

# Deepak Baby

APPLIED SCIENTIST · AMAZON ALEXA AGI

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## Experience

### Applied Scientist

Oct 2020 – Present

AMAZON ALEXA AGI

Aachen, Germany.

- Working on developing state-of-the-art multi-modal large language models.
- Lead scientist in establishing incremental learning framework for Alexa ASR models for model freshness and hotfixing.
- Develop and maintain speech recognition models deployed in Alexa devices on multiple languages.
- Close collaboration with various engineering teams automating the Alexa ASR production model builds.
- Develop quick solutions for customer facing issues in production models.
- Extensive experience working with big data, developing machine learning models and continuously improving them for production deployment.

### Post-doctoral Researcher

May 2019 - June 2020

IDIAP RESEARCH INSTITUTE

Martigny, Switzerland.

- Post-doctoral research fellow in the SNSF project 'SHISSM' with Prof. Hervé Bourlard.
- Collaborated with several PhD students providing support and guidance on their research.
- Developed speech enhancement (denoising and dereverberation) approaches using variational and adversarial auto-encoders.

### Post-doctoral Researcher

Feb 2017 - Apr 2019

GHENT UNIVERSITY

Ghent, Belgium.

- Post-doctoral research fellow in the ERC project 'RobSpear' with Prof. Sarah Verhulst.
- Developed neural network-based machine learning techniques for modelling and correcting hearing impairment.
- Seminal work on using neural networks for approximating computational auditory models and hearing aids.
- Patent on neural network-based computational auditory models and publications in Nature: Machine Intelligence and Nature Communications.
- The patent was eventually granted \$1M ERC funding for startup.

### Visiting Researcher

Apr - Jun 2015

NUANCE COMMUNICATIONS INC.

Merelbeke, Belgium.

- Investigated the previously proposed exemplar-based speech enhancement approaches as front-end for Nuance's ASR tasks on automotive data.

### Visiting Researcher

Jun - Aug 2013

TAMPERE UNIVERSITY OF TECHNOLOGY

Tampere, Finland.

- Internship with Prof. Tuomas Virtanen, Audio Research Group, Dept. of Signal Processing.
- Investigated the use of Modulation Envelope features for feature enhancement to improve the noise robustness of Automatic Speech Recognition systems

### Teaching Assistant

2013 - 2016

KU LEUVEN

Leuven, Belgium..

- Conducted the exercise sessions for the course 'Stochastic Signal and System Analysis'.

## Education

### KU Leuven

Leuven, Belgium.

DOCTOR OF PHILOSOPHY (PHD)

2012 - 2016

**Thesis** : Non-negative Sparse Representations for Speech Enhancement and Recognition

**Supervisor**: Prof. Hugo Van hamme

### IIT Bombay

Mumbai, India.

MASTER OF TECHNOLOGY (M.TECH)

2010 - 2012

**Specialization**: Communication and Signal Processing (GPA: 9.45/10)

**Thesis** : Extensions to Greedy Algorithms in Compressed Sensing

**Supervisor** : Prof. Sibi Raj B Pillai

### College of Engineering

Trivandrum, India.

BACHELOR OF TECHNOLOGY (B.TECH)

2005 - 2009

**Specialization**: Electronics and Communication Engineering (GPA: 7.57/10)

## Skills

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<b>Programming</b>	Python, Tensorflow, PyTorch, MATLAB
<b>Cloud Infrastructure and DevOps</b>	AWS, SageMaker, Docker, CI/CD, GNU/Linux
<b>Data Engineering</b>	PySpark, Pandas

## Academic Service & Supervision

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### MENTORING INTERNS AND MASTERS THESIS STUDENTS

2024	<b>Alkis Koudounas</b> , Intern project: Learning from AI feedback for LLMs	<i>Amazon Alexa</i>
2022	<b>Sungjun Han</b> , Intern project: Incremental learning for ASR using residual adapters	<i>Amazon Alexa</i>
2019	<b>Arthur Van Den Broucke</b> , MS Thesis: Deep learning techniques for individualized auditory profiles	<i>Ghent University</i>
2015	<b>Joris Verhaegen</b> , MS Thesis: NMF-based reduction of background sounds in TV shows for ASR	<i>KU Leuven</i>
2015	<b>Shubham Sharma</b> , Intern project: De-reverberation using non-negative matrix factorisation	<i>KU Leuven</i>

### REVIEWING

**Journals** Nature: Machine Intelligence  
IEEE Transactions on Audio, Speech and Language Processing  
IEEE Transactions on Signal Processing  
IEEE Signal Processing Letters  
Computer, Speech & Language  
Speech Communication  
Trends in Hearing

**Conferences** INTERSPEECH  
IEEE International Conference on Audio, Speech and Signal Processing  
IEEE International Conference on Multimedia and Expo

## Patents & Publications

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### PATENTS

#### NEURAL NETWORK MODEL FOR COCHLEAR MECHANICS AND PROCESSING

**Deepak Baby**, Sarah Verhulst, Fotios Drakopoulos, Arthur Van Den Broucke  
*U.S. Patent 11 800 301, October 2023* ([link](#))

### PEER REVIEWED JOURNALS

Biophysically realistic neural-network models of auditory neurons and synapses for neuroscience and machine-hearing applications

Sarah Verhulst, Fotios Drakopoulos, Arthur Van Den Broucke, **Deepak Baby**  
*JOURNAL OF COMPUTATIONAL NEUROSCIENCE* 49.SUPPL. 1 (2021) S30–S31. 2021

A convolutional neural-network model of human cochlear mechanics and filter tuning for real-time applications

**Deepak Baby**, Arthur Van Den Broucke, Sarah Verhulst  
*Nature Machine Intelligence* 3.2 (FEB. 2021) PP. 134–143. 2021

A convolutional neural-network framework for modelling auditory sensory cells and synapses

Fotios Drakopoulos, **Deepak Baby**, Sarah Verhulst  
*Communications Biology* 4.1 (JUNE 2021) P. 827. 2021

Automated speech analysis to improve TMS-based language mapping: Algorithm and proof of concept

Laura Seynaeve, **Deepak Baby**, Hugo Van hamme, Steven De Vleeschouwer, Patrick Dupont, Wim Van Paesschen  
*Brain Stimulation: Basic, Translational, and Clinical Research in Neuromodulation* (OCT. 2019). ELSEVIER, 2019

Joint Denoising and Dereverberation Using Exemplar-Based Sparse Representations and Decaying Norm Constraint

**Deepak Baby**, Hugo Van hamme  
*IEEE/ACM Trans. Audio, Speech & Language Processing* 25.10 (2017) PP. 2024–2035. 2017

Coupled Dictionaries for Exemplar-Based Speech Enhancement and Automatic Speech Recognition

**Deepak Baby**, Tuomas Virtanen, Jort F. Gemmeke, Hugo Van hamme  
*IEEE/ACM Trans. Audio, Speech & Language Processing* 23.11 (2015) PP. 1788–1799. 2015

### CONFERENCES & WORKSHOPS

Residual Adapters for Targeted Updates in RNN-Transducer based Speech Recognition System

Sungjun Han, **Deepak Baby**, Valentin Mendelev  
*Spoken Language Technology Workshop (SLT), 2022 IEEE, 2023, Doha, Qatar*

**Incremental learning for RNN-Transducer based speech recognition models**  
**Deepak Baby**, Pasquale D'Alterio, Valentin Mendelev  
*INTERSPEECH, 2022, Incheon, South Korea*

**Speech Dereverberation Using Variational Autoencoders**  
**Deepak Baby**, Hervé Boudlard  
*Acoustics, Speech and Signal Processing (ICASSP), 2021 IEEE International Conference on, 2021*

**Hearing-Impaired Bio-Inspired Cochlear Models for Real-Time Auditory Applications**  
Arthur Van Den Broucke, **Deepak Baby**, Sarah Verhulst  
*INTERSPEECH, 2020, Shanghai, China*

**SERGAN: Speech Enhancement using Relativistic Generative Adversarial Networks with Gradient Penalty**  
**Deepak Baby**, Sarah Verhulst  
*Acoustics, Speech and Signal Processing (ICASSP), 2019 IEEE International Conference on, 2019, Brighton, UK*

**Real-Time Audio Processing on a Raspberry Pi using Deep Neural Networks**  
Fotios Drakopoulos, **Deepak Baby**, Sarah Verhulst  
*23rd International Congress on Acoustics (ICA), 2019, Aachen, Germany*

**Biophysically-inspired Features Improve the Generalizability of Neural Network-based Speech Enhancement Systems**  
**Deepak Baby**, Sarah Verhulst  
*Proc. INTERSPEECH, 2018, Hyderabad, India*

**Supervised Speech Dereverberation in Noisy Environments using Exemplar-based Sparse Representations**  
**Deepak Baby**, Hugo Van hamme  
*Acoustics, Speech and Signal Processing (ICASSP), 2016 IEEE International Conference on, 2016, Shanghai, China*

**Exemplar-based Speech Enhancement for Deep Neural Network based Automatic Speech Recognition**  
**Deepak Baby**, Jort F. Gemmeke, Tuomas Virtanen, Hugo Van hamme  
*Acoustics, Speech and Signal Processing (ICASSP), 2015 IEEE International Conference on, 2015, Brisbane, Australia*

**Hybrid Input Spaces for Exemplar-based Noise Robust Speech Recognition using coupled dictionaries**  
**Deepak Baby**, Hugo Van hamme  
*23rd European Signal Processing Conference (EUSIPCO), 2015, Nice, France*

**Investigating Modulation Spectrogram Features for Deep Neural Network-based Automatic Speech Recognition**  
**Deepak Baby**, Hugo Van hamme  
*Proc. INTERSPEECH, 2015, Dresden, Germany*

**Noise Robust Exemplar Matching for Speech Enhancement: Applications to Automatic Speech Recognition**  
Emre Yilmaz, **Deepak Baby**, Hugo Van hamme  
*Proc. INTERSPEECH, 2015, Dresden, Germany*

**Noise Robust Exemplar Matching with Coupled Dictionaries for Single-Channel Speech Enhancement**  
Emre Yilmaz, **Deepak Baby**, Hugo Van hamme  
*23rd European Signal Processing Conference (EUSIPCO), 2015, Nice, France*

**Coupled Dictionary Training for Exemplar-based Speech Enhancement**  
**Deepak Baby**, Tuomas Virtanen, Tom Barker, Hugo Van hamme  
*Acoustics, Speech and Signal Processing (ICASSP), 2014 IEEE International Conference on, 2014, Florence, Italy*

**Exemplar-based Noise Robust Speech Recognition using Modulation Spectrogram Features**  
**Deepak Baby**, Tuomas Virtanen, Jort F. Gemmeke, Tom Barker, Hugo Van hamme  
*Spoken Language Technology Workshop (SLT), 2014 IEEE, 2014, South Lake Tahoe, USA*

**Ordered Orthogonal Matching Pursuit**  
**Deepak Baby**, Sibi Raj B. Pillai  
*Communications (NCC), 2012 National Conference on, 2012, Kharagpur, India*

## PREPRINTS

**iSEGAN: Improved Speech Enhancement Generative Adversarial Networks**  
**Deepak Baby**  
[CoRR ABS/2002.08796 \(MAR. 2020\). 2020](#)

## References

### Prof. Sarah Verhulst

ASSISTANT PROFESSOR, GHENT UNIVERSITY

[sarah.verhulst@ugent.be](mailto:sarah.verhulst@ugent.be)

### Prof. Hugo Van hamme

ASSISTANT PROFESSOR, KU LEUVEN

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