Edmund Brekke

Contact Information

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Education

Norwegian University of Science and Technology (NTNU), Trondheim, Norway

Ph.D., Engineering Cybernetics, June 2010, Dissertation Topic: "Clutter Mitigation for Target Tracking".

M.Sc., Industrial Mathematics (Statistics), June 2005, Dissertation Topic: "Bayesian Inversion of Time Lapse Seismic Data using a Blocky Model".

Academic Career

Norwegian University of Science and Technology (NTNU), Trondheim, Norway
Professor, Dept. of Engineering Cybernetics **January 2014 - Present**

Norwegian University of Science and Technology (NTNU), Trondheim, Norway
Associate Professor, Dept. of Engineering Cybernetics **April 2014 - December 2023**

National University of Singapore (NUS), Singapore
Postdoctoral Research Fellow, TMSI **October 2010 - March 2014**

Research Profile

My research is focused on the three areas of target tracking, inertial navigation and simultaneous localization and mapping (SLAM). I am particularly interested in the theoretical foundations for multi-target tracking, in the relationships between target tracking and navigation and SLAM, and in applications of these research areas in collision avoidance for autonomous vehicles. I have authored and contributed to more than 115 peer-reviewed papers on these and related topics. My Google Scholar H-index in early 2025 is 25.

Journal Papers and Book Chapters

Eide, E., Breivik, M., Brekke, E., Eriksen, B.-O. H., Wilthil, E., Helgesen, Ø., Thyri, E., Veitch, E. and Alsos, O. A., "The autonomous urban passenger ferry milliAmpere2: Design and testing", J. Offshore Mech. Arct. Eng., December 2024.

Hagen, I. B., Murvold, M., Johansen, T. and Brekke, E., "Grounding Hazard Considerations in Evaluation of COLREGS Collision Avoidance Algorithms", Ocean Engineering, vol. 308, September 2024.

Hagen, I. B., Knutsen, K., Johansen, T. and Brekke, E., "Exploration of COLREG-relevant parameters from historical AIS-data", Journal of Navigation, 2024.

Nygård, T, Dalhaug, N., Mester, R., Brekke, E. and Stahl, A., "Stereo Camera-based Free Space Estimation for Docking in Urban Waters", Modeling, Identification and Control, vol. 45, July 2024.

Gaglione, D., Braca, P., Soldi, G., Meyer, F., Hem, A. G., Brekke, E. and Hlawatsch, F., "Comments on 'Variations of Joint Integrated Data Association with Radar and Target-Provided Measurements'", Journal of Advances in Information Fusion, vol. 18, no. 2, pp. 93-101, April 2024.

Hem, A. G. and Brekke, E., "Validation of Automatic Identification System Information With Exteroceptive Sensor Fusion for Unmanned Marine Operations", IEEE Intelligent Transportation Systems Magazine, May 2024.

Hem, A. G., Baerveldt, M. and Brekke, E., "PMBM Filtering With Fusion of Target-Provided and Exteroceptive Measurements: Applications to Maritime Point and Extended Object Tracking", IEEE Access, April 2024.

Helgesen, Ø., Thyri, E. H., Brekke, E., Stahl. A. and Breivik, M., "Experimental validation of camera-based maritime collision avoidance for autonomous urban passenger ferries", accepted for publication in Modeling, Identification and Control (MIC).

Hagen, I. B., Vassbotn, O., Skogvold, M., Johansen, T., and Brekke, E., "Safety and COLREG evaluation for marine collision avoidance algorithms", Ocean Engineering, vol. 288, November 2023.

Leonardi, M., Stahl. A., Brekke, E. and Ludvigsen, M., "UVS: underwater visual SLAM - a robust monocular visual SLAM system for lifelong underwater operations", Autonomous Robots, vol. 47, pp. 1367?1385, September 2023.

Helgesen, Ø., Stahl. A. and Brekke, E., "Maritime tracking with georeferenced multi-camera fusion", IEEE Access, March 2023.

Hem, A. and Brekke, E., "Variations of joint integrated data association with radar and target-provided measurements", Journal of Advances in Information Fusion, vol. 17, no. 2, pp 97-115, February 2023.

Rothmund, S., Tengesdal, T., Brekke, E. and Johansen, T., "Intention modeling and inference for autonomous collision avoidance at sea", Ocean Engineering, vol. 266, December 2022.

Jellum E., Orlandic, M., Brekke, E., Johansen, T. and Bryne, T. "Solving Sparse Assignment Problems on FPGAs", ACM Transactions on Architecture and Code Optimization, vol. 19, no. 4, December 2022.

Helgesen, Ø., Vasstein, K., Brekke, E. and Stahl. A., "Heterogeneous multi-sensor tracking for an autonomous surface vehicle in a littoral environment", Ocean Engineering, vol. 252, May 2022.

Brekke, E., Hem, A. and Tokle, L.-C., "Multi-target tracking with multiple models and visibility: Derivation and verification on maritime radar data", IEEE Journal of Oceanic Engineering, vol. 46, no. 4, October 2021.

Tengesdal, T., Johansen, T. and Brekke, E., "Ship Collision Avoidance Utilizing the Cross-Entropy Method for Collision Risk Assessment", IEEE Transactions on Intelligent Transportation Systems, August 2021.

Bjørne E., Brekke, E. and Johansen, T. A., "Semi-globally Asymptotically Stable Nonlinear Observer for Camera Aided Navigation", accepted for publication in IEEE Transactions on Control Systems Technology.

Bjørne E., Brekke, E., Bryne, T. Delaune, J. and Johansen, T. A., "Globally Stable Velocity Estimation Using Normalized Velocity Measurement", International Journal of Robotics Research, vol. 39, no. 1, pp. 143-157, November 2019.

Kufoalor, D. K. M., Johansen, T. A., Brekke, E., Hepsø, A. and Trnka, K., "Autonomous maritime collision avoidance: Field verification of autonomous surface vehicle behavior in challenging scenarios", Journal of Field Robotics, November 2019.

Eriksen, B.-O. H., Breivik, M., Wilthil, E., Flåten, A. and Brekke, E., "The Branching-Course MPC Algorithm for Maritime Collision Avoidance", Journal of Field Robotics, vol. 36, no. 7, pp. 1222-1249, August 2019.

Sans-Muntadas, A., Kelasadi, E., Pettersen, K. Y. and Brekke, E., "Learning an AUV docking maneuver with a convolutional neural network", IFAC Journal of Systems and Control, vol. 8, no. 30, June 2019.

Andersson, L. E., Imsland, L., Brekke, E. and Scibilia, F., "On Kalman filtering with linear state equality constraints", Automatica, vol. 101, pp. 467-470, March 2019.

Sans-Muntadas, A., Brekke, E., Pettersen, K. Y. and Kelasadi, E., "Path planning and guidance for underactuated vehicles with limited field-of-view", Ocean Engineering, vol. 174, pp. 84-95, February 2019

Brekke, E. and Chitre, M., "Relationship between Finite Set Statistics and the Multiple Hypothesis Tracker", IEEE Transactions on Aerospace and Electronic Systems, vol. 54, no. 4, pp. 1902-1917, August 2018.

Wilthil, E., Flåten, A. and Brekke, E., "A Target Tracking System for ASV Collision Avoidance Based on the PDAF", in "Sensing and Control for Autonomous Vehicles", eds. Fossen, T., Pettersen, K. and Nijmeijer, H., Springer, pp. 269-288, May 2017.

Arbo, M., Utstumo, T., Brekke, E., and Gravdahl, J. T. "Unscented Multi-point Smoother for Fusion of Delayed Displacement Measurements: Application to Agricultural Robots", Modeling, Identification and Control, vol. 38, no. 1, March 2017.

Ganesan, V., Chitre, M. and Brekke, E., "Robust underwater obstacle detection and collision avoidance", Autonomous Robots, December 2015.

Brekke, E. and Chitre, M. "A multi-hypothesis solution to data association for the two-frame SLAM problem", The International Journal of Robotics Research, vol. 34, no. 1, pp. 43-63, January 2015.

Brekke, E., Hallingstad, O. and Glattetre, J., "Improved Target Tracking in the Presence of Wakes", Transactions on Aerospace and Electronic Systems, vol. 48, no. 2, pp. 1005-1017, April 2012.

Brekke, E., Hallingstad, O. and Glattetre, J., "The Modified Riccati Equation for Amplitude-Aided Target Tracking in Heavy-Tailed Clutter", Transactions on Aerospace and Electronic Systems, vol. 47, no. 4, pp. 2874-86, October 2011.

Brekke, E., Hallingstad, O. and Glattetre, J., "Tracking Small Targets in Heavy-Tailed Clutter Using Amplitude Information", Journal of Oceanic Engineering, vol. 35, no. 2, pp. 314-329, May 2010.

Conference Papers

Martens, E., Brekke, E., Mester, R. and Stahl, A., "A Lightweight, Polarization-Camera Equipped Sensor Rig for the Development of Autonomous Surface Vehicles", in proceedings of ICMASS 2024, Trondheim, Norway.

Nygård, T., Brekke, E., Mester, R. and Stahl, A., "Dynamic Scene Representation for Docking in Urban Waters Using a Stereo Camera", in proceedings of ICMASS 2024, Trondheim, Norway.

Herrmann, L., Brekke, E. and Eide, E., "Coherent Integration of Optical Flow for Track-Before-Detect Radar Detection", in proceedings of Fusion 2024, Venice, Italy.

Lopez, E., Vasstein, K., Brekke, E., Mester, R. and Stahl, A., "A General Low-Parameter 3D Ship Hull Extent Model for Object Tracking", in proceedings of Fusion 2024, Venice, Italy.

Dalhaug, N., Stahl, A., Mester, R. and Brekke, E., "Combining short and wide baseline stereo cameras for improved maritime target tracking", in proceedings of Fusion 2024, Venice, Italy.

Baerveldt, M., Shuai, J. and Brekke, E., "AImproved Fusion of AIS Data for Multiple

Extended Object Tracking", in proceedings of Fusion 2024, Venice, Italy.

Hangerhagen, P., Brekke, E., Eide, E. and Skjetne, R., "A Radar Dataset from the Trondheim City Canal", in proceedings of Fusion 2024, Venice, Italy.

Grini, J., Mester, R., Nygård, T., Dalhaug, N., Brekke, E., and Stahl, A., "FusedWSS: Water Surface Segmentation Fusing Machine Learning and Geometric Cues", in proceedings of Fusion 2024, Venice, Italy.

Hilmarsen, H., Dalhaug, N., Nygård, T., Brekke, E., Mester, R. and Stahl, A., "Maritime Tracking-By-Detection with Object Mask Depth Retrieval Through Stereo Vision and Lidar", in proceedings of Fusion 2024, Venice, Italy.

Dalhaug, N., Nygård, T., Stahl, A., Mester, R. and Brekke, E., "Advancing Sparse Classical Scene Flow into the Maritime Domain", in proceedings of CAMS 2024, Blacksburg, VA, USA.

Hem, A. G., Brekke, E., Kufoalor, D. K. M. and Kingman, I., "Autonomous Marine Collision Avoidance With Sensor Fusion of AIS and Radar", in proceedings of CAMS 2024, Blacksburg, VA, USA.

Herrmann, L., Brekke, E. and Eide, E., "Histogram-probabilistic multi-hypothesis tracking with a Poisson mixture measurement process", in proceedings of SPIE Defence + Security 2023, Amsterdam, Netherlands.

Paasche, M., Helgesen , Ø. and Brekke, E., "Real-time 360 degrees view for the operator of milliAmpere 2", in proceedings of ICMASS 2023, Rotterdam, Netherlands.

Baerveldt, M., Hem, A. G. and Brekke, E., "Comparing Multiple Extended Object Tracking with Point Based Multi Object Tracking for LiDAR in a Maritime Context", in proceedings of ICMASS 2023, Rotterdam, Netherlands.

Brekke, E. and Hem, A. G., "A long simulation scenario for evaluation of multi-target tracking methods", in Proceedings of 2023 ICECCME, Santa Cruz de Tenerife, Spain.

Rotmund, S., Haugen, H., Veglo, G. D., Brekke, E., and Johansen, T., "Validation of ship intention model for maritime collision avoidance control using historical AIS data", in proceedings of ECC 2023, Bucharest, Romania.

Vasstein, K., Helgesen, Ø. and Brekke, E., "Hellinger Metrics for Validating High Fidelity Simulators Using Target Tracking", in proceedings of MESAS 2022, Prague, Czech Republic.

Baerveldt, M., Lopez, M. E. and Brekke, E., "Extended target PMBM tracker with a Gaussian Process target model on LiDAR data", in proceedings of Fusion 2023, Charleston, SC, USA.

Lopez, M. E., Brekke, E., Mester, R. and Stahl, A., "Multiscan Shape Estimation for Extended Object Tracking", in proceedings of Fusion 2023, Charleston, SC, USA.

Severinsen, O., Tolke, L.-C. and Brekke, E., "Belief propagation for marginal probabilities in multiple hypothesis tracking", in proceedings of Fusion 2023, Charleston, SC, USA.

Flemmen, H., Mester, R., Stahl, A., Bryne, T. and Brekke, E., "Maritime radar odometry inspired by visual odometry", in proceedings of Fusion 2023, Charleston, SC, USA.

Bjerkehagen, D., Brekke, E., Grøtli, E. I. and Tjønnås, J., "Automatic Estimation of Ship-Mounted Cameras' Orientation by Hand-Eye Calibration", in proceedings of Fusion

2023, Charleston, SC, USA.

Hem, A. G., Alvheim, H. G., and Brekke, E., "WakeIPDA: Target tracking with existence modeling in the presence of wakes", in proceedings of Fusion 2023, Charleston, SC, USA.

Rothmund, S., Haugen, H. E., Veglo, G. D., Brekke, E. and Johansen, T., "Validation of ship intention model for maritime collision avoidance control using historical AIS data", in proceedings of ECC 2023, Bucharest, Romania.

Tengesdal, T., Millefiori L., Braca, P. and Brekke, E., "Joint Stochastic Prediction of Vessel Kinematics and Destination based on a Maritime Traffic Graph", in Proceedings of 2022 ICECCME, Maldives.

Hem, A. and Brekke, E., "Compensating radar rotation in target tracking", in Proceedings of SDF 2022, Bonn, Germany.

Hagen, I. B., Kufoalor, D. K. M., Johansen, T. and Brekke, E., "Scenario-Based Model Predictive Control with Different Numbers of Decision Steps for COLREGS Compliant Ship Collision Avoidance", in Proceedings of CAMS 2022, Kongens Lyngby, Denmark.

Brekke, E. and Tokle, L.-C., "Hypothesis Exploration in Multiple Hypothesis Tracking with Multiple Clusters", in Proceedings of Fusion 2022, Linköping, Sweden.

Jain, P., Brekke, E., and Rashid, A. "Unsupervised Clustering of Marine Vessel Trajectories in Historical AIS Database", in Proceedings of Fusion 2022, Linköping, Sweden.

Brekke, E., Eide, E., Eriksen, B.-O., Wilthil, E., Breivik, M., Skjellaug, E., Helgesen, Ø., Lekkas, A., Martinsen, A., Thyri, E., Torben, T., Veitch, E., Alsos, O., Johansen, T. "milliAmpere: An Autonomous Ferry Prototype", in Proceedings of ICMASS 2022, Singapore.

Sagild, J., Hem, A. and Brekke, E. "Counting Technique versus Single-Time Test for Track-to-Track Association", in Proceedings of Fusion 2021, Sun City, South Africa.

Vasstein, K., Brekke, E., Mester, R. and Eide, E., "Autoferry Gemini: a real-time simulation platform for electromagnetic radiation sensors on autonomous ships", in Proceedings of ICMASS 2020, Ulsan, South Korea (virtual).

Brekke, E., Hem, A. and Tokle, L.-C., "The VIMMJIPDA: Hybrid state formulation and verification on maritime radar benchmark data", in Proceedings of Oceans 2020 Singapore - Gulf Coast (virtual).

Hagen, I. B. and Brekke, E., "Kayak Tracking using a Direct Lidar Model", in Proceedings of Oceans 2020 Singapore - Gulf Coast (virtual).

Helgesen, Ø., Brekke, E., Stahl, A. and Engelhardtsen, Ø., "Low Altitude Georeferencing for Imaging Sensors in Maritime Tracking", in Proceedings of IFAC World Congress 2020 (virtual).

Tengesdal, T., Johansen, T. and Brekke, E., "On Collision Risk Assessment for Autonomous Ships Using Scenario-Based MPC", in Proceedings of IFAC World Congress 2020 (virtual).

Tengesdal, T., Johansen, T. and Brekke, E., "Risk-based Autonomous Maritime Collision Avoidance Considering Obstacle Intentions", in Proceedings of Fusion 2020 (virtual).

Skjellaug, E., Brekke, E. and Stahl, A., "Feature-Based Laser Odometry for Autonomous Surface Vehicles utilizing the Point Cloud Library", in Proceedings of Fusion 2020 (virtual).

Brekke, E., Wilthil, E., Eriksen, B.-O. H., Kufoalor, D. K. M., Helgesen, Ø., Hagen, I., Breivik, M. and Johansen, T., "The Autosea project: Developing closed-loop target tracking and collision avoidance systems", in Proceedings of ICMASS 2019, Trondheim, Norway, November 2019.

Helgesen, Ø., Brekke, E., Helgesen, H. and Engelhardtsen, Ø., "Sensor Combinations in Heterogeneous Multi-sensor Fusion for Maritime Target Tracking", in Proceedings of Fusion 2019, Ottawa,Canada, July 2019.

Wilthil, E., Bar-Shalom, Y., Willett, P. and Brekke, E., "Estimation of Target Detectability for Maritime Target Tracking in the PDA Framework", in Proceedings of Fusion 2019, Ottawa,Canada, July 2019.

Bjørne, E., Johansen, T. and Brekke, E., "Cascaded Bearing Only SLAM with Uniform Semi-Global Asymptotic Stability", in Proceedings of Fusion 2019, Ottawa,Canada, July 2019.

Kufoalor, D. K. M., Wilthil, E., Hagen, I., Brekke, E. and Johansen, T. A., "Autonomous COLREGs-Compliant Decision Making Using Maritime Radar Tracking and Model Predictive Control", in Proceedings of European Control Conference, Naples, Italy, June 2019.

Wu, O., Imsland, L., Brekke, E., Schneider, S., Bouaswaig, A. E. and Roth, M., "Robust State Estimation for Fouling Evolution in Batch Processes Using the EM Algorithm", in Proceedings of 12th IFAC Symposium on Dynamics and Control of Process Systems, Florianopolis, Brazil, April 2019.

Cisek, K., Brekke, E., Jahangir, M. and Johansen, T. A., "Track-to-track data fusion for Unmanned Traffic Management System,", in Proceedings of IEEE Aerospace Conference, Big Sky, MT, USA, February 2019.

Ruud, K. A., Brekke, E. and Eidsvik, J., "LIDAR Extended Object Tracking of a Maritime Vessel Using an Ellipsoidal Contour Model,", in Proceedings of Symposium Data Fusion 2018, Bonn, Germany, October 2018.

Kufoalor, D. K. M., Brekke, E. and Johansen, T. A., "Proactive Collision Avoidance for ASVs using A Dynamic Reciprocal Velocity Obstacles Method", in Proceedings of IROS 2018, Madrid, Spain, October 2018.

Alfheim, H., Muggerud, K., Breivik, M., Brekke, E., Eide, E. and Engelhardtsen, Ø., "Development of a Dynamic Positioning System for the ReVolt Model Ship", in Proceedings of IFAC CAMS, Opatija, Croatia, September 2018.

Brekke, E. and Chitre, M., "Success Rates and Posterior Probabilities in Multiple Hypothesis Tracking", in Proceedings of Fusion 2018, Cambridge, UK, July 2018.

Wilthil, E., Brekke, E. and Asplin, O., "Track Initiation for Maritime Radar Tracking with and without Prior Information", in Proceedings of Fusion 2018, Cambridge, UK, July 2018.

Dalsnes, B., Eriksen, B.-O., Flåten, A. and Brekke, E., "The Neighbor Course Distribution Method with Gaussian Mixture Models for AIS-based Vessel Trajectory Prediction", in Proceedings of Fusion 2018, Cambridge, UK, July 2018.

Hagen, I., Kufoalor, D., Johansen T. and Brekke, E.,"MPC-based Collision Avoidance Strategy for Existing Marine Vessel Guidance Systems", in Proceedings of ICRA 2018, May 2018.

Eriksen, B.-O., Wilthil, F., Flåten, A., Brekke, E. and Breivik, M., "Radar-based Mar-

itime Collision Avoidance using Dynamic Window", in Proceedings of IEEE Aerospace Conference, Big Sky, MT, USA, March 2018.

Sans-Muntadas, A., Brekke, E. and Pettersen, K., "Vehicle Guidance with Control Action Computed by a Rao-Blackwellized Particle Filter.", in Proceedings of ASCC, Gold Coast, Australia. December 2017.

Haugo, S., Stahl, A. and Brekke, E.,"Continuous signed distance functions for 3d vision", in Proceedings of 3DV 2017, Qingdao, China, October 2017.

Sans-Muntadas, A., Pettersen, K., Brekke, E. and Kelasadi, E., "Learning an AUV docking maneuver with a convolutional neural network", in Proceedings of Oceans 2017, Anchorage, AK, USA. September 2017.

Olofsson, J., Brekke, E. and Johansen, T., "Cooperative remote sensing of ice using a Spatially Indexed Labeled Multi-Bernoulli filter", in Proceedings of ICUAS 2017, Miami, FL, USA. July 2017.

Sans-Muntadas, A., Kelasadi, E., Pettersen, K. and Brekke, E., "Spiral path planning for docking of underactuated vehicles with limited FOV", in Proceedings of CCTA 2017, Hawai'i, USA. August 2017.

Bjørne, E., Brekke, E. and Johansen, T., "Cascade Attitude Observer for the SLAM filtering problem", in Proceedings of CCTA 2017, Hawai'i, USA. August 2017.

Flåten, A. and Brekke, E., "Stability of Line-Of-Sight Based Trajectory-Tracking in Two Dimensions", in Proceedings of CCTA 2017, Hawai'i, USA. August 2017.

Brekke, E. and Chitre, M., "The Multiple Hypothesis Tracker Derived from Finite Set Statistics", in Proceedings of FUSION 2017, Xi'An, China. July 2017.

Bjørne, E., Johansen, T. and Brekke, E., "Redesign and Analysis of Globally Asymptotically Stable Bearing Only SLAM", in Proceedings of FUSION 2017, Xi'An, China. July 2017.

Hexeberg, S., Flåten, A., Eriksen, B-O. and Brekke, E., "AIS-based Vessel Trajectory Prediction", in Proceedings of FUSION 2017, Xi'An, China. July 2017.

Andersson, L., Imsland, L., Brekke, E. and Scibilia, F., "Constrained Posterior Cramer-Rao Bound for Discrete-Time Systems", in Proceedings of 20th IFAC World Congress, Toulose, France. July 2017.

Olofsson, J., Brekke, E., Fossen, T. and Johansen, T., "Spatially Indexed Clustering for Scalable Tracking of Remotely Sensed Drift Ice", in Proceedings of IEEE Aerospace Conference, Big Sky, MT, USA. March 2017.

Brekke, E. and Wilthil, E., "Suboptimal Kalman Filters for Target Tracking with Navigation Uncertainty in One Dimension", in Proceedings of IEEE Aerospace Conference, Big Sky, MT, USA. March 2017.

Flåten, A. and Brekke, E., "Rao-Blackwellized Particle Filter for Turn Rate Estimation", in Proceedings of IEEE Aerospace Conference, Big Sky, MT, USA. March 2017.

Sans Muntadas, A., Pettersen, K., Brekke, E. and Henriksen, V. "A hybrid approach to underwater docking of AUVs with cross-current", in Proceedings of OCEANS, Monterey, CA, USA. September 2016.

Sans Muntadas, A., Pettersen, K. and Brekke, E. "Vision Restricted Path Planning and

Control for Underactuated Vehicles", in Proceedings of 10th IFAC Conference on Control Applications in Marine Systems, Trondheim, Norway. September 2016.

Wilthil, E. and Brekke, E., "Compensation of Navigation Uncertainty for Target Tracking on a Moving Platform", in Proceedings of FUSION 2016, Heidelberg, Germany. July 2016.

Flåten, A. and Brekke, E., "Performance Prediction of Tracking Sensors for Surface Vehicle Collision Avoidance", in Proceedings of FUSION 2016, Heidelberg, Germany. July 2016.

Johansen, T. A. and Brekke, E., "Globally Exponentially Stable Kalman Filtering for SLAM with AHRS", in Proceedings of FUSION 2016, Heidelberg, Germany. July 2016.

Sans Muntadas, A., Brekke, E., Hegrenæs, Ø. and Pettersen, K., "Navigation and Probability Assessment for Successful AUV Docking Using USBL", in Proceedings of IFAC Conference on Manoeuvring and Control of Marine Craft, Copenhagen, Denmark. August 2015.

Ganesan, V., Chitre, M. and Brekke, E., "Robust Underwater Obstacle Detection for Collision Avoidance", in Proceedings of ISER 2014, Essaouira, Morocco, June 2014.

Brekke, E., Kalyan, B. and Chitre, M., "A novel formulation of the Bayes recursion for single-cluster filtering", in Proceedings of IEEE Aerospace Conference, Big Sky, MT, USA. March 2014.

Brekke, E. and Chitre, M., "Bayesian Multi-Hypothesis Scan Matching", in Proceedings of OCEANS'13, Bergen, Norway. June 2013.

Brekke, E., Hallingstad, O. and Glattetre, J., "The Signal-to-Noise Ratio of Human Divers", in Proceedings of OCEANS'10, Sydney, NSW, Australia. June 2010. Nominated for student poster competition.

Brekke, E., Hallingstad, O. and Glattetre, J., "Target Tracking in State Dependent Wake Clutter", in Proceedings of OCEANS'10, Sydney, NSW, Australia. June 2010. Nominated for student poster competition.

Stakkeland, M., Overrein, Ø., Hallingstad, O. and Brekke, E., "Tracking of targets with state dependent measurement errors using recursive BLUE filters", in Proceedings of FUSION'09, Seattle, WA, USA. July 2009.

Brekke, E., Hallingstad, O. and Glattetre, J., "Performance of PDAF-based Tracking Methods in Heavy-Tailed Clutter", in Proceedings of FUSION'09, Seattle, WA, USA. July 2009.

Brekke, E., Hallingstad, O. and Glattetre, J., "Target Tracking in Heavy-Tailed Clutter Using Amplitude Information", in Proceedings of FUSION'09, Seattle, WA, USA. July 2009.

Pan, Y., Ge, S. S., Mamum, A. A. and Brekke, E., "Sound Source Recognition for Human Robot Interaction", in Proceedings of RO-MAN 2008, Munich, Germany. August 2008.

Brekke, E., Kirubarajan, T. and Tharmarasa, R., "Tracking Dim Targets Using Integrated Clutter Estimation", in Proceedings of SPIE, San Diego, CA, USA. August 2007.

Invited talks

"Tracking and prediction for autonomous maritime collision avoidance", CAMS, Daejeon, Korea, *IFAC*, September 2019.

"Situational awareness in maritime collision avoidance", Autonomous Ship Technology Symposium, Amsterdam, Netherlands, *UKI Media*, June 2019.

"Sensor fusion and collision avoidance for autonomous surface vehicles", Haugesundkonferansen, Haugesund, Norway, February 2019.

"Sensor fusion and collision avoidance for autonomous surface vehicles", Autonomous Ship Technology Symposium, Amsterdam, Netherlands, *UKIP Media*, June 2016.

Grants

Research Council of Norway **August 2022 - July 2025**
"Autonomy through stereo vision near the seashore". NOK 14 721 000.
Project manager.

EU Commission **November 2021 - October 2025**
"AUTOBarge". EUR 4 090 128.
PhD supervisor.

Research Council of Norway **December 2020 - November 2028**
"SFI Autoship". NOK 242 000 000.
WP Manager of WP1 AutoRemote. WP budget NOK 57 225 000.

Research Council of Norway **August 2019 - October 2024**
"Autonomous ships, intentions and situational awareness". NOK 12 520 000.
Project manager.

NTNU (Internal grant for PhD scholarship) **January 2019 - December 2023**
"Sensor fusion for autonomous ferry".
Main PhD supervisor.

NTNU (Internal grant for PhD scholarship) **August 2017 - July 2021**
"Collision avoidance for autonomous ferry".
Main PhD supervisor.

Research Council of Norway **August 2015 - July 2019**
"Sensor fusion and collision avoidance for autonomous surface vehicles". NOK 10 202 000.
Project manager.

Ministry of Defence, Singapore **January 2013 - April 2014**
"Detection and Tracking of Underwater Mine-like-objects Using AUVs". S$ 50 000.
Co-PI together with Bharath Kalyan.

Courses taught

- Sensor Fusion (4th year MSc level). NTNU, autumn 2019 −.
- Systems Theory, Introdution (4th year MSc level). NTNU, autumn 2014-2018.
- Nonlinear State Estimation (PhD level). NTNU, spring 2016, 2018, 2020 and 2024.

PhD candidates

- Lukas Herrmann (2022 −, co-advised). *Ship-shore radar network.*
- Daniel Menges (2022 −, co-advised). *Situational Awareness of Autonomous Ships using Digital Twins.*
- Trym Anthonsen Nygård (2022 −, co-advised). *Sensor fusion for docking: Stereo-based localization.*
- Nicholas Dalhaug (2022 −). *Near-shore stereo extended object tracking.*
- Martin Baerveldt (2022 −). *Unifying Simultaneous Localization and Mapping (SLAM) and Extended Object Tracking (EOT) for autonomous vessels in confined waterways.*
- Emil Martens (2021 −, co-advised). *Multi-sensor detection.*
- Henrik Flemmen (2021 −). *SLAM for autonomous ships.*
- Kjetil Vasstein (2021 −). *Trustworthy autonomy for marine ferries from using video games.*
- Ernesto López (2020 −, co-advised). *Pose estimation and extended object tracking.*
- Audun Gullikstad Hem (2019−2024). *Maritime Target Tracking with Exteroceptive Sensors and Target-Provided Information.*

- Trym Tengesdal (2019−2022, co-advised). *Risk-based Traffic Rules Compliant Collision Avoidance for Autonomous Ships.*
- Øystein Kaarstad Helgesen (2019−2023). *Multi-Sensor Tracking for Autonomous Surface Vehicles.*
- Lars-Christian Tokle (2019 −). *Sensor fusion for autonomous ferry.*
- Georgios Kavallieratos (2018−2021, co-advised). *Security of the Cyber-enabled ship.*
- Inger Hagen (2017−2022). *Topics on Marine Collision Avoidance.*
- Simen Haugo (2017 −, co-advised). *Situational awareness for pilots of UAVs.*
- Elias Bjørne (2016−2019, co-advised). *Globally Stable Observers for Simultaneous Localization and Mapping.*
- Marco Leonardi (2016−2023, co-advised). *Designing and Improving Techniques for Underwater Visual SLAM and Obstacle Avoidance.*
- Erik Wilthil (2015−2019). *Maritime target tracking with varying sensor performance.*
- Bjørn-Olav H. Eriksen (2015−2019, co-advised). *Motion Control and Collision Avoidance for Autonomous Surface Vehicles.*
- Albert Sans Muntadas (2014−2018, co-advised). *Navigation and Guidance tools for docking underactuated AUVs.*

MSc candidates

I have been main supervisor for a total of 70 graduated MSc's.

Service

I am an Associate Editor for the IEEE Journal of Oceanic Engineering. I am regularly reviewing for Transactions on Signal Processing, Transactions on Aerospace and Electronic Systems, ISIF/IEEE International Conference on Information Fusion, etc. I have been a member of 6 PhD committees and participated in the evaluation of 3 associate professors. I was a member of the Council for Research and Researcher Education at the IE Faculty, NTNU during 2018-2019.

I am general co-chair of the 29th International Conference on Information Fusion (Fusion 2026).

Membership of Societies

- TEKNA (2003 −). I was editor of TEKNA's student magazine *a priori* in 2004.
- IEEE (Student member 2010, Member 2011, Senior member 2021).

Innovation

Co-founder of Zeabuz AS (2019).