

# Gomez Chavez, Arturo

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## FOCUS AREAS

Computer vision, robotics, stereo-vision, machine learning, deep learning, underwater object recognition, underwater localization, camera calibration.

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## EDUCATION

<b>Jacobs University Bremen gGmbH</b>	Bremen, Germany
<i>Ph.D. Candidate Robotics, Cognitive Systems and Processes</i>	<i>September. 2019</i>

Dissertation Title: “Robust Underwater Perception: Using Geometry and Uncertainty Estimation in Object Recognition Frameworks”

Advisor: Prof. Andreas Birk

<b>Jacobs University Bremen gGmbH</b>	Bremen, Germany
<i>M.S. Computer Science</i>	<i>August 2015</i>

Thesis title: “Visual diver detection using multi-descriptor random forests in the context of underwater human robot interaction”

<b>Instituto Tecnológico de Monterrey (ITESM-CCM)</b>	Mexico City, Mexico
<i>B.S. Electronic Systems and Telecommunications</i>	<i>May 2013</i>

Thesis title: “Extraction of Athletes Statistics from Video”

*Best GPA class 2013*

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## WORK EXPERIENCE

<b>Research Associate</b>	Jacobs University Bremen gGmbH
Main funded projects:	<i>September 2013 to date</i>

BMBF Valentin 3D (2018-present): ([www.valentin3d.de](http://www.valentin3d.de)) – 3D acquisition of the memorial site U-Boot Bunker Valentin with air, ground and underwater robots.

EU-H2020 DexROV (2016-18): “Effective dexterous Remotely Operated Vehicle operations in presence of communication latencies” ([www.dexrov.eu](http://www.dexrov.eu)) – Implementation and testing of algorithms for underwater object segmentation, recognition and tracking to enable manipulation of oil-company’s equipment.

EU-FP7 CADDY (2015-17): “Cognitive Autonomous Diving Buddy” ([www.caddy-fp7.eu](http://www.caddy-fp7.eu)) – Computer Vision Team Leader. Developed underwater hand gesture recognition from stereo vision and communication protocol for Human-Robot Interaction; successfully tested in field trials with diver biologists.

EU-FP7 MORPH (2014-15): “Marine robotic system of self-organizing, logically linked physical nodes” ([www.morph-project.eu](http://www.morph-project.eu)) – Implemented computer vision tool for automatic marine species counting in real time to aid marine biologists. Algorithm performs better than human (93.7% accuracy) and removes the need of long diving expeditions.

**Research Intern**

Robotics Institute, Carnegie Mellon University  
*Summer 2012 and 2011*

Multiagent and Cooperative Robotics Lab (2012): Designed an intelligent sampling algorithm to account for sensors' hysteresis and information aggregation from a swarm of airboats. A local lake's pH model was obtained twice as fast as with previous methods and proved to be scalable in a fleet of six to ten airboats.

Astrobotics Technology, Inc. (2011): Implemented image processing algorithm to compare photos taken from a Lunar Lander with those in a database of the Moon's surface to retrieve a spacecraft's landing orbit. Each image was processed  $\approx 600$  times faster when reconstructing the trajectory of a flight over Penn State using down face imagery.

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**JOURNAL PUBLICATIONS**

- [1] **A. Gomez Chavez**, C. A. Mueller, T. Doernbach, and A. Birk, "Underwater navigation using visual markers in the context of intervention missions," *International Journal of Advanced Robotic Systems*, vol. 16, no. 2, 2019. doi:[10.1177/1729881419838967](https://doi.org/10.1177/1729881419838967)
- [2] **A. Gomez Chavez**, A. Ranieri, D. Chiarella, E. Zereik, A. Babić, and A. Birk, "Caddy underwater stereo-vision dataset for human-robot interaction (HRI) in the context of diver activities," *Journal of Marine Science and Engineering*, vol. 7, 2019. doi:[10.3390/jmse7010016](https://doi.org/10.3390/jmse7010016)
- [3] A. Birk, T. Doernbach, C. Mueller, T. Luczynski, **A. Gomez Chavez**, D. Koehntopp, A. Kupcsik, S. Calinon, A. K. Tanwani, G. Antonelli, *et al.*, "Dexterous underwater manipulation from onshore locations: Streamlining efficiencies for remotely operated underwater vehicles," *IEEE Robotics & Automation Magazine*, 2018. doi:[10.1109/MRA.2018.2869523](https://doi.org/10.1109/MRA.2018.2869523)
- [4] **A. Gomez Chavez**, A. Ranieri, D. Chiarella, E. Zereik, A. Babić, and A. Birk, "Robust vision-based underwater hand gesture recognition in the context of human robot interaction in diver missions," *Journal of Field Robotics*. [Submitted on November 2018]

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**BOOK CHAPTERS**

- [5] C. A. Mueller, **A. Gomez Chavez**, T. Doernbach, D. Koehntopp, and A. Birk, "Continuous system integration and validation for underwater perception in offshore inspection and intervention tasks," *Fundamental design and automation technologies in offshore robotics*. [To be submitted on September 2019]

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**REFEREED CONFERENCE PUBLICATIONS**

- [6] **A. Gomez Chavez**, Q. Xu, C. A. Mueller, S. Schwertfeger, and A. Birk, "Adaptive navigation scheme for optimal deep-sea localization using multimodal perception cues," *arXiv preprint*, 2019. [Accepted at IROS 2019]. [arXiv: 1906.04888 \[cs.RO\]](https://arxiv.org/abs/1906.04888)
- [7] **A. Gomez Chavez**, Q. Xu, C. A. Mueller, S. Schwertfeger, and A. Birk, "Towards accurate deep-sea localization in structured environments based on perception quality cues," in *Proceedings of the 18th International Conference on Autonomous Agents and MultiAgent Systems, AAMAS '19*, 2019. acmid:[3306127.3331986](https://doi.org/10.1145/3306127.3331986)
- [8] Q. Xu, **A. Gomez Chavez**, H. Buelow, A. Birk, and S. Schwertfeger, "Improved fourier mellin invariant for robust rotation estimation with omni-cameras," *arXiv preprint*, 2018. [Accepted at ICIP 2019]. [arXiv: 1811.05306 \[cs.CV\]](https://arxiv.org/abs/1811.05306)
- [9] C. A. Mueller, T. Fromm, **A. Gomez Chavez**, D. Koehntopp, and A. Birk, "Robust continuous system integration for critical deep-sea robot operations using knowledge-enabled simulation

- in the loop,” in *2018 IEEE International Conference on Intelligent Robots and Systems (IROS)*, 2018. doi:[10.1109/IROS.2018.8594392](https://doi.org/10.1109/IROS.2018.8594392)
- [10] T. Doernbach, **A. Gomez Chavez**, C. A. Mueller, and A. Birk, “High-fidelity deep-sea perception using simulation in the loop,” *IFAC-PapersOnLine*, vol. 51, no. 29, 2018. **Finalist best paper student award** doi:[10.1016/j.ifacol.2018.09.465](https://doi.org/10.1016/j.ifacol.2018.09.465)
- [11] **A. Gomez Chavez**, C. A. Mueller, A. Birk, A. Babic, and N. Miskovic, “Stereo-vision based diver pose estimation using lstm recurrent neural networks for auv navigation guidance,” in *OCEANS 2017-Aberdeen*, IEEE, 2017. doi:[10.1109/OCEANSE.2017.8085020](https://doi.org/10.1109/OCEANSE.2017.8085020)
- [12] **A. Gomez Chavez**, J. Fontes, P. Afonso, M. Pfingsthorn, and A. Birk, “Automated species counting using a hierarchical classification approach with haar cascades and multi-descriptor random forests,” in *OCEANS 2016-Shanghai*, IEEE, 2016. doi:[10.1109/OCEANSAP.2016.7485544](https://doi.org/10.1109/OCEANSAP.2016.7485544)
- [13] **A. Gomez Chavez**, M. Pfingsthorn, R. Rathnam, and A. Birk, “Visual speed adaptation for improved sensor coverage in a multi-vehicle survey mission,” in *OCEANS 2016-Shanghai*, IEEE, 2016. doi:[10.1109/OCEANSAP.2016.7485710](https://doi.org/10.1109/OCEANSAP.2016.7485710)
- [14] **A. Gomez Chavez**, M. Pfingsthorn, A. Birk, I. Rendulić, and N. Misković, “Visual diver detection using multi-descriptor nearest-class-mean random forests in the context of underwater human robot interaction (hri),” in *OCEANS 2015-Genova*, IEEE, 2015. doi:[10.1109/OCEANS-Genova.2015.7271556](https://doi.org/10.1109/OCEANS-Genova.2015.7271556)

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#### WORKSHOPS AND INVITED TALKS

- [T1] **A. Gomez Chavez**, C. A. Mueller, E. Zereik, and F. Maurelli, “Underwater robotics perception,” *2019 IEEE International Conference on Robotics and Automation (ICRA)*, 2019. **Main Organizer**. Website: [icra-2019-uwroboticsperception.ge.issia.cnr.it](http://icra-2019-uwroboticsperception.ge.issia.cnr.it)
- [T2] **A. Gomez Chavez**, C. A. Mueller, T. Doernbach, D. Chiarella, and A. Birk, “Robust gesture-based communication for underwater human-robot interaction in the context of search and rescue diver missions,” *arXiv preprint*, 2018. [Accepted at IROS 2018 Workshop “Human Aiding Robotics”]. [arXiv:1810.07122](https://arxiv.org/abs/1810.07122) [cs.RO]
- [T3] **A. Gomez Chavez** and A. Birk, “Best methodologies for object recognition underwater,” *DGR (German Society for Robotics) Days & EASE (Everyday Activity Science and Engineering) Symposium*, 2017. Website: <http://dgr2017.informatik.uni-bremen.de>
- [T4] **A. Gomez Chavez**, C. A. Mueller, and A. Birk, “EU-funded dexrov project presentation – computer vision framewrok for deep-sea applications,” *Breaking the Surface 2017, International Interdisciplinary Field Workshop of Maritime Robotics and Applications*, 2017. Website: [bts.fer.hr/2017](http://bts.fer.hr/2017)

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#### OTHER PROFESSIONAL EVENTS AND ACTIVITIES

- [P1] Jacobs Startup Competition – Part of the 10 startup teams out of 160, with our concept *PacketAnt* ([packetant.org](http://packetant.org)) for community-based packaging reuse. 2019.
- [P2] Bremen.AI events – (<https://bremen.ai>) A series of AI/startup/meetup events of the cluster for Artificial Intelligence in Bremen. 2018-2019.
- [P3] Workshop – EU funded Marine Robotics and Application, Newcastle, UK. 2016.
- [P4] Workshop – NVIDIA Deep Learning using Tensorflow, London, UK. 2016.
- [P5] Workshop – EU funded Marine Robotics and Application, Lisbon, Portugal. 2015.
- [P6] Summer school – Vision Understanding and Machine Intelligence Summer School (VISUM), Porto, Portugal. 2015.

- [P7] Summer School – Neural Dynamic Approaches to Cognitive Robotics Summer School, Bochum, Germany. *2014*.
- [P8] SpaceBotCup 2013 – Participation in the DLR (German Aerospace Center) SpaceBotCup event as part of the Jacobs Robotics Team with a Husky-Powerball platform, Rheinbreitbach, Germany. *2013*.

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#### TEACHING EXPERIENCE

- [TE1] Invited lectures for undergraduate courses: Computer vision, Artificial Intelligence for Robotics, Marine Robotics. Jacobs University Bremen gGmbH.
- [TE2] Abrish Sabri, undergraduate student, spring 2019 semester. Supervised undergraduate thesis: “Path planing comparison using occupancy grids for a Remote Operated Vehicle (ROV)”, which includes supervision and revision of the technical implementation in an underwater environment simulator.

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#### RELATED PROFESSIONAL SKILLS

<b>Programming</b>	<b>Libraries/Frameworks</b>	<b>Development/Deployment</b>	<b>Others</b>
C/C++	Tensorflow	Subversion control/git	Latex
Python	Pytorch	Docker	Jekyll
Matlab/Octave	OpenCV		
VHDL	Robot Operating System (ROS)		
	Point Cloud Library (PCL)		

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#### SERVICE

##### Peer review: Conferences

- [RC1] IEEE International Conference on Robotics and Automation (ICRA) 2019: 2018
- [RC2] IEEE/RSJ International Conference on Intelligent Robots (IROS) 2018: 2018
- [RC3] IEEE International Convention on Information and Communication Technology, Electronics and Microelectronics (MIPRO) 2016: 2016

##### Peer review: Journals

- [RJ1] IEEE – IEEE Robotics and Automation Magazine (RAM): 2019
- [RJ2] MDPI – Journal of Marine Science and Engineering: 2019
- [RJ3] Frontiers in Robotics and AI, section Robotic Control Systems: 2019
- [RJ4] Elsevier – Annual Reviews in Control: 2018