

EDUCATION

The Johns Hopkins University

Ph.D. in Computer Science

Baltimore, US

2018–Present

- Advisors: Sanjeev Khudanpur, Dan Povey
- Research interests: Speech recognition, speaker diarization

Indian Institute of Technology Guwahati

B.Tech. in Computer Science and Engineering, GPA: 9.35/10.00

Guwahati, India

2013–2017

- Advisor: Ashish Anand
- Thesis: “Relation extraction for biomedical text”

PROJECTS

Informed target-speaker ASR

JSALT 2020

Advisors: Marc Delcroix (NTT, Japan), Shinji Watanabe (JHU)

- Devised a novel constrained optimization based approach for overlap-aware diarization; improves DER over baseline system on LibriCSS data from 16.3% to 9.3%
- Experimented with training strategies for target speaker ASR – architecture of embedding usage, discriminative training, etc; cumulative improvement in WER from 27.9% to 16.6%.
- Integrated both components to recognize multi-speaker overlapping speech without explicit separation.

Integration of separation, diarization, and ASR

JSALT 2020

Collaborators: Zhuo Chen (Microsoft), Hakan Erdogan (Google)

- Created modular Kaldi pipeline integrating speech separation, diarization, and ASR.
- Implemented a novel cross-stream clustering technique to diarize multiple audio streams simultaneously — pipeline provides 37.6% relative WER improvement over single-stream approach.
- Evaluated the pipeline with different variants of each module.

CHiME-6 challenge

Spring 2020

Advisors: Paola Garcia, Shinji Watanabe, Sanjeev Khudanpur

- Created baseline Kaldi recipe for the challenge: TDNN-stats based SAD (5.1% error rate on dev) and x-vector + PLDA backend for diarization (~36% DER on dev)
- Led diarization efforts for JHU team’s participation in the challenge – added multi-array fusion and VB-HMM based overlap assignment to the pipeline.
- Final WER improved by 10% absolute compared with baseline – finished top 2 in “diarization + ASR” track. Prepared system description manuscript for the submission.

EXPERIENCE

Samsung Research

Research Engineer in Advanced Technology Lab (ATL)

Bengaluru, India

June 2017 – June 2018

- Context engine for conversational assistant

Microsoft India

Software Developer Intern

- Cross-platform application for digital contracting system

Hyderabad, India

Summer 2016

Hanyang University

Research Intern in Pattern Recognition & Fuzzy Systems Lab (Advisor: Frank Rhee)

Ansan, Korea

Summer 2015

- Analysis of multi-dimensional type-2 fuzzy membership functions, and application to fuzzy ART algorithm for image segmentation

TEACHING

- **Teaching Assistant** at Johns Hopkins University Fall 2020
Introduction to Human Language Technology (601.647/667)

MENTORSHIP & PROFESSIONAL SERVICES

- **Reviewer:** IEEE SLT 2021
- CLSP Graduate Admissions Committee: 2021
- CLSP Student Recruitment Committee: 2019, 2020
- Student Mentor for 8 freshmen at IIT Guwahati 2014-15

SKILLS

- **ML/DL Toolkits:** PyTorch, Tensorflow, Scikit-learn
- **ASR Frameworks:** Kaldi, ESPNet
- **Other:** Audacity, Git

LANGUAGES

- **Programming:** Python, C++, Bash
- **Natural:** English, Hindi, French (beginner)
- **TOEFL:** 119/120

ACHIEVEMENTS

- **Top 2** in the CHiME-6 challenge track 2 (diarization + ASR) 2020
- **INAE Travel Grant** by Govt. of India (worth INR 50,000) 2017
- **Kalyani Research Scholarship** from Alumni Affairs, IIT Guwahati 2017
- **INSPIRE Scholarship for Higher Education (SHE)** from DST, Govt. of India (refused) 2013

PUBLICATIONS

- [1] **D. Raj**, P. Denisov, Z. Chen, H. Erdogan, Z. Huang, M. He, S. Watanabe, J. Du, T. Yoshioka, Y. Luo, N. Kanda, J. Li, S. Wisdom, and J. R. Hershey, “Integration of speech separation, diarization, and recognition for multi-speaker meetings: System description, comparison, and analysis”, *IEEE SLT*, 2021.
- [2] **D. Raj**, P. Garcia, Z. Huang, S. Watanabe, D. Povey, A. Stolcke, and S. Khudanpur, “DOVER-Lap: A method for combining overlap-aware diarization outputs”, in *IEEE SLT*, 2021.
- [3] **D. Raj**, Z. Huang, and S. Khudanpur, “Multi-class spectral clustering with overlaps for speaker diarization”, *IEEE SLT*, 2021.
- [4] Z.-Q. Wang, H. Erdogan, S. Wisdom, K. Wilson, **D. Raj**, S. Watanabe, Z. Chen, and J. R. Hershey, “Sequential multi-frame neural beamforming for speech separation and enhancement”, *IEEE SLT*, 2021.
- [5] A. Arora, **D. Raj**, A. S. Subramanian, K. Li, B. Ben-Yair, M. Maciejewski, P. Zelasko, P. Garcia, S. Watanabe, and S. Khudanpur, “The JHU multi-microphone multi-speaker ASR system for the CHiME-6 challenge”, *CHiME-6 Workshop at IEEE ICASSP*, 2020.

- [6] **D. Raj**, D. Snyder, D. Povey, and S. Khudanpur, “Probing the information encoded in x-vectors”, *IEEE ASRU*, 2019.
- [7] **D. Raj**, S. K. Sahu, and A. Anand, “Learning local and global contexts using a convolutional recurrent network model for relation classification in biomedical text”, in *CoNLL*, 2017.