Ariel Vardi

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Education

Ph.D., MIT/WHOI Joint-Program — Cambridge, MA, USA
Mechanical Engineering and Applied Ocean Science & Engineering — *May 2025*
Thesis Subject: Deep Learning Framework for Geoacoustic Inversion using Normal Mode Theory

M.Sc., Technion - Israel Institute of Technology — Haifa, Israel
Energy Engineering, cum laude — *2020*
Thesis: Sorption-Based Cooling Using Acoustic Waves - Experimental and Theoretical Exploration

B.Sc., Technion - Israel Institute of Technology — Haifa, Israel
Environmental and Chemical Engineering, cum laude — *2017*

Experience

Research Assistant — 2020-2025
Woods Hole Oceanographic Institution — *WHOI, MA*

- Established a new Deep Learning framework for inferring ocean sediment acoustic properties using a fully automated pipeline using PyTorch and Tensorflow.
- Participated in multiple at-sea experiments that included the deployment and recovery of hydrophones, and collaborated with scientists from all over the world.
- Processed and analyzed hundreds of hours of acoustic data using Python, MATLAB and Julia.
- Developed multiple differentiable programs for underwater acoustic field modeling using Julia.
- Developed analytical models that were integrated with neural networks for establishing physics-based deep learning frameworks.

Research Assistant — 2016 - 2020
Thermoacoustics Lab - Technion — *Haifa, Israel*

- Led the Thermoacoustic Cooling project which resulted in a 450% increase in cooling efficiency using a novel adsorption-based system.
- Developed and built an experimental Thermoacoustic system with the ability to sustain both vacuum and high pressures.
- Defined specifications, quality assurance and full development of a DAQ system using National Instruments modules and LABView.
- Derived simultaneously a mathematical model that describes the operation of the novel Thermoacoustic system and solved numerically using MATLAB.

Conferences

A. Vardi, J. Leonard and J. Bonnel. Spatial Variability of the Sound Speed Ratio in the New England Mud Patch Using Neural Networks. SBCEX Workshop, Providence, Rhode Island (USA), May 2024.

A. Vardi and J. Bonnel. A deep learning approach for geoacoustic inversion using a distributed array of unsynchronized hydrophones and explosive sound sources. In IEEE UASP meeting, Exeter, (USA), Oct. 2023.

A. Vardi and J, Bonnel. An end-to-end deep learning approach for geoacoustic inversion: Application to SBCEX22 TOSSIT data. In SBCEX Workshop, San Diego CA (USA), Feb. 2023.

A. Vardi-Chouchana and J. Bonnel. An end-to-end deep learning approach for joint detection, source localization, and environmental characterization using a single hydrophone in shallow water. In ASA meeting, Nashville (USA), Dec. 2022.

Skills

Programming	Python, MATLAB, Julia, Wolfram Mathematica, FORTRAN, C, High Performance Computing
Software Libraries	PyTorch, JAX, Tensorflow, Numpy, Scipy, Lux.jl, SciML.jl
Language	English (fluent), Hebrew (native), French (native)

Field Experience

New England Seamount Experiment (MA, USA) 2023

New England Mudpatch - Seabed Characterization Experiment (MA, USA) 2022

New England Mudpatch - Seabed Characterization Experiment (MA, USA) 2021

Teaching Experience

Workshop: Introduction to Python Summer 2023 & 2024

Workshop instructor *Woods Hole, MA, USA*

Workshop: Introduction to MATLAB Summer 2021

Workshop instructor *Woods Hole, MA, USA*

Transport Phenomena Spring 2019

Part of creation team, frontal teaching and course assignment grading *Technion, Haifa, Israel*

Introduction to Environmental Engineering Spring 2018, Spring 2019

Frontal teaching in recitations and course assignment grading *Technion, Haifa, Israel*

Fluid Mechanics Fall 2017, Fall 2018

Frontal teaching in recitations and course assignment grading *Technion, Haifa, Israel*

Fellowships, Awards and Honors

Doctoral Fellowship 2020-2025

WHOI-MIT Joint Program *MA, USA*

Schulich Scholarship 2015

The Inter-University Institute for Marine Sciences and Dalhousie University *Eilat, Israel and Halifax, Canada*

Publications

A. Vardi, G. Averbuch, J. Leonard, Sensitivity Analysis of Normal Mode Models using Automatic Differentiation, *to be submitted*.

A. Vardi, P. H. Dahl, D. Dall'Osto, D. Knobles, P. Wilson, J. Leonard, J. Bonnel, Estimation of the spatial variability of the New England Mud Patch geoacoustic properties using a distributed array of hydrophones and deep learning. J Acoust Soc Am 156, 4229–4241 (2024).

A. Vardi and J. Bonnel, "End-to-End Geoacoustic Inversion with Neural Networks in Shallow Water Using a Single Hydrophone", IEEE Journal of Oceanic Engineering, vol. 49, no. 2, pp. 380-389 (2024)

R. Yang, N. Blanc, **A., Vardi**, N. Ouzana and G.Z.. Ramon, "PC-TAS: A design environment for phase-change and classical thermoacoustic systems", SoftwareX, 19, p.101142 (2022)

A. Vardi and G.Z. Ramon, "Acoustically Driven Sorption Heat Pump", Physical Review Applied, 16(4), p.044044 (2021)

Volunteering and Additional Activities

2010-2013 Served as a combatant and field medic in the Israel Defense Forces

2013-2017 Volunteer in "*Aharai Labagrut*" Mentoring for 16-19 year-old students from low social-economic backgrounds in Israel.

2015-2017 Co-Founder of "*Ha-Asam Cooperative*" A cooperative specialized in selling food produce from farmers at lowered prices in Israel.