mallabiisc.github.io/events/ibm-iisc-day-2018/>

### Japan Advanced Institute of Science and Technology (JAIST)

*Bangalore, India*

INTERNAL TALK

*August 10 2017*

- Presented our work on natural language querying over databases to a team visiting from JAIST comprising of senior researchers and students.

## Skills

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- Languages** Java, C, C++, Python, Shell scripting, JavaScript
- Deep Learning Tools** Tensorflow, Pytorch, OpenNMT
- Softwares and Tools** scikit-learn, NLTK,  $\text{\LaTeX}$ , D3.js
- IBM Tools** IBM Bluemix, IBM Watson Assistant, IBM Language Translator, IBM Text-to-speech