

Karan Thakkar

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EDUCATION

- **Johns Hopkins University** Baltimore, MD
Ph.D. student in Electrical and Computer Engineering; GPA: 3.98 Aug. 2021 – Present
- **Vellore Institute of Technology** Vellore, India
Bachelor of Technology in Electrical and Electronics; GPA: 3.72 (9.33/10.0) Aug. 2016 – July. 2020

RESEARCH EXPERIENCE

- **Laboratory for Computational Audio Perception** Ph.D. Candidate
Python, MATLAB, PyTorch, PsychoPy, EEGLAB Aug 2021 - Present
 - **State Space Modeling of Top-Down and Bottom-Up Auditory Attention:** Developing dynamic and explainable models of Auditory Attention, leveraging audio stimuli to analyze and interpret brain states from EEG data.
 - **Self Supervised Features for Auditory Attention Decoding:** Evaluated 12 self-supervised and 2 shallow representations for Auditory Attention Decoding in EEG data from 57 subjects, revealing deep features' superiority in decoding across multiple languages.
 - **Interdisciplinary Neural Systems Research:** Investigated auditory segregation in ferrets and compared neural responses with neural activations, revealing enhanced processing of attended audio in both experiments.
 - **Generative Model for Sound Separation:** Innovated generative diffusion probabilistic model for target sound extraction, outperforming discriminative methods in perceptual qualities by 10%. [project link](#)
 - **Bio-inspired Framework for Speech and Music Separation:** Engineered the Explicit Memory Multiresolution Adaptive framework drawing inspiration from neuro-auditory principles of temporal coherence, memory and adaptation.
- **DeepSync Technologies (now DubPro.ai)** Machine Learning Engineer
Bash, Git, Python, PyTorch, Azure Jul 2020 - Jul 2021
 - **Signal Pre-Processing Automation:** Developed and implemented an automated system for audio data collection, verification, and pre-processing from various artists, efficiently handling over 10k hours of raw data.
 - **Scalable Text to Speech (TTS) System Development:** Developed a high-efficiency end-to-end TTS, inspired by Microsoft's FastSpeech2, achieving a 7x faster speech inference time compared to Google's Tacotron.
 - **Fast and Efficient Vocoding:** Innovated a mel-spectrogram to waveform vocoder inspired by HiFi-GAN and VocGAN.
- **VIT Vellore and NUS Singapore** Undergraduate Research Fellow
Python, MATLAB, Keras, Tensorflow, GCP, Hadoop Jul 2018 - Apr 2020
 - **Deep Learning in Wireless Communication Systems:** Developed and optimized an OFDM system with an $O(n)$ deep signal detection algorithm, outperforming traditional MMSE and LS methods. Integrated a deep learning-based recovery and denoising block enhancing noise robustness and independence from Cyclic Prefix.
 - **Speech Emotion and Sentiment Analysis @ National University of Singapore:** Explored chirp wavelet-based features for classifying emotions in speech. Secured 2nd prize in Kaggle text sentiment analysis competition with a custom-developed LSTM model.

ACADEMIC PROJECTS & OPEN SOURCE CONTRIBUTIONS

- **Telluride Neuromorphic Workshop; Audio-Motor Coupling in Speech and Music:** [Report]
- **Stress Testing Chain-of-Thought Prompting for Large Language Models:** arXiv:2309.16621
- **Enabling Visual Perception for the Blind through Auditory Signals:** [Report]
- **OS Audio:** facebookresearch/audiocraft, carankt/CovidDetection, carankt/FastSpeech2, rishikksh20/VocGAN
- **OS EEG decoding:** carankt/vlaai-pytorch, carankt/synthetic_telepathy

PUBLICATIONS & PREPRINTS

- **Thakkar, K.**, Hai, J., Elhilali M. (2023). Investigating Self-Supervised Deep Representations for EEG-based Auditory Attention Decoding. arXiv:2311.00814.(Submitted to ICASSP '24)
- Hai, J., Wang, H., Yang, D., **Thakkar, K.**, Chong, D., Dehak, N., Elhilali, M. (2023). DPM-TSE: A Diffusion Probabilistic Model for Target Sound Extraction. arXiv:2310.04567(Submitted to ICASSP '24)
- Bellur, A., **Thakkar, K.** Elhilali, M. Explicit-memory multiresolution adaptive framework for speech and music separation (2023) <https://doi.org/10.1186/s13636-023-00286-7>
- **K. Thakkar**, A. Goyal, and B. Bhattacharyya, (2020) Emergence of Deep Learning as a potential solution for Detection, Recovery, and De-noising of Signals in Communication Systems <https://doi.org/10.1016/j.ijin.2020.12.001>.
- **K. Thakkar**, A. Goyal, and B. Bhattacharyya, (2020) Deep Learning and Channel Estimation doi:10.1109/ICACCS48705.2020.9074414.