Jarno Ralli

Computer Vision Systems Lead

CONTACT INFO

Phone:	**+358 40 5612585**
Address:	**Hitchin, U.K**
Website:	**www.jarnoralli.fi**
Email:	**jarno@ralli.fi**

I'm a computer vision scientist (Ph.D) with 10+ years of experience in the field (academy+industry). Since I have worked in different industries varying from mining- to automotive industry, apart from developing algorithms, I have a solid background in software development, project management, product development and team building. I am good at organizing teams, and setting processes and best practices, so that the teams can work efficiently.

My main strengths are working with people having different backgrounds, getting them working together, towards a common goal, converting complex theoretical concepts into fully functional products, and planning projects so that the goals are achievable with the given resources.

For more information, please visit

- www.jarnoralli.fi
- https://www.linkedin.com/in/jarnoralli/

SKILLS

C/C++, Python, CMake build systems, agile software development, git, continuous integration, Atlassian tool stack (Jira, Bamboo, etc.), 3D-reconstruction, optical-flow, SLAM, leadership skills, project management, product development, optics, industrial automation

LANGUAGES

Finnish (Native or bilingual proficiency), English (Full professional proficiency), Spanish (Full professional proficiency)

EDUCATION

University of Granada, Spain

2006 TO 2011

Ph.D

My Ph.D thesis is related to advanced driving assistance systems (ADAS). More specifically, I concentrated on generating 3D-reconstruction based on stereo algorithms, approximating movement of objects projected to the camera plane (optical-flow), and segmentation using level-sets.

Lappeenranta University of Technology, Finland

2002 TO 2006

M.Sc

At LUT (Lappeenranta University of Technology) I studied subjects related to AI (artificial intelligence), such as fuzzy logic, neural networks, expert systems, etc. My M.Sc thesis was related to computer vision, more specifically to increasing efficiency of disparity calculation (i.e. 3D-reconstruction based on stereo images) using interpolation.

Jyväskylä Institute of Technology, Finland

1994 TO 2000

B.Sc

At JYTOL (Jyväskylä Institute of Technology), currently known as JAMK University of Applied Sciences, I studied industrial automation.

EXPERIENCE

AnyVision, U.K

FEB 2020 ONWARDS

Computer Vision Systems Lead

AnyVision has built the world's leading recognition platform that can be used in various different scenarios, varying from access control to digitalized assets management. Currently I'm building a new research at at AnyVision's London office.

ACHIEVEMENTS

- Organizing several research/engineering teams (on different geographical locations) so that these can be effectively managed
- Alignment of goals across several research teams in order for these to be able to deliver new features for the product(s)

Varjo Technologies, Finland

OCT 2019 TO JAN 2020

Technical Lead, Visual Inertial SLAM

Varjo's VR-1 was the world's first human eye resolution virtual reality (VR) headset. Since the industry is moving towards extended reality (ER) and mixed reality (MR) products where the need to reliable and highly accurate inside-out tracking is essential, I was in leading development of Visual Inertial SLAM technology at Varjo.

ACHIEVEMENTS

- Kick-start development of Visual-Inertial SLAM technology
- Organize implementation of tooling needed to manage the project
- Plan the roadmap for the SLAM technology so that it aligned with projected launch dates of new products
- Work together with the team setting up build tools, scripts, helper functions etc.

DENSO, Germany

NOV 2018 TO AUG 2019

Team Leader, Computer Vision for Autonomous Driving

In my role as a team leader at DENSO I was in charge of a multinational, highly skilled team of computer vision engineers working in different key areas of computer vision based solutions for autonomous driving (AD) and advanced driving assistance systems (ADAS). DENSO is one of the world's leading developers and providers of components and systems in the areas of air conditioning, powertrain, electrics, electronics, driver assistance and infotainment, with around 151,000 employees in 38 countries.

ACHIEVEMENTS

- Product owner for project that received a request for quotation from one of the largest car manufacturers (OEM).
- Initiated a company wide continuous learning process related to SW development
- Proposal and organization of major code refactoring
- Introduction of new unit- and performance test tools in the continuous integration (CI) tool chain

DENSO, Germany

JUL 2018 TO NOV 2018

Computer Vision Engineer, Autonomous Driving

I started working at DENSO as a computer vision engineer, working in projects related to advanced driving assistance systems (ADAS) that use computer vision at their core. Such ADAS systems can, for example, map surroundings of the vehicle in 3D and understand the scene. These kinds of systems provide the driver with valuable information of the surroundings of the vehicle and these are also at the core of autonomous driving (AD).

ACHIEVEMENTS

- Improvements in the CMake based build system
- Improvements in SfM (structure from motion) and SLAM code base (C++

Ralli Oy, Finland

AUG 2016 TO JUN 2018

Chief Technology Officer

At Ralli Oy I was in charge of industrial automation projects related to food industry. We designed and produced fully automatic falling film evaporators and industrial dryers for global markets. My responsibilities were related to sales, design, project management, and outsourcing.

ACHIEVEMENTS

- Managing client projects
- Designing automation systems

Fuel3D, U.K

JUN 2015 TO AUG 2016

Team Leader, Computer Vision

I worked as Team Leader responsible for leading a team of 5 computer vision scientists developing cutting edge computer vision algorithms at Fuel3D. All the team members had PhD:s in relevant areas, such as computer vision or applied mathematics. The team was geographically distributed on two different sites (United Kingdom and United States). We worked on various aspects of image processing tasks related to 3D-reconstruction based on stereo- and photometric-stereo.

ACHIEVEMENTS

- Managing a team spread on two different continents
- Setting up agile software development framework
- Leading research activities to further improve results from the image processing algorithms

Fuel3D, U.K

AUG 2014 TO MAY 2015

Computer Vision Researcher

I worked in a team responsible for development of the core algorithms behind Fuel3D's 3D scanning technology, such as stereo vision, shape from shading (SFS), 3D reconstruction, image registration, and related techniques. I had a pivotal role in both designing the architecture of the image processing pipeline and improving accuracy of the core algorithms.

ACHIEVEMENTS

- Complete re-design of a fully reconfigurable image processing pipeline, written in C++
- Considerable improvements in precision of the core algorithms for converting 2D images into 3D data, written in C++
- Technical lead for several customer projects
- Development algorithms for taking automatic measurements of subcutaneous tumors (medical application, cancer drug development)
- Development algorithms for a foot scanning application used by podiatrists

ValueFrame Oy, Finland

APR 2013 TO AUG 2014

Software Project Manager for a Cloud Based Solution

ValueFrame provides a cloud based PSA (professional services automation) system that covers customer relationship management (CRM), project and resource planning (ERP), documentation management etc. At ValueFrame my responsibilities consisted of writing specifications for new product features and managing implementation of these, interacting with the development team on a daily basis, and writing specialized software for the back-end.

ACHIEVEMENTS

- Leading implementation of a new project manager's page in the project management part of the software
- Specification and implementation of a REST interface for the back-end
- Writing REST-aware applications
- Writing code for the back-end for for prediction of accumulated hours for a project (related to project planning) and an interpolation scheme for showing the results for the user

University of Granada, Spain

DEC 2011 TO APR 2013

Postdoctoral Computer Vision Researcher

After obtaining my PhD degree in December 2011, I continued as a post-doctoral researcher at the University of Granada, Spain, until 2013. During that period, among other things, I worked as a visiting scholar at University of Chile, Chile, where I collaborated with the Scientific Image Analysis (SCIAN-Lab) group at the faculty of medicine. Apart from the work at the SCIAN-Lab, I also did research for Outotec PLC (a Finnish company that makes mining equipment), related to the use of machine vision in hydro-metallurgical applications.

ACHIEVEMENTS

- Application of optical-flow in the study of cellular migration

University of Granada, Spain

2006 TO 2011

Computer Vision Researcher/PhD student

From 2006 to 2011 I worked as a computer vision researcher at the University of Granada (Spain), participating in both national (Spanish) and European level research projects. The main project I worked in was a European Commission funded project related to ADAS (advanced driving assistance systems), called DRIVSCO (http://www.pspc.unige.it/~drivsco/). Within the scope of DRIVSCO, I developed methods related to 3D-reconstruction based on stereo-images, optical-flow approximation, and segmentation based on the level-set theorem.

ACHIEVEMENTS

- Improving robustness of 3D-reconstruction based on calculus of variations
- Improving robustness of optical-flow calculation based on calculus of variations

Ralli Oy, Finland

2003 TO 2006

Technical Adviser and Partner

Technical adviser related to automation and ICT (information and communications technology) projects. Most notable automation project carried out during this time was refurbishing a control system of a cleaning in place (CIP) system at a dairy plant in Al Bayda, Libya, in 2004. The project involved quoting and designing the system, managing the project and participating in the start-up.

ACHIEVEMENTS

- Design and implementation of complete turn-key automation systems for evaporators and dryers
- Taking part in customer negotiations and drafting offers

Larox Chile, Chile

JAN 2000 TO DEC 2002

Automation Engineer

I worked for two years at Larox's regional office in Chile (Santiago de Chile). My tasks consisted of modernisation projects, occasional sales support etc. Larox is now part of Outotec.

Larox HQ, Finland

JAN 1998 TO DEC 1999

Automation Engineer

I worked at Larox as an automation engineer, in the after sales department. My tasks consisted of participating in new projects, after sales activities, modernization of existing installations, and R&D activities. I worked with different kinds of automation systems ranging from Siemens PLCs to SCADA systems and electrically controlled hydraulic systems. Larox is now part of Outotec.

ACHIEVEMENTS

- Solved two of the most problematic issues related to Larox pressure filters. Both of the problems were in the top 10 list of worst problems.

PROJECTS

ADAS/AD Trailer Assist (Denso)

NOVEMBER 2018 TO APRIL 2019

At Denso I was the product owner of a computer vision based trailer assist system that was capable of parking the trailer automatically, in reverse, in a parking space/lot indicated by the user. Denso got a request for quotation from an major car manufacturer (OEM) for the system.

TOOLS USED

- Jira, git, Bamboo
- C/C++, OpenCV, Eigen, Keras

ADAS/AD Surround View (Denso)

JULY 2018 TO APRIL 2019

At Denso I worked in a surround camera system that generates 3D awareness of the vehicle's surroundings. The system was based on a combination of deep learning and geometry based approaches. I initially worked as developer in the project and later on I became the product owner of this technology.

TOOLS USED

- Jira, git, Bamboo
- C++, OpenCV, Eigen, Google Test, Google Performance
- Caffe, Keras

3D foot scanner for orthotics manufacturing (Fuel3D)

MARCH 2015 TO JUNE 2016

https://www.geeky-gadgets.com/fuel3d-unviled-new-cryoscan3d-foot-scanner-03-06-2016/

While working for Fuel3D, in my team we developed the algorithms and the software for a 3D foot scanner used by podiatrists for making custom tailored orthotics. All the code was written in C++. The scanner was used for scanning the patient's feet in non-, semi- and full-weight bearing configurations, thus producing more information about the geometry of the feet than typical off the shelf 3D scanner.

TOOLS USED

- Jira, git, CMake
- C++, OpenCV, Eigen, PCL, Boost

Implementation of Image Processing Pipeline (Fuel3D)

FEB 2015 TO DEC 2015

http://www.jarnoralli.fi/joomla/portfolio/3d-scanner-development

While working for Fuel3D, together with the other team members we designed and implemented an image processing pipeline that converts 2D images, containing both binocular and monocular depth cues, into 3D information. All the code was written in C++. Output from the algorithms is a 3D mesh in metric space. The image processing pipeline was, and still is, an integral part of Fuel3D's technology suite.

TOOLS USED

- Jira, git, CMake
- C++, OpenCV, Eigen, PCL, Boost

Automation of MVR Evaporator for Concentrating Whey Permeate (Ralli Oy)

JUNE 2014 TO MARCH 2015

http://www.jarnoralli.fi/joomla/portfolio/evaporator-automation

While working at Ralli Oy, we designed a complete automation system, controlling a MVR evaporator, for a Lithuanian dairy called Vilkyskiu Pienine. The evaporator is used for concentrating whey permeate. Scope of delivery consisted of specifying and choosing all the control system components (motor contactors, VFDs, safety equipment, PLC and so on), making a complete set of electrical drawings, programming both the PLC and SCADA programs, and commissioning the complete system.

Multi-modal Optimisation Using a Cray Super-computer (University of Granada)

2011

During my stay at the KTH (Stockholm, Sweden) as computer vision researcher, I used one of PDC Center's super computers for optimizing a multi-modal optimization problem. The computer used to crunch the numbers was a Cray XE6 system. Using around 50 computational units it took approximately 48h to optimize the problem.

TOOLS USED

- Matlab
- C, assembler

Modernisation of CIP-system at Al Bayda dairy plant (Ralli Oy)

FEB 2005 TO MAY 2005

In 2005 Ralli Oy modernized a CIP (Cleaning In Place) system, upgrading most of the equipment, in a dairy plant located at Al Bayda, Libya. My responsibility was to refurbish the control system of the CIP. Scope of work consisted of designing and dimensioning the new control system, choosing all the field equipment, programming both the PLC and HMI systems, supervising installation of the system and commissioning it.

Startup, Escondida Phase IV (Larox)

2000 TO 2001

I participated in the phase IV of the Escondida mine expansion project. Escondida is a copper mine in the Atacama desert in Antofagasta Region, Chile, while working at the regional office of Larox in Chile.

HIGHLIGHTS

- Startup of the 4th Larox PowerPF 144m2 pressure filter.
- Modernization of the oldest (1st) Larox PowerPF pressure filter at the filtration plant. This included changing the complete automation system and the hydraulic power unit of the filter.
- Design and implementation of optimizing communication (Modbus+) between the 4 pressure filters and the plant PLC in order to maximize production (tons/hour) from the filters.

Modernization of Automation System at Millennium Inorganic Chemicals (Larox)

2001 TO 2001

Modernization of two Larox pressure filters at Millennium Inorganic Chemicals (part of Cristal Global), Stallinborough Installation, UK. Cristal Global produces titanium dioxide products. Titanium dioxide is used, among other things, as a pigment in paints, varnishes, paper and plastics. Together with Mikko Marjakoski (customer manager at the time) we managed all the aspects of the project from sales to installation and commissioning.

HIGHLIGHTS

- Replacing Siemens S5 PLCs with Allen Bradley SLC 500 PLCs.
- Modernizing control of the hydraulic power units.
- Several mechanical upgrades to the pressure filters.

Modernization of Automation System at Amylum Group Nederland BV (Larox)

1999 TO 1999

Control system modernization of two Larox pressure filters located at Amylum Group Nederland BV (now part of Tate&Lyle). Together with Mikko Marjakoski (customer manager at the time) we managed all the aspects of the project from sales to installation and commissioning.

HIGHLIGHTS

- Replacing existing Siemens S5 control systems with Siemens S7 control systems
- Replacing old HMIs with new HMIs
- Modernization of the hydraulic control system
- Several other mechanical improvements to the pressure filters

PUBLICATIONS

A Method for Sparse Disparity Densification Using Voting Mask Propagation

2009

Journal of VIsual Communication and Image Representation

We describe a novel method for propagating disparity values using directional masks and a voting scheme. The driving force of the propagation direction is image gradient, making the process anisotropic, whilst ambiguities between propagated values are resolved using a voting scheme. This kind of anisotropic densification process achieves significant density enhancement at a very low error cost: in some cases erroneous disparities are voted out, resulting not only in a denser but also a more accurate final disparity map. Due to the simplicity of the method it is suitable for embedded implementation and can also be included as part of a system-on-chip (SOC). Therefore, it can be of great interest to the sector of the machine vision community that deals with embedded and/or real-time applications.

Disparity Disambiguation by Fusion of Signal- and Symbolic-level Information

2010

Machine Vision and Applications

We describe a method for resolving ambiguities in low-level disparity calculations in a stereo-vision scheme by using a recurrent mechanism that we call signal-symbol loop. Due to the local nature of low-level processing it is not always possible to estimate the correct disparity values produced at this level. Symbolic abstraction of the signal produces robust, high confidence, multimodal image features which can be used to interpret the scene more accurately and therefore disambiguate low-level interpretations by biasing the correct disparity. The fusion process is capable of producing more accurate dense disparity maps than the low- and symbolic-level algorithms can produce independently. Therefore we describe an efficient fusion scheme that allows symbolic- and low-level cues to complement each other, resulting in a more accurate and dense disparity representation of the scene.

Spatial and temporal constraints in variational correspondence methods

2011

Machine Vision and Applications

In this paper we describe a novel use for a well known temporal constraint term in the framework of variational correspondence methods. The new use, that we call spatial constraining, allows bounding of the solution based on what is known of the solution beforehand. This knowledge can be something that (a) is known since the geometrical properties of the scene are known or (b) is deduced by a higher-level algorithm capable of inferring this information. In the latter case the spatial constraint term enables fusion of information between high- and low-level vision systems: high-level makes a hypothesis of a possible scene setup which then is tested by the low-level, recurrently. Since high-level vision systems incorporate knowledge of the world that surrounds us, this kind of hypothesis testing loop between the high- and low-level vision systems should converge to a more coherent solution.

From sensors to spikes: evolving receptive fields to enhance sensorimotor information in a robot-arm

2012

International Journal of Neural Systems

In biological systems, instead of actual encoders at different joints, proprioception signals are acquired through distributed receptive fields. In robotics, a single and accurate sensor output per link (encoder) is commonly used to track the position and the velocity. Interfacing bio-inspired control systems with spiking neural networks emulating the cerebellum with conventional robots is not a straight forward task. Therefore, it is necessary to adapt this one-dimensional measure (encoder output) into a multidimensional space (inputs for a spiking neural network) to connect, for instance, the spiking cerebellar architecture; i.e. a translation from an analog space into a distributed

population coding in terms of spikes. This paper analyzes how evolved receptive fields (optimized towards information transmission) can efficiently generate a sensorimotor representation that facilitates its discrimination from other "sensorimotor states". This can be seen as an abstraction of the Cuneate Nucleus (CN) functionality in a robot-arm scenario. We model the CN as a spiking neuron population coding in time according to the response of mechanoreceptors during a multi-joint movement in a robot joint space. An encoding scheme that takes into account the relative spiking time of the signals propagating from peripheral nerve fibers to second-order somatosensory neurons is proposed. Due to the enormous number of possible encodings, we have applied an evolutionary algorithm to evolve the sensory receptive field representation from random to optimized encoding. Following the nature-inspired analogy, evolved configurations have shown to outperform simple hand-tuned configurations and other homogenized configurations based on the solution provided by the optimization engine (evolutionary algorithm). We have used artificial evolutionary engines as the optimization tool to circumvent nonlinearity responses in receptive fields.

Optical Flow for Motion Estimation and Tracking of Subcellular, Cellular and Supracellular Dynamic

2012

Chilean Society for Cell Biology XXVI Annual Meeting

Cell migration, formation of cellular protrusions (e.g. blebs, filopodia), and structural reorganization are important phenomena in cell biology. Precise quantifications of movement/deformation are crucial to understand these processes at different levels of organization. We apply computer vision methods for combined optical flow (OF) and multi-scale (MS) motion estimation of membrane translations, end growing and protrusion formation in fluorescence microscopy images. For these cases we bound OF error and optimal sampling rate, in order to guide biologists on their experimental conditions. We also
show the advantages of OF methods compared with manual segmentation and tracking.

Low-cost sensor to detect overtaking based on optical flow

2011

Machine Vision and Applications/Springer

The automotive industry invests substantial amounts of money in driver-security and driver-assistance systems. We propose an overtaking detection system based on visual motion cues that combines feature extraction, optical flow, solid-objects segmentation and geometry filtering, working with a low-cost compact architecture based on one focal plane and an on-chip embedded processor. The processing is divided into two stages: firstly analog processing on the focal plane processor dedicated to image conditioning and relevant image-structure selection, and secondly, vehicle tracking and warning-signal generation by optical flow, using a simple digital microcontroller. Our model can detect an approaching vehicle (multiple-lane overtaking scenarios) and warn the driver about the risk of changing lanes. Thanks to the use of tightly coupled analog and digital processors, the system is able to perform this complex task in real time with very constrained computing resources. The proposed method has been validated with a sequence of more than 15,000 frames (90 overtaking maneuvers) and is effective under different traffic situations, as well as weather and illumination conditions.