DESH RAJ

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EDUCATION

Johns Hopkins University *ongoing*
Ph.D. in Computer Science
Primary Advisor: Sanjeev Khudanpur
Research Interests: Speech recognition, speaker diarization

Indian Institute of Technology Guwahati *June 2017*
B.Tech. in Computer Science & Engineering
GPA: 9.35/10
Thesis: Relation extraction in clinical text using deep learning

SELECTED PROJECTS

Integration of speech separation, diarization, and recognition JSALT 2020
Main collaborator: Zhuo Chen (Microsoft)

· 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; leading efforts to submit a manuscript describing the findings to SLT 2021.

Informed target speaker ASR JSALT 2020
Main collaborators: 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% (draft in preparation for SLT 2021)
· 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%.
· Integrating both components to recognize multi-speaker overlapping speech without explicit separation.

CHiME-6 challenge Spring 2020

· 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 Institute Bangalore June 2017 - June 2018
Research Engineer *Bangalore, India*

· Conceptualized and implemented several key features like undo, selective delete, etc., as part of Context Engine team in Conversational Intelligence

· Devised a bit truncation method to reduce word embeddings size for on-device AI; achieved 75% compression with 95% correlation in word similarity task

Microsoft India May 2016 - July 2016
Software Development Engineering Intern *Hyderabad, India*

· Developed a cross-platform mobile application in Xamarin Forms for OEM digital contracting system
· Conceptualized statistics APIs to improve business efficiency

SELECTED PUBLICATIONS

A.Arora, **D.Raj**, A.S.Subramanian, K.Li, B.Benyair, M.Maciejewski, P.Zelasko, P.Garcia, S.Watanabe, S.Khudanpur , *The JHU multi-microphone multi-speaker ASR system for the CHiME-6 challenge.* CHiME-6 Workshop at IEEE ICASSP 2020.

D.Raj, D.Snyder, D.Povey, S.Khudanpur , *Probing the information encoded in x-vectors.* IEEE Workshop on Automatic Speech Recognition and Understanding (ASRU) 2019.

D.Raj, S.K.Sahu, A.Anand, *Learning local and global contexts using a convolutional recurrent network model for relation classification in biomedical text.* SIGNLL Conference on Computational Natural Language Learning (CoNLL) 2017. PP 311–321

D.Raj, A.Gupta, B.Garg, K.Tanna, F.C.H.Rhee, *Analysis of data generated from multidimensional type-1 and type-2 fuzzy membership functions.* IEEE Transactions on Fuzzy Systems.

ACHIEVEMENTS

Finished **top 2** in the CHiME-6 challenge track 2 (diarization + ASR).

Recepient of **INAE Travel Grant Scheme** by Govt. of India for oral presentation at WCCI 2016.

Recepient of **Kalyani Research Scholarship** from Alumni Affairs (IIT Guwahati) for publishing at an international conference during B.Tech.

TECHNICAL SKILLS

Programming Languages	Python, C++, Bash
Libraries & Frameworks	Kaldi, ESPNet, PyTorch

GRADUATE COURSEWORK

ML courses	Machine Learning, Data to Models, Information Extraction
Math courses	Bayesian Statistics, Matrix Analysis, Nonlinear Optimization
Other	Parallel Programming, Causal Inference, Information Theory