

Navinda Kottege

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EDUCATION

- **PhD in Engineering** - The Australian National University (ANU) - Australia (2009)
⇒ Thesis title: '*Underwater Acoustic Localisation in the context of Autonomous Submersibles*'.
- BSc (Honours) in Engineering Physics (**First Class**) - University of Colombo - Sri Lanka (2003)
- BIT (Second Class Upper Division) - University of Colombo School of Computing - Sri Lanka (2004)

RESEARCH CAREER

- Commonwealth Scientific & Industrial Research Organisation (CSIRO) (2009 to present)
⇒ **Research Team Leader** – Data61 (2018 to present)
 - Leading the Dynamic Platforms research team within the Robotics and Autonomous Systems Group.
 - Research Lead/Co-PI of CSIRO Data61 team competing in the DARPA Subterranean Challenge.
- ⇒ **Research Scientist / Senior Research Scientist / Principal Research Scientist** – Data61 (2012 to 2016 / 2017 to 2020 / 2020 to present)
 - Initiated legged robot research within CSIRO and Research Lead for legged robots within the group.
 - Co-authored CSIRO's DARPA Subterranean Challenge proposal leading to the \$14M project over 3yrs.
 - Operationalised and led the Sixth Wave Alliance, pre-cursor to the Robotics Australia Network (2018-2019).
 - Successfully managed and led projects with total value of over \$1.5M for a North American industrial client with major commercialisation milestones and patent application.
 - Coordinator of student engagement for Autonomous Systems Lab (2014-2016).
 - Member of the CSIRO team teaching CSSE4011: Advanced embedded systems at UQ (2013 to 2018).
 - Co-supervised 4 PhD and 7 Masters students, supervised 15 honours students and 10 Summer scholars.
- ⇒ **Postdoctoral Fellow** - Autonomous Systems Lab. (2009 to 2012)
 - Conducted research in using acoustic sensor networks for biodiversity & ecological monitoring.
 - Successfully led a project for external client Seqwater where acoustic sensor nodes were developed and deployed along a river system to monitor ecological health.
 - Member of the CSIRO team teaching CSSE4011: Advanced embedded systems at UQ (2011 – 2012).
 - Supervised a Masters student, 3 final year thesis students and 3 Summer scholars.

ADJUNCTS

- The Queensland University of Technology (QUT) (2016 to present)
⇒ **Adjunct Associate Professor** - School of Electrical Engineering & Computer Science.
- The University of Queensland (UQ) (2012 to present)
⇒ **Honorary Senior Lecturer** - School of Information Technology & Electrical Engineering.

VOLUNTEER

- **Chair** - Queensland joint chapter of IEEE Robotics & Automation and Control Systems Societies (2020 to present)
- Treasurer/Executive committee member - IEEE Ocean Engineering Society Australia Chapter (2015 to 2018)
- Executive committee member - IEEE Queensland Section (2015 to present)
- Scientists/STEM Professionals in Schools program (2010 to present)
- Young ICT Explorers Australia - Competition for year 4 - 12 school students
⇒ **Judge** - Queensland competition (2012, 2013, 2015)
- The Australian National University
⇒ **Senior mentor** - Student Information & Guidance Network (SIGN) mentoring program (2008 to 2009)

COMMITTEES/EDITORIAL BOARDS

- **Associate editor** - IEEE Robotics and Automation Letters Journal (2020 to present)
- Guest editor - Field Robotics Journal special issue on ‘Advancements and lessons learned during Phase I & II of the DARPA Subterranean Challenge’ (2021)
- Guest editor - Frontiers in Robotics and AI journal special issue on ‘Towards Real-World Deployment of Legged Robots’ (2021)
- Co-organiser - IEEE/RSJ IROS 2021 workshop on ‘Field Robotics’
- Co-organiser - IEEE ICRA 2019, 2020 & 2021 workshops on ‘Towards Real-World Deployment of Legged Robots’
- Main organiser - IEEE ICRA 2018 workshop on ‘Multilegged Robots: Towards Robust Real-World Deployments’
- Local arrangements co-chair – IEEE ICRA 2018 Brisbane.
- I served as session co-chair for the ‘Legged Robotics’ sessions at:
 - IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), October 2016, Daejeon.
 - IEEE International Conference on Robotics and Automation (ICRA), May 2017, Singapore.
- I have served on the technical program committees of multiple international conferences including the Australasian Conference on Robotics and Automation (ACRA), the Intelligent Sensors, Sensor Networks & Information Processing conference (ISSNIP), the ACM International Workshop on Underwater Networks & Systems (WUWNet) and the International Symposium on Distributed Autonomous Robotics Systems (DARS).

AWARDS

- Queensland State **iAward (Research and Development)** for the Springbrook wireless sensor network (2012)
- CSIRO **Learning Culture Award** for teaching the Advanced Embedded Systems course at UQ (2011)
- CSIRO Teamwork award commendation for Springbrook Rainforest monitoring phase 2 & 3 project team (2011)

SELECTED PUBLICATIONS

Patents

- Haddon, D., Wood, B., **Kottege, N.**, & Flick., P. (2016), Low Resolution Adaptive Distance Display. U.S. Patent: 10685548, June 2020.

Books

- **Kottege, N.**, (2011), *Underwater Acoustic Localization: in the context of Autonomous Submersibles*, LAP Lambert academic publishing, ISBN: 978-3844320312.

Refereed Book Chapters

- **Kottege, N.**, Schill, F., Bahr, A., & Zimmer, U. R. (2013), Underwater Robot Swarms: Challenges & Opportunities. In S. Kernbach (Ed.), *Handbook of Collective Robotics – Fundamentals & Challenges*, pp. 115-126, Pan Stanford.

Refereed Journal Articles

- Ahmadi, A., Nygaard, T., **Kottege, N.**, Howard, D., Hudson, N. (2021), Semi-supervised Gated Recurrent Neural Network for Robotics Terrain Classification, *IEEE Robotics and Automation Letters* (in press).
- Tam, B., Talbot, F., Steindl, R., Elfes, A., **Kottege, N.**, (2020), OpenSHC: A Versatile Multilegged Robot Controller, in *IEEE Access*, vol. 8, pp. 188908-188926.
- Buchanan, R., Wellhausen L., Bjelonic, M., Bandyopadhyay, T., **Kottege, N.**, Hutter, M. (2020), Perceptive whole-body planning for multilegged robots in confined spaces, *Journal of Field Robotics*, Wiley.
- Buchanan, R., Bandyopadhyay, T., Bjelonic, M., Wellhausen, L., Hutter, M., **Kottege, N.**, (2019), Walking Posture Adaptation for Legged Robot Navigation in Confined Spaces, *IEEE Robotics and Automation Letters*, 4(2), pp. 2148-2155.
- Bjelonic, M., **Kottege, N.**, Homberger, T., Borges, P., Beckerle, P., Chli, M. (2018), Weaver: Hexapod Robot for Autonomous Navigation on Unstructured Terrain, *Journal of Field Robotics*, 35(7), pp. 1063-1079, Wiley.
- Sommer, P., Kusy, B., Jurdak, R., **Kottege, N.**, Liu, J., Zhao, K., McKeown, A., & Westcott, D. (2016), From the Lab into the Wild: Design and Deployment Methods for Multi-Modal Tracking Platforms, *Pervasive and Mobile Computing*, 30, pp. 1-17.

- **Kottege, N.**, Jurdak, R., Kroon, F., & Jones, D. (2015), Automated Detection of Broadband Clicks of Freshwater Fish using Spectro-Temporal Features, *Journal of the Acoustical Society of America*, 137(5).
- Jurdak, R., Elfes, A., Kusy, B., Tews, A., Hu, W., Hernandez, E., **Kottege, N.**, & Sikka, P. (2015), Autonomous Surveillance for Biosecurity, *Trends in Biotechnology*, 33(4), pp. 201–207.
- Misra, P., **Kottege, N.**, Kusy, B., Ostry, D., & Jha, S. (2013). Acoustical Ranging Techniques in Embedded Wireless Sensor Networked Devices, *ACM Transactions on Sensor Networks*, 10(1), ACM. ISSN: 1550-4859.
- Croker, B., & **Kottege, N.** (2012). Using feature vectors to detect frog calls in wireless sensor networks. *Journal of the Acoustical Society of America*, 131(5), pp. EL400-EL405. ISSN: 0001-4966.
- **Kottege, N.**, & Zimmer, U. R. (2011). Underwater acoustic localization for small submersibles. *Journal of Field Robotics*, 28(1), pp. 40-69, Wiley.

Refereed Conference Proceedings

- Steindl, R., Molnar, T., Talbot, F., Hudson, N., Tam, B., Murrell, S., & **Kottege, N.** (2020), Bruce: Design and Development of a Dynamic Hexapod Robot, In proceedings of the Australasian Conference on Robotics & Automation (ACRA), Brisbane, QLD, December 2020.
- Silva, B., & **Kottege, N.** (2020), Accessible Torque Bandwidth of a Series Elastic Actuator Considering the Thermodynamic Limitations, In proceedings of the Australasian Conference on Robotics & Automation (ACRA), Brisbane, QLD, December 2020.
- Lu, B., Tam, B., & **Kottege, N.** (2020), Autonomous Obstacle Legipulation with a Hexapod Robot, In proceedings of the Australasian Conference on Robotics & Automation (ACRA), Brisbane, QLD, December 2020.
- Chathuranga, T. S., Padmal, M., Bibile, D., Jayasekara, P., & **Kottege, N.**, (2020), Sensor Deck Development for Sparse Localization and Mapping for Micro UAVs to Assist in Disaster Response, In proceedings of the Australasian Conference on Robotics & Automation (ACRA), Brisbane, QLD, December 2020.
- Vanderkop, A., & **Kottege, N.** (2020), Online Gait Adaptation for Legged Robots in Rough Terrain using Deep Reinforcement Learning, In proceedings of the Australasian Conference on Robotics & Automation (ACRA), Brisbane, QLD, December 2020.
- Tennakoon, E., Peynot, T., Roberts, J., **Kottege, N.**, (2020), Probe-before-step walking strategy for multi-legged robots on terrain with risk of collapse, In proceedings of the IEEE International Conference on Robots and Automation (ICRA), Paris, France, June 2020.
- Thoreau, M., & **Kottege, N.**, (2019), Deep Similarity Metric Learning for Real-Time Pedestrian Tracking. In proceedings of the Australasian Conference on Robotics & Automation (ACRA), Adelaide, SA, December 2019.
- Tennakoon, E., **Kottege, N.**, Peynot, T., Roberts, J. (2018), Safe terrain probing method for multi-legged robots operating on brittle surfaces, In proceedings of the International Symposium on Experimental Robotics (ISER), Buenos Aires, Argentina, November 2018.
- Bandyopadhyay, T., Steindl, R., Talbot, F., **Kottege, N.**, Dungavell, R., Wood, B., Barker, J., Hoehn, K., Elfes, A. (2018), Magneto: A Versatile Multi-Limbed Inspection Robot, In proceedings of the IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), Madrid, Spain, October, 2018.
- Tam, B., **Kottege, N.**, Kusy, B. (2017), Augmented Telepresence for Remote Inspection with Legged Robots, In proceedings of the Australasian Conference on Robotics and Automation (ACRA), Sydney, NSW, Australia, December 2017.
- Molnar, T., Steindl, R., **Kottege, N.**, Talbot, F., Elfes, A. (2017), Steep Terrain Ascension Controller for Hexapod Robots, In proceedings of the Australasian Conference on Robotics and Automation (ACRA), Sydney, NSW, Australia, December 2017.
- Bjelonic, M., Homberger, T., **Kottege, N.**, Borges, P., Chli, M., & Beckerle, P. (2017), Autonomous Navigation of Hexapod Robots With Vision-based Controller Adaptation, In proceedings of the IEEE International Conference on Robots and Automation (ICRA), Singapore.
- Heijnen, H., Howard, D., & **Kottege, N.** (2017), A Testbed that Evolves Hexapod Controllers in Hardware, In proceedings of the IEEE International Conference on Robots and Automation (ICRA), Singapore.
- Elfes, A., Steindl, R. J., Talbot, F., Kendoul, F., Sikka, P., Lowe, T., **Kottege, N.**, Bjelonic, M., Dungavell, R., Bandyopadhyay, T., Hoerger, M., Tam, B., & Rytz, D. (2017), The Multilegged Autonomous eXplorer (MAX), In proceedings of the IEEE International Conference on Robots and Automation (ICRA), Singapore.

- Tam, B., & **Kottege, N.**, (2016), Fall Avoidance and Recovery for Bipedal Robots using Walking Sticks. In proceedings of the Australasian Conference on Robotics & Automation (ACRA), Brisbane, QLD, December 2016.
- Williamson, D., **Kottege, N.**, & Moghadam, P. (2016), Terrain Characterisation and Gait Adaptation by a Hexapod Robot. In proceedings of the Australasian Conference on Robotics & Automation (ACRA), Brisbane, QLD, December 2016.
- Bjelonic, M., **Kottege, N.**, & Beckerle, P. (2016), Proprioceptive Control of an Over-Actuated Hexapod Robot in Unstructured Terrain, In proceedings of the IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), Daejeon, South Korea.
- Homberger, T., Bjelonic, M., **Kottege, N.**, & Borges, P. (2016), Terrain-Dependant Motion Adaptation for Hexapod Robots, In proceedings of the International Symposium on Experimental Robotics (ISER), Tokyo, Japan.
- Christie, J., & **Kottege, N.** (2016), Acoustics based Terrain Classification for Legged Robots. In proceedings of the IEEE International Conference on Robotics and Automation (ICRA), Stockholm, Sweden.
- Phillips, L., Berry-Potter, C., **Kottege, N.**, D'Souza, M. J. A., & Ros, M. (2015), Machine Learning Based Acoustic Sensing for Indoor Room Localisation Using Mobile Phones. In proceedings of the IEEE International Conference on Sensing Technology (ICST), Auckland, New Zealand.
- **Kottege, N.**, Parkinson, C., Moghadam, P., Elfes, A., & Singh, S. P. N. (2015), Energetics-Informed Hexapod Gait Transitions, In proceedings of the IEEE International Conference on Robotics and Automation (ICRA), Seattle, WA, USA.
- Rozado, D., Stephen, L., & **Kottege, N.** (2014), Interacting with objects in the environment using gaze tracking glasses and speech. In proceedings of the 26th Australian Computer-Human Interaction Conference on Designing Futures: The Future of Design (OzCHI).
- Hoerger, M., **Kottege, N.**, Bandyopadhyay, T., Moghadam, P., & Elfes, A. (2014), Real-time Stabilisation for Hexapod Robots, In proceedings of the International Symposium on Experimental Robotics (ISER), Morocco.
- Best, G., Moghadam, P., **Kottege, N.**, & Kleeman, L. (2013), Terrain Classification Using a Hexapod Robot. In proceedings of the Australasian Conference on Robotics and Automation (ACRA 2013), Sydney, NSW, December 2013.
- Jurdak, R., Sommer, P., Kusy, B., **Kottege, N.**, Crossman, C., McKeown, A., Westcott, D., (2013). Camazotz: Multimodal Activity-Based GPS Sampling. In proceedings of the ACM/IEEE conference on Information Processing in Sensor Networks (IPSN), Philadelphia, PA, USA.
- **Kottege, N.**, Jurdak, R., Kroon, F., & Jones, D. (2012). Classification of Underwater Broadband Bioacoustics Using Spectro-Temporal Features, In proceedings of ACM International Conference on Underwater Networks and Systems (WUWNet). Los Angeles, CA, USA.
- Misra, P., Ostry, D., **Kottege, N.**, & Jha, S. (2011). TWEET: An envelope detection based broadband ultrasonic ranging system. In proceedings of the ACM international conference on modeling, analysis, & simulation of wireless and mobile systems (MSWiM), Miami, FL.
- **Kottege, N.**, & Zimmer, U. R. (2008). Cross-correlation tracking for Maximum Length Sequence based acoustic localization. In proceedings of the Australasian Conference on Robotics & Automation (ACRA), Canberra, ACT, December 2008.
- **Kottege, N.**, & Zimmer, U. R. (2007). Relative 4ocalization for AUV swarms. In proceedings of the IEEE international symposium on underwater technology, Tokyo, Japan.
- **Kottege, N.**, & Zimmer, U. R. (2006). Acoustical localization in schools of submersibles. In proceedings of IEEE/OES Oceans 2006, Singapore.

I have presented invited talks at the following venues:

- University of Moratuwa, hosted by the IEEE RAS Sri Lanka Section, Katubedda, Sri Lanka (January 2020).
- Arthur C. Clarke Institute for Modern Technologies, Moratuwa, Sri Lanka (January 2020).
- University of Queensland, hosted by Dr. Matt D'Sousa, QLD, Australia (June 2019).
- Google X, hosted by Dr. Michael Quinlan, Mountain View, CA, USA (May 2019).
- University of Moratuwa, hosted by the IEEE RAS Sri Lanka Section, Katubedda, Sri Lanka (May 2017).
- University of Moratuwa, hosted by Dr. Sulochana Sooriyaarachchi, Katubedda, Sri Lanka (Dec. 2016).
- Autonomous Systems Lab, Eidgenössische Technische Hochschule Zürich (ETHZ), hosted by Dr. Juan Nieto, Switzerland (May 2016).
- ICRA 2016 workshop on 'Legged Robot Falling: Fall Detection, Damage Prevention, and Recovery Actions' hosted by Dr. Dimitrios Kanoulas, Stockholm, Sweden (May 2016).
- Ambassador's residence, hosted by Australian Ambassador Mr. Gerald Thompson, Stockholm, Sweden (May 2016).
- Google X, hosted by Dr. Kurt Konoldige, Mountain View, CA, USA (April 2016).
- Bosch Research and Technology Center, hosted by Dr. Riano Lorenzo, Palo alto, CA, USA (Apr. 2016).
- UQ Robotics Club, University of Queensland, hosted by Mr. Michael Smith, QLD, Australia (Mar. 2016).
- NASA Jet Propulsion Laboratory, hosted by Dr. Larry Mathies, Pasadena, CA, USA (June 2015).
- Kentucky Transportation Center, College of Engineering, University of Kentucky, hosted by Dr. Abheetha Peiris, Lexington, KY, USA (June 2015).
- Biomimetic Millisystems Lab, UC Berkeley, hosted by Prof. Ronald Fearing, Berkeley, CA, USA (May 2015).
- AI Lab, Stanford University, hosted by Prof. Oussama Khatib, Stanford, CA, USA (May 2015).
- Queensland University of Technology, hosted by Dr. Thierry Peynot, QLD, Australia (Nov. 2014).
- University of Queensland, hosted by Dr. Adam Postula, QLD, Australia (May. 2014).
- University of Colombo, hosted by Prof. Sumedha Jayanetti, Colombo, Sri Lanka (Nov. 2013).
- NASA Jet Propulsion Laboratory, hosted by Dr. Adrian Stoica, Pasadena, CA, USA (Nov. 2012).
- Robotics Embedded Systems Laboratory, University of Southern California, hosted by Prof. Gaurav Sukhatme, Los Angeles, CA, USA (Nov. 2012).
- Australian Centre for Field Robotics, hosted by Prof. Stefan Williams, NSW, Australia (Nov. 2011).