# RAMI BEN-ARI

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Computer Vision, Computational Photography, Machine Learning, Deep Learning
Hands on: Python, Pytorch, Matlab (CUDA & C++ in the past)
Computer vision and deep learning technical lead. Over 40 scientific publications and 9 patents.

**EDUCATION**

2008 **Tel-Aviv University, Tel-Aviv**
*Ph.D.* School of Mathematical Sciences, Dept. of Applied Math
*Advisor*: Prof. Nir Sochen

1993 **Technion, Israel Institute of Technology, Haifa**
*M.Sc.* Faculty of Aerospace Engineering
*Advisor*: Prof. Aviv Rosen

1990 **Technion, Israel Institute of Technology, Haifa**
*B.Sc.* Faculty of Aerospace Engineering, Cum-laude

2014 – Present **IBM Research-AI, Video-AI Technical lead**
Leading a team of 3-5 researchers.

- Multimodal and self-supervised learning in video
- Action recognition
- Text recognition
- Presenting SOTA results in several video analysis tasks (see publication list)

2014 - 2018 **IBM Research – Medical Imaging**

- Classification & Detection in Medical Images
- Deep Learning lead and co-organizer in Dream Challenge, see IBM Research Blog, Press coverage
- Deep Learning in Mammography

2018 – Present **Bar-Ilan University, Adjunct Professor**
Teaching a graduate course: Decision Support Systems in Medical Imaging, EE&CS Depart., Faculty of Engineering

2013 - 2014 **eyeSight-Technologies, Senior Algorithm Researcher**

- Gesture Recognition in Video
- Research lead at several new technologies

2009 - 2013 **Orbotech Ltd. – Corp. R&D, Computer Vision Expert**

- Computational Photography (see Publications).

2007-2008 **Orbotech Ltd., Corp. R&D, Algorithm Researcher**

- Segmentation, 3D, Pattern Recognition (see Publications).

2002-2007 **Tel-Aviv University**, **Head of the MVP lab (in conjunction with PhD studies)**
Established the Mathematical Visual Perception (MVP) lab and supervised computer vision projects.

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| **POST-DOC** | 2008-2009 | **Technion, Civil Engineering – Research Associate** |
| **RESEARCH** | | ▪ Optimization, Optimal Control, Stochastic Filtering |
| | 2008-2009 | **Ben-Gurion Univ, Computer Science – Research Associate** |
| | | ▪ Object Tracking |
| **REVIWER** | | IEEE Trans. on Pattern Analysis and Machine Intelligence<br>ACCV, IEEE Transactions in Systems, Man and Cybernetics,<br>Pattern Recognition Letters<br>Journal of Machine Vision and Applications, Elsevier- Signal<br>Processing: Image Communication, Journal of Medical Physics,<br>MICCAI, IEEE Trans. In Medical Imaging |
| **TEACHING** | 1990-2009 | Held various teaching positions and supervision at Technion and<br>Tel-Aviv University (TAU) in the following courses Dynamics,<br>Calculus and Computer Vision |

**Invited Talks**

- Tel-Aviv University CV Seminar, "Depth from Defocus and Registration in one Shot", 2014
- Haifa University, "Deep Learning for Medical Image Analytics", 2016
- PACS conference, "Watson for Radiology", Netherland 2016
- IBM CAS center, "Medical Sieve", Netherland 2016
- IBM Research-Australia, "Cognitive Radiology Assistance for Breast Imaging", Melbourne, April 2017
- Technion EE, "Cognitive Radiology Assistance" Invited talk at graduate course, July 2017
- Technion Pixel-Club, "Weakly Supervised Learning for Mammogram Classification", January 2018
- Panelist - BHI Industry panel: The Role of AI in Connected Health, March 2018
- Holon Institute of Technology (HiT), "Deep Learning for Mammogram Classification and Detection", April 2018
- BGU EE, "Decision Support Systems in Mammography", June 2018

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| Program Committee | MICCAI DLMIA workshop 2017<br>**Organizer** and Chair at Special Session in BHI-2018<br>Industry Panel – The Role of AI in Connected Health, BHI 2018<br>**Co-organizer** of Workshop on Multi-modal Video Analysis and Moments in Time in ECCV 2020 |
| Professional Activities | Member of patent evaluation board<br>Co-organizer of DREAM Challenge in Digital Mammography and Deep learning |

For more details on publications please see my webpage

**Journal Articles:**

[J1] T. Shaffter et al., "Evaluation of Combined Artificial Intelligence and Radiologist Assessment to Interpret Screening Mammograms", JAMA Networks Open, March 2020.

[J2] R. Bakalo, J. Goldberger and **R. Ben-Ari**, "Weakly and Semi Supervised Detection in Medical Imaging via Deep Dual Branch Net", submitted to Neurocomputing.

[J3] A. Akselrod-Ballin, L. Karlinsky, S. Alpert, S. Hashoul, **R. Ben-Ari** and E. Barkan, "A Region Based Convolutional Neural Network for Mass Detection and Classification in Breast Mammography", *Computer Methods in Biomechanics and Biomedical Engineering: Imaging and Visualization (TCIV)*, 2017

[J4] **R. Ben-Ari**, "A unified approach for registration and depth in Depth from Defocus", *IEEE TPAMI,* 2014. **Editor's selection for spotlight paper**

[J5] **R. Ben-Ari** & O. Ben-Shahar, "A fast tracker with direct appearance-kinematic measure and adaptive Kalman filter", *Journal of real-time image processing*, March 2013.

[J6] **R. Ben-Ari** & N. Sochen, "Stereo Matching with Mumford-Shah Regularization and Occlusion Handling", *IEEE Transactions in Machine Intelligence and Pattern Recognition*, 2010.

[J7] **R. Ben-Ari** & N. Sochen, "A Geometric Framework and a New Criterion in Optical Flow Modeling", *Journal of Mathematical Imaging and Vision*, 2009

[J8] **R. Ben-Ari** & N. Sochen, "A Geometric Framework for Regularization of the Data Term in Stereo Vision", *Journal of Mathematical Imaging and Vision*, 2008

[J9] **R. Ben-Ari** & A. Rosen, "A Mathematical Modeling of Helicopter Track and Balance – Results", *Journal of Sound and Vibration*, 1997

[J10] A. Rosen & **R. Ben-Ari**, "A Mathematical Modeling of Helicopter Track and Balance – Theory", *Journal of Sound and Vibration*, 1997

**Peer Reviewed Conference Proceedings:**

[C1] E. Amrani, **R. Ben-Ari,** I. Shapira, T. Hakim and A. Bronstein, "Self-Supervised Object Detection and Retrieval Using Unlabeled Videos", CVPRW 2020.

[C2] E. Amrani, **R. Ben-Ari** and A. Bronstein, "Learning to Detect and Retrieve Objects from Unlabeled Videos", ICCV-Workshop 2019. Arguably the first attempt for learning an object detector from unlabeled videos.

[C3] **R. Ben-Ari**, Yoel Shoshan, Tal Tlusty, "Mammogram classification with ordered loss", AIME 2019 (20% acceptance rate) – **Nominated for the best paper award.**

[C4] R. Bakalo, **R. Ben-Ari**, J. Golberger, "Classification and detection in mammograms with weak supervision vis dual branch deep neural network", IEEE International Symposium in Biomedical Engineering, 2019

[C5] R. Bakalo, J. Golberger, R. Ben-Ari, "Classification and Localization in Mammograms via Weakly and Semi Supervised Deep Learning", IEEE Int. Conference on Science of Electrical, Israel, 2018

[C6] T. Tlusty, G. Amit, **R. Ben-Ari**, "Unsupervised clustering of mammograms for outlier detection and breast density estimation", ICPR, 2018.

[C7] **R. Ben-Ari**, "Digital Mammography DREAM Challenge: The Core of Top Performing

Methods", Special Session, Biomedical Health Informatics, 2018.

[C8] R. Bakalo, J. Goldberger and R. Ben-Ari, "Weakly Supervised Classification and Localization in Mammograms via Dual Branch Deep Network, IMVC 2018.

[C9] Y. Choukroun, R. Bakalo, **R. Ben-Ari**, A. Akselrod-Ballin, E. Barkan and P. Kisilev, "Mammogram Classification and Abnormality Detection from Nonlocal Labels using Deep Learning Multiple Instance Neural Network, EG VCBM, 2017 (Oral)

[C10] J. Sulam, **R. Ben-Ari** and P. Kisilev, "Maximizing AUC with Deep Learning for Classification of Imbalanced Mammogram Datasets", *EG VCBM*, 2017 (short paper-Oral)

[C11] G. Amit, O. Hadad, S. Alpert, T. Tlusty, Y. Gur, **R. Ben-Ari** and S. Hashoul, "Hybrid Mass Detection in Breast MRI Combining Unsupervised Saliency Analysis and Deep Learning", *MICCAI*, 2017

[C12] O. Hadad, R. Bakalo, **R. Ben-Ari**, S. Hashoul, G. Amit, "Classification of Breast Lesions using Cross-Modal Deep Learning", ISBI 2017.

[C13] **R. Ben-Ari**, A. Akselrod-Ballin, L. Karlinsky, S. Hashoul, "Domain Specific Convolutional Neural Nets for Detection of Architectural Distortion in Mammograms", ISBI 2017

[C14] G. Amit, **R. Ben-Ari**, et al, "Classification of Breast MRI Lesions using Small-Size Training Sets: Comparison to Deep Learning Approaches", SPIE 2017.

[C15] T. Syeda-Mahmood et al, "Medical Sieve: A Cognitive Assistance for Radiologists and Cardiologists, SPIE 2016.

[C16] S. Hashoul, E. Walach, A. Khateeb, Algit Walach, ,Guy Amit **R. Ben-Ari**, E. Barkan & P. Kisilev, "Efficiency of an automatic decision support system in facilitating diagnosis of Thyroid diseases. RSNA 2016.

[C17] A. Balin-Akselrod, L. Karlinsky, S. Alpert, S. Hashoul, **R. Ben-Ari** & E. Barkan, "A region based convolutional network for tumor detection and classification in breast mammography, DLMIA-MICCAI, 2016

[C18] R. Ben-Ari, S. Hashoul, "Recognizing Architectural Distortion in Mammogram using pre-trained DNN, IBM 1st Deep Learning Workshop, NY, 2016

[C19] Y. Frommer, **R. Ben-Ari** & N. Kiryati, "Adaptive Shape from Focus with High order Derivatives", IMVC 2016 – **Best student paper.**

[C20] **R. Ben-Ari**, A. Zlotnick & S. Hashoul, "A weakly labeled approach for breast tissue segmentation and breast density estimation in digital mammography, ISBI 2016.

[C21] Y. Frommer, **R. Ben-Ari** & N. Kiryati, "Shape from focus with adaptive focus measure and high order derivatives", BMVC 2015.

[C22] **R. Ben-Ari** & G. Raveh, "Variational Depth from Defocus in Real-Time", GPU Workshop, *ICCV* 2011 (Oral)

[C23] S. Cohen & **R. Ben-Ari**, "Image denoising by Bayesian Regression", *ICIAP* 2011 (oral)

[C24] **R. Ben-Ari** & D. Aiger, "Geodesic Active Contours with Combined Shape and Appearance Priors", *In Advanced Concepts in Intelligent Vision Systems*, 2008 (Oral)

[C25] **R. Ben-Ari** & N. Sochen, "Variational Stereo Vision with Sharp Discontinuities and Occlusion Handling", *ICCV*, 2007

[C26] **R. Ben-Ari** & N. Sochen, "A General Framework and New Alignment Criterion for Dense

Optical Flow", *CVPR*, 2006

[C27] **R. Ben-Ari** & N. Sochen, "Non-Isotropic Regularization of the Correspondence Space in Stereo Vision", *ICPR*, 2004 (Oral)

[C28] **R. Ben-Ari** & A. Rosen, "Investigation of Helicopter Rotor Track and Balance", *Israel Annual Conference on Aerospace Sciences*, 1997 (Oral)

**Other Conferences:**

[C29] **R. Ben-Ari** & O. Ben-Shahar, "A Real-Time and Robust Tracker for Robot Vision", *The 3rd Israeli Conference on Robotics*, 2010.

[C30] **R. Ben-Ari** & O. Ben-Shahar, "A Prediction Based Fast and Robust Tracker", *Israel* Machine Vision Conference, 2011.

**PATENTS (partial list):**

[P1] Y. Choukrun, R. Bakalo, R. Ben-Ari, A. Akselrod-Balin and P. Kisilev, "Systems and Methods for Automatic Detection of an Indication of Abnormality in an Anatomic Image, Filed.

[P2] J. Sulam, R. Ben-Ari and P. Kisilev, "A Patch-wise Deep Learning Approach for Classification of Weakly Labeled and Imbalanced Mammogram Sets", Filed.

[P3] R. Ben-Ari, S. Hashoul, "Systems and methods for Automatic Detection of Architectural Distortion in two Dimensional Mammographic Images, US10037601.

[P4] R. Ben-Ari, A. Zlotnick, Automated Fibro-Glandular Tissue Segmentation in Digital Mammography Using Fuzzy Logic, US9918686B2

Y. Moskivitch et al., A method and system for processing and analyzing digital terrain data, CA 2508320, 2010