

# Curriculum vitae with track record (for researchers)



Role in the project    Project manager     Project participant

## Personal information

First name, Surname:	Belbachir, Ahmed Nabil		
Date of birth:	24.03.1973	Sex:	Male
Nationality:	Austrian		
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## \* EDUCATION

2005	PhD in Computer Science: Disputation date: 08.03.2005. Faculty of Informatics / Department of Computer-aided Automation, Vienna University of Technology, Austria
2000	Master in Signal Processing Electrical Engineering Faculty / Electronics Department, Oran University, Algeria

## CURRENT AND PREVIOUS POSITIONS

2018-present	Research Director, DARWIN Group, Technology Division, NORCE Norwegian Research Centre AS, Norway
2014-2018	Chief Scientist, Smart Instrumentation Department, Teknova AS, Norway
2005- 2018	Senior Scientist, ICT Department, University of Agder, Norway
2009-2015	Senior Scientist, Digital Safety and Security Department, AIT Austrian Institute of Technology GmbH, Austria
2007-2014	Product Manager Industrial Vision System, AIT Austrian Institute of Technology GmbH
2006-2009	Senior Scientist, Information and Communication Technology Department, ARC- Austrian Research Centers GmbH, Austria
2000-2006	Research Scientist, Computer Science Faculty, TU Vienna, Austria.

## PROJECT MANAGEMENT EXPERIENCE

2000-2006	<b>ESA-Herschel:</b> "Herschel Infrared Space Observatory- PACS camera: On-board data compression", European Space Agency project with co-funding from several Austrian Ministries, ~1,600,000€, Work package leader.
2006-2010	<b>VSoC:</b> "Vision Systems on-Chip", Project funded by the Austrian Council for Research and Innovation, 5,000,000€, coPI.
2009 –2010	<b>SmartCountPlus:</b> "Automated Counting and Classification of Pedestrians and Bicycles Using a Biologically-inspired Stereo Vision Sensor", cooperative project funding from Austrian Ministry of Transport, Innovation & Technology, 300,000€, PI
2009- 2011	<b>CARE:</b> "Automated Fall Detection in Private Homes of Elderly Persons Using a Biologically-inspired Stereo Vision Sensor", EU Project on Ambient Assisted Living with 6 EU Partners co-funded by EC and Austrian Ministry of Transport, Innovation and Technology, 3,200,000€, Coordinator and PI.
2010-2012	<b>SilverGame:</b> "Multimedia Communication Platform Reducing Isolation of Elderly Persons Living Alone at home", EU Project on Ambient Assisted Living with 7 EU Partners co-funded by EC and Austrian Ministry, 4,000,000€, Co-investigator
2010-2013	<b>SEAMOVES:</b> "New Smart 360° Panorama Camera (biologically-inspired) for Situation Awareness", EUREKA Project with 9 EU Partners funded by the Austrian Foundation for Research and Technology, 12,000,000€, PI and Patent Holder.
2012-2014	<b>BiCa360:</b> "3D 360° Vision for Autonomous Robot Vision", Project funded by Austrian Ministry of Transport, Innovation & Technology, 400,000€, Coordinator and Patent Holder.
2014-2016	<b>SECURESCUE:</b> "Multi-sensing Fusion for Situation Awareness in Security Applications", cooperative project funding from Austrian Ministry of Transport, Innovation and Technology, 600,000€, PI and former coordinator.

2014- (2018) 2016	<b>MANTIS:</b> “Cyber Physical System based Proactive Collaborative Maintenance”, cooperative ECSEL project with co-funding EU and several European ministries, 36,000,000€, coPI. <b>AutoDeb:</b> “Real-time 3D Vision for Accurate Robot Guidance in Deburring of Industrial Offshore Castings”, project funding from Industry, 50,000€, Project coordination and PI. <b>ARIS:</b> “Intelligent Sensing for Energy-Efficient Building”, cooperative project funding from Austrian Ministry of Transport, Innovation, Technology, 500,000€, PI.
2014 -2016	<b>OffshoreLift:</b> “Real-time Vision for Automated Offshore Lifting and Handling”, cooperative project funding from Industry and Regional funding, 500,000 €, PI.
2016- 2017	<b>DigiProcess:</b> “Real-time 3D Vision and Industrial Robotics for Automated Manufacturing and Quality Control of Nickel Project”, cooperative project funding from Industry and Regional Funding, 450,000 €, PI.
2017 -2018	<b>iTrack:</b> “Integrated system for real-time TRACKing and collective intelligence in civilian humanitarian missions”, project funding from Horizon2020 programme, 3,900,000 €, coPI.
2016 –2019	<b>RIWUP:</b> “Remote Inspection of Wooden Utility Poles”, cooperative project funding from Industry & Research Council of Norway, 1,000,000 €, PI and project coordinator.
2018 -2024	<b>ALSPIN:</b> “Automation of Field Inspection in Large Scale Solar Farms”, cooperative project funding from Industry & Research Council of Norway, 2,100,000 €.
2019-2023	<b>Deep3D:</b> “Spacetime Vision – Towards Unsupervised Learning in the 4D World”, cooperative project with funding from EEA/Norway Grants, 1,500,000 €, PI.
2019-2024	<b>MONCOVID-19:</b> “Technologies for Monitoring COVID-19 Epidemiological Development”, Research Council of Norway 400,000 €, PI and project coordinator.
2020-2022	<b>ULEARN:</b> “Unsupervised Lifelong Learning”, Research Council of Norway 1,200,000 €, PI.
2020-2024	<b>SMARTCAM:</b> “Smart 3D Vision with Embedded Intelligence”, Research Council of Norway 1,300,000 €, PI and project coordinator
2021-2025	<b>REMON-SO2:</b> “Remote SO2 detection and monitoring system in real-time for maritime applications”, EUROSTARS Project with 4 Partners (2 Norway, 1 Canada and 1 Japan) co-funded by the EU and the Research Council of Norway 1,700,000 €, PI.
2021-2024	<b>KOMPFORSK:</b> “EU Competence Centre in Agder”, Project co-funded by Sørlandet competence funds in west and east Agder with UiA, Fylkeskommune and Europa office as Partners 630,000 €, Project Coordination.
2022-2026	<b>COGNIMAN:</b> “Cognitive Industries for Smart Manufacturing”, Horizon Europe Project on AI, Data and Robotics with 15 EU Partners funded by EC, 10,953,000€, Coordinator and PI.
2023-2027	

### SUPERVISION OF GRADUATE STUDENTS AND RESEARCH FELLOWS

2002-now	20 8 2	Master’s PhDs Postdocs	University of Applied Science, Vienna, UiA UiB/NMBU/UiT/ Vienna University of Technology / Leiden Uni. NMBU / Vienna University of Technology
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### TEACHING ACTIVITIES

2015	Lecturer – Smart Cameras / University of Naples “Parthenope” / Italy.
2014	Guest lecturer – Dynamic Vision Imaging Sensors: Taking Smart Cameras to the Next Level Smart Cameras / Huawei University / China.
2003-2005	Lecturer assistant – Digital Image Processing / Vienna University of Tech. / Austria
1996-1998	Lecturer – Introduction to Computer Science / University of Oran / Algeria

### ORGANISATION OF MEETINGS

2020-2024	General chair of IEEE Embedded Vision Workshop 16 <sup>th</sup> -20 <sup>th</sup> editions
2016	Workshop with GCE NODE cluster companies on embedded sensing (30 persons)
2010-2012	General chair of IEEE Embedded Vision Workshop / USA (150 -200 persons)
2009	Program chair of IEEE Embedded Computer Vision Workshop / Japan (50 persons)

### INSTITUTIONAL RESPONSIBILITIES

2022-now	Executive board at ADRA Aisbl partnership for roadmapping and strategy towards EU
2021-now	Director at euRobotics AISBL
2015-2018	Management board member, TEKNOVA AS/ Norway
2014	Jury member of a PhD defense, University of Verona, Italy, 2014
2012-now	Member of the steering committee of the IEEE Embedded Vision.
2009-2010	Member of the advisory board on image compression for the British library, UK.

### COMMISSIONS OF TRUST IN ACADEMIC, PUBLIC OR PRIVATE ORGANISATIONS (if applicable)

2006-now	Independent expert evaluator for the EC framework programs FP6, FP7, H2020 and EUREKA as well as reviewers for several IEEE and Elsevier journals
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## MEMBERSHIPS OF ACADEMIES / SCIENTIFIC SOCIETIES / NETWORKS

2022-now	Member of AI, Data and Robotics Partnership Aisbl
2015-now	Member of euRobotics cluster
2018-now	Member of EPIC (European Photonics Cluster)
2019-now	Member of CLAIRE.AI (European AI cluster)
2002-2013	Technical Committee "Pattern Recognition for Astronomy and Astrophysics" - IAPR-TC13 -
2010-now	Member of Technical Committee for Pattern Analysis and Machine Intelligence.

## MAJOR COLLABORATIONS

Prof. Marius Leordeanu (U. Bucharest, RO):	Machine Learning, Computer Vision.
Prof. Rene Vidal (John Hopkins U., USA):	Machine Learning, Computer Vision.
Prof. Tobi Delbrück (ETH Zürich, CH):	Neuroinformatics, Dynamic Vision Sensors.

## Track record ~170 publications, H-index 25.

More than 25 years research and high-ranked contributions in the field of computer vision, pattern recognition and artificial intelligence. I published the single-source reference "Smart Cameras" as editor (2009) covering large research spectrum from disparate scientific, technological and application fields. A Chinese translation of this English book appeared in 2014. In total, I contributed with more than 130 high-ranked publications incl. 2 books, 16 peer-reviewed journals and more than 150 conference papers. Furthermore, I have articles in French, Austrian, Norwegian and European newspapers and [Euronews TV documentary on smart cameras for elderly care](#). I succeeded with over 1000 MNOK awards, national grants (Austria and Norway) and EU grants that fund projects realizing my own ideas on basic and applied research.

- 1) **IEEE ICCV Workshops (2023), "Self-supervised Hypergraphs for Learning Multiple World Interpretations" A.Marcu, M.Pirvu, D.Costea, E.Haller, E.Slusanschi, A.N.Belbachir, R.Sukthankar, M.Leordeanu.** This work contributes with a hypergraph representation that model knowledge in space and time that can be used as automatic trustworthy teachers for student deep neural nets.
- 2) **IEEE ICCV Workshops (2023), "Clustering-based Domain-Incremental Learning," C.Lamers, R.Vidal, A.N. Belbachir, N. Van Stein, T. Bäck, P.Giampouras.** This work contributes with task agnostic lifelong learning by introduction a clustering-based method that reduces catastrophic forgetting.
- 3) **Advances in Visual Computing (2022), "Saliency Can Be All You Need in Contrastive Self-supervised Learning," V. Kocaman, O.M. Shir, T. Bäck, A.N. Belbachir.** This work contributes with an augmentation policy for Contrastive Self-Supervised Learning in form of an already established Salient Image Segmentation technique entitled Global Contrast based Salient Region Detection.
- 4) **Journal of Integrated Design and Process Science (2022) "The vision of self-evolving computing systems," D. Weyns, T. Baeck, R. Vidal, X. Yao, and A.N. Belbachir.** It provides an arguable opinion for the vision of self-evolving computing systems that are equipped with an evolutionary engine enabling them to evolve autonomously. Specifically, when self-evolving computing detects conditions outside its operations i.e., an anomaly or new goals, it activates an evolutionary engine that runs online experiments to determine how the system needs to evolve to deal with changes, thereby evolving its architecture.
- 5) **ACM Journal (2022), "Lifelong Computing," D. Weyns, T. Bäck, R. Vidal, X. Yao, A.N. Belbachir**  
This is a novel paradigm in artificial intelligence "Lifelong Computing" that will transform future design and operation of long running computing systems in ever-changing environments. Today's computing systems can only cope with conditions they were designed for. In the future hyper-connected digital world, computing systems will need to work radically different from today. The essence of this research is to replace the existing design of computing and learning systems with a-priori-designed architectures that rely on humans-in-the-loop for every evolutionary step by autonomous computing-learning systems that adapt and evolve their dynamic architectures in a holistic lifetime manner.
- 6) **Springer New York (Dec. 2009) / China Machine Press (Jan. 2014), "Smart Cameras", Ahmed Nabil Belbachir as editor and contributor with two chapters.**  
This reference provides the first unified single definition of smart cameras with content from different research fields for an interdisciplinary audience of professionals, practitioners and academia. The book integrates coverage of hardware electronics, signal processing, embedded computing, computer vision, camera networks, smart cameras applications and market analysis
- 7) **IEEE Transactions on Industrial Electronics Vol. 58, issue 3, pp. 770-783, (March, 2011), "High Speed Embedded Object Analysis Using a Dual-Line Timed-Address-Event Temporal Contrast Vision Sensor", Ahmed Nabil Belbachir, Michael Hofstätter and Peter Schön.**

The event-driven dynamic vision line sensor has the great advantage to provide ultra-high temporal resolution, wide dynamic range and low data rate. In this paper, we have presented for the first time the real-time concept and application of this unique sensor in high-speed vision

- 8) **IEEE CVPR workshops, pp. 425-432, (June 2014), "A Novel HDR Depth Camera for Real-time 3D 360° Panoramic Vision", Ahmed Nabil Belbachir, Stephan Schraml, Manfred Mayerhofer, Michael Hofstätter (Best paper Award).**

This paper presents a novel High Dynamic Range camera for real-time 3D 360° panoramic computer vision. The design includes a pair of dynamic vision line sensors, a high-speed mechanical device rotating at 10 revolutions per second and on-board processing for detector configuration and fine-tuning. This camera system was a basis for several subsequent works with panoramic imaging in natural environment

- 9) **IEEE Transactions on Industrial Electronics, issue 99, (Jan. 2016), "An Event-Driven Stereo System for Real-Time 3D 360° Panoramic Vision", Stephan Schraml, Ahmed Nabil Belbachir, Horst Bischof.**

In this paper, we presented the first multi-perspective stereo concept using event-driven sensors for real-time 3D 360° panoramic vision.

- 10) **Measurement & Technology Journal (2014), "Cooperative and Asynchronous stereo vision for Dynamic Vision Sensors," Ewa Piatkowska, Ahmed Nabil Belbachir and Margit Gelautz.**

This paper is one of first references for 4D vision using event-driven stereo sensors and artificial vision. It introduces adaptive cooperative network concept for asynchronous stereo matching.

- 11) **IEEE CVPR workshops, pp. 53-60, (2017), "Improved Cooperative Stereo Matching for Dynamic Vision Sensors with Ground Truth Evaluation," E. Piatkowska, J. Kogler, A.N. Belbachir and M. Gelautz.**

This paper is an extension of paper 4 that aims to reduce ambiguity when doing asynchronous stereo matching of single events by adding time and space constraints.

- 12) **IEEE In. con. Pattern Recognition (2018), "Real-Time Vehicle Localization and Tracking Using Monocular Panomorph Panoramic Vision," Ahmed Nabil Belbachir, Lisa Maria Svendsen and Benyamin Akdemir**

This paper is an example of artificial vision for vehicle navigation by simultaneous localization and tracking of visual features.

#### **Granted Patents (4 granted out of 7 filed)**

- 1) **Austrian Patent: AT507.543 (15.05.2010), European application: EP 2182720A2, "Visual 360° Panorama Scanner", A.N. Belbachir and R. Pflugfelder.**

The idea of realizing a new event-driven camera for distortion-free 360° panoramic views in real-time was granted as Austrian patent (European patent pending). The camera was realized (Belbachir2014).

- 2) **Austrian Patent: AT507.687 (15.07.2010), "A New Approach for Inspecting Moving Objects", A.N. Belbachir, M. Hofstätter & P. Schön.**

To improve the spatial sensitivity of the event-driven dynamic vision sensor to moving objects, a new approach has been designed and patented in Austria. The results of the new approach on spatiotemporal information processing were a turning point for industrial vision and high-speed object inspection.

- 3) **Austrian Patent: AT160/2009 (15.07.2010), "An Event-driven Approach for Classification of Pedestrian and Bicycles", A.N. Belbachir, M. Litzenberger, N. Brändle, S. Schraml, P. Schön and B. Kohn.**

A pioneering event-driven stereo vision concept for the spatiotemporal classification and counting of pedestrian and bicycles has been patented in Austria.

- 4) **Austrian Patent: AT507.764 (12.12.2012), "An Event-driven Approach for Space-time Processing", A.N. Belbachir, M. Litzenberger, R. Pflugfelder, C. Beleznai & N. Brändle.**

A new concept was introduced for the analysis of the visual code from event-driven sensors using joint detection, segmentation and tracking in the spatiotemporal data space.

#### **Selected Research Works**

- **Artificial Vision:** [Link](#)
- **High-speed Vision** [http://belbachir.info/Videos/IVS\\_HighSpeed\\_Vision.wmv](http://belbachir.info/Videos/IVS_HighSpeed_Vision.wmv)
- **Bio-inspired Stereo Vision** [http://belbachir.info/Videos/Event\\_Based\\_Stereo\\_Vision.wmv](http://belbachir.info/Videos/Event_Based_Stereo_Vision.wmv)
- **360° Panoramic Vision** <http://www.belbachir.info/Videos/BICA360.wmv>

**Invited talks** More than 80 invited talks, keynotes and lectures at workshops and companies

**Examples of leadership in industrial innovation:** Leadership experience in Austria and Norway of a team of scientists and engineers for innovative systems for industries and society, mainly dealing with automation.