

# Raghuv eer Thirukovalluru

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## EDUCATION

### UMASS AMHERST | MS IN COMPUTER SCIENCE

Graduated July 2021 | Amherst, Massachusetts

- Cum. GPA: 4.0/4.0

### DUKE UNIVERSITY | PHD IN COMPUTER SCIENCE

2021-Present | Durham, North Carolina

ADVISORS: DR. BHUWAN DHINGRA, DR. SAM WISEMAN

- Cum. GPA: 4.0/4.0

### IIT KANPUR | B.TECH IN ELECTRICAL ENGG.

Graduated July, 2016 | Kanpur, India

- Cum. GPA: 8.9 / 10.0

## PUBLICATIONS

- R. Thirukovalluru, N. Monath, K. Shridhar, M. Zaheer, M. Sachan, and A. McCallum. Scaling within document coreference to long texts. In *Findings of the Association for Computational Linguistics: ACL-IJCNLP 2021*, pages 3921–3931, 2021
- R. Thirukovalluru\*, M. Sridhar\*, D. Thai\*, S. Chanumolu, N. Monath, S. Ananthkrishnan, and A. McCallum. Knowledge informed semantic parsing for conversational question answering. In *Proceedings of the 6th Workshop on Representation Learning for NLP (Repl4NLP-2021)*, pages 231–240, 2021
- D. Thai\*, R. Thirukovalluru\*, T. Bansal \*, and A. McCallum. Simultaneously self-attending to text and entities for knowledge-informed text representations. In *Proceedings of the 6th Workshop on Representation Learning for NLP (Repl4NLP-2021)*, pages 241–247, 2021
- S.Gupta, R.Thirukovalluru, M.Sinha, and S.Mannarswamy. CIMTDetect: A Community Infused Matrix-Tensor Coupled Factorization Based Method for Fake News Detection. *IEEE/ACM International Conference on Advances in Social Networks Analysis and Mining (ASONAM), Spain, 2018*
- N.K.Verma\*, R.K.Sevakula\*, and R.Thirukovalluru\*. Pattern Analysis Framework with Graphical Indices for Condition-Based Monitoring. *IEEE Transactions on Reliability, vol. 66, no. 4, pp. 1085-1100, 2017*
- R.Thirukovalluru, S.Dixit, R.K.Sevakula, N.K.Verma, and A.Salour. Generating Feature Sets for Fault Diagnosis using Denoising Stacked Autoencoder. *IEEE International Conference on Prognostics and Health Management (ICPHM), Canada, 2016*

## PATENTS

- R.Thirukovalluru, R.Mariyappan, and S.Roy. Method and System for Real-time Summary Generation of Conversation. *USPTO, US9881614*
- N.K.Verma\*, R.K.Sevakula\*, and R.Thirukovalluru\*. Condition monitoring setup for long term reliability in fault recognition. *IPASS, 201611029228A*

[\*Equal Co-Author]

## EXPERIENCE

### INFORMATION EXTRACTION & SYNTHESIS LAB | RESEARCH ASSISTANT

Summers 2019 | Amherst

- Worked on multiple high impact NLP problems- Coreference Resolution, Knowledge graphs etc. Details in Research Section.

### AI IN FINANCE | CO-FOUNDER

August 2018 - May 2019 | Bangalore (Non-Incorporated)

Designed and developed a credit card alternative with better creditworthiness estimation, lower NPAs and higher user incentives.

- **Pricing & Growth Models** - Designed game-theoretic models to find optimal price, cashback settings to balance incentives for the users and returns for retail merchants. Estimated and optimised initial cashburn to achieve fast adoption of the platform.
- **Hardware & Software** - Developed wireless payment firmware for payments device(PiZW) and secure mobile payments app.

### XEROX RESEARCH CENTRE, INDIA | BUDDING SCIENTIST, TEXT & GRAPH ANALYTICS

July 2016 – July 2018 | Bangalore

- **Conversation Summarization** - Devised a **deep entailment** technique to build a tree of conversation turns. Utility of each turn was found using a feed forward network and tree knapsack was finally used to produce **extractive summary**.
- **Trending Topic Analysis** - Designed a graphical model inspired by LDA on sentence multi-grams and their syntactic features addressing the sparsity problem. Topic distributions across sliding windows were analysed to give trending topics.

## RESEARCH

### FASTER LANGUAGE MODEL PRETRAINING | MENTOR : DR. BHUWAN DHINGRA, DR. SAM WISEMAN

Sept 2021 – Present | Duke UNniversity

- **Problem Statement:** Propose a methodology to improve language model pretraining time.
- **Approach:** Working on an auxiliary model which can filter out some less important examples for the language model at a given state during training. These examples while not contributing much to pretraining of the language model, eat up time.

### COREFERENCE RESOLUTION | MENTORS: NICHOLAS MONATH, DR. MANZIL ZAHEER, DR. MRINMAYA SACHAN, DR. ANDREW MCCALLUM

June 2020 – Present | IESL, UMass Amherst

- **Problem Statement:** Propose techniques to perform coreference on long documents having found that existing tools dont scale.
- **Approach:** Proposed a token level mechanism to perform coreference. Each token was scored for a start score and end score using feed forward networks. Mention scores were found by composing token level scores of all spans. Antecedent scoring was performed on all pairs of top scoring spans, again at a token level capturing cross token scores. The overall system performed on par with existing neural arts while consuming < 10% GPU RAM and being 4x faster on longer documents.

### CONVERSATIONAL QUESTION ANSWERING | MENTORS: MUKUND, DUNG THAI, DR. ANDREW MCCALLUM

Feb 2020-July 2020 | Amazon Alexa AI & UMass Amherst

- **Problem Statement:** Involves a conversation turn containing a complex natural language question with references to previous turns. The question can be answered on a knowledge graph(KG). Dataset: "Complex Sequential Question Answering" (CSQA).
- **Approach:** Built on top of existing semantic parsing based approaches to convert the question into a logical form query. Developed a knowledge graph(KG) driven semantic parsing approach to generate logical forms conforming to the KG subgraph required to answer the question. This addressed the problem of non executable logical forms and resulted in 2.5 F1 improvement, 4% accuracy improvement. The model also performed on par with baseline with just 10% of baseline parameters.

### KNOWLEDGE INFORM TRANSFORMER | MENTORS: D. THAI, TRAPIT BANSAL, DR. ANDREW MCCALLUM

Aug 2019 – Sept 2020 | IESL, UMass Amherst

- **Problem Statement** Can we build knowledge augmented language model without any supervised data.
- **Approach:** Mention detection was performed using off the shelf tools. All candidate entities corresponding to each mention within an example found using surface form matching were appended to the example. Pretraining was performed with entity ranking loss - candidates of a mention are ranked higher than the candidates of other mentions, along with masked language modelling, masked mention modelling losses. Results show improvements in downstream tasks of entity typing, entity linking.

## FAKE NEWS DETECTION

Jan 2018 – July 2018 | Xerox Research Centre, India

- **Problem Statement:** Involves identifying validity of news given the content and propagation of article in a social network.
- **Approach:** Modeling the echo-chambers as closely-connected communities within the social network, we represented a news article as a 3-mode tensor of the structure - <News, User, Community> and proposed a tensor factorization based method to extract latent representation of news. Classification is performed on the latent embeddings to identify fake news.

## COURSEWORK

- Adv. Algorithms • Machine Learning • Reinforcement Learning • Algo. for Data Science • Probabilistic Graphical Models • Adv. NLP
- Theory Software Engineering • Software Architecture
- Discrete Mathematics • Game Theory

## AWARDS

- Academic Excellence Award, IIT Kanpur, 2013.
- All India Rank 26 in Kishore Vaigyanik Protsahan Yojana (KVPY 2012).
- All India Rank 588 (amongst 5,00,000 students) in IIT-JEE 2012.
- All India Rank 87 (amongst 10,00,000 students) in AIEEE.BA 2012.

## PROGRAMMING

**ML Libraries:** TensorFlow • PyTorch  
**Programming Languages:** Python • JS • C++ • Java  
**Frameworks:** Android • NodeJS

## EX. CURRICULAR

- **Chess** - Regular player of chess. Rated 1500+(rapid), 1400+(blitz) on chess.com.
- **Table Tennis** - Regular player. Won multiple office contests.