

## References

- [1] *FastTriggs*. <https://pypose.org/docs/main/generated/pypose.optim.corrector.FastTriggs/>.
- [2] *LieTensor*. <https://pypose.org/docs/main/generated/pypose.LieTensor>.
- [3] *PyPose Documents*. <https://pypose.org/docs/>.
- [4] *PyPose Tutorial*. <https://github.com/pypose/tutorials>.
- [5] *Reality Labs Chief Scientist Outlines a New Compute Architecture for True AR Glasses*. <https://www.roadtovr.com/michael-abrash-iedm-2021-compute-architecture-for-ar-glasses/>.
- [6] 2015. *You Only Look Once: Unified, Real-Time Object Detection*.
- [7] 2025 (Mar.). *Meta Quest 3: Technical Specifications*.
- [8] A, Zeng, Attarian, M., Ichter, B., Choromanski, K., Wong, A., Welker, S., Tombari, F., Purohit, A., Ryoo, M., Sindhwani, V., Lee, J., Vanhoucke, V., and Florence, P. 2022. Socratic Models: Composing Zero-Shot Multimodal Reasoning with Language. *arXiv*.
- [9] Abadi, Martín, Barham, Paul, Chen, Jianmin, Chen, Zhifeng, Davis, Andy, Dean, Jeffrey, Devin, Matthieu, Ghemawat, Sanjay, Irving, Geoffrey, Isard, Michael, et al. 2016. TensorFlow: a system for Large-Scale machine learning. Pages 265–283 of: *12th USENIX symposium on operating systems design and implementation (OSDI 16)*.
- [10] Abate, M., Chang, Y., Hughes, N., and Carlone, L. 2023a. Kimera2: Robust and Accurate Metric-Semantic SLAM in the Real World. In: *Intl. Sym. on Experimental Robotics (ISER)*.
- [11] Abate, M., Schwartz, A., Wong, X.I., Luo, W., Littman, R., Klinger, M., Kuhnert, L., Blue, D., and Carlone, L. 2023b. Multi-Camera Visual-Inertial Simultaneous Localization and Mapping for Autonomous Valet Parking. In: *Intl. Sym. on Experimental Robotics (ISER)*. ,.
- [12] Achiam, Josh, Adler, Steven, Agarwal, Sandhini, Ahmad, Lama, Akkaya, Ilge, Aleman, Florencia Leoni, Almeida, Diogo, Altschmidt, Janko, Altman, Sam, Anadkat, Shyamal, et al. 2023. Gpt-4 technical report. *arXiv preprint arXiv:2303.08774*.
- [13] Adolfsson, Daniel, Magnusson, Martin, Alhashimi, Anas, Lilienthal, Achim J., and Andreasson, Henrik. 2021. CFEAR Radarodometry – Conservative Filtering for Efficient and Accurate Radar Odometry. Pages 5462–5469 of: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*.

- [14] Adolfsson, Daniel, Castellano-Quero, Manuel, Magnusson, Martin, Lilienthal, Achim J., and Andreasson, Henrik. 2022. CorAl: Introspection for robust radar and lidar perception in diverse environments using differential entropy. *Robotics and Autonomous Systems*, May, 104136.
- [15] Adolfsson, Daniel, Magnusson, Martin, Alhashimi, Anas, Lilienthal, Achim J., and Andreasson, Henrik. 2023a. Lidar-Level Localization With Radar? The CFAR Approach to Accurate, Fast, and Robust Large-Scale Radar Odometry in Diverse Environments. *IEEE Trans. Robotics*, **39**(2), 1476–1495.
- [16] Adolfsson, Daniel, Karlsson, Mattias, Kubelka, Vladimír, Magnusson, Martin, and Andreasson, Henrik. 2023b. TBV Radar SLAM – trust but verify loop candidates. *IEEE Robotics and Automation Letters*, **8**, 3613–3620.
- [17] Aftab, Khurram, and Hartley, Richard. 2015. Convergence of iteratively re-weighted least squares to robust m-estimators. Pages 480–487 of: *2015 IEEE Winter Conference on Applications of Computer Vision*. IEEE.
- [18] Agarwal, P., Grisetti, G., Tipaldi, G. D., Spinello, L., Burgard, W., and Stachniss, C. 2014. Experimental Analysis of Dynamic Covariance Scaling for Robust Map Optimization Under Bad Initial Estimates. In: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [19] Agarwal, Pratik, Tipaldi, Gian Diego, Spinello, Luciano, Stachniss, Cyrill, and Burgard, Wolfram. 2013. Robust map optimization using dynamic covariance scaling. In: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [20] Agarwal, Sameer, Snavely, Noah, Simon, Ian, Seitz, Steven M, and Szeliski, Richard. 2009. Building Rome in a day. Pages 72–79 of: *Intl. Conf. on Computer Vision (ICCV)*. IEEE.
- [21] Agarwal, Sameer, Furukawa, Yasutaka, Snavely, Noah, Simon, Ian, Curless, Brian, Seitz, Steven M, and Szeliski, Richard. 2011. Building Rome in a day. *Communications of the ACM*, **54**(10), 105–112.
- [22] Agarwal, Sameer, Mierle, Keir, and Team, The Ceres Solver. 2022 (3). *Ceres Solver*.
- [23] Agate, M., Grimsdale, R. L., and Lister, P. F. 1991. The HERO Algorithm for Ray-tracing Octrees. Pages 61–73 of: *Advances in Computer Graphics Hardware IV*.
- [24] Agia, Christopher, Jatavallabhula, Krishna Murthy, Khodeir, Mohamed, Miksik, Ondrej, Vineet, Vibhav, Mukadam, Mustafa, Paull, Liam, and Shkurti, Florian. 2022. Taskography: Evaluating Robot Task Planning over Large 3D Scene Graphs. Pages 46–58 of: *Conf. on Robot Learning (CoRL)*.
- [25] Agrawal, A., Amos, B., Barratt, S., Boyd, S., Diamond, S., and Kolter, Z. 2019. Differentiable Convex Optimization Layers. In: *Advances in Neural Information Processing Systems*.
- [26] Agrawal, Varun, Bertrand, Sylvain, Griffin, Robert J., and Dellaert, Frank. 2022. Proprioceptive State Estimation of Legged Robots with Kinematic Chain Modeling. Pages 178–185 of: *IEEE Intl. Conf. on Humanoid Robots*.
- [27] Agudo, Antonio, and Moreno-Noguer, Francesc. 2015. Simultaneous pose and non-rigid shape with particle dynamics. In: *CVPR*.
- [28] Agudo, Antonio, Agapito, Lourdes, Calvo, Begona, and Montiel, J.M.M. 2014. Good vibrations: A modal analysis approach for sequential non-rigid structure from motion. In: *CVPR*.

- [29] Agudo, Antonio, Moreno-Noguer, Francesc, Calvo, Begoña, and Montiel, José María Martínez. 2015. Sequential non-rigid structure from motion using physical priors. *IEEE transactions on pattern analysis and machine intelligence*, **38**(5), 979–994.
- [30] Akhter, Ijaz, Sheikh, Yaser, Khan, Sohaib, and Kanade, Takeo. 2011. Trajectory space: A dual representation for nonrigid structure from motion. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, **33**(7), 1442–1456.
- [31] Al-Rfou, Rami, Alain, Guillaume, Almahairi, Amjad, Angermueller, Christof, Bahdanau, Dzmitry, Ballas, Nicolas, Bastien, Frédéric, Bayer, Justin, Belikov, Anatoly, Belopolsky, Alexander, et al. 2016. Theano: A Python framework for fast computation of mathematical expressions. *arXiv e-prints*, arXiv–1605.
- [32] Alhashimi, Anas, Adolfsson, Daniel, Andreasson, Henrik, Lilienthal, Achim J., and Magnusson, Martin. 2024. BFAR: improving radar odometry estimation using a bounded false alarm rate detector. *Autonomous Robots*, **48**(29).
- [33] Alismail, Hatem, Browning, Brett, and Lucey, Simon. 2016. Photometric Bundle Adjustment for Vision-Based SLAM. Pages 324–341 of: *Asian Conf. on Computer Vision (ACCV)*.
- [34] Alizadeh, F., Haeberly, J.P.A., and Overton, M.L. 1997. Complementarity and nondegeneracy in semidefinite programming. *Mathematical Programming*, **77**, 111–128.
- [35] Ambruş, Rareş, Bore, Nils, Folkesson, John, and Jensfelt, Patric. 2014. Meta-rooms: Building and maintaining long term spatial models in a dynamic world. Pages 1854–1861 of: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*. IEEE.
- [36] Amestoy, P.R., Davis, T., and Duff, I.S. 1996. An approximate minimum degree ordering algorithm. *SIAM Journal on Matrix Analysis and Applications*, **17**(4), 886–905.
- [37] Amini, Alexander, Wang, Tsun-Hsuan, Gilitschenski, Igor, Schwardt, Wilko, Liu, Zhijian, Han, Song, Karaman, Sertac, and Rus, Daniela. 2022. VISTA 2.0: An Open, Data-driven Simulator for Multimodal Sensing and Policy Learning for Autonomous Vehicles. In: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*. IEEE.
- [38] Amir, Arnon, Taba, Brian, Berg, David, Melano, Timothy, McKinstry, Jeffrey, Nolfo, Carmelo Di, Nayak, Tapan, Andreopoulos, Alexander, Garreau, Guillaume, Mendoza, Marcela, Kusnitz, Jeff, Debole, Michael, Esser, Steve, Delbruck, Tobi, Flickner, Myron, and Modha, Dharmendra. 2017. A Low Power, Fully Event-Based Gesture Recognition System. Pages 7388–7397 of: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [39] Andersson, Joel AE, Gillis, Joris, Horn, Greg, Rawlings, James B, and Diehl, Moritz. 2019. CasADi: a software framework for nonlinear optimization and optimal control. *Mathematical Programming Computation*, **11**(1), 1–36.
- [40] Ankenbauer, Jacqueline, Lusk, Parker C., and How, Jonathan P. 2023 (Mar.). *Global Localization in Unstructured Environments Using Semantic Object Maps Built from Various Viewpoints*.

- [41] Antonante, P., Tzoumas, V., Yang, H., and Carlone, L. 2021. Outlier-Robust Estimation: Hardness, Minimally Tuned Algorithms, and Applications. *IEEE Trans. Robotics*, **38**(1), 281–301. .
- [42] Arandjelovic, Relja, Gronat, Petr, Torii, Akihiko, Pajdla, Tomas, and Sivic, Josef. 2016. NetVLAD: CNN architecture for weakly supervised place recognition. Pages 5297–5307 of: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [43] Armeni, Iro, He, Zhi-Yang, Gwak, JunYoung, Zamir, Amir R, Fischer, Martin, Malik, Jitendra, and Savarese, Silvio. 2019. 3D Scene Graph: A Structure for Unified Semantics, 3D Space, and Camera. Pages 5664–5673 of: *Intl. Conf. on Computer Vision (ICCV)*.
- [44] Asgharivaskasi, Arash, and Atanasov, Nikolay. 2023. Semantic OcTree Mapping and Shannon Mutual Information Computation for Robot Exploration. *IEEE Trans. Robotics*, **39**(3), 1910–1928.
- [45] Asgharivaskasi, Arash, Girke, Fritz, and Atanasov, Nikolay. 2025. Riemannian Optimization for Active Mapping With Robot Teams. *IEEE Trans. Robotics*, **41**, 1077–1097.
- [46] Asokan, Anju, and Anitha, JJESI. 2019. Change detection techniques for remote sensing applications: A survey. *Earth Science Informatics*, **12**, 143–160.
- [47] Atanasov, Nikolay, Zhu, Menglong, Daniilidis, Kostas, and Pappas, George J. 2014. Semantic Localization Via the Matrix Permanent. In: *Robotics: Science and Systems*.
- [48] Atanasov, Nikolay, Zhu, Menglong, Daniilidis, Kostas, and Pappas, George J. 2016. Localization from semantic observations via the matrix permanent. *Intl. J. of Robotics Research*, **35**(1-3), 73–99.
- [49] Bae, Gwangtak, Choi, Changwoon, Heo, Hyeongjun, Kim, Sang Min, and Kim, Young Min. 2024. I2-SLAM: Inverting Imaging Process for Robust Photorealistic Dense SLAM. In: *European Conf. on Computer Vision (ECCV)*.
- [50] Bahdanau, Dzmitry, Cho, Kyunghyun, and Bengio, Yoshua. 2015. Neural machine translation by jointly learning to align and translate. In: *ICLR*.
- [51] Ballester, Irene, Fontán, Alejandro, Civera, Javier, Strobl, Klaus H, and Triebel, Rudolph. 2021. DOT: Dynamic object tracking for visual SLAM. Pages 11705–11711 of: *2021 IEEE international conference on robotics and automation (ICRA)*. IEEE.
- [52] Banani, M. El, Raj, A., Maninis, K., Kar, A., Li, Y., Rubinstein, M., Sun, D., Guibas, L., Johnson, J., and Jampani, V. 2024. Probing the 3D Awareness of Visual Foundation Models. In: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [53] Barath, Daniel, Noskova, Jana, Ivashechkin, Maksym, and Matas, Jiri. 2020. MAGSAC++, a fast, reliable and accurate robust estimator. Pages 1304–1312 of: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [54] Barfoot, T D. 2024. *State Estimation for Robotics*. 2nd edn. Cambridge University Press.
- [55] Barfoot, T. D., and Furgale, P. T. 2014. Associating Uncertainty with Three-Dimensional Poses for use in Estimation Problems. *IEEE Trans. Robotics*, **30**(3), 679–693.

- [56] Barfoot, T D, Forbes, J R, and D’Eleuterio, G M T. 2022. Vectorial Parameterizations of Pose. *Robotica*, **40**(7), 2409–2427.
- [57] Barfoot, Tim D, Tong, Chi Hay, and Särkkä, Simo. 2014. Batch Continuous-Time Trajectory Estimation as Exactly Sparse Gaussian Process Regression. Pages 1–10 of: *Robotics: Science and Systems (RSS)*, vol. 10. Citeseer.
- [58] Barfoot, Timothy D. 2017. *State estimation for robotics*. Cambridge University Press.
- [59] Barnes, Dan, and Posner, Ingmar. 2020. Under the Radar: Learning to Predict Robust Keypoints for Odometry Estimation and Metric Localisation in Radar. Pages 9484–9490 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [60] Barnes, Dan, Weston, Rob, and Posner, Ingmar. 2019. Masking by Moving: Learning Distraction-Free Radar Odometry from Pose Information. In: *Conference on Robot Learning*.
- [61] Barnes, Dan, Gadd, Matthew, Murcutt, Paul, Newman, Paul, and Posner, Ingmar. 2020. The Oxford radar robotcar dataset: A radar extension to the Oxford robotcar dataset. Pages 6433–6438 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [62] Barranco, Francisco, Fermuller, Cornelia, Aloimonos, Yiannis, and Delbruck, Tobi. 2016. A Dataset for Visual Navigation with Neuromorphic Methods. *Front. Neurosci.*, **10**, 49.
- [63] Barrau, A., and Bonnabel, S. 2017. The Invariant Extended Kalman Filter as a Stable Observer. *IEEE Trans. on Automatic Control*, **62**(4), 1797–1812.
- [64] Barron, Jonathan T. 2019. A general and adaptive robust loss function. Pages 4331–4339 of: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [65] Barron, Jonathan T., Mildenhall, Ben, Verbin, Dor, Srinivasan, Pratul P., and Hedman, Peter. 2022. Mip-NeRF 360: Unbounded Anti-Aliased Neural Radiance Fields. *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [66] Bartoli, Adrien, Gérard, Yan, Chadebecq, François, Collins, Toby, and Pizarro, Daniel. 2015. Shape-from-template. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, **37**(10), 2099–2118.
- [67] Bauernfeind, Carl Max v. 1856. *Elemente der Vermessungskunde: ein Lehrbuch der praktischen Geometrie*. Cotta.
- [68] Bavle, Hriday, Sanchez-Lopez, Jose Luis, Shaheer, Muhammad, Civera, Javier, and Voos, Holger. 2022. Situational Graphs for Robot Navigation in Structured Indoor Environments. *IEEE Robotics and Automation Letters*, **7**(4), 9107–9114.
- [69] Bay, Herbert, Tuytelaars, Tinne, and Van Gool, Luc. 2006. Surf: Speeded up robust features. Pages 404–417 of: *European Conf. on Computer Vision (ECCV)*. Springer.
- [70] Bay, Herbert, Ess, Andreas, Tuytelaars, Tinne, and Van Gool, Luc. 2008. Speeded-Up Robust Features (SURF). *Computer Vision and Image Understanding (CVIU)*, **110**(3), 346–359.
- [71] Bazin, J.C., Seo, Y., Hartley, R.I., and Pollefeys, M. 2014. Globally optimal inlier set maximization with unknown rotation and focal length. Pages 803–817 of: *European Conf. on Computer Vision (ECCV)*.

- [72] Beeson, Patrick, Modayil, Joseph, and Kuipers, Benjamin. 2010. Factoring the mapping problem: Mobile robot map-building in the hybrid spatial semantic hierarchy. *Intl. J. of Robotics Research*, **29**(4), 428–459.
- [73] Behley, J., and Stachniss, C. 2018. Efficient Surfel-Based SLAM using 3D Laser Range Data in Urban Environments. In: *Robotics: Science and Systems (RSS)*.
- [74] Behley, J., Steinhage, V., and Cremers, A. B. 2012. Performance of Histogram Descriptors for the Classification of 3D Laser Range Data in Urban Environments. In: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [75] Behley, J., Garbade, M., Milioto, A., Quenzel, J., Behnke, S., Stachniss, C., and Gall, J. 2019. SemanticKITTI: A Dataset for Semantic Scene Understanding of LiDAR Sequences. In: *Intl. Conf. on Computer Vision (ICCV)*.
- [76] Behley, J., Milioto, A., and Stachniss, C. 2021. A Benchmark for LiDAR-based Panoptic Segmentation based on KITTI. In: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [77] Behley, Jens, Steinhage, Volker, and Cremers, Armin B. 2015. Efficient Radius Neighbor Search in Three-dimensional Point Clouds. In: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [78] Bennett, M. S. 2024. *A Brief History of Intelligence*. Harper Collins.
- [79] Bentley, J.L. 1975. Multidimensional Binary Search Trees Used for Associative Searching. *Communications of the ACM*, **18**(9), 509–517.
- [80] Berg, Matthew, Konidaris, George, and Tellex, Stefanie. 2022. Using Language to Generate State Abstractions for Long-Range Planning in Outdoor Environments. Pages 1888–1895 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [81] Bernreiter, Lukas, Gawel, Abel, Sommer, Hannes, Nieto, Juan, Siegwart, Roland, and Lerma, Cesar Cadena. 2019. Multiple Hypothesis Semantic Mapping for Robust Data Association. *IEEE Robotics and Automation Letters*, **4**(4), 3255–3262.
- [82] Bescós, Berta, Civera, Javier, and Neira, José. 2017. Removing dynamic objects from 3d maps using geometry and learning.
- [83] Bescos, Berta, Campos, Carlos, Tardós, Juan D., and Neira, José. 2021. DynaSLAM II: Tightly-Coupled Multi-Object Tracking and SLAM. *IEEE Robotics and Automation Letters*, **6**(3), 5191–5198.
- [84] Bescós, Berta, Cadena, César, and Neira, José. 2021. Empty Cities: A Dynamic-Object-Invariant Space for Visual SLAM. *IEEE Transactions on Robotics*, **37**(2), 433–451.
- [85] Besl, Paul J, and McKay, Neil D. 1992a. Method for registration of 3-D shapes. Pages 586–606 of: *Sensor fusion IV: control paradigms and data structures*, vol. 1611. Spie.
- [86] Besl, Paul J, and McKay, Neil D. 1992b. Method for registration of 3-D shapes. *IEEE Trans. Pattern Anal. Machine Intell.*, **14**(2), 239–256.
- [87] Bezdek, James C, and Hathaway, Richard J. 2003. Convergence of alternating optimization. *Neural, Parallel & Scientific Computations*, **11**(4), 351–368.
- [88] Bhardwaj, Mohak, Boots, Byron, and Mukadam, Mustafa. 2020. Differentiable gaussian process motion planning. Pages 10598–10604 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*. IEEE.

- [89] Biber, Peter, and Straßer, Wolfgang. 2003. The normal distributions transform: A new approach to laser scan matching. Pages 2743–2748 of: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*, vol. 3. IEEE.
- [90] Bierman, G.J. 1977. *Factorization methods for discrete sequential estimation*. Mathematics in Science and Engineering, vol. 128. New York: Academic Press.
- [91] Black, Kevin, Brown, Noah, Driess, Danny, Esmail, Adnan, Equi, Michael, Finn, Chelsea, Fusai, Niccolo, Groom, Lachy, Hausman, Karol, Ichter, Brian, Jakubczak, Szymon, Jones, Tim, Ke, Liyiming, Levine, Sergey, Li-Bell, Adrian, Mothukuri, Mohith, Nair, Suraj, Pertsch, Karl, Shi, Lucy Xiaoyang, Tanner, James, Vuong, Quan, Walling, Anna, Wang, Haohuan, and Zhilinsky, Ury. 2024.  $\pi_0$ : A Vision-Language-Action Flow Model for General Robot Control.
- [92] Black, Michael J., and Rangarajan, Anand. 1996. On the unification of line processes, outlier rejection, and robust statistics with applications in early vision. *Intl. J. of Computer Vision*, **19**(1), 57–91.
- [93] Blake, Andrew, and Zisserman, Andrew. 1987. *Visual reconstruction*. MIT Press.
- [94] Bloesch, Michael, Hutter, Marco, Hoepflinger, Mark, Leutenegger, Stefan, Gehring, Christian, Remy, C. David, and Siegwart, Roland. 2012. State Estimation for Legged Robots - Consistent Fusion of Leg Kinematics and IMU. In: *Robotics: Science and Systems (RSS)*.
- [95] Bloesch, Michael, Gehring, Christian, Fankhauser, Péter, Hutter, Marco, Hoepflinger, Mark A., and Siegwart, Roland. 2013. State estimation for legged robots on unstable and slippery terrain. Pages 6058–6064 of: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*.
- [96] Bloesch, Michael, Omari, Sammy, Hutter, Marco, and Siegwart, Roland. 2015. Robust visual inertial odometry using a direct EKF-based approach. Pages 298–304 of: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*. IEEE.
- [97] Bloesch, Michael, Czarnowski, Jan, Clark, Ronald, Leutenegger, Stefan, and Davison, Andrew J. 2018a. CodeSLAM—learning a compact, optimisable representation for dense visual SLAM. Pages 2560–2568 of: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [98] Bloesch, Michael, Burri, Michael, Sommer, Hannes, Siegwart, Roland, and Hutter, Marco. 2018b. The Two-State Implicit Filter Recursive Estimation for Mobile Robots. *IEEE Robotics and Automation Letters*, **3**(1), 573–580.
- [99] Bodlaender, Hans L. 2006. Treewidth: Characterizations, Applications, and Computations. Pages 1–14 of: *Graph-Theoretic Concepts in Computer Science*. Springer Berlin Heidelberg.
- [100] Bohren, Jonathan, Foote, Tully, Keller, Jim, Kushleyev, Alex, Lee, Daniel, Stewart, Alex, Vernaza, Paul, Derenick, Jason, Spletzer, John, and Satterfield, Brian. 2008. Little Ben: The Ben Franklin Racing Team’s entry in the 2007 DARPA Urban Challenge. *J. of Field Robotics*, **25**(9), 598–614.
- [101] Bonnabel, Silvére, and Barrau, Axel. 2015. An intrinsic Cramér-Rao bound on Lie groups. Pages 664–672 of: *International Conference on Geometric Science of Information*. Springer.

- [102] Bore, Nils, Ekekrantz, Johan, Jensfelt, Patric, and Folkesson, John. 2018. Detection and tracking of general movable objects in large three-dimensional maps. *IEEE Transactions on Robotics*, **35**(1), 231–247.
- [103] Borrmann, Dorit, Nüchter, Andreas, Dakulović, Marija, Maurović, Ivan, Petrović, Ivan, Osmanković, Dinko, and Velagić, Jasmin. 2014. A mobile robot based system for fully automated thermal 3D mapping. *Advanced Engineering Informatics*, **28**(4), 425–440.
- [104] Borts, David, Liang, Erich, Broedermann, Tim, Ramazzina, Andrea, Walz, Stefanie, Palladin, Edoardo, Sun, Jipeng, Brueggemann, David, Sakaridis, Christos, Van Gool, Luc, Bijelic, Mario, and Heide, Felix. 2024. Radar Fields: Frequency-Space Neural Scene Representations for FMCW Radar. In: *Intl. Conf. on Computer Graphics and Interactive Techniques (SIGGRAPH)*. SIGGRAPH '24. New York, NY, USA: Association for Computing Machinery.
- [105] Bosse, M., Agamennoni, G., and Gilitschenski, I. 2016. Robust Estimation and Applications in Robotics. *Foundations and Trends in Robotics*, **4**(4), 225–269.
- [106] Bosse, Michael, and Zlot, Robert. 2009. Continuous 3D scan-matching with a spinning 2D laser. Pages 4312–4319 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [107] Bosse, Michael, and Zlot, Robert. 2013. Place recognition using keypoint voting in large 3D lidar datasets. Pages 2677–2684 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*. IEEE.
- [108] Bosse, Michael, Zlot, Robert, and Flick, Paul. 2012. Zebedee: Design of a spring-mounted 3-d range sensor with application to mobile mapping. *IEEE Trans. Robotics*, **28**(5), 1104–1119.
- [109] Botsch, M., Spornat, M., and Kobbelt, L. 2004. Phong splatting. In: *Symposium on Point-Based Graphics (PBG)*.
- [110] Botsch, Mario, Hornung, Alexander, Zwicker, Matthias, and Kobbelt, Leif. 2005. High-Quality Surface Splatting on Today's GPUs. In: *Symposium on Point-Based Graphics (PBG)*.
- [111] Boumal, N., Voroninski, V., and Bandeira, A. 2016. The non-convex Burer–Monteiro approach works on smooth semidefinite programs. Pages 2757–2765 of: *Conf. Neural Information Processing Systems (NIPS)*.
- [112] Boumal, Nicolas. 2013. On intrinsic Cramér-Rao bounds for Riemannian submanifolds and quotient manifolds. *IEEE transactions on signal processing*, **61**(7), 1809–1821.
- [113] Boumal, Nicolas. 2023. *An introduction to optimization on smooth manifolds*.
- [114] Bowman, S.L., Atanasov, N., Daniilidis, K., and Pappas, G.J. 2017. Probabilistic data association for semantic SLAM. Pages 1722–1729 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [115] Boyle, Michael. 2017. The Integration of Angular Velocity. *Advances in Applied Clifford Algebras*, **27**(3), 2345–2374.
- [116] Bradbury, James, Frostig, Roy, Hawkins, Peter, Johnson, Matthew James, Leary, Chris, Maclaurin, Dougal, Necula, George, Paszke, Adam, VanderPlas, Jake, Wanderman-Milne, Skye, and Zhang, Qiao. 2018. *JAX: composable transformations of Python+NumPy programs*.



- [117] Brandli, Christian, Berner, Raphael, Yang, Minhao, Liu, Shih-Chii, and Delbruck, Tobi. 2014. A 240x180 130dB 3 $\mu$ s Latency Global Shutter Spatiotemporal Vision Sensor. *IEEE J. Solid-State Circuits*, **49**(10), 2333–2341.
- [118] Brandão, Martim, Aladag, Omer Burak, and Havoutis, Ioannis. 2020. GaitMesh: Controller-Aware Navigation Meshes for Long-Range Legged Locomotion Planning in Multi-Layered Environments. *IEEE Robotics and Automation Letters*, **5**(2), 3596–3603.
- [119] Bregler, Christoph, Hertzmann, Aaron, and Biermann, Henning. 2000. Recovering non-rigid 3D shape from image streams. In: *CVPR*.
- [120] Briales, J., and Gonzalez-Jimenez, J. 2016 (Oct). Fast global optimality verification in 3D SLAM. Pages 4630–4636 of: *IEEE/RSSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*.
- [121] Briales, Jesus, and Gonzalez-Jimenez, Javier. 2017. Convex Global 3D Registration with Lagrangian Duality. In: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [122] Briales, Jesus, Kneip, Laurent, and Gonzalez-Jimenez, Javier. 2018. A Certifiably Globally Optimal Solution to the Non-Minimal Relative Pose Problem. In: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [123] Brogan, William L. 1991. *Modern Control Theory*. Upper Saddle River, NJ: Prentice Hall.
- [124] Brohan, Anthony, Brown, Noah, Carbajal, Justice, Chebotar, Yevgen, Dabis, Joseph, Finn, Chelsea, Gopalakrishnan, Keerthana, Hausman, Karol, Herzog, Alex, Hsu, Jasmine, Ibarz, Julian, Ichter, Brian, Irpan, Alex, Jackson, Tomas, Jesmonth, Sally, Joshi, Nikhil, Julian, Ryan, Kalashnikov, Dmitry, Kuang, Yuheng, Leal, Isabel, Lee, Kuang-Huei, Levine, Sergey, Lu, Yao, Malla, Utsav, Manjunath, Deeksha, Mordatch, Igor, Nachum, Ofir, Parada, Carolina, Peralta, Jodilyn, Perez, Emily, Pertsch, Karl, Quiambao, Jornell, Rao, Kanishka, Ryoo, Michael, Salazar, Grecia, Sanketi, Pannag, Sayed, Kevin, Singh, Jaspiar, Sontakke, Sumedh, Stone, Austin, Tan, Clayton, Tran, Huong, Vanhoucke, Vincent, Vega, Steve, Vuong, Quan, Xia, Fei, Xiao, Ted, Xu, Peng, Xu, Sichun, Yu, Tianhe, and Zitkovich, Brianna. 2022. RT-1: Robotics Transformer for Real-World Control at Scale. In: *arXiv preprint arXiv:2212.06817*.
- [125] Brohan, Anthony, Brown, Noah, Carbajal, Justice, Chebotar, Yevgen, Chen, Xi, Choromanski, Krzysztof, Ding, Tianli, Driess, Danny, Dubey, Avinava, Finn, Chelsea, Florence, Pete, Fu, Chuyuan, Arenas, Montse Gonzalez, Gopalakrishnan, Keerthana, Han, Kehang, Hausman, Karol, Herzog, Alex, Hsu, Jasmine, Ichter, Brian, Irpan, Alex, Joshi, Nikhil, Julian, Ryan, Kalashnikov, Dmitry, Kuang, Yuheng, Leal, Isabel, Lee, Lisa, Lee, Tsang-Wei Edward, Levine, Sergey, Lu, Yao, Michalewski, Henryk, Mordatch, Igor, Pertsch, Karl, Rao, Kanishka, Reymann, Krista, Ryoo, Michael, Salazar, Grecia, Sanketi, Pannag, Sermanet, Pierre, Singh, Jaspiar, Singh, Anikait, Soricut, Radu, Tran, Huong, Vanhoucke, Vincent, Vuong, Quan, Wahid, Ayzaan, Welker, Stefan, Wohlhart, Paul, Wu, Jialin, Xia, Fei, Xiao, Ted, Xu, Peng, Xu, Sichun, Yu, Tianhe, and Zitkovich, Brianna. 2023. RT-2: Vision-Language-Action Models Transfer Web Knowledge to Robotic Control. In: *arXiv preprint arXiv:2307.15818*.
- [126] Brossard, Martin, Barrau, Axel, Chauchat, Paul, and Bonnabel, Silvére. 2022. Associating Uncertainty to Extended Poses for on Lie Group IMU

- Preintegration With Rotating Earth. *IEEE Trans. Robotics*, **38**(2), 998–1015.
- [127] Brune, Marvin, Meisen, Tobias, and Pomp, André. 2024. Survey of Deep Learning-Based Methods for FMCW Radar Odometry and Ego-Localization. *Applied Sciences*, **14**(6).
  - [128] Brynte, Lucas, Larsson, Viktor, Iglesias, José Pedro, Olsson, Carl, and Kahl, Fredrik. 2021. On the Tightness of Semidefinite Relaxations for Rotation Estimation. *Journal of Mathematical Imaging and Vision*, **64**(1), 57–67.
  - [129] Buchanan, Russell, Agrawal, Varun, Camurri, Marco, Dellaert, Frank, and Fallon, Maurice. 2023. Deep IMU Bias Inference for Robust Visual-Inertial Odometry With Factor Graphs. *IEEE Robotics and Automation Letters*, **8**(1), 41–48.
  - [130] Burer, S., and Monteiro, R. 2004. Local Minima and Convergence in Low-Rank Semidefinite Programming. *Mathematical Programming*, **103**(3), 427–444.
  - [131] Burer, Samuel, and Monteiro, Renato D C. 2003. A nonlinear programming algorithm for solving semidefinite programs via low-rank factorization. *Mathematical Programming*, **95**(2), 329–357.
  - [132] Burner, Levi, Mitrokhin, Anton, Fermüller, Cornelia, and Aloimonos, Yiannis. 2022. EVIMO2: An Event Camera Dataset for Motion Segmentation, Optical Flow, Structure from Motion, and Visual Inertial Odometry in Indoor Scenes with Monocular or Stereo Algorithms. *arXiv preprint*, May.
  - [133] Burnett, Keenan, Wu, Yuchen, Yoon, David J., Schoellig, Angela P., and Barfoot, Timothy D. 2022. Are We Ready for Radar to Replace Lidar in All-Weather Mapping and Localization? *IEEE Robotics and Automation Letters*, **7**(4), 10328–10335.
  - [134] Burnett, Keenan, Yoon, David J, Wu, Yuchen, Li, Andrew Zou, Zhang, Haowei, Lu, Shichen, Qian, Jingxing, Tseng, Wei-Kang, Lambert, Andrew, Leung, Keith YK, Schoellig, Angela P, and Barfoot, Timothy D. 2023. Boreas: A Multi-Season Autonomous Driving Dataset. *Intl. J. of Robotics Research*, **42**(12), 33–42.
  - [135] Burnett, Keenan, Schoellig, Angela P., and Barfoot, Timothy D. 2024. *Continuous-Time Radar-Inertial and Lidar-Inertial Odometry using a Gaussian Process Motion Prior*.
  - [136] Burnett, Keenan, Schoellig, Angela P., and Barfoot, Timothy D. 2025. IMU as an input versus a measurement of the state in inertial-aided state estimation. *Robotica*, 1–21.
  - [137] Burri, Michael, Nikolic, Janosch, Gohl, Pascal, Schneider, Thomas, Rehder, Joern, Omari, Sammy, Achtelik, Markus W, and Siegwart, Roland. 2016. The EuRoC micro aerial vehicle datasets. *Intl. J. of Robotics Research*, **35**(10), 1157–1163.
  - [138] Bustos, Á. P., and Chin, T. J. 2018. Guaranteed outlier removal for point cloud registration with correspondences. *IEEE Trans. Pattern Anal. Machine Intell.*, **40**(12), 2868–2882.
  - [139] Bustos, Alvaro Parra, Chin, Tat-Jun, Neumann, Frank, Friedrich, Tobias, and Katzmann, Maximilian. 2019. A Practical Maximum Clique Algorithm for Matching with Pairwise Constraints. *arXiv preprint arXiv:1902.01534*.
  - [140] Bylow, Erik, Sturm, Jürgen, Kerl, Christian, Kahl, Fredrik, and Cremers,

- Daniel. 2013. Real-time camera tracking and 3D reconstruction using signed distance functions. Page 2 of: *Robotics: Science and Systems (RSS)*, vol. 2.
- [141] Cabon, Yann, Stofl, Lucas, Antsfeld, Leonid, Csurka, Gabriela, Chidlovskii, Boris, Revaud, Jérôme, and Leroy, Vincent. 2025. *MUST3R: Multi-view Network for Stereo 3D Reconstruction*.
- [142] Cadena, Cesar, Carlone, Luca, Carrillo, Henry, Latif, Yasir, Scaramuzza, Davide, Neira, José, Reid, Ian, and Leonard, John J. 2016. Past, present, and future of simultaneous localization and mapping: Toward the robust-perception age. *IEEE Trans. Robotics*, **32**(6), 1309–1332.
- [143] Caesar, Holger, Bankiti, Varun, Lang, Alex H, Vora, Sourabh, Liong, Venice Erin, Xu, Qiang, Krishnan, Anush, Pan, Yu, Baldan, Giancarlo, and Beijbom, Oscar. 2020. nuscenes: A multimodal dataset for autonomous driving. Pages 11621–11631 of: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [144] Cai, Hongrui, Feng, Wanquan, Feng, Xuetao, Wang, Yan, and Zhang, Juyong. 2022a. Neural Surface Reconstruction of Dynamic Scenes with Monocular RGB-D Camera. In: *Advances in Neural Information Processing Systems (NIPS)*.
- [145] Cai, Kaiwen, Wang, Bing, and Lu, Chris Xiaoxuan. 2022b. AutoPlace: Robust Place Recognition with Single-chip Automotive Radar. Pages 2222–2228 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [146] Callmer, Jonas, Törnqvist, David, Gustafsson, Fredrik, Svensson, Henrik, and Carlbom, Pelle. 2011. Radar SLAM using visual features. *EURASIP Journal on Advances in Signal Processing*, **2011**(09), 1–11.
- [147] Calonder, Michael, Lepetit, Vincent, Strecha, Christoph, and Fua, Pascal. 2010. BRIEF: Binary Robust Independent Elementary Features. Pages 778–792 of: *European Conference on Computer Vision (ECCV)*.
- [148] Campos, Carlos, Elvira, Richard, Rodríguez, Juan J Gómez, Montiel, José MM, and Tardós, Juan D. 2021. Orb-slam3: An accurate open-source library for visual, visual-inertial, and multimap slam. *IEEE Trans. Robotics*, **37**(6), 1874–1890.
- [149] Camurri, Marco, Fallon, Maurice, Bazeille, Stéphane, Radulescu, Andreea, Barasuol, Victor, Caldwell, Darwin G., and Semini, Claudio. 2017. Probabilistic Contact Estimation and Impact Detection for State Estimation of Quadruped Robots. *IEEE Robotics and Automation Letters*, **2**(2), 1023–1030.
- [150] Camurri, Marco, Ramezani, Milad, Nobili, Simona, and Fallon, Maurice. 2020. Pronto: A Multi-Sensor State Estimator for Legged Robots in Real-World Scenarios. *Frontiers in Robotics and AI*, **7**.
- [151] Cao, Shaozu, Lu, Xiuyuan, and Shen, Shaojie. 2022. GVINS: Tightly Coupled GNSS–Visual–Inertial Fusion for Smooth and Consistent State Estimation. *IEEE Trans. Robotics*, **38**(4), 2004–2021.
- [152] Carion, Nicolas, Massa, Francisco, Synnaeve, Gabriel, Usunier, Nicolas, Kirillov, Alexander, and Zagoruyko, Sergey. 2020. End-to-End Object Detection with Transformers. In: *ECCV*.
- [153] Carlone, L. 2023. Estimation Contracts for Outlier-Robust Geometric Perception. *Foundations and Trends (FnT) in Robotics*, *arXiv preprint: 2208.10521*. .

- [154] Carlone, L., and Censi, A. 2014. From Angular Manifolds to the Integer Lattice: Guaranteed Orientation Estimation With Application to Pose Graph Optimization. *IEEE Trans. Robotics*, **30**(2), 475–492. (datasets: ).
- [155] Carlone, L., and Dellaert, F. 2015. Duality-based Verification Techniques for 2D SLAM. Pages 4589–4596 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*. .
- [156] Carlone, L., and Karaman, S. 2018. Attention and Anticipation in Fast Visual-Inertial Navigation. *IEEE Trans. Robotics*. arxiv preprint: 1610.03344, .
- [157] Carlone, L., Rosen, D.M., Calafiore, G.C., Leonard, J.J., and Dellaert, F. 2015a. Lagrangian Duality in 3D SLAM: Verification Techniques and Optimal Solutions. Pages 125–132 of: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*. (datasets: ) (supplemental material: ).
- [158] Carlone, L., Calafiore, G., and Dellaert, F. 2015b. Pose Graph Optimization in the Complex Domain: Lagrangian Duality and Optimal Solutions. In: *Robotics: Science and Systems (RSS), Workshop “Reviewing the review process”*. .
- [159] Carlone, Luca, and Calafiore, Giuseppe C. 2018. Convex relaxations for pose graph optimization with outliers. *IEEE Robotics and Automation Letters*, **3**(2), 1160–1167.
- [160] Caron, Mathilde, Touvron, Hugo, Misra, Ishan, Jégou, Hervé, Mairal, Julien, Bojanowski, Piotr, and Joulin, Armand. 2021. Emerging properties in self-supervised vision transformers. Pages 9650–9660 of: *Intl. Conf. on Computer Vision (ICCV)*.
- [161] Carr, J. C., Beatson, R. K., Cherrie, J. B., Mitchell, T. J., Fright, W. R., McCallum, B. C., and Evans, T. R. 2001. Reconstruction and representation of 3D objects with radial basis functions. Pages 67–76 of: *Intl. Conf. on Computer Graphics and Interactive Techniques (SIGGRAPH)*. Association for Computing Machinery.
- [162] Cattaneo, Daniele, Vaghi, Matteo, and Valada, Abhinav. 2022. Lcdnet: Deep loop closure detection and point cloud registration for lidar slam. *IEEE Trans. Robotics*, **38**(4), 2074–2093.
- [163] Cazals, Frédéric, and Giesen, Joachim. 2006. *Delaunay Triangulation Based Surface Reconstruction*. Springer Berlin Heidelberg. Pages 231–276.
- [164] Cen, Sarah H., and Newman, Paul. 2018. Precise Ego-Motion Estimation with Millimeter-Wave Radar Under Diverse and Challenging Conditions. Pages 6045–6052 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*. IEEE.
- [165] Censi, A. 2007. An accurate closed-form estimate of ICP’s covariance. In: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [166] Censi, Andrea, and Scaramuzza, Davide. 2014. Low-Latency Event-Based Visual Odometry. Pages 703–710 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [167] Chadwick, Jeffrey N, and Bindel, David S. 2015. An efficient solver for sparse linear systems based on rank-structured Cholesky factorization. *arXiv preprint arXiv:1507.05593*.
- [168] Chakravarthi, Bharatesh, Verma, Aayush Atul, Daniilidis, Kostas, Fermüller, Cornelia, and Yang, Yezhou. 2024. Recent Event Camera Innovations: A Survey. In: *European Conf. on Computer Vision Workshops*.

- [169] Chaney, Kenneth, Cladera, Fernando, Wang, Ziyun, Bisulco, Anthony, Hsieh, M. Ani, Korpela, Christopher, Kumar, Vijay, Taylor, Camillo J., and Daniilidis, Kostas. 2023. M3ED: Multi-Robot, Multi-Sensor, Multi-Environment Event Dataset. Pages 4016–4023 of: *IEEE/CVF Conf. on Computer Vision and Pattern Recognition Workshops*.
- [170] Chang, Haonan, Boyalakuntla, Kowndinya, Lu, Shiyang, Cai, Siwei, Jing, Eric Pu, Keskar, Shreesh, Geng, Shijie, Abbas, Adeeb, Zhou, Lifeng, Bekris, Kostas, and Boulariou, Abdeslam. 2023a. Context-Aware Entity Grounding with Open-Vocabulary 3D Scene Graphs. In: *7th Annual Conference on Robot Learning*.
- [171] Chang, Y., Ebadi, K., Denniston, C., Ginting, M. Fadhil, Rosinol, A., Reinke, A., Palieri, M., Shi, J., A, Chatterjee, Morrell, B., Agha-mohammadi, A., and Carlone, L. 2022. LAMP 2.0: A Robust Multi-Robot SLAM System for Operation in Challenging Large-Scale Underground Environments. *IEEE Robotics and Automation Letters*, **7**(4), 9175–9182. .
- [172] Chang, Y., Ballotta, L., and Carlone, L. 2023b. D-Lite: Navigation-Oriented Compression of 3D Scene Graphs under Communication Constraints. *IEEE Robotics and Automation Letters*.
- [173] Chang, Y., Hughes, N., Ray, A., and Carlone, L. 2023c. Hydra-Multi: Collaborative Online Construction of 3D Scene Graphs with Multi-Robot Teams. In: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*.
- [174] Chang, Y., Fermoselle, L., Ta, D., Bucher, B., Carlone, L., and Wang, J. 2025. ASHiTA: Automatic Scene-grounded HIERarchical Task Analysis. In: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [175] Charatan, David, Li, Sizhe, Tagliasacchi, Andrea, and Sitzmann, Vincent. 2024. pixelSplat: 3D Gaussian Splats from Image Pairs for Scalable Generalizable 3D Reconstruction. In: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [176] Charrow, Benjamin, Kahn, Gregory, Patil, Sachin, Liu, Sikang, Goldberg, Ken, Abbeel, Pieter, Michael, Nathan, and Kumar, Vijay. 2015. Information-Theoretic Planning with Trajectory Optimization for Dense 3D Mapping. In: *Robotics: Science and Systems (RSS)*.
- [177] Chatfield, Averil B. 1997. *Fundamentals of High Accuracy Inertial Navigation*. AIAA.
- [178] Chatila, Raja, and Laumond, Jean-Paul. 1985. Position referencing and consistent world modeling for mobile robots. Pages 138–145 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [179] Chatterjee, A., and Govindu, V. M. 2013. Efficient and Robust Large-Scale Rotation Averaging. Pages 521–528 of: *Intl. Conf. on Computer Vision (ICCV)*.
- [180] Chebrolu, Nived, Läbe, Thomas, Vysotska, Olga, Behley, Jens, and Stachniss, Cyrill. 2020. Adaptive Robust Kernels for Non-Linear Least Squares Problems. *arXiv preprint arXiv:2004.14938*.
- [181] Chebrolu, Nived, Magistri, Federico, Läbe, Thomas, and Stachniss, Cyrill. 2021. Registration of spatio-temporal point clouds of plants for phenotyping. *PLOS ONE*, **16**(2), e0247243.
- [182] Checchin, Paul, Gérossier, Franck, Blanc, Christophe, Chapuis, Roland, and Trassoudaine, Laurent. 2010. Radar Scan Matching SLAM Using the Fourier-Mellin Transform. Pages 151–161 of: Howard, Andrew, Iagnemma,

- Karl, and Kelly, Alonzo (eds), *Field and Service Robotics*. Berlin, Heidelberg: Springer Berlin Heidelberg.
- [183] Chen, B., Xu, Z., Kirmani, S., Ichter, B., Sadigh, D., Guibas, L., and Xia, F. 2024a. SpatialVLM: Endowing Vision-Language Models with Spatial Reasoning Capabilities. Pages 14455–14465 of: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
  - [184] Chen, Boyuan, Xia, Fei, Ichter, Brian, Rao, Kanishka, Gopalakrishnan, Keerthana, Ryoo, Michael S, Stone, Austin, and Kappler, Daniel. 2023a. Open-vocabulary queryable scene representations for real world planning. Pages 11509–11522 of: *2023 IEEE International Conference on Robotics and Automation (ICRA)*. IEEE.
  - [185] Chen, Changhao, Lu, Xiaoxuan, Markham, Andrew, and Trigoni, Niki. 2018. Ionet: Learning to cure the curse of drift in inertial odometry. In: *Proceedings of the AAAI Conference on Artificial Intelligence*, vol. 32.
  - [186] Chen, Chuchu, Geneva, Patrick, Peng, Yuxiang, Lee, Woosik, and Huang, Guoquan. 2023b. Optimization-Based VINS: Consistency, Marginalization, and FEJ. Pages 1517–1524 of: *2023 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*.
  - [187] Chen, Chuchu, Peng, Yuxiang, and Huang, Guoquan. 2024b (May). Fast and Consistent Covariance Recovery for Sliding-window Optimization-based VINS. In: *Proc. International Conference on Robotics and Automation*.
  - [188] Chen, Hansheng, Wang, Pichao, Wang, Fan, Tian, Wei, Xiong, Lu, and Li, Hao. 2022a. EPro-PnP: Generalized End-to-End Probabilistic Perspective-n-Points for Monocular Object Pose Estimation. Pages 2781–2790 of: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
  - [189] Chen, Peiyu, Guan, Weipeng, and Lu, Peng. 2023c. ESPIO: Event-based Stereo Visual Inertial Odometry. *IEEE Robotics and Automation Letters*, 8(6), 3661–3668.
  - [190] Chen, Tianqi, Li, Mu, Li, Yutian, Lin, Min, Wang, Naiyan, Wang, Minjie, Xiao, Tianjun, Xu, Bing, Zhang, Chiyuan, and Zhang, Zheng. 2015. Mxnet: A flexible and efficient machine learning library for heterogeneous distributed systems. *arXiv preprint arXiv:1512.01274*.
  - [191] Chen, Ting, Kornblith, Simon, Norouzi, Mohammad, and Hinton, Geoffrey. 2020. A Simple Framework for Contrastive Learning of Visual Representations. Pages 1597–1607 of: *Proceedings of the 37th International Conference on Machine Learning*, vol. 119. PMLR.
  - [192] Chen, X., Milioto, A., Palazzolo, E., Giguère, P., Behley, J., and Stachniss, C. 2019a. SuMa++: Efficient LiDAR-based Semantic SLAM. In: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*.
  - [193] Chen, Xiangyu, Yang, Fan, and Wang, Chen. 2024c. iA\*: Imperative Learning-based A\* Search for Pathfinding. *arXiv preprint arXiv:2403.15870*.
  - [194] Chen, Xieyuanli, Milioto, Andres, Palazzolo, Emanuele, Giguere, Philippe, Behley, Jens, and Stachniss, Cyrill. 2019b. Suma++: Efficient lidar-based semantic slam. Pages 4530–4537 of: *2019 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. IEEE.
  - [195] Chen, Xieyuanli, Läbe, Thomas, Milioto, Andres, Röhling, Timo, Behley, Jens, and Stachniss, Cyrill. 2022b. OverlapNet: A siamese network for computing LiDAR scan similarity with applications to loop closing and localization. *Autonomous Robots*, 1–21.

- [196] Chen, Y., Davis, T.A., Hager, W.W., and Rajamanickam, S. 2008. Algorithm 887: CHOLMOD, Supernodal Sparse Cholesky Factorization and Update/-Downdate. *ACM Trans. Math. Softw.*, **35**(3), 22:1–22:14.
- [197] Chen, Yongbo, Huang, Shoudong, Zhao, Liang, and Dissanayake, Gamini. 2021. Cramér–Rao bounds and optimal design metrics for pose-graph SLAM. *IEEE Trans. Robotics*, **37**(2), 627–641.
- [198] Chen, Yuedong, Xu, Haoifei, Zheng, Chuanxia, Zhuang, Bohan, Pollefeys, Marc, Geiger, Andreas, Cham, Tat-Jen, and Cai, Jianfei. 2024d. MVSplat: Efficient 3D Gaussian Splatting from Sparse Multi-View Images. *European Conf. on Computer Vision (ECCV)*.
- [199] Chen, Zhiqin, and Zhang, Hao. 2019. Learning implicit fields for generative shape modeling. In: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [200] Cheng, Q, Zeller, N, and Cremers, D. 2022a. Vision-Based Large-scale 3D Semantic Mapping for Autonomous Driving Applications. Pages 9235–9242 of: *International Conference on Robotics and Automation (ICRA)*.
- [201] Cheng, Q., Zeller, N., and Cremers, D. 2022b. Vision-Based Large-scale 3D Semantic Mapping for Autonomous Driving Applications. In: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [202] Cheng, Tianheng, Song, Lin, Ge, Yixiao, Liu, Wenyu, Wang, Xinggang, and Shan, Ying. 2024. YOLO-World: Real-Time Open-Vocabulary Object Detection. In: *Proc. IEEE Conf. Computer Vision and Pattern Recognition (CVPR)*.
- [203] Cheng, Yuwei, Su, Jingran, Jiang, Mengxin, and Liu, Yimin. 2022c. A Novel Radar Point Cloud Generation Method for Robot Environment Perception. *IEEE Trans. Robotics*.
- [204] Chhatkuli, Ajad, Pizarro, Daniel, and Bartoli, Adrien. 2014. Non-Rigid Shape-from-Motion for Isometric Surfaces using Infinitesimal Planarity. In: *BMVC*.
- [205] Chhatkuli, Ajad, Pizarro, Daniel, Collins, Toby, and Bartoli, Adrien. 2016. Inextensible Non-Rigid Shape-from-Motion by second-order cone programming. In: *CVPR*.
- [206] Chhatkuli, Ajad, Pizarro, Daniel, Bartoli, Adrien, and Collins, Toby. 2017. A stable analytical framework for isometric shape-from-template by surface integration. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, **39**(5), 833–850.
- [207] Chi, Cheng, Xu, Zhenjia, Feng, Siyuan, Cousineau, Eric, Du, Yilun, Burchfiel, Benjamin, Tedrake, Russ, and Song, Shuran. 2024a. Diffusion Policy: Visuomotor Policy Learning via Action Diffusion. *The International Journal of Robotics Research*.
- [208] Chi, Cheng, Xu, Zhenjia, Pan, Chuer, Cousineau, Eric, Burchfiel, Benjamin, Feng, Siyuan, Tedrake, Russ, and Song, Shuran. 2024b. Universal Manipulation Interface: In-The-Wild Robot Teaching Without In-The-Wild Robots. In: *Proceedings of Robotics: Science and Systems (RSS)*.
- [209] Chiang, Hao-Tien, Lewis, Xu, Zhuo, Fu, Zipeng, Jacob, Mithun George, Zhang, Tingnan, Lee, Tsang-Wei Edward, Yu, Wenhao, Schenck, Connor, Rendleman, David, Shah, Dhruv, et al. 2024. Mobility vla: Multimodal instruction navigation with long-context vlms and topological graphs. *arXiv preprint arXiv:2407.07775*.

- [210] Chilian, Annett, Hirschmüller, Heiko, and Görner, Martin. 2011. Multisensor data fusion for robust pose estimation of a six-legged walking robot. Pages 2497–2504 of: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*.
- [211] Chin, T., Kee, Y. H., Eriksson, A., and Neumann, F. 2016 (June). Guaranteed Outlier Removal with Mixed Integer Linear Programs. Pages 5858–5866 of: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [212] Chin, Tat-Jun, Bagchi, Samya, Eriksson, Anders P., and van Schaik, André. 2019. Star Tracking using an Event Camera. Pages 1646–1655 of: *IEEE/CVF Conf. on Computer Vision and Pattern Recognition Workshops*.
- [213] Chirikjian, G. S. 2009. *Stochastic Models, Information Theory, and Lie Groups, Volume 1: Classical Results and Geometric Methods (Applied and Numerical Harmonic Analysis)*. Birkhauser.
- [214] Chirikjian, G. S. 2012. *Stochastic Models, Information Theory, and Lie Groups, Volume 2: Analytic Methods and Modern Applications (Applied and Numerical Harmonic Analysis)*. Birkhauser.
- [215] Chirikjian, G. S., and Kyatkin, A. B. 2001. *Engineering Applications of Non-commutative Harmonic Analysis: With Emphasis on Rotation and Motion Groups*. Boca Raton: CRC Press.
- [216] Chitta, Sachin, Vemaza, Paul, Geykhman, Roman, and Lee, Daniel D. 2007. Proprioceptive localization for a quadrupedal robot on known terrain. Pages 4582–4587 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [217] Chiuso, A., Favaro, P., Jin, Hailin, and Soatto, S. 2002. Structure from motion causally integrated over time. *IEEE Trans. Pattern Anal. Machine Intell.*, **24**(4), 523–535.
- [218] Cho, Younggun, Kim, Giseop, and Kim, Ayoung. 2020. Unsupervised Geometry-Aware Deep LiDAR Odometry. Pages 2145–2152 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [219] Cho, Younghun, Kim, Giseop, Lee, Sangmin, and Ryu, Jee-Hwan. 2022. Openstreetmap-based lidar global localization in urban environment without a prior lidar map. *IEEE Robotics and Automation Letters*, **7**(2), 4999–5006.
- [220] Choi, Minseong, Yang, Seunghoon, Han, Seungho, Lee, Yeongseok, Lee, Minyoung, Choi, Keun Ha, and Kim, Kyung-Soo. 2023. MSC-RAD4R: ROS-Based Automotive Dataset With 4D Radar. *IEEE Robotics and Automation Letters*, **8**(11), 7194–7201.
- [221] Choset, Howie, and Nagatani, Keiji. 2001. Topological simultaneous localization and mapping (SLAM): toward exact localization without explicit localization. *IEEE Trans. Robot. Automat.*, **17**(2), 125 – 137.
- [222] Choy, Christopher B, Gwak, JunYoung, Savarese, Silvio, and Chandraker, Manmohan. 2016. Universal correspondence network. *Advances in neural information processing systems*, **29**.
- [223] Chum, O., and Matas, J. 2005. Matching with PROSAC - Progressive Sample Consensus. In: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [224] Chum, Ondřej, Matas, Jiří, and Kittler, Josef. 2003. Locally optimized RANSAC. Pages 236–243 of: *Joint Pattern Recognition Symposium*. Springer.
- [225] Chung, Junyoung, Gulcehre, Caglar, Cho, KyungHyun, and Bengio, Yoshua.



2014. Empirical evaluation of gated recurrent neural networks on sequence modeling. *arXiv preprint arXiv:1412.3555*.
- [226] Chung, Timothy H., Orekhov, Viktor, and Maio, Angela. 2023. Into the Robotic Depths: Analysis and Insights from the DARPA Subterranean Challenge. *Annual Review of Control, Robotics, and Autonomous Systems*, **6**(1).
- [227] Churchill, Winston, and Newman, Paul. 2013. Experience-based navigation for long-term localisation. *Intl. J. of Robotics Research*, **32**(14), 1645–1661.
- [228] Cioffi, Giovanni, Bauersfeld, Leonard, Kaufmann, Elia, and Scaramuzza, Davide. 2023. Learned inertial odometry for autonomous drone racing. *IEEE Robotics and Automation Letters*, **8**(5), 2684–2691.
- [229] Cipolla, Roberto, Gal, Yarin, and Kendall, Alex. 2018. Multi-task Learning Using Uncertainty to Weigh Losses for Scene Geometry and Semantics. Pages 7482–7491 of: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [230] Civera, Javier, Grasa, Oscar G., Davison, Andrew J., and Montiel, J. M. M. 2010. 1-Point RANSAC for extended Kalman filtering: Application to real-time structure from motion and visual odometry. *J. of Field Robotics*, **27**(5), 609–631.
- [231] Clark, J.H. 1976. Hierarchical geometric models for visible surface algorithms. *Communications of the ACM*, **19**(1), 547–554.
- [232] Clark, Steve, and Durrant-Whyte, Hugh. 1998. Autonomous land vehicle navigation using millimeter wave radar. Pages 3697–3702 of: *Proceedings. 1998 IEEE International Conference on Robotics and Automation (Cat. No. 98CH36146)*, vol. 4. IEEE.
- [233] Cohen, Nadav, and Klein, Itzik. 2024. *Inertial Navigation Meets Deep Learning: A Survey of Current Trends and Future Directions*.
- [234] Collaboration, Open X-Embodiment, O'Neill, Abby, Rehman, Abdul, Gupta, Abhinav, Maddukuri, Abhiram, Gupta, Abhishek, Padalkar, Abhishek, Lee, Abraham, Pooley, Acorn, Gupta, Agrim, Mandlekar, Ajay, Jain, Ajinkya, Tung, Albert, Bewley, Alex, Herzog, Alex, Irpan, Alex, Khazatsky, Alexander, Rai, Anant, Gupta, Anchit, Wang, Andrew, Kolobov, Andrey, Singh, Anikait, Garg, Animesh, Kembhavi, Aniruddha, Xie, Annie, Brohan, Anthony, Raffin, Antonin, Sharma, Archit, Yavary, Arefeh, Jain, Arhan, Balakrishna, Ashwin, Wahid, Ayzaan, Burgess-Limerick, Ben, Kim, Beomjoon, Schölkopf, Bernhard, Wulfe, Blake, Ichter, Brian, Lu, Cewu, Xu, Charles, Le, Charlotte, Finn, Chelsea, Wang, Chen, Xu, Chenfeng, Chi, Cheng, Huang, Chenguang, Chan, Christine, Agia, Christopher, Pan, Chuer, Fu, Chuyuan, Devin, Coline, Xu, Danfei, Morton, Daniel, Driess, Danny, Chen, Daphne, Pathak, Deepak, Shah, Dhruv, Büchler, Dieter, Jayaraman, Dinesh, Kalashnikov, Dmitry, Sadigh, Dorsa, Johns, Edward, Foster, Ethan, Liu, Fangchen, Ceola, Federico, Xia, Fei, Zhao, Feiyu, Frueh, Felipe Vieira, Stulp, Freek, Zhou, Gaoyue, Sukhatme, Gaurav S., Salhotra, Gautam, Yan, Ge, Feng, Gilbert, Schiavi, Giulio, Berseth, Glen, Kahn, Gregory, Yang, Guangwen, Wang, Guanzhi, Su, Hao, Fang, Hao-Shu, Shi, Haochen, Bao, Henghui, Amor, Heni Ben, Christensen, Henrik I, Furuta, Hiroki, Bharadhwaj, Homanga, Walke, Homer, Fang, Hongjie, Ha, Huy, Mordatch, Igor, Radosavovic, Ilija, Leal, Isabel, Liang, Jacky, Abou-Chakra, Jad, Kim, Jaehyung, Drake, Jaimyn, Peters, Jan, Schneider, Jan, Hsu, Jasmine, Vakil,

- Jay, Bohg, Jeannette, Bingham, Jeffrey, Wu, Jeffrey, Gao, Jensen, Hu, Jiaheng, Wu, Jiajun, Wu, Jialin, Sun, Jiankai, Luo, Jianlan, Gu, Jiayuan, Tan, Jie, Oh, Jihoon, Wu, Jimmy, Lu, Jingpei, Yang, Jingyun, Malik, Jitendra, Silvério, João, Hejna, Joey, Booher, Jonathan, Tompson, Jonathan, Yang, Jonathan, Salvador, Jordi, Lim, Joseph J., Han, Junhyek, Wang, Kaiyuan, Rao, Kanishka, Pertsch, Karl, Hausman, Karol, Go, Keegan, Gopalakrishnan, Keerthana, Goldberg, Ken, Byrne, Kendra, Oslund, Kenneth, Kawaharazuka, Kento, Black, Kevin, Lin, Kevin, Zhang, Kevin, Ehsani, Kiana, Lekkala, Kiran, Ellis, Kirsty, Rana, Krishan, Srinivasan, Krishnan, Fang, Kuan, Singh, Kunal Pratap, Zeng, Kuo-Hao, Hatch, Kyle, Hsu, Kyle, Itti, Laurent, Chen, Lawrence Yunliang, Pinto, Lerrel, Fei-Fei, Li, Tan, Liam, Fan, Linxi "Jim", Ott, Lionel, Lee, Lisa, Weihs, Luca, Chen, Magnum, Lepert, Marion, Memmel, Marius, Tomizuka, Masayoshi, Itkina, Masha, Castro, Mateo Guaman, Spero, Max, Du, Maximilian, Ahn, Michael, Yip, Michael C., Zhang, Mingtong, Ding, Mingyu, Heo, Minho, Srirama, Mohan Kumar, Sharma, Mohit, Kim, Moo Jin, Kanazawa, Naoaki, Hansen, Nicklas, Heess, Nicolas, Joshi, Nikhil J, Suenderhauf, Niko, Liu, Ning, Palo, Norman Di, Shafiullah, Nur Muhammad Mahi, Mees, Oier, Kroemer, Oliver, Bastani, Osbert, Sanketi, Pannag R, Miller, Patrick "Tree", Yin, Patrick, Wohlhart, Paul, Xu, Peng, Fagan, Peter David, Mitrano, Peter, Sermanet, Pierre, Abbeel, Pieter, Sundaresan, Priya, Chen, Qiuyu, Vuong, Quan, Rafailov, Rafael, Tian, Ran, Doshi, Ria, Mart'in-Mart'in, Roberto, Baijal, Rohan, Scalise, Rosario, Hendrix, Rose, Lin, Roy, Qian, Runjia, Zhang, Ruohan, Mendonca, Russell, Shah, Rutav, Hoque, Ryan, Julian, Ryan, Bustamante, Samuel, Kirmani, Sean, Levine, Sergey, Lin, Shan, Moore, Sherry, Bahl, Shikhar, Dass, Shivin, Sonawani, Shubham, Tulsiani, Shubham, Song, Shuran, Xu, Sichun, Haldar, Siddhant, Karamcheti, Siddharth, Adebola, Simeon, Guist, Simon, Nasiriany, Soroush, Schaal, Stefan, Welker, Stefan, Tian, Stephen, Ramamoorthy, Subramanian, Dasari, Sudeep, Belkhale, Suneel, Park, Sungjae, Nair, Suraj, Mirchandani, Suvir, Osa, Takayuki, Gupta, Tanmay, Harada, Tatsuya, Matsushima, Tatsuya, Xiao, Ted, Kollar, Thomas, Yu, Tianhe, Ding, Tianli, Davchev, Todor, Zhao, Tony Z., Armstrong, Travis, Darrell, Trevor, Chung, Trinity, Jain, Vidhi, Kumar, Vikash, Vanhoucke, Vincent, Zhan, Wei, Zhou, Wenxuan, Burgard, Wolfram, Chen, Xi, Chen, Xiangyu, Wang, Xiaolong, Zhu, Xinghao, Geng, Xinyang, Liu, Xiyuan, Liangwei, Xu, Li, Xuanlin, Pang, Yansong, Lu, Yao, Ma, Yecheng Jason, Kim, Yejin, Chebotar, Yevgen, Zhou, Yifan, Zhu, Yifeng, Wu, Yilin, Xu, Ying, Wang, Yixuan, Bisk, Yonatan, Dou, Yongqiang, Cho, Yoonyoung, Lee, Youngwoon, Cui, Yuchen, Cao, Yue, Wu, Yueh-Hua, Tang, Yujin, Zhu, Yuke, Zhang, Yunchu, Jiang, Yunfan, Li, Yunshuang, Li, Yunzhu, Iwasawa, Yusuke, Matsuo, Yutaka, Ma, Zehan, Xu, Zhuo, Cui, Zichen Jeff, Zhang, Zichen, Fu, Zipeng, and Lin, Zipeng. 2023. *Open X-Embodiment: Robotic Learning Datasets and RT-X Models*. <https://arxiv.org/abs/2310.08864>.
- [235] Collins, T, and Bartoli, A. 2010. Locally affine and planar deformable surface reconstruction from video. In: *International Workshop on Vision, Modeling and Visualization*.
- [236] Collobert, Ronan, Bengio, Samy, and Mariéthoz, Johnny. 2002. *Torch: a modular machine learning software library*. Tech. rept. Idiap.

- [237] Cook, Matthew, Gugelmann, Luca, Jug, Florian, Krautz, Christoph, and Steger, Angelika. 2011. Interacting maps for fast visual interpretation. Pages 770–776 of: *Int. Joint Conf. Neural Netw. (IJCNN)*.
- [238] Cooper, Gregory F. 1990. *Artificial Intelligence*, **42**(2-3), 393–405.
- [239] Cootes, Timothy F., Taylor, Christopher J., Cooper, David H., and Graham, Jim. 1995. Active shape models - their training and application. *Comput. Vis. Image Underst.*, **61**(1), 38–59.
- [240] Crassidis, J.L. 2006. Sigma-point Kalman filtering for integrated GPS and inertial navigation. *IEEE Trans. Aerosp. Electron. Syst.*, **42**(2), 750–756.
- [241] Crowley, J.L. 1989. World modeling and position estimation for a mobile robot using ultra-sonic ranging. Pages 674–680 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [242] Curless, Brian, and Levoy, Marc. 1996. A volumetric method for building complex models from range images. Pages 303–312 of: *Intl. Conf. on Computer Graphics and Interactive Techniques (SIGGRAPH)*.
- [243] Czarnowski, J., Leutenegger, S., and Davison, A. J. 2017. Semantic Texture for Robust Dense Tracking. In: *Proceedings of the International Conference on Computer Vision Workshops (ICCVW)*.
- [244] Czarnowski, Jan, Laidlow, Tristan, Clark, Ronald, and Davison, Andrew J. 2020. Deepfactors: Real-time probabilistic dense monocular slam. *IEEE Robotics and Automation Letters*, **5**(2), 721–728.
- [245] Dai, A., Chang, A. X., Savva, M., Halber, M., Funkhouser, T., and Niessner, M. 2017a (Jul.). ScanNet: Richly-Annotated 3D Reconstructions of Indoor Scenes. Pages 2432–2443 of: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [246] Dai, Angela, Nießner, Matthias, Zollhöfer, Michael, Izadi, Shahram, and Theobalt, Christian. 2017b. BundleFusion: Real-Time Globally Consistent 3D Reconstruction Using On-the-Fly Surface Reintegration. *ACM Trans. on Graphics*, **36**(3).
- [247] Dai, Angela, Chang, Angel X., Savva, Manolis, Halber, Maciej, Funkhouser, Thomas, and Nießner, Matthias. 2017c. ScanNet: Richly-annotated 3D Reconstructions of Indoor Scene. In: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [248] Dai, Yuchao, Li, Hongdong, and He, Mingyi. 2014. A simple prior-free method for non-rigid structure-from-motion factorization. *International Journal of Computer Vision*, **107**(2), 101–122.
- [249] Davis, T.A. 2011. Algorithm 915: SuiteSparseQR, A multifrontal multi-threaded sparse QR factorization package. *ACM Trans. Math. Softw.*, **38**(1), 8:1–8:22.
- [250] Davis, T.A., Gilbert, J.R., Larimore, S.I., and Ng, E.G. 2004. A column approximate minimum degree ordering algorithm. *ACM Trans. Math. Softw.*, **30**(3), 353–376.
- [251] Davison, A. J., and Ortiz, J. 2019. FutureMapping 2: Gaussian Belief Propagation for Spatial AI. *arXiv preprint arXiv:1910.14139*.
- [252] Davison, A. J., Molton, N. D., Reid, I., and Stasse, O. 2007. MonoSLAM: Real-Time Single Camera SLAM. *IEEE Trans. Pattern Anal. Machine Intell.*, **29**(6), 1052–1067.
- [253] Davison, Andrew J. 2003 (Oct). Real-time simultaneous localisation and

- mapping with a single camera. Pages 1403–1410, vol. 2 of: *Intl. Conf. on Computer Vision (ICCV)*.
- [254] Davison, Andrew J. 2018. FutureMapping: The computational structure of spatial AI systems. *arXiv preprint arXiv:1803.11288*.
  - [255] De Martini, Daniele, Gadd, Matthew, and Newman, Paul. 2020. kRadar++: Coarse-to-Fine FMCW Scanning Radar Localisation. *Sensors*, **20**(21).
  - [256] Dechter, Rina, and Mateescu, Robert. 2007. AND/OR Search Spaces for Graphical Models. *Artificial Intelligence*, **171**(2-3), 73–106.
  - [257] Deems, Jeffrey S., Painter, Thomas H., and Finnegan, David C. 2013. Lidar measurement of snow depth: a review. *Journal of Glaciology*, **59**(215), 467–479.
  - [258] Dellaert, F. 2005. Square Root SAM: Simultaneous Location and Mapping via Square Root Information Smoothing. In: *Robotics: Science and Systems (RSS)*.
  - [259] Dellaert, F. 2021. Factor Graphs: Exploiting Structure in Robotics. *Annual Review of Control, Robotics, and Autonomous Systems*, **4**, 141–166.
  - [260] Dellaert, Frank. 2012. *Factor graphs and GTSAM: A hands-on introduction*. Tech. rept. Georgia Institute of Technology.
  - [261] Dellaert, Frank, and Contributors, GTSAM. 2022 (May). *GTSAM: Georgia Tech Smoothing and Mapping Library*. Georgia Tech Borg Lab.
  - [262] Dellaert, Frank, and Kaess, Michael. 2006. Square Root SAM: Simultaneous localization and mapping via square root information smoothing. *The International Journal of Robotics Research*, **25**(12), 1181–1203.
  - [263] Dellaert, Frank, Kaess, Michael, et al. 2017. Factor graphs for robot perception. *Foundations and Trends® in Robotics*, **6**(1-2), 1–139.
  - [264] Dellenbach, P., Deschaud, J., Jacquet, B., and Goulette, F. 2022. CT-ICP Real-Time Elastic LiDAR Odometry with Loop Closure. In: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
  - [265] Delmerico, Jeffrey, Cieslewski, Titus, Rebecq, Henri, Faessler, Matthias, and Scaramuzza, Davide. 2019. Are We Ready for Autonomous Drone Racing? The UZH-FPV Drone Racing Dataset. Pages 6713–6719 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
  - [266] Demmel, N, Sommer, C, Cremers, D, and Usenko, V. 2021a. Square Root Bundle Adjustment for Large-Scale Reconstruction. In: *IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*.
  - [267] Demmel, N, Schubert, D, Sommer, C, Cremers, D, and Usenko, V. 2021b. Square Root Marginalization for Sliding-Window Bundle Adjustment. In: *IEEE International Conference on Computer Vision (ICCV)*.
  - [268] Deng, Jia, Dong, Wei, Socher, Richard, Li, Li-Jia, Li, Kai, and Fei-Fei, Li. 2009. Imagenet: A large-scale hierarchical image database. Pages 248–255 of: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*. Ieee.
  - [269] Deng, Junyuan, Chen, Xieyuanli, Xia, Songpengcheng, Sun, Zhen, Liu, Guoqing, Yu, Wenxian, and Pei, Ling. 2023a. NeRF-LOAM: Neural Implicit Representation for Large-Scale Incremental LiDAR Odometry and Mapping. In: *Intl. Conf. on Computer Vision (ICCV)*.
  - [270] Deng, Tianchen, Xie, Hongle, Wang, Jingchuan, and Chen, Weidong. 2023b. Long-term visual simultaneous localization and mapping: Using a bayesian persistence filter-based global map prediction. *IEEE Robotics & Automation Magazine*, **30**(1), 36–49.

- [271] Deng, Yinan, Wang, Jiahui, Zhao, Jingyu, Tian, Xinyu, Chen, Guangyan, Yang, Yi, and Yue, Yufeng. 2024. OpenGraph: Open-Vocabulary Hierarchical 3D Graph Representation in Large-Scale Outdoor Environments. *IEEE Robotics and Automation Letters*, 9(10), 8402–8409.
- [272] Dennis, J.E., and Schnabel, R.B. 1983. *Numerical methods for unconstrained optimization and nonlinear equations*. Prentice-Hall.
- [273] Deschaud, J.-E. 2018. IMLS-SLAM: Scan-to-Model Matching Based on 3D Data. In: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [274] Deschênes, S.-P., Baril, D., Boxan, M., Laconte, J., Giguère, P., and Pomerleau, F. 2024. Saturation-Aware Angular Velocity Estimation: Extending the Robustness of SLAM to Aggressive Motions. In: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [275] DeTone, Daniel, Malisiewicz, Tomasz, and Rabinovich, Andrew. 2018. Superpoint: Self-supervised interest point detection and description. Pages 224–236 of: *IEEE/CVF Conf. on Computer Vision and Pattern Recognition Workshops*.
- [276] Devlin, Jacob, Chang, Ming-Wei, Lee, Kenton, and Toutanova, Kristina. 2019. BERT: Pre-training of deep bidirectional transformers for language understanding. Pages 4171–4186 of: *Proceedings of the 2019 conference of the North American chapter of the association for computational linguistics: human language technologies, volume 1 (long and short papers)*.
- [277] Dexheimer, E., and Davison, A. J. 2024. COMO: Compact Mapping and Odometry. In: *European Conf. on Computer Vision (ECCV)*.
- [278] Diebel, James. 2006. *Representing Attitude: Euler Angles, Unit Quaternions, and Rotation Vectors*. Tech. rept. Stanford University.
- [279] Dissanayake, MWM Gamini, Newman, Paul, Clark, Steve, Durrant-Whyte, Hugh F, and Csorba, Michael. 2001. A solution to the simultaneous localization and map building (SLAM) problem. *IEEE Transactions on robotics and automation*, 17(3), 229–241.
- [280] Doer, Christopher, and Trommer, Gert F. 2020. An EKF Based Approach to Radar Inertial Odometry. Pages 152–159 of: *2020 IEEE International Conference on Multisensor Fusion and Integration for Intelligent Systems (MFI)*.
- [281] Doer, Christopher, and Trommer, Gert F. 2021. Radar Visual Inertial Odometry and Radar Thermal Inertial Odometry: Robust Navigation even in Challenging Visual Conditions. Pages 331–338 of: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*.
- [282] Doherty, Kevin, Fourie, Dehann, and Leonard, John J. 2019. Multimodal Semantic SLAM with Probabilistic Data Association. In: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [283] Doherty, Kevin, Papalia, Alan, Huang, Yewei, Rosen, David, Englot, Brendan, and Leonard, John. 2024. MAC: Graph Sparsification by Maximizing Algebraic Connectivity. *arXiv preprint arXiv:2403.19879*.
- [284] Doherty, Kevin J, Lu, Ziqi, Singh, Kurran, and Leonard, John J. 2022. Discrete-Continuous Smoothing and Mapping. *IEEE Robotics and Automation Letters*, October.
- [285] Dong, Hang, and Barfoot, Timothy D. 2013. Lighting-invariant visual odometry using lidar intensity imagery and pose interpolation. Pages 327–342

- of: *Field and Service Robotics: Results of the 8th International Conference*. Springer.
- [286] Dosovitskiy, Alexey, Fischer, Philipp, Ilg, Eddy, Hausser, Philip, Hazirbas, Caner, Golkov, Vladimir, Van Der Smagt, Patrick, Cremers, Daniel, and Brox, Thomas. 2015. FlowNet: Learning optical flow with convolutional networks. Pages 2758–2766 of: *Intl. Conf. on Computer Vision (ICCV)*.
  - [287] Dosovitskiy, Alexey, Ros, German, Codevilla, Felipe, Lopez, Antonio, and Koltun, Vladlen. 2017. CARLA: An Open Urban Driving Simulator. In: *Conf. on Robot Learning (CoRL)*.
  - [288] Dosovitskiy, Alexey, Beyer, Lucas, Kolesnikov, Alexander, Weissenborn, Dirk, Zhai, Xiaohua, Unterthiner, Thomas, Dehghani, Mostafa, Minderer, Matthias, Heigold, Georg, Gelly, Sylvain, Uszkoreit, Jakob, and Hounsby, Neil. 2021. An Image is Worth 16x16 Words: Transformers for Image Recognition at Scale. *Intl. Conf. on Learning Representations (ICLR)*.
  - [289] Driess, Danny, Xia, Fei, Sajjadi, Mehdi S. M., Lynch, Corey, Chowdhery, Aakanksha, Ichter, Brian, Wahid, Ayzaan, Tompson, Jonathan, Vuong, Quan, Yu, Tianhe, Huang, Wenlong, Chebotar, Yevgen, Sermanet, Pierre, Duckworth, Daniel, Levine, Sergey, Vanhoucke, Vincent, Hausman, Karol, Toussaint, Marc, Greff, Klaus, Zeng, Andy, Mordatch, Igor, and Florence, Pete. 2023. PaLM-E: An Embodied Multimodal Language Model. In: *arXiv preprint arXiv:2303.03378*.
  - [290] Droschel, D., and Behnke, S. 2018. Efficient Continuous-Time SLAM for 3D Lidar-Based Online Mapping. In: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
  - [291] Duane, C Brown. 1971. Close-range camera calibration. *Photogramm. Eng.*, **37**(8), 855–866.
  - [292] Dubé, Renaud, Gawel, Abel, Sommer, Hannes, Nieto, Juan, Siegwart, Roland, and Cadena, Cesar. 2017. An online multi-robot SLAM system for 3D LiDARs. Pages 1004–1011 of: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*.
  - [293] Dubé, Renaud, Cramariuc, Andrei, Dugas, Daniel, Sommer, Hannes, Dymczyk, Marcin, Nieto, Juan, Siegwart, Roland, and Cadena, Cesar. 2020. SegMap: Segment-based mapping and localization using data-driven descriptors. *Intl. J. of Robotics Research*, **39**(2-3), 339–355.
  - [294] Duberg, D., and Jensfelt, P. 2020. UFOMap: An Efficient Probabilistic 3D Mapping Framework That Embraces the Unknown. *IEEE Robotics and Automation Letters*, **5**(4), 6411–6418.
  - [295] Duckett, T., Marsland, S., and Shapiro, J. 2002. Fast, On-line Learning of Globally Consistent Maps. *Autonomous Robots*, **12**(3), 287–300.
  - [296] Duff, I. S., and Reid, J. K. 1983. The Multifrontal Solution of Indefinite Sparse Symmetric Linear Systems. *ACM Trans. Math. Softw.*, **9**(3), 302–325.
  - [297] Duisterhof, Bardienus, Zust, Lojze, Weinzaepfel, Philippe, Leroy, Vincent, Cabon, Johann, and Revaud, Jérôme. 2025. MAST3R-SfM: a Fully-Integrated Solution for Unconstrained Structure-from-Motion. In: *Intl. Conf. on 3D Vision (3DV)*.
  - [298] Dumbgen, F., Holmes, C., Agro, B., and Barfoot, T. 2024. Toward Globally Optimal State Estimation Using Automatically Tightened Semidefinite Relaxations. *IEEE Trans. Robotics*, **40**, 4338–4358.

- [299] Dunkley, O., Engel, J., Sturm, J., and Cremers, D. 2014. Visual-Inertial Navigation for a Camera-Equipped 25g Nano-Quadrotor. In: *IROS2014 Aerial Open Source Robotics Workshop*.
- [300] Dunning, Iain, Huchette, Joey, and Lubin, Miles. 2017. JuMP: A modeling language for mathematical optimization. *SIAM review*, **59**(2), 295–320.
- [301] Durrant-Whyte, H.F. 1988. Uncertain geometry in robotics. *IEEE Trans. Robot. Automat.*, **4**(1), 23–31.
- [302] Durrant-Whyte, H.F., Rye, D., and Nebot, E. 1996. Localisation of automatic guided vehicles. Pages 613–625 of: Giralt, G., and Hirzinger, G. (eds), *Robotics Research: The 7th International Symposium (ISRR 95)*. Springer-Verlag.
- [303] Dusmanu, Mihai, Rocco, Ignacio, Pajdla, Tomás, Pollefeys, Marc, Sivic, Josef, Torii, Akihiko, and Sattler, Torsten. 2019. D2-Net: A Trainable CNN for Joint Description and Detection of Local Features. Pages 8092–8101 of: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [304] Dymczyk, Marcin, Lynen, Simon, Cieslewski, Titus, Bosse, Michael, Siegwart, Roland, and Furgale, Paul. 2015. The gist of maps-summarizing experience for lifelong localization. Pages 2767–2773 of: *2015 IEEE international conference on robotics and automation (ICRA)*. IEEE.
- [305] Dziri, Nouha, Lu, Ximing, Sclar, Melanie, Li, Xiang Lorraine, Jian, Liwei, Lin, Bill Yuchen, West, Peter, Bhagavatula, Chandra, Bras, Ronan Le, Hwang, Jena D, et al. 2023. Faith and Fate: Limits of Transformers on Compositionality. *arXiv preprint arXiv:2305.18654*.
- [306] Ebadi, K., Chang, Y., Palieri, M., Stephens, A., Hatteland, A., Heiden, E., Thakur, A., Morrell, B., Carlone, L., and Aghamohammadi, A. 2020. LAMP: Large-Scale Autonomous Mapping and Positioning for Exploration of Perceptually-Degraded Subterranean Environments. In: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [307] Ebadi, Kamak, Bernreiter, Lukas, Biggie, Harel, Catt, Gavin, Chang, Yun, Chatterjee, Arghya, Denniston, Christopher E, Deschênes, Simon-Pierre, Harlow, Kyle, Khattak, Shehryar, et al. 2023. Present and future of slam in extreme environments: The darpa subt challenge. *IEEE Trans. Robotics*, **40**, 936–959.
- [308] Eckenhoff, Kevin, Geneva, Patrick, and Huang, Guoquan. 2019. Closed-form preintegration methods for graph-based visual-inertial navigation. *Intl. J. of Robotics Research*, **38**(5), 563–586.
- [309] Eckenhoff, Kevin, Geneva, Patrick, and Huang, Guoquan. 2021. MIMC-VINS: A Versatile and Resilient Multi-IMU Multi-Camera Visual-Inertial Navigation System. *IEEE Transactions on Robotics*, **37**(5), 1360–1380.
- [310] Eigen, David, Puhrsch, Christian, and Fergus, Rob. 2014. Depth map prediction from a single image using a multi-scale deep network. Pages 2366–2374 of: *Conf. Neural Information Processing Systems (NIPS)*.
- [311] El Moudni, Anass, Morbidi, Fabio, Kramm, Sebastien, and Bouteau, Rémi. 2023. An Event-based Stereo 3D Mapping and Tracking Pipeline for Autonomous Vehicles. Pages 5962–5968 of: *IEEE Intl. Conf. on Intelligent Transportation Systems (ITSC)*.
- [312] Elfes, A. 1989. Using occupancy grids for mobile robot perception and navigation. *Computer*, **22**(6), 46–57.

- [313] Elseberg, J., Borrmann, D., and Nüchter, A. 2013. One billion points in the cloud – an octree for efficient processing of 3D laser scans. *ISPRS J. of Photogrammetry and Remote Sensing (JPRS)*, **76**, 76–88.
- [314] Engel, J., Sturm, J., and Cremers, D. 2012 (Oct.). Accurate Figure Flying with a Quadrocopter Using Onboard Visual and Inertial Sensing. In: *Proc. of the Workshop on Visual Control of Mobile Robots (ViCoMoR) at the IEEE/RJS International Conference on Intelligent Robot Systems (IROS)*.
- [315] Engel, Jakob, Schöps, Thomas, and Cremers, Daniel. 2014. LSD-SLAM: Large-scale direct monocular SLAM. Pages 834–849 of: *European Conf. on Computer Vision (ECCV)*. Springer.
- [316] Engel, Jakob, Koltun, Vladlen, and Cremers, Daniel. 2017. Direct sparse odometry. *IEEE Trans. Pattern Anal. Machine Intell.*, **40**(3), 611–625.
- [317] Enqvist, O., Josephson, K., and Kahl, F. 2009. Optimal correspondences from pairwise constraints. Pages 1295–1302 of: *Intl. Conf. on Computer Vision (ICCV)*.
- [318] Eriksson, A., Olsson, C., Kahl, F., and Chin, T.-J. 2018. Rotation averaging and strong duality. *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [319] Ester, Martin, Kriegel, Hans-Peter, Sander, Jorg, Xu, Xiaowei, et al. 1996. A density-based algorithm for discovering clusters in large spatial databases with noise. Pages 226–231 of: *kdd*, vol. 96.
- [320] Eustice, R., Singh, H., and Leonard, J. 2005a (April). Exactly Sparse Delayed-State Filters. Pages 2417–2424 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [321] Eustice, R., Walter, M., and Leonard, J. 2005b (Aug). Sparse Extended Information Filters: Insights into Sparsification. Pages 3281–3288 of: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*.
- [322] Fahmi, Shamel, Fink, Geoff, and Semini, Claudio. 2021. On State Estimation for Legged Locomotion Over Soft Terrain. *IEEE Sensors Letters*, **5**(1), 1–4.
- [323] Fallon, Maurice F., Antone, Matthew, Roy, Nicholas, and Teller, Seth. 2014. Drift-free humanoid state estimation fusing kinematic, inertial and LIDAR sensing. Pages 112–119 of: *IEEE Intl. Conf. on Humanoid Robots*.
- [324] Fallon, Maurice F., Marion, Pat, Deits, Robin, Whelan, Thomas, Antone, Matthew E., McDonald, John, and Tedrake, Russ. 2015. Continuous humanoid locomotion over uneven terrain using stereo fusion. Pages 881–888 of: *IEEE Intl. Conf. on Humanoid Robots*.
- [325] Faramarzi, Farnaz, Linares-Barranco, Bernabé, and Serrano-Gotarredona, Teresa. 2024. A 128×128 Electronically Multi-Foveated Dynamic Vision Sensor With Real-Time Resolution Reconfiguration. *IEEE Access*, **12**, 192656–192671.
- [326] Farrell, J.A. 2008. *Aided Navigation: GPS with High Rate Sensors*. McGraw-Hill.
- [327] Featherstone, Roy. 2007. *Rigid Body Dynamics Algorithms*. Berlin, Heidelberg: Springer-Verlag.
- [328] Feder, Tomás, and Vardi, Moshe Y. 1993. Monotone monadic SNP and constraint satisfaction. Pages 612–622 of: *ACM Symp. on Theory of Computing (STOC)*. New York, NY, USA: ACM Press.
- [329] Fehr, Marius, Furrer, Fadri, Dryanovski, Ivan, Sturm, Jürgen, Gilitschenki, Igor, Siegwart, Roland, and Cadena, Cesar. 2017. TSDF-based change



- detection for consistent long-term dense reconstruction and dynamic object discovery. Pages 5237–5244 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*. IEEE.
- [330] Feige, Uriel, Goldwasser, Shafi, Lovász, László, Safra, Shmuel, and Szegedy, Mario. 1991 (Sept.). Approximating clique is almost NP-complete. Pages 2–12 of: *Symp. on Foundations of Computer Science*.
  - [331] Feng, Qiaojun, Meng, Yue, Shan, Mo, and Atanasov, Nikolay. 2019. Localization and Mapping using Instance-specific Mesh Models. Pages 4985–4991 of: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*.
  - [332] Fent, Felix, Kutenreich, Fabian, Ruch, Florian, Rizwin, Farija, Juergens, Stefan, Lechermann, Lorenz, Nissler, Christian, Perl, Andrea, Voll, Ulrich, Yan, Min, and Lienkamp, Markus. 2024. MAN TruckScenes: A multimodal dataset for autonomous trucking in diverse conditions. In: *Advances in Neural Information Processing Systems (NIPS)*.
  - [333] Fernandez-Cortizas, M., Bavle, H., Perez-Saura, D., Sanchez-Lopez, J., Campoy, P., and Voos, H. 2024. Multi S-Graphs: An Efficient Distributed Semantic-Relational Collaborative SLAM. *IEEE Robotics and Automation Letters*, **9**(6), 6004–6011.
  - [334] Finateu, Thomas, Niwa, Atsumi, Matolin, Daniel, Tsuchimoto, Koya, Mascheroni, Andrea, Reynaud, Etienne, Mostafalu, Pooria, Brady, Frederick, Chotard, Ludovic, LeGoff, Florian, Takahashi, Hirotugu, Wakabayashi, Hayato, Oike, Yusuke, and Posch, Christoph. 2020. A 1280x720 Back-Illuminated Stacked Temporal Contrast Event-Based Vision Sensor with 4.86 $\mu$ m Pixels, 1.066GEPS Readout, Programmable Event-Rate Controller and Compressive Data-Formatting Pipeline. Pages 112–114 of: *IEEE Int. Solid-State Circuits Conf. (ISSCC)*.
  - [335] Finman, Ross, Whelan, Thomas, Kaess, Michael, and Leonard, John J. 2013. Toward lifelong object segmentation from change detection in dense rgb-d maps. Pages 178–185 of: *2013 European Conference on Mobile Robots*. IEEE.
  - [336] Fischler, Martin A, and Bolles, Robert C. 1981. Random sample consensus: a paradigm for model fitting with applications to image analysis and automated cartography. *Communications of the ACM*, **24**(6), 381–395.
  - [337] Focchi, Michele, Orsolino, Romeo, Camurri, Marco, Barasuol, Victor, Mastalli, Carlos, Caldwell, Darwin G., and Semini, Claudio. 2019. *Heuristic Planning for Rough Terrain Locomotion in Presence of External Disturbances and Variable Perception Quality*. Springer International Publishing. Pages 165–209.
  - [338] Fong, W., Mohan, R., Hurtado, J., Zhou, L., Caesar, H., Beijbom, O., and Valada, A. 2022. Panoptic nuScenes: A Large-Scale Benchmark for LiDAR Panoptic Segmentation and Tracking. In: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
  - [339] Fornasier, A., van Goor, P., Allak, E., Mahony, R., and Weiss, S. 2024. MSCEqF: A Multi State Constraint Equivariant Filter for Vision-Aided Inertial Navigation. *IEEE Robotics and Automation Letters*, **9**(1), 731–738.
  - [340] Forsgren, Brendon, Kaess, Michael, Vasudevan, Ram, McLain, Timothy W., and Mangelson, Joshua G. 2024. Group-k consistent measurement set maximization via maximum clique over k-uniform hypergraphs for robust multi-robot map merging. *Intl. J. of Robotics Research*.

- [341] Forster, Christian, Pizzoli, Matia, and Scaramuzza, Davide. 2014. SVO: Fast semi-direct monocular visual odometry. Pages 15–22 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*. IEEE.
- [342] Forster, Christian, Carlone, Luca, Dellaert, Frank, and Scaramuzza, Davide. 2015 (July 13–17,). IMU preintegration on manifold for efficient visual-inertial maximum-a-posteriori estimation. In: *Robotics: Science and Systems (RSS)*.
- [343] Forster, Christian, Carlone, Luca, Dellaert, Frank, and Scaramuzza, Davide. 2016. On-manifold preintegration for real-time visual-inertial odometry. *IEEE Transactions on Robotics*, **33**(1), 1–21.
- [344] Fourie, Dehann. 2017. *Multi-modal and inertial sensor solutions for navigation-type factor graphs*. Ph.D. thesis, MIT.
- [345] Fourie, Dehann, Leonard, John, and Kaess, Michael. 2016. A nonparametric belief solution to the Bayes tree. Pages 2189–2196 of: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*. IEEE.
- [346] Fredriksson, Johan, and Olsson, Carl. 2012. Simultaneous multiple rotation averaging using lagrangian duality. Pages 245–258 of: *Asian Conf. on Computer Vision (ACCV)*. Springer.
- [347] Frese, U. 2005. Treemap: An  $O(\log n)$  Algorithm for Simultaneous Localization and Mapping. Pages 455–476 of: *Spatial Cognition IV*. Springer Verlag.
- [348] Frese, U., Larsson, P., and Duckett, T. 2005. A Multilevel Relaxation Algorithm for Simultaneous Localisation and Mapping. *IEEE Trans. Robotics*, **21**(2), 196–207.
- [349] Fridovich-Keil, Sara, Yu, Alex, Tancik, Matthew, Chen, Qinrong, Recht, Benjamin, and Kanazawa, Angjoo. 2022. Plenoxels: Radiance fields without neural networks. In: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [350] Fritsche, Paul, Kueppers, Simon, Briese, Gunnar, and Wagner, Bernardo. 2016. Radar and LiDAR Sensorfusion in Low Visibility Environments. Pages 30–36 of: *ICINCO*.
- [351] Fritsche, Paul, Kueppers, Simon, Briese, Gunnar, and Wagner, Bernardo. 2018. *Fusing LiDAR and Radar Data to Perform SLAM in Harsh Environments*. Cham: Springer International Publishing. Pages 175–189.
- [352] Fu, Jiahui, Huang, Qiangqiang, Doherty, Kevin, Wang, Yue, and Leonard, John J. 2021. A multi-hypothesis approach to pose ambiguity in object-based SLAM. Pages 7639–7646 of: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*. IEEE.
- [353] Fu, Jiahui, Du, Yilun, Singh, Kurran, Tenenbaum, Joshua B, and Leonard, John J. 2023. Neuse: Neural se (3)-equivariant embedding for consistent spatial understanding with objects. *Robotics: Science and Systems (RSS)*.
- [354] Fu, Taimeng, Su, Shaoshu, Lu, Yiren, and Wang, Chen. 2024. iSLAM: Imperative SLAM. *IEEE Robotics and Automation Letters (RA-L)*.
- [355] Funk, N., Tarrio, J., Papatheodorou, S., Popović, M., Alcantarilla, P. F., and Leutenegger, S. 2021. Multi-resolution 3D Mapping with Explicit Free Space Representation for Fast and Accurate Mobile Robot Motion Planning. *IEEE Robotics and Automation Letters*, **6**(2), 3553–3560.
- [356] Furber, S. B., Galluppi, F., Temple, S., and Plana, L. A. 2014. The SpiN-Naker Project. *Proceedings of the IEEE*, **102**, 652–665.

- [357] Furgale, P., Barfoot, T.D., and Sibley, G. 2012. Continuous-time batch estimation using temporal basis functions. Pages 2088–2095 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*. IEEE.
- [358] Furgale, Paul, Rehder, Joern, and Siegwart, Roland. 2013. Unified temporal and spatial calibration for multi-sensor systems. Pages 1280–1286 of: *2013 IEEE/RSJ International Conference on Intelligent Robots and Systems*. IEEE.
- [359] Furrer, Fadri, Novkovic, Tonci, Fehr, Marius, Gawel, Abel, Grinvald, Margarita, Sattler, Torsten, Siegwart, Roland, and Nieto, Juan. 2018. Incremental object database: Building 3d models from multiple partial observations. Pages 6835–6842 of: *2018 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. IEEE.
- [360] Gadd, Matthew, De Martini, Daniele, and Newman, Paul. 2021. Contrastive Learning for Unsupervised Radar Place Recognition. Pages 344–349 of: *Intl. Conf. on Advanced Robotics (ICAR)*.
- [361] Gadd, Matthew, De Martini, Daniele, Bartlett, Oliver, Murcutt, Paul, Towlson, Matt, Widodo, Matthew, Muşat, Valentina, Robinson, Luke, Panagiotaki, Efimia, Pramatarov, Georgi, et al. 2024. OORD: The Oxford Offroad Radar Dataset. *arXiv preprint arXiv:2403.02845*.
- [362] Galeote-Luque, Andres, Kubelka, Vladimír, Magnusson, Martin, Ruiz-Sarmiento, Jose-Raul, and Gonzalez-Jimenez, Javier. 2024. Doppler-only Single-scan 3D Vehicle Odometry. In: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [363] Galindo, Cipriano, Saffiotti, Alessandro, Coradeschi, Silvia, Buschka, Pär, Fernandez-Madrigal, Juan-Antonio, and González, Javier. 2005. Multi-Hierarchical Semantic Maps for Mobile Robotics. Pages 3492–3497 of: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*.
- [364] Gallego, Guillermo, and Scaramuzza, Davide. 2017. Accurate Angular Velocity Estimation with an Event Camera. *IEEE Robotics and Automation Letters*, **2**(2), 632–639.
- [365] Gallego, Guillermo, Mueggler, Elias, and Sturm, Peter. 2017. Translation of "Zur Ermittlung eines Objektes aus zwei Perspektiven mit innerer Orientierung" by Erwin Kruppa (1913). *arXiv preprint*.
- [366] Gallego, Guillermo, Lund, Jon E. A., Mueggler, Elias, Rebecq, Henri, Delbruck, Tobi, and Scaramuzza, Davide. 2018a. Event-based, 6-DOF Camera Tracking from Photometric Depth Maps. *IEEE Trans. Pattern Anal. Machine Intell.*, **40**(10), 2402–2412.
- [367] Gallego, Guillermo, Rebecq, Henri, and Scaramuzza, Davide. 2018b. A Unifying Contrast Maximization Framework for Event Cameras, with Applications to Motion, Depth, and Optical Flow Estimation. Pages 3867–3876 of: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [368] Gallego, Guillermo, Gehrig, Mathias, and Scaramuzza, Davide. 2019. Focus Is All You Need: Loss Functions For Event-based Vision. Pages 12272–12281 of: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [369] Gallego, Guillermo, Delbruck, Tobi, Orchard, Garrick, Bartolozzi, Chiara, Taba, Brian, Censi, Andrea, Leutenegger, Stefan, Davison, Andrew, Conradt, Jörg, Daniilidis, Kostas, and Scaramuzza, Davide. 2022. Event-based Vision: A Survey. *IEEE Trans. Pattern Anal. Machine Intell.*, **44**(1), 154–180.

- [370] Gálvez-López, Dorian, and Tardos, Juan D. 2012. Bags of binary words for fast place recognition in image sequences. *IEEE Transactions on robotics*, **28**(5), 1188–1197.
- [371] Gao, Ling, Liang, Yuxuan, Yang, Jiaqi, Wu, Shaoxun, Wang, Chenyu, Chen, Jiaben, and Kneip, Laurent. 2022. VECtor: A Versatile Event-Centric Benchmark for Multi-Sensor SLAM. *IEEE Robotics and Automation Letters*, **7**(3), 8217–8224.
- [372] Gao, Wei, and Tedrake, Russ. 2019. SurfelWarp: Efficient non-volumetric single view dynamic reconstruction. *arXiv preprint arXiv:1904.13073*.
- [373] Gao, X., Wang, R., Demmel, N., and Cremers, D. 2018 (October). LDSO: Direct Sparse Odometry with Loop Closure. In: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*.
- [374] Gao, Yiming, Cao, Yan-Pei, and Shan, Ying. 2023. SurfelNeRF: Neural Surfel Radiance Fields for Online Photorealistic Reconstruction of Indoor Scenes. In: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [375] Garcia-Salguero, Mercedes, Briaes, Jesus, and Gonzalez-Jimenez, Javier. 2021. Certifiable relative pose estimation. *Image and Vision Computing*, **109**, 104142.
- [376] Garg, Ravi, Roussos, Anastasios, and Agapito, Lourdes. 2013. Dense variational reconstruction of non-rigid surfaces from monocular video. In: *CVPR*.
- [377] Gawel, Abel, Del Don, Carlo, Siegwart, Roland, Nieto, Juan, and Cadena, Cesar. 2018. X-view: Graph-based semantic multi-view localization. *IEEE Robotics and Automation Letters*, **3**(3), 1687–1694.
- [378] Gehrig, Daniel, Loquercio, Antonio, Derpanis, Konstantinos G., and Scaramuzza, Davide. 2019. End-to-End Learning of Representations for Asynchronous Event-Based Data. Pages 5632–5642 of: *Intl. Conf. on Computer Vision (ICCV)*.
- [379] Gehrig, Daniel, Gehrig, Mathias, Hidalgo-Carrió, Javier, and Scaramuzza, Davide. 2020. Video to Events: Recycling Video Datasets for Event Cameras. Pages 3583–3592 of: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [380] Gehrig, Mathias, Aarents, Willem, Gehrig, Daniel, and Scaramuzza, Davide. 2021. DSEC: A Stereo Event Camera Dataset for Driving Scenarios. *IEEE Robotics and Automation Letters*, **6**(3), 4947–4954.
- [381] Geiger, A., Lenz, P., and Urtasun, R. 2012 (June). Are we ready for Autonomous Driving? The KITTI Vision Benchmark Suite. Pages 3354–3361 of: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [382] Geneva, Patrick, Eckenhoff, Kevin, Yang, Yulin, and Huang, Guoquan. 2018. Lips: Lidar-inertial 3d plane slam. Pages 123–130 of: *2018 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. IEEE.
- [383] Geneva, Patrick, Eckenhoff, Kevin, Lee, Woosik, Yang, Yulin, and Huang, Guoquan. 2020. OpenVINS: A Research Platform for Visual-Inertial Estimation. In: *Proc. of the IEEE International Conference on Robotics and Automation*.
- [384] Gentil, Cedric Le, and Vidal-Calleja, Teresa. 2023. Continuous latent state preintegration for inertial-aided systems. *Intl. J. of Robotics Research*, **42**(10), 874–900.

- [385] Gentil, Cédric Le, Vayugundla, Mallikarjuna, Giubilato, Riccardo, Sturzl, Wolfgang, Vidal-Calleja, Teresa, and Triebel, Rudolph. 2020. Gaussian Process Gradient Maps for Loop-Closure Detection in Unstructured Planetary Environments. Pages 1895–1902 of: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*.
- [386] Ghaffari Jadidi, Maani, Valls Miro, Jaime, and Dissanayake, Gamini. 2018. Gaussian processes autonomous mapping and exploration for range-sensing mobile robots. *Autonomous Robots*, **42**(2), 273–290.
- [387] Ghiasi, Golnaz, Gu, Xiuye, Cui, Yin, and Lin, Tsung-Yi. 2022. Scaling open-vocabulary image segmentation with image-level labels. Pages 540–557 of: *European conference on computer vision*. Springer.
- [388] Ghosh, Suman, and Gallego, Guillermo. 2024. Event-based Stereo Depth Estimation: A Survey. *arXiv preprint*.
- [389] Ghosh, Suman, Cavinato, Valentina, and Gallego, Guillermo. 2024. ESPTAM: Event-based Stereo Parallel Tracking and Mapping. In: *European Conf. on Computer Vision Workshops*.
- [390] Giamou, Matthew, Ma, Ziye, Peretroukhin, Valentin, and Kelly, Jonathan. 2019. Certifiably Globally Optimal Extrinsic Calibration From Per-Sensor Egomotion. *IEEE Robotics and Automation Letters*, **4**(2), 367–374.
- [391] Giftthaler, Markus, Neunert, Michael, Stäuble, Markus, and Buchli, Jonas. 2018. The control toolbox-an open-source c++ library for robotics, optimal and model predictive control. Pages 123–129 of: *2018 IEEE International Conference on Simulation, Modeling, and Programming for Autonomous Robots (SIMPAR)*. IEEE.
- [392] Girshick, Ross, Donahue, Jeff, Darrell, Trevor, and Malik, Jitendra. 2016. Region-Based Convolutional Networks for Accurate Object Detection and Segmentation. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, **38**(1), 142–158.
- [393] Gladkova, M, Wang, R, Zeller, N, and Cremers, D. 2021. Tight Integration of Feature-based Relocalization in Monocular Direct Visual Odometry. In: *Proc. of the IEEE International Conference on Robotics and Automation (ICRA)*.
- [394] Gladkova, M, Korobov, N, Demmel, N, Ošep, A, Leal-Taixé, L, and Cremers, D. 2022. DirectTracker: 3D Multi-Object Tracking Using Direct Image Alignment and Photometric Bundle Adjustment. In: *International Conference on Intelligent Robots and Systems (IROS)*.
- [395] Godard, Clément, Mac Aodha, Oisín, and Brostow, Gabriel J. 2016. Unsupervised monocular depth estimation with left-right consistency. *arXiv preprint arXiv:1609.03677*.
- [396] Golkov, Vladimir, Skwark, Marcin J, Golkov, Antonij, Dosovitskiy, Alexey, Brox, Thomas, Meiler, Jens, and Cremers, Daniel. 2016. Protein contact prediction from amino acid co-evolution using convolutional networks for graph-valued images. *Advances in Neural Information Processing Systems*, **29**.
- [397] Golub, G.H., and Loan, C.F. Van. 1996. *Matrix Computations*. Third edn. Baltimore: Johns Hopkins University Press.
- [398] Gomez, Jorge, Patel, Saavan, Sarwar, Syed Shakib, Li, Ziyun, Capoccia, Raffaele, Wang, Zhao, Pinkham, Reid, Berkovich, Andrew, Tsai, Tsung-Hsun, De Salvo, Barbara, and Liu, Chiao. 2022. *Distributed On-Sensor Compute*

*System for AR/VR Devices: A Semi-Analytical Simulation Framework for Power Estimation.*

- [399] Gómez-Rodríguez, Juan J, Lamarca, José, Morlana, Javier, Tardós, Juan D, and Montiel, J.M.M. 2021. SD-DefSLAM: Semi-direct monocular SLAM for deformable and intracorporeal scenes. Pages 5170–5177 of: *2021 IEEE international conference on robotics and automation (ICRA)*. IEEE.
- [400] Goodfellow, Ian, Bengio, Yoshua, and Courville, Aaron. 2016. *Deep Learning*. MIT Press. <http://www.deeplearningbook.org>.
- [401] Gorlo, N., Schmid, L., and Carlone, L. 2024a. Long-Term Human Trajectory Prediction using 3D Dynamic Scene Graphs. *IEEE Robotics and Automation Letters*.
- [402] Gorlo, Nicolas, Schmid, Lukas, and Carlone, Luca. 2024b. Long-Term Human Trajectory Prediction using 3D Dynamic Scene Graphs. *IEEE Robotics and Automation Letters*.
- [403] Gotardo, Paulo FU, and Martinez, Aleix M. 2011a. Kernel non-rigid structure from motion. In: *ICCV*.
- [404] Gotardo, Paulo FU, and Martinez, Aleix M. 2011b. Non-rigid structure from motion with complementary rank-3 spaces. In: *CVPR*.
- [405] Greve, Elias, Büchner, Martin, Vödisch, Niclas, Burgard, Wolfram, and Valada, Abhinav. 2024. Collaborative dynamic 3d scene graphs for automated driving. Pages 11118–11124 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*. IEEE.
- [406] Grimmering, Felix, Meduri, Avadesh, Khadiv, Majid, Viereck, Julian, Wüthrich, Manuel, Naveau, Maximilien, Berenz, Vincent, Heim, Steve, Widmaier, Felix, Flayols, Thomas, Fiene, Jonathan, Badri-Spröwitz, Alexander, and Righetti, Ludovic. 2020. An Open Torque-Controlled Modular Robot Architecture for Legged Locomotion Research. *IEEE Robotics and Automation Letters*, **5**(2), 3650–3657.
- [407] Grinvald, Margarita, Furrer, Fadri, Novkovic, Tonci, Chung, Jen Jen, Cadena, Cesar, Siegwart, Roland, and Nieto, Juan. 2019. Volumetric instance-aware semantic mapping and 3D object discovery. *IEEE Robotics and Automation Letters*, **4**(3), 3037–3044.
- [408] Grisetti, G., Stachniss, C., and Burgard, W. 2007. Improved Techniques for Grid Mapping With Rao-Blackwellized particle filters. *IEEE Trans. Robotics*, **23**(1), 34–46.
- [409] Grisetti, Giorgio, Kümmerle, Rainer, Stachniss, Cyrill, Frese, Udo, and Hertzberg, Christoph. 2010 (5). Hierarchical optimization on manifolds for online 2D and 3D mapping. Pages 273–278 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [410] Grisetti, Giorgio, Kümmerle, Rainer, Strasdat, Hauke, and Konolige, Kurt. 2011. g2o: A general framework for (hyper) graph optimization. Pages 9–13 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [411] Grohe, Martin, Neuen, Daniel, Schweitzer, Pascal, and Wiebking, Daniel. 2020. An Improved Isomorphism Test for Bounded-Tree-Width Graphs. *ACM Trans. on Algorithms (TALG)*, **16**(3).
- [412] Gropp, Amos, Yariv, Lior, Haim, Niv, Atzmon, Matan, and Lipman, Yaron. 2020. Implicit Geometric Regularization for Learning Shapes. Pages 3789–3799 of: *Intl. Conf. on Machine Learning (ICML)*.

- [413] Grupp, Michael. 2017. *evo: Python package for the evaluation of odometry and SLAM*. <https://github.com/MichaelGrupp/evo>.
- [414] Gu, Albert, Goel, Karan, and Ré, Christopher. 2022. Efficiently Modeling Long Sequences with Structured State Spaces. In: *The International Conference on Learning Representations (ICLR)*.
- [415] Gu, Qiao, Kuwajerwala, Ali, Morin, Sacha, Jatavallabhula, Krishna Murthy, Sen, Bipasha, Agarwal, Aditya, Rivera, Corban, Paul, William, Ellis, Kirsty, Chellappa, Rama, et al. 2024. Conceptgraphs: Open-vocabulary 3d scene graphs for perception and planning. Pages 5021–5028 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*. IEEE.
- [416] Guan, Weipeng, Lin, Fuling, Chen, Peiyu, and Lu, Peng. 2024a. DEIO: Deep Event Inertial Odometry. *arXiv preprint*.
- [417] Guan, Weipeng, Chen, Peiyu, Zhao, Huibin, Wang, Yu, and Lu, Peng. 2024b. EVI-SAM: Robust, Real-Time, Tightly-Coupled Event–Visual–Inertial State Estimation and 3D Dense Mapping. *Adv. Intell. Syst.*, **6**(12), 2400243.
- [418] Guan, Weipeng, Chen, Peiyu, Xie, Yuhang, and Lu, Peng. 2024c. PL-EVIO: Robust Monocular Event-Based Visual Inertial Odometry With Point and Line Features. *IEEE Trans. Autom. Sci. Eng.*, **21**(4), 6277–6293.
- [419] Guédon, Antoine, and Lepetit, Vincent. 2024. Sugar: Surface-aligned gaussian splatting for efficient 3d mesh reconstruction and high-quality mesh rendering. In: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [420] Guennebaud, Gaël, Jacob, Benoit, et al. 2010. Eigen. URL: <http://eigen.tuxfamily.org>, **3**.
- [421] Guo, Chao X, and Roumeliotis, Stergios I. 2013. IMU-RGBD camera navigation using point and plane features. Pages 3164–3171 of: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*.
- [422] Guo, Jiadong, Borges, Paulo VK, Park, Chanoh, and Gawel, Abel. 2019. Local descriptor for robust place recognition using lidar intensity. *IEEE Robotics and Automation Letters*, **4**(2), 1470–1477.
- [423] Guo, Shuang, and Gallego, Guillermo. 2024a. CMax-SLAM: Event-based Rotational-Motion Bundle Adjustment and SLAM System using Contrast Maximization. *IEEE Trans. Robotics*, **40**, 2442–2461.
- [424] Guo, Shuang, and Gallego, Guillermo. 2024b. Event-based Mosaicing Bundle Adjustment. Pages 479–496 of: *European Conf. on Computer Vision (ECCV)*.
- [425] Guo, Shuang, and Gallego, Guillermo. 2024c. Event-based Photometric Bundle Adjustment. *arXiv preprint*.
- [426] Guo, Yifan, Ren, Zhongqiang, and Wang, Chen. 2024. iMTSP: Solving Min-Max Multiple Traveling Salesman Problem with Imperative Learning. In: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*.
- [427] Gutmann, J.-S., and Konolige, K. 2000 (November). Incremental Mapping of Large Cyclic Environments. Pages 318–325 of: *IEEE Intl. Symp. on Computational Intelligence in Robotics and Automation (CIRA)*.
- [428] Guzhov, Andrey, Raue, Federico, Hees, Jörn, and Dengel, Andreas. 2022. Audioclip: Extending clip to image, text and audio. Pages 976–980 of: *ICASSP 2022-2022 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*. IEEE.

- [429] Gómez Rodríguez, Juan J., Montiel, J.M.M., and Tardós, Juan D. 2022. Tracking monocular camera pose and deformation for SLAM inside the human body. Pages 5278–5285 of: *2022 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*.
- [430] Ha, D., and Schmidhuber, J. 2018. World Models. In: *Advances in Neural Information Processing Systems (NIPS)*.
- [431] Ha, Seongbo, Yeon, Jiung, and Yu, Hyeonwoo. 2024. RGBD GS-ICP SLAM. In: *European Conf. on Computer Vision (ECCV)*.
- [432] Hadviger, Antea, Cvišić, Igor, Marković, Ivan, Vražić, Sacha, and Petrović, Ivan. 2021. Feature-based event stereo visual odometry. Pages 1–6 of: *European Conf. on Mobile Robotics (ECMR)*.
- [433] Han, Luxin, Gao, Fei, Zhou, Boyu, and Shen, Shaojie. 2019. Fiesta: Fast incremental euclidean distance fields for online motion planning of aerial robots. Pages 4423–4430 of: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*.
- [434] Hanan, S. 1989. Implementing Ray-tracing with Octrees and Neighbor Finding. *Computers & Graphics*, **13**(4), 445–460.
- [435] Handa, A., Newcombe, R. A., Angeli, A., and Davison, A. J. 2012. Real-Time Camera Tracking: When is High Frame-Rate Best? In: *European Conf. on Computer Vision (ECCV)*.
- [436] Handa, A., Whelan, T., McDonald, J. B., and Davison, A. J. 2014. A Benchmark for RGB-D Visual Odometry, 3D Reconstruction and SLAM. In: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [437] Handa, Ankur, Bloesch, Michael, Pătrăucean, Viorica, Stent, Simon, McCormac, John, and Davison, Andrew. 2016. gvn: Neural network library for geometric computer vision. Pages 67–82 of: *Computer Vision–ECCV 2016 Workshops: Amsterdam, The Netherlands, October 8–10 and 15–16, 2016, Proceedings, Part III 14*. Springer.
- [438] Harnad, Stevan. 1990. The symbol grounding problem. *Physica D: Nonlinear Phenomena*, **42**(1), 335–346.
- [439] Harris, C., and Stephens, M. 1988. A combined corner and edge detector. Pages 147–151 of: *Proceedings of the Alvey Vision Conference*.
- [440] Harrison, Alastair, and Newman, Paul. 2008. High quality 3D laser ranging under general vehicle motion. Pages 7–12 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [441] Hart, William E, Laird, Carl D, Watson, Jean-Paul, Woodruff, David L, Hackebeit, Gabriel A, Nicholson, Bethany L, Siirola, John D, et al. 2017. *Pyomo-optimization modeling in python*. Vol. 67. Springer.
- [442] Hartley, R., Trumpf, J., Dai, Y., and Li, H. 2013. Rotation Averaging. *Intl. J. of Computer Vision*, **103**(3), 267–305.
- [443] Hartley, R.I., and Kahl, F. 2009. Global optimization through rotation space search. *Intl. J. of Computer Vision*, **82**(1), 64–79.
- [444] Hartley, Richard, and Zisserman, Andrew. 2003. *Multiple view geometry in computer vision*. Cambridge university press.
- [445] Hartley, Ross, Jadidi, Maani Ghaffari, Grizzle, Jessy, and Eustice, Ryan M. 2018a. Contact-Aided Invariant Extended Kalman Filtering for Legged Robot State Estimation. In: *Robotics: Science and Systems (RSS)*.
- [446] Hartley, Ross, Jadidi, Maani Ghaffari, Gan, Lu, Huang, Jiunn-Kai, Grizzle, Jessy W., and Eustice, Ryan M. 2018b. Hybrid Contact Preintegration for



- Visual-Inertial-Contact State Estimation Using Factor Graphs. Pages 3783–3790 of: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*.
- [447] Hartley, Ross, Mangelson, Josh, Gan, Lu, Ghaffari Jadidi, Maani, Walls, Jeffrey M., Eustice, Ryan M., and Grizzle, Jessy W. 2018c. Legged Robot State-Estimation Through Combined Forward Kinematic and Preintegrated Contact Factors. Pages 4422–4429 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [448] Hartley, Ross, Ghaffari, Maani, Eustice, Ryan M, and Grizzle, Jessy W. 2020. Contact-aided invariant extended Kalman filtering for robot state estimation. *The International Journal of Robotics Research*, **39**(4), 402–430.
- [449] He, Dongjiao, Xu, Wei, Chen, Nan, Kong, Fanze, Yuan, Chongjian, and Zhang, Fu. 2023. Point-LIO: Robust High-Bandwidth Light Detection and Ranging Inertial Odometry. *Advanced Intelligent Systems*, **5**(7), 2200459.
- [450] He, Kaiming, Zhang, Xiangyu, Ren, Shaoqing, and Sun, Jian. 2016a. Deep residual learning for image recognition. Pages 770–778 of: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [451] He, Kaiming, Gkioxari, Georgia, Dollár, Piotr, and Girshick, Ross. 2017a. Mask r-cnn. Pages 2961–2969 of: *Intl. Conf. on Computer Vision (ICCV)*.
- [452] He, Kaiming, Gkioxari, Georgia, Dollár, Piotr, and Girshick, Ross. 2017b. Mask R-CNN. Pages 2980–2988 of: *Intl. Conf. on Computer Vision (ICCV)*.
- [453] He, Li, Wang, Xiaolong, and Zhang, Hong. 2016b. M2DP: A novel 3D point cloud descriptor and its application in loop closure detection. Pages 231–237 of: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*. IEEE.
- [454] Heck, Martijn J.R. 2017. Highly integrated optical phased arrays: photonic integrated circuits for optical beam shaping and beam steering. *Nanophotonics*, **6**(1), 93–107.
- [455] Hendrycks, Dan, and Gimpel, Kevin. 2016. Bridging Nonlinearities and Stochastic Regularizers with Gaussian Error Linear Units. *arXiv preprint arXiv:1606.08415*.
- [456] Henein, Mina, Zhang, Jun, Mahony, Robert, and Ila, Viorela. 2020. Dynamic SLAM: The need for speed. Pages 2123–2129 of: *2020 IEEE International Conference on Robotics and Automation (ICRA)*. IEEE.
- [457] Henning, Dorian F, Laidlow, Tristan, and Leutenegger, Stefan. 2022. BodySLAM: joint camera localisation, mapping, and human motion tracking. Pages 656–673 of: *European Conf. on Computer Vision (ECCV)*. Springer.
- [458] Henning, Dorian F, Choi, Christopher, Schaefer, Simon, and Leutenegger, Stefan. 2023. BodySLAM++: Fast and tightly-coupled visual-inertial camera and human motion tracking. Pages 3781–3788 of: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*. IEEE.
- [459] Herath, Sachini, Yan, Hang, and Furukawa, Yasutaka. 2020. Ronin: Robust neural inertial navigation in the wild: Benchmark, evaluations, & new methods. Pages 3146–3152 of: *2020 IEEE international conference on robotics and automation (ICRA)*. IEEE.
- [460] Herath, Sachini, Caruso, David, Liu, Chen, Chen, Yufan, and Furukawa, Yasutaka. 2022. Neural inertial localization. Pages 6604–6613 of: *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition*.
- [461] Hermann, R., and Krener, A. 1977. Nonlinear controllability and observability. *IEEE Trans. on Automatic Control*, **22**(5), 728–740.

- [462] Herraiez, Daniel Casado, Chang, Le, Zeller, Matthias, Wiesmann, Louis, Behley, Jens, Heidingsfeld, Michael, and Stachniss, Cyrill. 2024. SPR: Single-Scan Radar Place Recognition. *IEEE Robotics and Automation Letters*.
- [463] Hesch, J. A., Mirzaei, F. M., Mariottini, G. L., and Roumeliotis, S. I. 2010 (May. 3 - 8). A Laser-Aided Inertial Navigation System (L-INS) for human localization in unknown indoor environments. Pages 5376–5382 of: *International Conference on Robotics and Automation*.
- [464] Hesch, J.A., Kottas, D.G., Bowman, S.L., and Roumeliotis, S.I. 2013a. Consistency Analysis and Improvement of Vision-aided Inertial Navigation. *IEEE Trans. Robotics*, **30**(1), 158–176.
- [465] Hesch, JoelA., Kottas, DimitriosG., Bowman, SeanL., and Roumeliotis, StergiosI. 2013b. Towards Consistent Vision-Aided Inertial Navigation. Pages 559–574 of: Frazzoli, Emilio, Lozano-Perez, Tomas, Roy, Nicholas, and Rus, Daniela (eds), *Algorithmic Foundations of Robotics X*. Springer Tracts in Advanced Robotics, vol. 86. Springer Berlin Heidelberg.
- [466] Hess, Wolfgang, Kohler, Damon, Rapp, Holger, and Andor, Daniel. 2016. Real-time loop closure in 2D LIDAR SLAM. Pages 1271–1278 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*. IEEE.
- [467] Hestenes, Magnus R, and Stiefel, Eduard. 1952. Methods of conjugate gradients for solving. *Journal of research of the National Bureau of Standards*, **49**(6), 409.
- [468] Hidalgo-Carrió, Javier, Gehrig, Daniel, and Scaramuzza, Davide. 2020 (Nov.). Learning Monocular Dense Depth from Events. Pages 534–542 of: *Intl. Conf. on 3D Vision (3DV)*.
- [469] Hidalgo-Carrió, Javier, Gallego, Guillermo, and Scaramuzza, Davide. 2022 (June). Event-aided Direct Sparse odometry. Pages 5781–5790 of: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [470] Himstedt, Marian, Frost, Jan, Hellbach, Sven, Böhme, Hans-Joachim, and Maehle, Erik. 2014. Large scale place recognition in 2D LIDAR scans using geometrical landmark relations. Pages 5030–5035 of: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*. IEEE.
- [471] Ho, Jonathan, Jain, Ajay, and Abbeel, Pieter. 2020. Denoising Diffusion Probabilistic Models. Pages 6840–6851 of: Larochelle, H., Ranzato, M., Hadsell, R., Balcan, M.F., and Lin, H. (eds), *Advances in Neural Information Processing Systems*, vol. 33. Curran Associates, Inc.
- [472] Hoeller, David, Rudin, Nikita, Sako, Dhionis V., and Hutter, Marco. 2024. ANYmal parkour: Learning agile navigation for quadrupedal robots. *Science Robotics*, **9**(88).
- [473] Holmes, Connor, and Barfoot, Timothy D. 2023. An efficient global optimality certificate for landmark-based SLAM. *IEEE Robotics and Automation Letters*, **8**(3), 1539–1546.
- [474] Holmes, Connor, Dümbgen, Frederike, and Barfoot, Timothy D. 2024. *On Semidefinite Relaxations for Matrix-Weighted State-Estimation Problems in Robotics*.
- [475] Holmstrom, Sven T. S., Baran, Utku, and Urey, Hakan. 2014. MEMS Laser Scanners: A Review. *Journal of Microelectromechanical Systems*, **23**(2), 259–275.
- [476] Honerkamp, Daniel, Büchner, Martin, Despinoy, Fabien, Welschhold, Tim, and Valada, Abhinav. 2024. Language-Grounded Dynamic Scene Graphs

- for Interactive Object Search with Mobile Manipulation. *IEEE Robotics and Automation Letters*.
- [477] Hong, Je Hyeong, Zach, Christopher, Fitzgibbon, Andrew, and Cipolla, Roberto. 2016. Projective bundle adjustment from arbitrary initialization using the variable projection method. Pages 477–493 of: *Computer Vision–ECCV 2016: 14th European Conference, Amsterdam, The Netherlands, October 11–14, 2016, Proceedings, Part I 14*. Springer.
  - [478] Hong, Je Hyeong, Zach, Christopher, and Fitzgibbon, Andrew. 2017. Revisiting the variable projection method for separable nonlinear least squares problems. Pages 5939–5947 of: *2017 IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*. IEEE.
  - [479] Hong, Sheng, and et al. 2024. LIV-GaussMap: LiDAR-Inertial-Visual Fusion for Real-time 3D Radiance Field Map Rendering. *IEEE Robotics and Automation Letters*.
  - [480] Hong, Yining, Lin, Chunru, Du, Yilun, Chen, Zhenfang, Tenenbaum, Joshua B, and Gan, Chuang. 2023a. 3d concept learning and reasoning from multi-view images. Pages 9202–9212 of: *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition*.
  - [481] Hong, Ziyang, Petillot, Yvan, and Wang, Sen. 2020. RadarSLAM: Radar based Large-Scale SLAM in All Weathers. Pages 5164–5170 of: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*.
  - [482] Hong, Ziyang, Petillot, Yvan, Wallace, Andrew, and Wang, Sen. 2022. RadarSLAM: A robust simultaneous localization and mapping system for all weather conditions. *Intl. J. of Robotics Research*, **41**(5), 519–542.
  - [483] Hong, Ziyang, Petillot, Yvan, Zhang, Kaicheng, Xu, Shida, and Wang, Sen. 2023b. Large-Scale Radar Localization using Online Public Maps. Pages 3990–3996 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
  - [484] Hoppe, Hugues, DeRose, Tony, Duchamp, Tom, McDonald, John, and Stuetzle, Werner. 1992. Surface reconstruction from unorganized points. Pages 71–78 of: *Intl. Conf. on Computer Graphics and Interactive Techniques (SIGGRAPH)*. Association for Computing Machinery.
  - [485] Horn, Berthold K. P. 1987. Closed-form solution of absolute orientation using unit quaternions. *J. Opt. Soc. Am. A*, **4**(4), 629–642.
  - [486] Hornung, Armin, Wurm, Kai M., Bennewitz, Maren, Stachniss, Cyrill, and Burgard, Wolfram. 2013. OctoMap: an efficient probabilistic 3D mapping framework based on octrees. *Autonomous Robots*, 189–206.
  - [487] Hsiao, Ming, and Kaess, Michael. 2019. MH-iSAM2: Multi-hypothesis isam using bayes tree and hypo-tree. Pages 1274–1280 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*. IEEE.
  - [488] Hu, Mu, Yin, Wei, Zhang, Chi, Cai, Zhipeng, Long, Xiaoxiao, Chen, Hao, Wang, Kaixuan, Yu, Gang, Shen, Chunhua, and Shen, Shaojie. 2024. Metric3d v2: A versatile monocular geometric foundation model for zero-shot metric depth and surface normal estimation. *IEEE Trans. Pattern Anal. Machine Intell.*
  - [489] Hu, Yuhuang, Liu, Shih-Chii, and Delbruck, Tobi. 2021. v2e: From Video Frames to Realistic DVS Events. Pages 1312–1321 of: *IEEE/CVF Conf. on Computer Vision and Pattern Recognition Workshops*.
  - [490] Huai, Jianzhu, Wang, Binliang, Zhuang, Yuan, Chen, Yiwen, Li, Qipeng, Han, Yulong, and Toth, Charles. 2024. Snail-Radar: A large-scale diverse

- dataset for the evaluation of 4D-radar-based SLAM systems. *arXiv preprint arXiv:2407.11705*.
- [491] Huang, Binbin, Yu, Zehao, Chen, Anpei, Geiger, Andreas, and Gao, Shenghua. 2024a. 2D Gaussian Splatting for Geometrically Accurate Radiance Fields. In: *SIGGRAPH 2024 Conference Papers*. Association for Computing Machinery.
  - [492] Huang, Chen, Mees, Oier, Zeng, Andy, and Burgard, Wolfram. 2022a. Visual Language Maps for Robot Navigation. *IEEE Intl. Conf. on Robotics and Automation (ICRA)*, 10608–10615.
  - [493] Huang, Guoquan. 2017. Towards Consistent Filtering for Discrete-Time Partially-Observable Nonlinear Systems. *Systems and Control Letters*, **106**(Aug.), 87–95.
  - [494] Huang, Guoquan, Mourikis, Anastasios I., and Roumeliotis, Stergios I. 2010. Observability-based Rules for Designing Consistent EKF SLAM Estimators. *International Journal of Robotics Research*, **29**(5), 502–528.
  - [495] Huang, Guoquan, Mourikis, Anastasios I., and Roumeliotis, Stergios I. 2011 (Sept.). An Observability Constrained Sliding Window Filter for SLAM. Pages 65–72 of: *Proc. of the IEEE/RSJ International Conference on Intelligent Robots and Systems*.
  - [496] Huang, Huajian, Li, Longwei, Hui, Cheng, and Yeung, Sai-Kit. 2024b. Photo-SLAM: Real-time Simultaneous Localization and Photorealistic Mapping for Monocular, Stereo, and RGB-D Cameras. In: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
  - [497] Huang, J.-T., Xu, R., Hinduja, A., and Kaess, M. 2024c (May). Multi-Radar Inertial Odometry for 3D State Estimation using mmWave Imaging Radar. In: *Proc. IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
  - [498] Huang, Qiangqiang, Pu, Can, Khosoussi, Kasra, Rosen, David M, Fourie, Dehann, How, Jonathan P, and Leonard, John J. 2022b. Incremental non-Gaussian inference for SLAM using normalizing flows. *IEEE Trans. Robotics*, **39**(2), 1458–1475.
  - [499] Huang, Shoudong, Chen, Yongbo, Zhao, Liang, Zhang, Yanhao, and Xu, Mengya. 2021. Some research questions for slam in deformable environments. Pages 7653–7660 of: *2021 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. IEEE.
  - [500] Huang, Yewei, Shan, Tixiao, Chen, Fanfei, and Englot, Brendan. 2022c. DiSCo-SLAM: Distributed Scan Context-Enabled Multi-Robot LiDAR SLAM With Two-Stage Global-Local Graph Optimization. *IEEE Robotics and Automation Letters*, **7**(2), 1150–1157.
  - [501] Huang, Zhaoyang, Shi, Xiaoyu, Zhang, Chao, Wang, Qiang, Cheung, Ka Chun, Qin, Hongwei, Dai, Jifeng, and Li, Hongsheng. 2022d. Flowformer: A transformer architecture for optical flow. Pages 668–685 of: *European Conf. on Computer Vision (ECCV)*. Springer.
  - [502] Huber, P. 1981. *Robust Statistics*. John Wiley & Sons, New York, NY.
  - [503] Hughes, N., Chang, Y., Hu, S., Talak, R., Abdulhai, R., Strader, J., and Carbone, L. 2024a. Foundations of Spatial Perception for Robotics: Hierarchical Representations and Real-time Systems. *Intl. J. of Robotics Research*.
  - [504] Hughes, N., Chang, Y., Hu, S., Talak, R., Abdulhai, R., Strader, J., and Carbone, L. 2024b. Foundations of Spatial Perception for Robotics: Hierarchical Representations and Real-time Systems. *Intl. J. of Robotics Research*.

- [505] Hwangbo, Jemin, Bellicoso, Carmine Dario, Fankhauser, Péter, and Hutter, Marco. 2016. Probabilistic foot contact estimation by fusing information from dynamics and differential/forward kinematics. Pages 3872–3878 of: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*.
- [506] Hwangbo, Jemin, Lee, Joonho, Dosovitskiy, Alexey, Bellicoso, Dario, Tsounis, Vassilios, Koltun, Vladlen, and Hutter, Marco. 2019. Learning agile and dynamic motor skills for legged robots. *Science Robotics*, **4**(26).
- [507] Hyypä, J., Hyypä, H., Leckie, D., Gougeon, F., Yu, X., and Maltamo, M. 2008. Review of methods of small-footprint airborne laser scanning for extracting forest inventory data in boreal forests. *International Journal of Remote Sensing*, **29**(5), 1339–1366.
- [508] ICRA Quadruped Robot Challenge. 2024. *ICRA Quadruped Robot Challenge*. <https://quadruped-robot-challenges.notion.site/Quadruped-Robot-Challenges-bdc4af35638c4036817c3212e602b0e3>. [Online; accessed 10-Jun-2024].
- [509] Iglesias, José Pedro, Olsson, Carl, and Kahl, Fredrik. 2020. Global Optimality for Point Set Registration Using Semidefinite Programming. In: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [510] Ilg, Eddy, Mayer, Nikolaus, Saikia, Tonmoy, Keuper, Margret, Dosovitskiy, Alexey, and Brox, Thomas. 2017. FlowNet 2.0: Evolution of optical flow estimation with deep networks. Pages 2462–2470 of: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [511] Indelman, V., Williams, S., Kaess, M., and Dellaert, F. 2012. Factor Graph Based Incremental Smoothing in Inertial Navigation Systems. In: *Intl. Conf. on Information Fusion (FUSION)*.
- [512] Innmann, Matthias, Zollhöfer, Michael, Nießner, Matthias, Theobalt, Christian, and Stamminger, Marc. 2016. VolumeDeform: Real-time volumetric non-rigid reconstruction. Pages 362–379 of: *European conference on computer vision*. Springer.
- [513] Ivan, Jean-Paul A, Stoyanov, Todor, and Stork, Johannes A. 2022. Online Distance Field Priors for Gaussian Process Implicit Surfaces. *IEEE Robotics and Automation Letters*, **7**(4), 8996–9003.
- [514] Izadi, Shahram, Kim, David, Hilliges, Otmar, Molyneaux, David, Newcombe, Richard, Kohli, Pushmeet, Shotton, Jamie, Hodges, Steve, Freeman, Dustin, Davison, Andrew, et al. 2011. KinectFusion: real-time 3D reconstruction and interaction using a moving depth camera. Pages 559–568 of: *ACM Symp. on User interface software and technology*.
- [515] Izatt, G., Dai, H., and Tedrake, R. 2017. Globally Optimal Object Pose Estimation in Point Clouds with Mixed-Integer Programming. In: *Intl. Symp. of Robotics Research (ISRR)*.
- [516] Izquierdo, Sergio, and Civera, Javier. 2024. Optimal transport aggregation for visual place recognition. Pages 17658–17668 of: *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition*.
- [517] Jaimez, M., Kerl, C., Gonzalez-Jimenez, J., and Cremers, D. 2017. Fast Odometry and Scene Flow from RGB-D Cameras based on Geometric Clustering. In: *Proc. of the IEEE Int. Conf. on Robotics and Automation (ICRA)*.
- [518] Jang, Hyesu, Jung, Minwoo, and Kim, Ayoung. 2023. RaPlace: Place Recognition for Imaging Radar using Radon Transform and Mutable Threshold.

- Pages 11194–11201 of: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*.
- [519] Jatavallabhula, Krishna Murthy, Iyer, Ganesh, and Paull, Liam. 2020.  $\nabla$  slam: Dense slam meets automatic differentiation. Pages 2130–2137 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*. IEEE.
  - [520] Jatavallabhula, Krishna Murthy, Kuwajerwala, Alihusein, Gu, Qiao, Omama, Mohd, Chen, Tao, Maalouf, Alaa, Li, Shuang, Iyer, Ganesh, Saryazdi, Soroush, Keetha, Nikhil, et al. 2023. Conceptfusion: Open-set multimodal 3d mapping. *arXiv preprint arXiv:2302.07241*.
  - [521] Jenelten, Fabian, Hwangbo, Jemin, Tresoldi, Fabian, Bellicoso, C. Dario, and Hutter, Marco. 2019. Dynamic Locomotion on Slippery Ground. *IEEE Robotics and Automation Letters*, 4(4), 4170–4176.
  - [522] Jeong, Jinyong, Cho, Younggun, Shin, Young-Sik, Roh, Hyunchul, and Kim, Ayong. 2019. Complex urban dataset with multi-level sensors from highly diverse urban environments. *The International Journal of Robotics Research*, 38(6), 642–657.
  - [523] Ji, Gwanghyeon, Mun, Juhyeok, Kim, Hyeongjun, and Hwangbo, Jemin. 2022. Concurrent Training of a Control Policy and a State Estimator for Dynamic and Robust Legged Locomotion. *IEEE Robotics and Automation Letters*, 7(2), 4630–4637.
  - [524] Ji, Kaiyi, Yang, Junjie, and Liang, Yingbin. 2021. Bilevel optimization: Convergence analysis and enhanced design. Pages 4882–4892 of: *International conference on machine learning*. PMLR.
  - [525] Jia, Yangqing, Shelhamer, Evan, Donahue, Jeff, Karayev, Sergey, Long, Jonathan, Girshick, Ross, Guadarrama, Sergio, and Darrell, Trevor. 2014. Caffe: Convolutional architecture for fast feature embedding. Pages 675–678 of: *22nd ACM international conference on Multimedia*.
  - [526] Jiang, Fan, Agrawal, Varun, Buchanan, Russell, Fallon, Maurice, and Dellaert, Frank. 2021. iMHS: An incremental multi-hypothesis smoother. *arXiv preprint arXiv:2103.13178*.
  - [527] Jiang, H., Huang, B., Wu, R., Li, Z., Garg, S., Nayyeri, H., Wang, S., and Li, Y. 2024. RoboEXP: Action-Conditioned Scene Graph via Interactive Exploration for Robotic Manipulation. In: *arXiv preprint: 2402.15487*.
  - [528] Jiang, Huaizu, Sun, Deqing, Jampani, Varun, Yang, Ming-Hsuan, Learned-Miller, Erik, and Kautz, Jan. 2018. Super SloMo: High Quality Estimation of Multiple Intermediate Frames for Video Interpolation. Pages 9000–9008 of: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
  - [529] Jiang, Kun, Gao, Shuang, Zhang, Xudong, Li, Jijunnan, Guo, Yandong, Liu, Shijie, Li, Chunlai, and Wang, Jianyu. 2023. SELVO: A Semantic-Enhanced Lidar-Visual Odometry. In: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*.
  - [530] Jiao, Jianhao, Wei, Hexiang, Hu, Tianshuai, Hu, Xiangcheng, Zhu, Yilong, He, Zhijian, Wu, Jin, Yu, Jingwen, Xie, Xupeng, Huang, Huaiyang, Geng, Ruoyu, Wang, Lujia, and Liu, Ming. 2022. FusionPortable: A Multi-Sensor Campus-Scene Dataset for Evaluation of Localization and Mapping Accuracy on Diverse Platforms. Pages 3851–3856 of: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*.
  - [531] Jin, Hailin, Favaro, Paolo, and Soatto, Stefano. 2000. Real-time 3D motion and structure of point features: a front-end system for vision-based control

- and interaction. Pages 778–779 of: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*, vol. 2.
- [532] Johari, Mohammad Mahdi, Carta, Camilla, and Fleuret, François. 2023. Eslam: Efficient dense slam system based on hybrid representation of signed distance fields. In: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
  - [533] Johnson, J, Mangelson, J, Barfoot, T D, and Beard, R. 2024. *Continuous-time Trajectory Estimation: A Comparative Study Between Gaussian Process and Spline-based Approaches*. (arXiv:2402.00399 [cs.RO]).
  - [534] Judd, Kevin M, Gammell, Jonathan D, and Newman, Paul. 2018. Multimotion visual odometry (MVO): Simultaneous estimation of camera and third-party motions. Pages 3949–3956 of: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*. IEEE.
  - [535] Jumper, John, Evans, Richard, Pritzel, Alexander, Green, Tim, Figurnov, Michael, Ronneberger, Olaf, Tunyasuvunakool, Kathryn, Bates, Russ, Židek, Augustin, Potapenko, Anna, et al. 2021. Highly accurate protein structure prediction with AlphaFold. *Nature*, **596**(7873), 583–589.
  - [536] Jung, Minwoo, Yang, Woosong, Lee, Dongjae, Gil, Hyeonjae, Kim, Giseop, and Kim, Ayoung. 0. HeLiPR: Heterogeneous LiDAR dataset for inter-LiDAR place recognition under spatiotemporal variations. *Intl. J. of Robotics Research*, **0**(0), 02783649241242136.
  - [537] Kabalar, Julia, Wu, Shun-Cheng, Wald, Johanna, Tateno, Keisuke, Navab, Nassir, and Tombari, Federico. 2023. Towards Long-Term Retrieval-Based Visual Localization in Indoor Environments With Changes. *IEEE Robotics and Automation Letters*, **8**(4), 1975–1982.
  - [538] Kaess, M., Ranganathan, A., and Dellaert, F. 2008. iSAM: Incremental Smoothing and Mapping. *IEEE Trans. Robotics*, **24**(6), 1365–1378.
  - [539] Kaess, M., Johannsson, H., Roberts, R., Ila, V., Leonard, J., and Dellaert, F. 2011 (May). iSAM2: Incremental Smoothing and Mapping with Fluid Relinearization and Incremental Variable Reordering. In: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
  - [540] Kaess, M., Johannsson, H., Roberts, R., Ila, V., Leonard, J.J., and Dellaert, F. 2012a. iSAM2: Incremental Smoothing and Mapping Using the Bayes Tree. *Intl. J. of Robotics Research*, **31**(2), 216–235.
  - [541] Kaess, M., Johannsson, H., Roberts, R., Ila, V., Leonard, J., and Dellaert, F. 2012b. iSAM2: Incremental Smoothing and Mapping Using the Bayes Tree. *Intl. J. of Robotics Research*, **31**(2), 216–235.
  - [542] Kaess, Michael. 2015. Simultaneous localization and mapping with infinite planes. Pages 4605–4611 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
  - [543] Kaiser, Jacques, Tieck, J. Camillo Vasquez, Hubschneider, Christian, Wolf, Peter, Weber, Michael, Hoff, Michael, Friedrich, Alexander, Wojtasik, Konrad, Roennau, Arne, Kohlhaas, Ralf, Dillmann, Rüdiger, and Zöllner, J. Marius. 2016. Towards a framework for end-to-end control of a simulated vehicle with spiking neural networks. Pages 127–134 of: *IEEE Int. Conf. on Simulation, Modeling, and Programming for Autonomous Robots (SIMPAN)*.
  - [544] Kammel, S., Ziegler, J., Pitzer, B., Werling, M., Gindele, T., Jagzent, D., Schröder, J., Thuy, M., Goebel, M., v. Hundelshausen, F., Pink, O., Frese,

- C., and Stiller, C. 2008. Team AnniWay’s Autonomous System for the 2007 DARPA Urban Challenge. *J. of Field Robotics*, 615–639.
- [545] Kannala, Juho, and Brandt, Sami S. 2006. A generic camera model and calibration method for conventional, wide-angle, and fish-eye lenses. *IEEE transactions on pattern analysis and machine intelligence*, **28**(8), 1335–1340.
- [546] Karimian, A., and Tron, R. 2023. Essential Matrix Estimation using Convex Relaxations in Orthogonal Space. In: *Intl. Conf. on Computer Vision (ICCV)*.
- [547] Kassab, Christina, Mattamala, Matías, Morin, Sacha, Büchner, Martin, Valada, Abhinav, Paull, Liam, and Fallon, Maurice. 2024a. The Bare Necessities: Designing Simple, Effective Open-Vocabulary Scene Graphs. *arXiv preprint arXiv:2412.01539*.
- [548] Kassab, Christina, Mattamala, Matias, Zhang, Lintong, and Fallon, Maurice. 2024b. Language-extended indoor slam (lexis): A versatile system for real-time visual scene understanding. Pages 15988–15994 of: *2024 IEEE International Conference on Robotics and Automation (ICRA)*. IEEE.
- [549] Kato, Hiroharu, Ushiku, Yoshitaka, and Harada, Tatsuya. 2018. Neural 3d mesh renderer. Pages 3907–3916 of: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [550] Kato, Hiroharu, Beker, Deniz, Morariu, Mihai, Ando, Takahiro, Matsuoka, Toru, Kehl, Wadim, and Gaidon, Adrien. 2020. Differentiable rendering: A survey. *arXiv preprint arXiv:2006.12057*.
- [551] Katragadda, Saimouli, Wu, Cho-Ying, Guo, Yuliang, Xinyu Huang, Guoquan Huang, and Ren, Liu. 2025. Online Language Splatting. In: *arxiv preprint: 2503.09447*.
- [552] Katz, Benjamin, Carlo, Jared Di, and Kim, Sangbae. 2019. Mini Cheetah: A Platform for Pushing the Limits of Dynamic Quadruped Control. Pages 6295–6301 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [553] Kazhdan, Michael, Bolitho, Matthew, and Hoppe, Hugues. 2006. Poisson surface reconstruction. Pages 61–70 of: *Proceedings of the fourth Eurographics symposium on Geometry processing*. Eurographics Association.
- [554] Keenan Burnett, Angela P. Schoellig, Timothy D. Barfoot. 2021. Do We Need to Compensate for Motion Distortion and Doppler Effects in Spinning Radar Navigation? *IEEE Robotics and Automation Letters*, **6**(2), 771–778.
- [555] Keetha, Nikhil, Mishra, Avneesh, Karhade, Jay, Jatavallabhula, Krishna Murthy, Scherer, Sebastian, Krishna, Madhava, and Garg, Sourav. 2023. Anyloc: Towards universal visual place recognition. *IEEE Robotics and Automation Letters*.
- [556] Keetha, Nikhil, Karhade, Jay, Jatavallabhula, Krishna Murthy, Yang, Gengshan, Scherer, Sebastian, Ramanan, Deva, and Luiten, Jonathon. 2024. Splatam: Splat track & map 3d gaussians for dense rgb-d slam. Pages 21357–21366 of: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [557] Keller, Maik, Lefloch, Damien, Lambers, Martin, Izadi, Shahram, Weyrich, Tim, and Kolb, Andreas. 2013. Real-time 3d reconstruction in dynamic scenes using point-based fusion. Pages 1–8 of: *Intl. Conf. on 3D Vision (3DV)*. IEEE.
- [558] Kellner, Dominik, Klappstein, Jens, and Dietmayer, Klaus. 2012. Grid-based



- DBSCAN for clustering extended objects in radar data. Pages 365–370 of: *IEEE Intelligent Vehicles Symposium (IV)*.
- [559] Kellner, Dominik, Barjenbruch, Michael, Klappstein, Jens, Dickmann, Jürgen, and Dietmayer, Klaus. 2013. Instantaneous ego-motion estimation using Doppler radar. Pages 869–874 of: *IEEE Intl. Conf. on Intelligent Transportation Systems (ITSC)*.
- [560] Kerbl, Bernhard, Kopanas, Georgios, Leimkühler, Thomas, and Drettakis, George. 2023. 3d gaussian splatting for real-time radiance field rendering. *ACM Trans. Graph.*, **42**(4), 139–1.
- [561] Kerl, Christian, Sturm, Jürgen, and Cremers, Daniel. 2013a. Dense visual SLAM for RGB-D cameras. Pages 2100–2106 of: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*. IEEE.
- [562] Kerl, Christian, Sturm, Jürgen, and Cremers, Daniel. 2013b. Robust odometry estimation for RGB-D cameras. Pages 3748–3754 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*. IEEE.
- [563] Kerr, Justin, Kim, Chung Min, Goldberg, Ken, Kanazawa, Angjoo, and Tancik, Matthew. 2023. LERF: Language Embedded Radiance Fields. In: *Intl. Conf. on Computer Vision (ICCV)*.
- [564] Keselman, Leonid, and Hebert, Martial. 2022. Approximate differentiable rendering with algebraic surfaces. Pages 596–614 of: *European Conference on Computer Vision*. Springer.
- [565] Khader, Motaz, and Cherian, Samir. 2020. An introduction to automotive lidar. *Texas Instruments*.
- [566] Khattak, Shehryar, Nguyen, Huan, Mascarich, Frank, Dang, Tung, and Alexis, Kostas. 2020. Complementary multi-modal sensor fusion for resilient robot pose estimation in subterranean environments. Pages 1024–1029 of: *Intl. Conf. on Unmanned Aircraft Systems (ICUAS)*.
- [567] Khazatsky, Alexander, Pertsch, Karl, Nair, Suraj, Balakrishna, Ashwin, Dasari, Sudeep, Karamcheti, Siddharth, Nasiriany, Soroush, Srirama, Mohan Kumar, Chen, Lawrence Yunliang, Ellis, Kirsty, Fagan, Peter David, Hejna, Joey, Itkina, Masha, Lepert, Marion, Ma, Yecheng Jason, Miller, Patrick Tree, Wu, Jimmy, Belkhale, Suneel, Dass, Shivin, Ha, Huy, Jain, Arhan, Lee, Abraham, Lee, Youngwoon, Memmel, Marius, Park, Sungjae, Radosavovic, Ilija, Wang, Kaiyuan, Zhan, Albert, Black, Kevin, Chi, Cheng, Hatch, Kyle Beltran, Lin, Shan, Lu, Jingpei, Mercat, Jean, Rehman, Abdul, Sanketi, Pannag R, Sharma, Archit, Simpson, Cody, Vuong, Quan, Walke, Homer Rich, Wulfe, Blake, Xiao, Ted, Yang, Jonathan Heewon, Yavary, Arefeh, Zhao, Tony Z., Agia, Christopher, Baijal, Rohan, Castro, Mateo Guaman, Chen, Daphne, Chen, Qiuyu, Chung, Trinity, Drake, Jaimyn, Foster, Ethan Paul, Gao, Jensen, Herrera, David Antonio, Heo, Minh, Hsu, Kyle, Hu, Jiaheng, Jackson, Donovan, Le, Charlotte, Li, Yunshuang, Lin, Kevin, Lin, Roy, Ma, Zehan, Maddukuri, Abhiram, Mirchandani, Suvir, Morton, Daniel, Nguyen, Tony, O’Neill, Abigail, Scalise, Rosario, Seale, Derick, Son, Victor, Tian, Stephen, Tran, Emi, Wang, Andrew E., Wu, Yilin, Xie, Annie, Yang, Jingyun, Yin, Patrick, Zhang, Yunchu, Bastani, Osbert, Berseth, Glen, Bohg, Jeannette, Goldberg, Ken, Gupta, Abhinav, Gupta, Abhishek, Jayaraman, Dinesh, Lim, Joseph J, Malik, Jitendra, Martín-Martín, Roberto, Ramamoorthy, Subramanian, Sadigh, Dorsa, Song, Shuran, Wu, Jiajun, Yip, Michael C., Zhu, Yuke, Kollar, Thomas, Levine,

- Sergey, and Finn, Chelsea. 2024. DROID: A Large-Scale In-The-Wild Robot Manipulation Dataset.
- [568] Khosoussi, Kasra, Huang, Shoudong, and Dissanayake, Gamini. 2016. Tree-connectivity: Evaluating the graphical structure of SLAM. Pages 1316–1322 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*. IEEE.
  - [569] Khosoussi, Kasra, Giamou, Matthew, Sukhatme, Gaurav S, Huang, Shoudong, Dissanayake, Gamini, and How, Jonathan P. 2019. Reliable graphs for SLAM. *Intl. J. of Robotics Research*, **38**(2-3), 260–298.
  - [570] Kim, Been, Kaess, Michael, Fletcher, Luke, Leonard, John, Bachrach, Abraham, Roy, Nicholas, and Teller, Seth. 2010. Multiple relative pose graphs for robust cooperative mapping. Pages 3185–3192 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*. IEEE.
  - [571] Kim, Giseop, and Kim, Ayoung. 2018. Scan context: Egocentric spatial descriptor for place recognition within 3d point cloud map. Pages 4802–4809 of: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*. IEEE.
  - [572] Kim, Giseop, and Kim, Ayoung. 2020. Remove, then revert: Static point cloud map construction using multiresolution range images. Pages 10758–10765 of: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*. IEEE.
  - [573] Kim, Giseop, and Kim, Ayoung. 2022. Lt-mapper: A modular framework for lidar-based lifelong mapping. Pages 7995–8002 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*. IEEE.
  - [574] Kim, Giseop, Park, Byungjae, and Kim, Ayoung. 2019a. 1-day learning, 1-year localization: Long-term lidar localization using scan context image. *IEEE Robotics and Automation Letters*, **4**(2), 1948–1955.
  - [575] Kim, Giseop, Park, Yeong Sang, Cho, Younghun, Jeong, Jinyong, and Kim, Ayoung. 2020. Mulran: Multimodal range dataset for urban place recognition. Pages 6246–6253 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*. IEEE.
  - [576] Kim, Giseop, Choi, Sunwook, and Kim, Ayoung. 2021. Scan context++: Structural place recognition robust to rotation and lateral variations in urban environments. *IEEE Trans. Robotics*, **38**(3), 1856–1874.
  - [577] Kim, Hanjun, Jung, Minwoo, Noh, Chiyun, Jung, Sangwoo, Song, Hyunho, Yang, Wooseong, Jang, Hyesu, and Kim, Ayoung. 2025. HeRCULES: Heterogeneous Radar Dataset in Complex Urban Environment for Multi-session Radar SLAM. In: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
  - [578] Kim, Hanme, Handa, Ankur, Benosman, Ryad, Ieng, Sio-Hoi, and Davison, Andrew J. 2014. Simultaneous Mosaicing and Tracking with an Event Camera. In: *British Machine Vision Conf. (BMVC)*.
  - [579] Kim, Hanme, Leutenegger, Stefan, and Davison, Andrew J. 2016. Real-Time 3D Reconstruction and 6-DoF Tracking with an Event Camera. Pages 349–364 of: *European Conf. on Computer Vision (ECCV)*.
  - [580] Kim, Haram, and Kim, H. Jin. 2021. Real-Time Rotational Motion Estimation With Contrast Maximization Over Globally Aligned Events. *IEEE Robotics and Automation Letters*, **6**(3), 6016–6023.
  - [581] Kim, Moo Jin, Pertsch, Karl, Karamcheti, Siddharth, Xiao, Ted, Balakrishna, Ashwin, Nair, Suraj, Rafailov, Rafael, Foster, Ethan, Lam, Grace, Sanketi, Pannag, Vuong, Quan, Kollar, Thomas, Burchfiel, Benjamin,

- Tedrake, Russ, Sadigh, Dorsa, Levine, Sergey, Liang, Percy, and Finn, Chelsea. 2024. OpenVLA: An Open-Source Vision-Language-Action Model. *arXiv preprint arXiv:2406.09246*.
- [582] Kim, S., and Kim, J. 2012. Building occupancy maps with a mixture of Gaussian processes. Pages 4756–4761 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [583] Kim, S., and Kim, J. 2013. Occupancy Mapping and Surface Reconstruction Using Local Gaussian Processes With Kinect Sensors. Pages 1335–1346 of: *IEEE Trans. on Cybernetics*.
- [584] Kim, Soohwan, and Kim, Jonghyuk. 2015. *GPmap: A Unified Framework for Robotic Mapping Based on Sparse Gaussian Processes*. Springer International Publishing. Pages 319–332.
- [585] Kim, Ue-Hwan, Park, Jin-Man, Song, Taek-Jin, and Kim, Jong-Hwan. 2019b. 3-D Scene Graph: A Sparse and Semantic Representation of Physical Environments for Intelligent Agents. *IEEE Trans. on Cybernetics*, **PP**(Aug.), 1–13.
- [586] Kim, Yeeun, Yu, Byeongho, Lee, Eungchang, Mason, Kim, Joon-ha, Park, Hae-won, and Myung, Hyun. 2022. STEP: State Estimator for Legged Robots Using a Preintegrated Foot Velocity Factor. *IEEE Robotics and Automation Letters*, **7**(2), 4456–4463.
- [587] Kingma, Diederik P, and Ba, Jimmy. 2014. Adam: A method for stochastic optimization. *arXiv preprint arXiv:1412.6980*.
- [588] Kirillov, Alexander, He, Kaiming, Girshick, Ross, Rother, Carsten, and Dollar, Piotr. 2019 (June). Panoptic Segmentation. In: *The IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*.
- [589] Kirillov, Alexander, Mintun, Eric, Ravi, Nikhila, Mao, Hanzi, Rolland, Chloe, Gustafson, Laura, Xiao, Tete, Whitehead, Spencer, Berg, Alexander C, Lo, Wan-Yen, et al. 2023. Segment anything. Pages 4015–4026 of: *Proceedings of the IEEE/CVF International Conference on Computer Vision*.
- [590] Kitanov, Andrej, and Indelman, Vadim. 2024. Topological belief space planning for active SLAM with pairwise Gaussian potentials and performance guarantees. *Intl. J. of Robotics Research*, **43**(1), 69–97.
- [591] Klein, Georg, and Murray, David. 2007. Parallel tracking and mapping for small AR workspaces. Pages 225–234 of: *IEEE and ACM Intl. Sym. on Mixed and Augmented Reality (ISMAR)*. IEEE.
- [592] Klenk, Simon, Chui, Jason, Demmel, Nikolaus, and Cremers, Daniel. 2021. TUM-VIE: The TUM Stereo Visual-Inertial Event Dataset. Pages 8601–8608 of: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*.
- [593] Klenk, Simon, Motzet, Marvin, Koestler, Lukas, and Cremers, Daniel. 2024. Deep Event Visual Odometry. Pages 739–749 of: *Intl. Conf. on 3D Vision (3DV)*.
- [594] Kobayashi, Sosuke, Matsumoto, Eiichi, and Sitzmann, Vincent. 2022. Decomposing nerf for editing via feature field distillation. *Advances in Neural Information Processing Systems (NIPS)*.
- [595] Koch, Sebastian, Hermosilla, Pedro, Vaskevicius, Narunas, Colosi, Mirco, and Ropinski, Timo. 2024a. Lang3DSG: Language-based contrastive pre-training for 3D Scene Graph prediction. In: *2024 International Conference on 3D Vision (3DV)*.

- [596] Koch, Sebastian, Vaskevicius, Narunas, Colosi, Mirco, Hermosilla, Pedro, and Ropinski, Timo. 2024b (June). Open3DSG: Open-Vocabulary 3D Scene Graphs from Point Clouds with Queryable Objects and Open-Set Relationships. In: *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)*.
- [597] Koch, Sebastian, Hermosilla, Pedro, Vaskevicius, Narunas, Colosi, Mirco, and Ropinski, Timo. 2024c (January). SGR3D: Self-Supervised 3D Scene Graph Learning via Object-Level Scene Reconstruction. Pages 3404–3414 of: *Proceedings of the IEEE/CVF Winter Conference on Applications of Computer Vision (WACV)*.
- [598] Koenemann, Jonas, Licitra, Giovanni, Alp, Mustafa, and Diehl, Moritz. 2017. *Openocl—open optimal control library*.
- [599] Koide, Kenji, Yokozuka, Masashi, Oishi, Shuji, and Banno, Atsuhiko. 2021. Voxelized gicp for fast and accurate 3d point cloud registration. Pages 11054–11059 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*. IEEE.
- [600] Koller, D., and Friedman, N. 2009. *Probabilistic Graphical Models: Principles and Techniques*. The MIT Press.
- [601] Kong, Xin, Yang, Xuemeng, Zhai, Guangyao, Zhao, Xiangrui, Zeng, Xianfang, Wang, Mengmeng, Liu, Yong, Li, Wanlong, and Wen, Feng. 2020. Semantic Graph Based Place Recognition for 3D Point Clouds. In: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*.
- [602] Konolige, K. 2004. Large-scale map-making. In: *Proc. 21<sup>th</sup> AAAI National Conference on AI*.
- [603] Konolige, K., and Agrawal, M. 2008. FrameSLAM: From Bundle Adjustment to Real-Time Visual Mapping. *IEEE Trans. Robotics*, **24**, 1066–1077.
- [604] Konolige, Kurt, Grisetti, Giorgio, Kümmerle, Rainer, Burgard, Wolfram, Limketkai, Benson, and Vincent, Regis. 2010. Efficient sparse pose adjustment for 2D mapping. Pages 22–29 of: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*. IEEE.
- [605] Kopanas, Georgios, Philip, Julien, Leimkühler, Thomas, and Drettakis, George. 2021. Point-Based Neural Rendering with Per-View Optimization. *Computer Graphics Forum (Proceedings of the Eurographics Symposium on Rendering)*, **40**(4).
- [606] Koskinen, Markku, Kostamovaara, Juha Tapio, and Myllylä, Risto A. 1992. Comparison of continuous-wave and pulsed time-of-flight laser range-finding techniques. Pages 296–305 of: *Optics, Illumination, and Image Sensing for Machine Vision VI*, vol. 1614.
- [607] Kottas, Dimitrios, and Roumeliotis, Stergios. 2013 (June 24–28,). Exploiting Urban Scenes for Vision-aided Inertial Navigation. In: *Robotics: Science and Systems (RSS)*.
- [608] Kottege, Navinda, Scherer, Sebastian, Faigl, J., and Agha, Ali. 2022. Special Issue on Advancements and Lessons Learned during Phases I and II of the DARPA Subterranean Challenge. *Field Robotics*, 1947–1950.
- [609] Kottege, Navinda, Williams, Jason, Tidd, Brendan, Talbot, Fletcher, Steindl, Ryan, Cox, Mark, Frousheger, Dennis, Hines, Thomas, Pitt, Alex, Tam, Benjamin, Wood, Brett, Hanson, Lauren, Surdo, Katrina Lo, Molnar, Thomas, Wildie, Matt, Stepanas, Kazys, Catt, Gavin, Tychsen-Smith, Lachlan, Penfold, Dean, Overs, Leslie, Ramezani, Milad, Khosoussi, Kasra, Kendoul, Farid, Wagner, Glenn, Palmer, Duncan, Manderson, Jack, Medek,

- Corey, O'Brien, Matthew, Chen, Shengkang, and Arkin, Ronald C. 2024. Heterogeneous Robot Teams with Unified Perception and Autonomy: How Team CSIRO Data61 Tied for the Top Score at the DARPA Subterranean Challenge. *Field Robotics*, 313–359.
- [610] Krajník, Tomáš, Fentanes, Jaime Pulido, Hanheide, Marc, and Duckett, Tom. 2016. Persistent localization and life-long mapping in changing environments using the frequency map enhancement. Pages 4558–4563 of: *2016 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. IEEE.
- [611] Krajník, Tomáš, Fentanes, Jaime P, Santos, Joao M, and Duckett, Tom. 2017. Fremen: Frequency map enhancement for long-term mobile robot autonomy in changing environments. *IEEE Trans. Robotics*, **33**(4), 964–977.
- [612] Kramer, Andrew, and Heckman, Christoffer. 2020. Radar-Inertial State Estimation and Obstacle Detection for Micro-Aerial Vehicles in Dense Fog. Pages 3–16 of: *International Symposium on Experimental Robotics*. Springer.
- [613] Kramer, Andrew, Stahoviak, Carl, Santamaria-Navarro, Angel, Agha-Mohammadi, Ali-Akbar, and Heckman, Christoffer. 2020. Radar-inertial ego-velocity estimation for visually degraded environments. Pages 5739–5746 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*. IEEE.
- [614] Kramer, Andrew, Harlow, Kyle, Williams, Christopher, and Heckman, Christoffer. 2022. ColoRadar: The Direct 3D Millimeter Wave Radar Dataset. *Intl. J. of Robotics Research*, **41**(4), 351–360.
- [615] Krizhevsky, A., Sutskever, I., and Hinton, G. 2012a. ImageNet classification with deep convolutional neural networks. In: *Conf. Neural Information Processing Systems (NIPS)*.
- [616] Krizhevsky, Alex, Sutskever, Ilya, and Hinton, Geoffrey E. 2012b. Imagenet classification with deep convolutional neural networks. *Advances in Neural Information Processing Systems (NIPS)*, **25**.
- [617] Kubelka, Vladimír, Fritz, Emil, and Magnusson, Martin. 2024. Do we need scan-matching in radar odometry? In: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [618] Kucner, Tomasz Piotr, Magnusson, Martin, Mghames, Sariah, Palmieri, Luigi, Verdoja, Francesco, Swaminathan, Chittaranjan Srinivas, Krajník, Tomáš, Schaffernicht, Erik, Bellotto, Nicola, Hanheide, Marc, et al. 2023. Survey of maps of dynamics for mobile robots. *Intl. J. of Robotics Research*, **42**(11), 977–1006.
- [619] Kueng, Beat, Mueggler, Elias, Gallego, Guillermo, and Scaramuzza, Davide. 2016. Low-latency Visual Odometry using Event-based Feature Tracks. Pages 16–23 of: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*.
- [620] Kuipers, Benjamin. 2000. The Spatial Semantic Hierarchy. *Artificial Intelligence*, **119**, 191–233.
- [621] Kukko, Antero, Kaijaluoto, Risto, Kaartinen, Harri, Lehtola, Ville V, Jaakkola, Anttoni, and Hyypä, Juha. 2017. Graph SLAM correction for single scanner MLS forest data under boreal forest canopy. *ISPRS Journal of Photogrammetry and Remote Sensing*, **132**, 199–209.
- [622] Kümmerle, Rainer, Grisetti, Giorgio, Strasdat, Hauke, Konolige, Kurt, and

- Burgard, Wolfram. 2011. G<sup>2</sup>o: A general framework for graph optimization. In: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [623] Kung, Pou-Chun, Wang, Chieh-Chih, and Lin, Wen-Chieh. 2021. A Normal Distribution Transform-Based Radar Odometry Designed For Scanning and Automotive Radars. Pages 14417–14423 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [624] Labbé, Mathieu, and Michaud, François. 2019. RTAB-Map as an open-source lidar and visual simultaneous localization and mapping library for large-scale and long-term online operation. *Journal of field robotics*, **36**(2), 416–446.
- [625] Laina, Sebastian Barbas, Boche, Simon, Papatheodorou, Sotiris, Schaefer, Simon, Jung, Jaehyung, and Leutenegger, Stefan. 2025. FindAnything: Open-Vocabulary and Object-Centric Mapping for Robot Exploration in Any Environment. *arXiv preprint*.
- [626] Lajoie, P., Hu, S., Beltrame, G., and Carlone, L. 2019. Modeling Perceptual Aliasing in SLAM via Discrete-Continuous Graphical Models. *IEEE Robotics and Automation Letters*.
- [627] Lamarca, Jose, and Montiel, J.M.M. 2018. Camera Tracking for SLAM in Deformable Maps. In: *4th Inter. Workshop on Recovering 6D Object Pose. In ECCVw*.
- [628] Lamarca, Jose, Parashar, Shaifali, Bartoli, Adrien, and Montiel, J.M.M. 2021. DefSLAM: Tracking and Mapping of Deforming Scenes From Monocular Sequences. *IEEE Transactions on robotics*, **37**(1), 291–303.
- [629] Lamarca, José, Gómez Rodríguez, Juan J., Tardós, Juan D., and Montiel, J.M.M. 2022. Direct and Sparse Deformable Tracking. *IEEE Robotics and Automation Letters*, **7**(4), 11450–11457.
- [630] Landry, David, Pomerleau, Francois, and Giguere, Philippe. 2019. CELLO-3D: Estimating the Covariance of ICP in the Real World. In: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [631] Lang, Xiaolei, Li, Laijian, Wu, Chenming, Zhao, Chen, Liu, Lina, Liu, Yong, Lv, Jiajun, and Zuo, Xingxing. 2025. Gaussian-LIC: Real-Time Photo-Realistic SLAM with Gaussian Splatting and LiDAR-Inertial-Camera Fusion. *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [632] Langer, Edith, Patten, Timothy, and Vincze, Markus. 2020. Robust and efficient object change detection by combining global semantic information and local geometric verification. Pages 8453–8460 of: *2020 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. IEEE.
- [633] Lasserre, J. 2010. *Moments, positive polynomials and their applications*. Vol. 1. World Scientific.
- [634] Lasserre, Jean B. 2001. Global optimization with polynomials and the problem of moments. *SIAM J. Optim.*, **11**(3), 796–817.
- [635] Latif, Y., Lerma, C. D. C., and Neira, J. 2012. Robust Loop Closing Over Time. In: *Robotics: Science and Systems (RSS)*.
- [636] Lau, Boris, Sprunk, Christoph, and Burgard, Wolfram. 2013. Efficient grid-based spatial representations for robot navigation in dynamic environments. *J. on Robotics and Autonomous Systems (RAS)*, **61**(10), 1116–1130.
- [637] Le Gentil, C., and Vidal-Calleja, T. 2021. Continuous Integration over SO(3) for IMU Preintegration. In: *Robotics: Science and Systems (RSS)*.

- [638] Le Gentil, Cedric, Vidal-Calleja, Teresa, and Huang, Shoudong. 2018. 3D Lidar-IMU Calibration based on Upsampled Preintegrated Measurements for Motion Distortion Correction. Pages 2149–2155 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*. IEEE.
- [639] Le Gentil, Cedric, Vidal-Calleja, Teresa, and Huang, Shoudong. 2020. Gaussian Process Preintegration for Inertial-Aided State Estimation. *IEEE Robotics and Automation Letters*, **5**(2), 2108–2114.
- [640] Le Gentil, Cedric, Vidal-Calleja, Teresa, and Huang, Shoudong. 2021. IN2LAAMA: Inertial Lidar Localization Autocalibration and Mapping. *IEEE Transactions on Robotics*, **37**(1), 275–290.
- [641] Le Gentil, Cedric, Ouabi, Othmane-Latif, Wu, Lan, Pradalier, Cedric, and Vidal-Calleja, Teresa. 2023. Accurate Gaussian-Process-based Distance Fields with Applications to Echolocation and Mapping. *IEEE Robotics and Automation Letters*, 1–8.
- [642] Lee, Alex Junho, Cho, Younggun, Shin, Young-sik, Kim, Ayoung, and Myung, Hyun. 2022. ViViD++: Vision for Visibility Dataset. *IEEE Robotics and Automation Letters*, **7**(3), 6282–6289.
- [643] Lee, Bhoram, Zhang, Clark, Huang, Zonghao, and Lee, Daniel D. 2019. On-line continuous mapping using gaussian process implicit surfaces. In: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [644] Lee, G. H., Fraundorfer, F., and Pollefeys, M. 2013. Robust pose-graph loop-closures with expectation-maximization. In: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*.
- [645] Lee, Joonho, Hwangbo, Jemin, Wellhausen, Lorenz, Koltun, Vladlen, and Hutter, Marco. 2020. Learning quadrupedal locomotion over challenging terrain. *Science Robotics*, **5**(47), 5986.
- [646] Leordeanu, Marius, and Hebert, Martial. 2005. A spectral technique for correspondence problems using pairwise constraints. Pages 1482–1489 of: *Intl. Conf. on Computer Vision (ICCV)*, vol. 2. IEEE.
- [647] Lepetit, Vincent, Moreno-Noguer, Francesc, and Fua, Pascal. 2009. Epnp: An accurate  $O(n)$  solution to the pnp problem. *Intl. J. of Computer Vision*, **81**(2), 155.
- [648] Lepora, Nathan F., and Lloyd, John. 2020. Optimal Deep Learning for Robot Touch: Training Accurate Pose Models of 3D Surfaces and Edges. *IEEE Robotics & Automation Magazine*, **27**(2), 66–77.
- [649] Leroy, Vincent, Cabon, Yohann, and Revaud, Jérôme. 2024. Grounding image matching in 3d with mast3r. Pages 71–91 of: *European Conf. on Computer Vision (ECCV)*. Springer.
- [650] Leutenegger, S., Chli, M., and Siegwart, R. 2011. BRISK: Binary Robust Invariance Scalable Keypoints. In: *Intl. Conf. on Computer Vision (ICCV)*.
- [651] Leutenegger, Stefan. 2022. Okvis2: Realtime scalable visual-inertial slam with loop closure. *arXiv preprint arXiv:2202.09199*.
- [652] Leutenegger, Stefan, Lynen, Simon, Bosse, Michael, Siegwart, Roland, and Furgale, Paul. 2015. Keyframe-based visual-inertial odometry using nonlinear optimization. *Intl. J. of Robotics Research*, **34**(3), 314–334.
- [653] Levenberg, K. 1944. A Method for the Solution of Certain Nonlinear Problems in Least Squares. *Quart. Appl. Math*, **2**(2), 164–168.

- [654] Li, Boyi, Weinberger, Kilian Q, Belongie, Serge, Koltun, Vladlen, and Rantftl, Rene. 2022. Language-driven Semantic Segmentation. In: *International Conference on Learning Representations*.
- [655] Li, Chunyuan, Wong, Cliff, Zhang, Sheng, Usuyama, Naoto, Liu, Haotian, Yang, Jianwei, Naumann, Tristan, Poon, Hoifung, and Gao, Jianfeng. 2024a. Llava-med: Training a large language-and-vision assistant for biomedicine in one day. *Advances in Neural Information Processing Systems*, **36**.
- [656] Li, Dongjiang, Shi, Xuesong, Long, Qiwei, Liu, Shenghui, Yang, Wei, Wang, Fangshi, Wei, Qi, and Qiao, Fei. 2020. DXSLAM: A Robust and Efficient Visual SLAM System with Deep Features. In: *IEEE/RSJ International conference on intelligent robots and systems (IROS)*.
- [657] Li, Fangting, Zhang, Guoqiang, and Yan, Jun. 2008. Coregistration Based on Sift Algorithm for Synthetic Aperture Radar Interferometry.
- [658] Li, H. 2009. Consensus set maximization with guaranteed global optimality for robust geometry estimation. Pages 1074–1080 of: *Intl. Conf. on Computer Vision (ICCV)*.
- [659] Li, Lin, Kong, Xin, Zhao, Xiangrui, Li, Wanlong, Wen, Feng, Zhang, Hongbo, and Liu, Yong. 2021. SA-LOAM: Semantic-aided LiDAR SLAM with Loop Closure. In: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [660] Li, M., and Mourikis, A. 2013. High-Precision, Consistent EKF-based Visual-Inertial Odometry. *Intl. J. of Robotics Research*, **32**(6), 690–711.
- [661] Li, M., and Mourikis, A. I. 2012 (May 14–18,). Improving the Accuracy of EKF-based Visual-Inertial Odometry. Pages 828–835 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [662] Li, Qing, Chen, Shaoyang, Wang, Cheng, Li, Xin, Wen, Chenglu, Cheng, Ming, and Li, Jonathan. 2019. LO-Net: Deep Real-Time Lidar Odometry. Pages 8465–8474 of: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [663] Li, Ruihao, Wang, Sen, Long, Zhiqiang, and Gu, Dongbing. 2018. Undeepvo: Monocular visual odometry through unsupervised deep learning. Pages 7286–7291 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*. IEEE.
- [664] Li, Wanhua, Zhou, Renping, Zhou, Jiawei, Song, Yingwei, Herter, Johannes, Qin, Minghan, Huang, Gao, and Pfister, Hanspeter. 2025. 4D LangSplat: 4D Language Gaussian Splatting via Multimodal Large Language Models.
- [665] Li, Xingyi, Zhang, Han, and Chen, Weidong. 2023. 4D Radar-based Pose Graph SLAM with Ego-velocity Pre-integration Factor. *IEEE Robotics and Automation Letters*, **8**(8), 5124–5131.
- [666] Li, Xudong, Wang, Zhixiang, Liu, Zihao, Zhang, Yizhai, Zhang, Fan, Yao, Xiuming, and Huang, Panfeng. 2024b. Asynchronous Event-Inertial Odometry using a Unified Gaussian Process Regression Framework. Pages 7773–7778 of: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*.
- [667] Li, Zhengqi, Tucker, Richard, Cole, Forrester, Wang, Qianqian, Jin, Linyi, Ye, Vickie, Kanazawa, Angjoo, Holynski, Aleksander, and Snavely, Noah. 2024c. Megasam: Accurate, fast, and robust structure and motion from casual dynamic videos. *arXiv preprint arXiv:2412.04463*.
- [668] Lichtsteiner, Patrick, Posch, Christoph, and Delbruck, Tobi. 2008. A 128×128 120 dB 15  $\mu$ s latency asynchronous temporal contrast vision sensor. *IEEE J. Solid-State Circuits*, **43**(2), 566–576.



- [669] Lim, Hyungtae, Hwang, Sungwon, and Myung, Hyun. 2021. ERASOR: Ego-centric ratio of pseudo occupancy-based dynamic object removal for static 3D point cloud map building. *IEEE Robotics and Automation Letters*, **6**(2), 2272–2279.
- [670] Lim, Hyungtae, Jang, Seoyeon, Mersch, Benedikt, Behley, Jens, Myung, Hyun, and Stachniss, Cyrill. 2024a. Helimos: A dataset for moving object segmentation in 3d point clouds from heterogeneous lidar sensors. Pages 14087–14094 of: *2024 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. IEEE.
- [671] Lim, Hyungtae, Kim, Beomsoo, Kim, Daebeom, Lee, Eungchang Mason, and Myung, Hyun. 2024b. Quatro++: Robust global registration exploiting ground segmentation for loop closing in LiDAR SLAM. *Intl. J. of Robotics Research*, **43**(5), 685–715.
- [672] Lim, Jaemin, and Tsiotras, Panagiotis. 2021. A Generalized A\* Algorithm for Finding Globally Optimal Paths in Weighted Colored Graphs. Pages 7503–7509 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [673] Lin, J., and Zhang, F. 2019. Loam\_livox A Robust LiDAR Odometry and Mapping LOAM Package for Livox LiDAR. In: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*.
- [674] Lin, Jiarong, and Zhang, Fu. 2020. Loam livox: A fast, robust, high-precision LiDAR odometry and mapping package for LiDARs of small FoV. Pages 3126–3131 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [675] Lin, Pei-Chun, Komsuoglu, Haldun, and Koditschek, Daniel E. 2005. A leg configuration measurement system for full-body pose estimates in a hexapod robot. *IEEE Trans. Robotics*, **21**(3), 411–422.
- [676] Lin, Tzu-Yuan, Zhang, Ray, Yu, Justin, and Ghaffari, Maani. 2022 (08–11 Nov). Legged Robot State Estimation using Invariant Kalman Filtering and Learned Contact Events. Pages 1057–1066 of: Faust, Aleksandra, Hsu, David, and Neumann, Gerhard (eds), *Conf. on Robot Learning (CoRL)*. Proceedings of Machine Learning Research, vol. 164.
- [677] Lindenberger, Philipp, Sarlin, Paul-Edouard, Larsson, Viktor, and Pollefeys, Marc. 2021. Pixel-perfect structure-from-motion with featuremetric refinement. Pages 5987–5997 of: *Proceedings of the IEEE/CVF international conference on computer vision*.
- [678] Lindenberger, Philipp, Sarlin, Paul-Edouard, and Pollefeys, Marc. 2023. Lightglue: Local feature matching at light speed. Pages 17627–17638 of: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [679] Lipson, Lahav, Teed, Zachary, and Deng, Jia. 2024. Deep patch visual slam. Pages 424–440 of: *European Conf. on Computer Vision (ECCV)*. Springer.
- [680] Liso, Lorenzo, Sandström, Erik, Yugay, Vladimir, Van Gool, Luc, and Oswald, Martin R. 2024. Loopy-slam: Dense neural slam with loop closures. Pages 20363–20373 of: *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition*.
- [681] Liston, Ronald A. 1967. Walking machine studies. *The Military Engineer*, **59**(388), 101–104.
- [682] Liu, Chenxi, Wang, Wei, Liu, Hairong, and Wang, Jun. 2022. Application of Hawk-Eye Technology to Sports Events. Pages 1–5 of: *intl. Conf. on Information Technology and Contemporary Sports (TCS)*.

- [683] Liu, Hanxiao, Simonyan, Karen, and Yang, Yiming. 2019a. Darts: Differentiable architecture search. In: *International Conference on Learning Representations (ICLR)*.
- [684] Liu, Liyang, Fryc, Simon, Wu, Lan, Vu, Thanh Long, Paul, Gavin, and Vidal-Calleja, Teresa. 2021a. Active and interactive mapping with dynamic Gaussian process implicit surfaces for mobile manipulators. *IEEE Robotics and Automation Letters*, **6**(2), 3679–3686.
- [685] Liu, P., Orru, Y., Paxton, C., Shafiullah, N.M.M., and Pinto, L. 2024a. OK-Robot: What Really Matters in Integrating Open-Knowledge Models for Robotics. *arXiv preprint arXiv:2401.12202*.
- [686] Liu, Risheng, Gao, Jiaxin, Zhang, Jin, Meng, Deyu, and Lin, Zhouchen. 2021b. Investigating bi-level optimization for learning and vision from a unified perspective: A survey and beyond. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, **44**(12), 10045–10067.
- [687] Liu, Shichen, Li, Tianye, Chen, Weikai, and Li, Hao. 2019b. Soft Rasterizer: A Differentiable Renderer for Image-based 3D Reasoning. In: *Intl. Conf. on Computer Vision (ICCV)*.
- [688] Liu, Shilong, Zeng, Zhaoyang, Ren, Tianhe, Li, Feng, Zhang, Hao, Yang, Jie, Jiang, Qing, Li, Chunyuan, Yang, Jianwei, Su, Hang, et al. 2024b. Grounding dino: Marrying dino with grounded pre-training for open-set object detection. Pages 38–55 of: *European Conference on Computer Vision*. Springer.
- [689] Liu, Wenxin, Caruso, David, Ilg, Eddy, Dong, Jing, Mourikis, Anastasios I., Daniilidis, Kostas, Kumar, Vijay R., and Engel, Jakob J. 2020. TLIO: Tight Learned Inertial Odometry. *IEEE Robotics and Automation Letters*, **5**, 5653–5660.
- [690] Liu, Xiaoye. 2008. Airborne LiDAR for DEM generation: some critical issues. *Progress in Physical Geography: Earth and Environment*, **32**(1), 31–49.
- [691] Liu, Xinghua, Xue, Hanjun, Gao, Xiang, Liu, Han, Chen, Badong, and Ge, Shuzhi Sam. 2023a. Cubic B-Spline-Based Feature Tracking for Visual-Inertial Odometry With Event Camera. *IEEE Trans. Instrum. Meas.*, **72**, 1–15.
- [692] Liu, Zhe, Shi, Dianxi, Li, Ruihao, and Yang, Shaowu. 2023b. ESVIO: Event-Based Stereo Visual-Inertial Odometry. *Sensors*, **23**(4).
- [693] Lobo, Jorge, and Dias, Jorge. 2007. Relative Pose Calibration Between Visual and Inertial Sensors. *Intl. J. of Robotics Research*, **26**(6), 561–575.
- [694] Lochman, Yaroslava, Liepeshov, Kostiantyn, Chen, Jianhui, Perdoch, Michal, Zach, Christopher, and Pritts, James. 2021. Babelcalib: A universal approach to calibrating central cameras. Pages 15253–15262 of: *Proceedings of the IEEE/CVF International Conference on Computer Vision*.
- [695] Lombardi, Stephen, Simon, Tomas, Saragih, Jason, Schwartz, Gabriel, Lehrmann, Andreas, and Sheikh, Yaser. 2019. Neural Volumes: Learning Dynamic Renderable Volumes from Images. *ACM Transactions on Graphics (TOG)*.
- [696] Long, A W, Wolfe, K C, Mashner, M J, and Chirikjian, G S. 2012. The Banana Distribution is Gaussian: A Localization Study with Exponential Coordinates. In: *Proceedings of Robotics: Science and Systems*.
- [697] Long, Jonathan, Shelhamer, Evan, and Darrell, Trevor. 2015. Fully convolutional networks for semantic segmentation. Pages 3431–3440 of: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.

- [698] Long, Ran, Rauch, Christian, Zhang, Tianwei, Ivan, Vladimir, and Vijayakumar, Sethu. 2021. Rigidfusion: Robot localisation and mapping in environments with large dynamic rigid objects. *IEEE Robotics and Automation Letters*, **6**(2), 3703–3710.
- [699] Loop, C., Cai, Q., Orts-Escolano, S., and Chou, P. A. 2016. A Closed-Form Bayesian Fusion Equation Using Occupancy Probabilities. Pages 380–388 of: *Intl. Conf. on 3D Vision (3DV)*.
- [700] Loper, Samuel, Rodriguez-Puigvert, Javier, Siegwart, Roland, Cadena, Cesar, and Schmid, Lukas. 2023. 3d vsg: Long-term semantic scene change prediction through 3d variable scene graphs. Pages 8179–8186 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*. IEEE.
- [701] Loper, Matthew, Mahmood, Naureen, Romero, Javier, Pons-Moll, Gerard, and Black, Michael J. 2023. SMPL: A skinned multi-person linear model. Pages 851–866 of: *Seminal Graphics Papers: Pushing the Boundaries, Volume 2*.
- [702] Loper, Matthew M, and Black, Michael J. 2014. OpenDR: An approximate differentiable renderer. In: *European Conf. on Computer Vision (ECCV)*.
- [703] Lorensen, William E, and Cline, Harvey E. 1987. Marching cubes: A high resolution 3D surface construction algorithm. *Intl. Conf. on Computer Graphics and Interactive Techniques (SIGGRAPH)*, **21**(4), 163–169.
- [704] Lourakis, Manolis LA, and Argyros, Antonis A. 2005. Is Levenberg-Marquardt the most efficient optimization algorithm for implementing bundle adjustment? Pages 1526–1531 of: *Intl. Conf. on Computer Vision (ICCV)*, vol. 2. IEEE.
- [705] Lovegrove, S. J. 2011. *Parametric Dense Visual SLAM*. Ph.D. thesis, Imperial College London.
- [706] Lowe, D.G. 2004. Distinctive Image Features from Scale-Invariant Keypoints. *Intl. J. of Computer Vision*, **60**(2), 91–110.
- [707] Lu, F., and Milios, E. 1997a. Globally consistent range scan alignment for environment mapping. *Autonomous Robots*, Apr, 333–349.
- [708] Lu, F., and Milios, E. 1997b. Robot pose estimation in unknown environments by matching 2D range scans. *J. of Intelligent and Robotic Systems*, April, 249:275.
- [709] Lu, Feng, and Milios, Evangelos. 1997c. Globally consistent range scan alignment for environment mapping. *Autonomous Robots*, **4**, 333–349.
- [710] Lu, Jingpei, Richter, Florian, and Yip, Michael C. 2023a. Markerless Camera-to-Robot Pose Estimation via Self-Supervised Sim-to-Real Transfer. Pages 21296–21306 of: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [711] Lu, Sha, Xu, Xuecheng, Yin, Huan, Chen, Zexi, Xiong, Rong, and Wang, Yue. 2022. One ring to rule them all: Radon sinogram for place recognition, orientation and translation estimation. Pages 2778–2785 of: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*. IEEE.
- [712] Lu, Shiyang, Chang, Haonan, Jing, Eric Pu, Boularias, Abdeslam, and Bekris, Kostas. 2023b. OVIR-3D: Open-Vocabulary 3D Instance Retrieval Without Training on 3D Data. In: *7th Annual Conference on Robot Learning*.
- [713] Lu, Ziqi, Huang, Qiangqiang, Doherty, Kevin, and Leonard, John J. 2021.

- Consensus-Informed Optimization Over Mixtures for Ambiguity-Aware Object SLAM. In: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*.
- [714] Lu, Ziqi, Ye, Jianbo, and Leonard, John. 2025. 3DGS-CD: 3D Gaussian Splatting-Based Change Detection for Physical Object Rearrangement. *IEEE Robotics and Automation Letters*.
  - [715] Lucas, Bruce D, and Kanade, Takeo. 1981. An iterative image registration technique with an application to stereo vision. Pages 674–679 of: *Intl. Joint Conf. on AI (IJCAI)*, vol. 2.
  - [716] Luo, Bin, and Hancock, Edwin R. 1999. Procrustes Alignment with the EM Algorithm. Pages 623–631 of: *Computer Analysis of Images and Patterns, CAIP*. Lecture Notes in Computer Science, vol. 1689. Springer.
  - [717] Lupton, T., and Sukkarieh, S. 2012. Visual-Inertial-Aided Navigation for High-Dynamic Motion in Built Environments Without Initial Conditions. *IEEE Trans. Robotics*, **28**(1), 61–76.
  - [718] Lusk, Parker C., and How, Jonathan P. 2022. Global Data Association for SLAM with 3D Grassmannian Manifold Objects. Pages 4463–4470 of: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*.
  - [719] Lusk, Parker C., Fathian, Kaveh, and How, Jonathan P. 2021a (May). CLIPPER: A Graph-Theoretic Framework for Robust Data Association. Pages 13828–13834 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
  - [720] Lusk, Parker C., Roy, Ronak, Fathian, Kaveh, and How, Jonathan P. 2021b (Nov.). *MIXER: A Principled Framework for Multimodal, Multiway Data Association*.
  - [721] Lusk, Parker C., Parikh, Devarth, and How, Jonathan P. 2023. GraffMatch: Global Matching of 3D Lines and Planes for Wide Baseline LiDAR Registration. *IEEE Robotics and Automation Letters*, **8**(2), 632–639.
  - [722] Lv, Jiajun, Xu, Jinhong, Hu, Kewei, Liu, Yong, and Zuo, Xingxing. 2020. Targetless Calibration of LiDAR-IMU System Based on Continuous-time Batch Estimation. Pages 9968–9975 of: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*.
  - [723] Lv, Jiajun, Hu, Kewei, Xu, Jinhong, Liu, Yong, Ma, Xiushui, and Zuo, Xingxing. 2021. CLINS: Continuous-time trajectory estimation for LiDAR-inertial system. Pages 6657–6663 of: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*. IEEE.
  - [724] Lv, Zhaoyang, Dellaert, Frank, Rehg, James M, and Geiger, Andreas. 2019. Taking a deeper look at the inverse compositional algorithm. Pages 4581–4590 of: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
  - [725] Lynch, Kevin M., and Park, Frank C. 2017a. *Modern Robotics - Mechanics, Planning, and Control*. USA: Cambridge University Press. Chap. 4, pages 137–152.
  - [726] Lynch, Kevin M., and Park, Frank C. 2017b. *Modern Robotics - Mechanics, Planning, and Control*. USA: Cambridge University Press. Chap. 5, pages 171–190.
  - [727] Lynch, Kevin M, Marchuk, Nicholas D, and Elwin, Matthew L. 2015. *Embedded Computing and Mechatronics with the PIC32 Microcontroller*. 1 edn. Newness. Chap. 21.
  - [728] Ma, Junyi, Zhang, Jun, Xu, Jintao, Ai, Rui, Gu, Weihao, and Chen, Xieyuanli. 2022. Overlaptransformer: An efficient and yaw-angle-invariant

- transformer network for lidar-based place recognition. *IEEE Robotics and Automation Letters*, **7**(3), 6958–6965.
- [729] Macenski, Steve, Tsai, David, and Feinberg, Max. 2020. Spatio-temporal voxel layer: A view on robot perception for the dynamic world. *Intl. J. of Advanced Robotic Systems*, **17**(2).
- [730] Maggio, D., and Carlone, L. 2025. Bayesian Fields: Task-driven Open-Set Semantic Gaussian Splatting. *arXiv preprint*.
- [731] Maggio, D., Chang, Y., Hughes, N., Trang, M., Griffith, D., Dougherty, C., Cristofalo, E., Schmid, L., and Carlone, L. 2024. Clio: Real-time Task-Driven Open-Set 3D Scene Graphs. *IEEE Robotics and Automation Letters*, **9**(10), 8921–8928.
- [732] Mahlknecht, Florian, Gehrig, Daniel, Nash, Jeremy, Rockenbauer, Friedrich M., Morrell, Benjamin, Delaune, Jeff, and Scaramuzza, Davide. 2022. Exploring Event Camera-based Odometry for Planetary Robots. *IEEE Robotics and Automation Letters*, **7**(4), 8651–8658.
- [733] Majumdar, Arjun, Ajay, Anurag, Zhang, Xiaohan, Putta, Pranav, Yenamandra, Sriram, Henaff, Mikael, Silwal, Sneha, Mcvay, Paul, Maksymets, Oleksandr, Arnaud, Sergio, et al. 2024. Openeqa: Embodied question answering in the era of foundation models. Pages 16488–16498 of: *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition*.
- [734] Malcolm, James, Yalamanchili, Pavan, McClanahan, Chris, Venugopalakrishnan, Vishwanath, Patel, Krunal, and Melonakos, John. 2012. ArrayFire: a GPU acceleration platform. Pages 49–56 of: *Modeling and simulation for defense systems and applications VII*, vol. 8403. SPIE.
- [735] Mangelson, J. G., Dominic, D., Eustice, R. M., and Vasudevan, R. 2018. Pairwise Consistent Measurement Set Maximization for Robust Multi-robot Map Merging. Pages 2916–2923 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [736] Maravgakis, Michael, Argiropoulos, Despina-Ekaterini, Piperakis, Stylianos, and Trahanias, Panos. 2023. Probabilistic Contact State Estimation for Legged Robots using Inertial Information. Pages 12163–12169 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [737] Marck, Jan Willem, Mohamoud, Ali, vd Houwen, Eric, and van Heijster, Rob. 2013. Indoor radar SLAM: A radar application for vision and GPS denied environments. Pages 471–474 of: *2013 European Radar Conference*.
- [738] Marquardt, D.W. 1963. An Algorithm for Least-Squares Estimation of Non-linear Parameters. *J. Soc. Indust. Appl. Math.*, **11**(2), 431–441.
- [739] Marr, David. 1983. *Vision: A Computational Investigation into the Human Representation and Processing of Visual Information*. W.H. Freeman and Company.
- [740] Marschner, Steve, and Shirley, Peter. 2018. *Fundamentals of computer graphics*. CRC Press.
- [741] Martel, J. 2019. *Unconventional Processing with Unconventional Visual Sensing*. Ph.D. thesis, ETH Zurich.
- [742] Martel, J., and Dudek, P. 2016. Vision Chips with In-pixel Processors for High-performance Low-power Embedded Vision Systems. In: *ASR-MOV Workshop, CGO*.
- [743] Martens, W., Poffet, Y., Soria, P. R., Fitch, R., and Sukkarieh, S. 2017.

- Geometric Priors for Gaussian Process Implicit Surfaces. *IEEE Robotics and Automation Letters*, 373–380.
- [744] Martinelli, A. 2013 (Nov.). Visual-inertial structure from motion: Observability and resolvability. Pages 4235–4242 of: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*.
- [745] MATLAB. 2010. *version 7.10.0 (R2010a)*. Natick, Massachusetts: The MathWorks Inc.
- [746] Matsuki, Hidenobu, von Stumberg, Lukas, Usenko, Vladyslav, Stückler, Jörg, and Cremers, Daniel. 2018. Omnidirectional DSO: Direct Sparse Odometry with Fisheye Cameras. *IEEE Robotics and Automation Letters*, **3**(4), 3693–3700.
- [747] Matsuki, Hidenobu, Murai, Riku, Kelly, Paul HJ, and Davison, Andrew J. 2024. Gaussian splatting slam. Pages 18039–18048 of: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [748] Matsuki, Hidenobu, Bae, Gwangbin, and Davison, Andrew. 2025. 4DTAM: Non-Rigid Tracking and Mapping via Dynamic Surface Gaussians. In: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [749] Maybeck, P. 1979. *Stochastic Models, Estimation and Control*. Vol. 1. New York: Academic Press.
- [750] Mayer, Nikolaus, Ilg, Eddy, Hausser, Philip, Fischer, Philipp, Cremers, Daniel, Dosovitskiy, Alexey, and Brox, Thomas. 2016. A large dataset to train convolutional networks for disparity, optical flow, and scene flow estimation. Pages 4040–4048 of: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [751] Mazur, K., Bae, G., and Davison, A. J. 2024. SuperPrimitive: Scene Reconstruction at a Primitive Level. In: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [752] Mazur, Kirill, Sucar, Edgar, and Davison, Andrew J. 2023. Feature-realistic neural fusion for real-time, open set scene understanding. Pages 8201–8207 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*. IEEE.
- [753] McCormac, J., Handa, A., Leutenegger, S., and Davison, A. J. 2017a. SceneNet RGB-D: Can 5M Synthetic Images Beat Generic ImageNet Pre-training on Indoor Segmentation? In: *Intl. Conf. on Computer Vision (ICCV)*.
- [754] McCormac, J., Handa, A., Davison, A. J., and Leutenegger, S. 2017b. SemanticFusion: Dense 3D Semantic Mapping with Convolutional Neural Networks. In: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [755] McCormac, John, Clark, Ronald, Bloesch, Michael, Davison, Andrew, and Leutenegger, Stefan. 2018. Fusion++: Volumetric object-level slam. Pages 32–41 of: *2018 international conference on 3D vision (3DV)*. IEEE.
- [756] McDonald, J., Kaess, M., Cadena, C., Neira, J., and Leonard, J.J. 2013. Real-time 6-DOF multi-session visual SLAM over large-scale environments. *Robotics and Autonomous Systems*, **61**(10), 1144–1158. European Conf. on Mobile Robotics (ECMR).
- [757] McGhee, Robert B. 1968. Some finite state aspects of legged locomotion. *Mathematical Biosciences*, **2**(1-2), 67–84.
- [758] McGhee, Robert B, and Iswandhi, Geoffrey I. 1979. Adaptive locomotion of a multilegged robot over rough terrain. *IEEE Trans. on Systems, Man, and Cybernetics*, **9**(4), 176–182.

- [759] Meagher, D. 1980. Octree Encoding: A New Technique for the Representation, Manipulation and Display of Arbitrary 3-D Objects by Computer. *Technical Report, Image Processing Laboratory, Rensselaer Polytechnic Institute*(IPL-TR-80-111).
- [760] Medioni, G., Lee, M.-S., , and Tang, C.-K. 2000. *A Computational Framework for Segmentation and Grouping*. Elsevier.
- [761] Mei, C., Sibley, G., Cummins, M., Newman, P., and Reid, I. 2011. RSLAM: A System for Large-Scale Mapping in Constant-Time Using Stereo. *Intl. J. of Computer Vision*, **94**, 198–214.
- [762] Melkumyan, Arman, and Ramos, Fabio Tozeto. 2009. A sparse covariance function for exact Gaussian process inference in large datasets. In: *Intl. Joint Conf. on AI (IJCAI)*.
- [763] Menze, Moritz, and Geiger, Andreas. 2015. Object scene flow for autonomous vehicles. Pages 3061–3070 of: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [764] Menze, Moritz, Heipke, Christian, and Geiger, Andreas. 2018. Object Scene Flow. *ISPRS Journal of Photogrammetry and Remote Sensing (JPRS)*.
- [765] Mersch, Benedikt, Chen, Xieyuanli, Vizzo, Ignacio, Nunes, Lucas, Behley, Jens, and Stachniss, Cyrill. 2022. Receding moving object segmentation in 3d lidar data using sparse 4d convolutions. *IEEE Robotics and Automation Letters*, **7**(3), 7503–7510.
- [766] Mescheder, Lars, Oechsle, Michael, Niemeyer, Michael, Nowozin, Sebastian, and Geiger, Andreas. 2019. Occupancy Networks: Learning 3D Reconstruction in Function Space. In: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [767] Messikommer, Nico, Fang, Carter, Gehrig, Mathias, and Scaramuzza, Davide. 2023. Data-driven feature tracking for event cameras. Pages 5642–5651 of: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [768] Miele, Malcolm, Magnusson, Martin, and Lilienthal, Achim J. 2019 (Sept.). A comparative analysis of radar and lidar sensing for localization and mapping. In: *European Conf. on Mobile Robotics (ECMR)*.
- [769] Miki, Takahiro, Lee, Joonho, Hwangbo, Jemin, Wellhausen, Lorenz, Koltun, Vladlen, and Hutter, Marco. 2022. Learning robust perceptive locomotion for quadrupedal robots in the wild. *Science Robotics*, **7**(62), eabk2822.
- [770] Mildenhall, Ben, Srinivasan, Pratul P, Tancik, Matthew, Barron, Jonathan T, Ramamoorthi, Ravi, and Ng, Ren. 2020. NeRF: Representing Scenes as Neural Radiance Fields for View Synthesis. Pages 405–421 of: *European Conf. on Computer Vision (ECCV)*. Springer.
- [771] Mildenhall, Ben, Srinivasan, Pratul P, Tancik, Matthew, Barron, Jonathan T, Ramamoorthi, Ravi, and Ng, Ren. 2021. NeRF: Representing scenes as neural radiance fields for view synthesis. *Communications of the ACM*, **65**(1), 99–106.
- [772] Milioto, A., and Stachniss, C. 2019. Bonnet: An Open-source Training and Deployment Framework for Semantic Segmentation in Robotics Using CNNs. Pages 7094–7100 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [773] Milioto, A., Behley, J., McCool, C., and Stachniss, C. 2020. LiDAR Panoptic Segmentation for Autonomous Driving. In: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*.

- [774] Milioto, Andres, Vizzo, Ignacio, Behley, Jens, and Stachniss, Cyrill. 2019. Rangenet++: Fast and accurate lidar semantic segmentation. Pages 4213–4220 of: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*. IEEE.
- [775] Mitrokhin, Anton, Ye, Chengxi, Fermuller, Cornelia, Aloimonos, Yiannis, and Delbruck, Tobi. 2019. EV-IMO: Motion Segmentation Dataset and Learning Pipeline for Event Cameras. Pages 6105–6112 of: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*.
- [776] Moeys, Diederik Paul, Corradi, Federico, Li, Chenghan, Bamford, Simeon A., Longinotti, Luca, Voigt, Fabian F., Berry, Stewart, Taverni, Gemma, Helmchen, Fritjof, and Delbruck, Tobi. 2018. A Sensitive Dynamic and Active Pixel Vision Sensor for Color or Neural Imaging Applications. *IEEE Trans. Biomed. Circuits Syst.*, **12**(1), 123–136.
- [777] Montemerlo, M., Thrun, S., Koller, D., and Wegbreit, B. 2002. FastSLAM: A Factored Solution to the Simultaneous Localization and Mapping Problem. In: *Proc. 19<sup>th</sup> AAAI National Conference on AI*.
- [778] Montemerlo, M., Becker, J., Bhat, S., Dahlkamp, H., Dolgov, D., Ettinger, S., Haehnel, D., Hilden, T., Hoffmann, G., Huhnke, B., Johnston, D., Klumpp, S., Langer, D., Levandowski, A., Levinson, J., Marcil, J., Orenstein, D., Paefgen, J., Penny, I., Petrovskaya, A., Pflueger, M., Stanek, G., Stavens, D., Vogt, A., and Thrun, S. 2008. Junior: The Stanford entry in the Urban Challenge. *J. of Field Robotics*, **25**(9), 569–597.
- [779] Mopidevi, A.N., Harlow, K., and Heckman, C. 2024 (Oct.). RMap: Millimeter-Wave Radar Mapping Through Volumetric Upsampling. In: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*.
- [780] Moravec, Hans, and Elfes, Alberto. 1985. High resolution maps from wide angle sonar. Pages 116–121 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [781] Moreno-Noguer, Francesc, and Porta, Josep M. 2011. Probabilistic simultaneous pose and non-rigid shape recovery. In: *CVPR*.
- [782] Mosher, Ralph S. 1969. Exploring the potential of a quadruped. *SAE Transactions*, 836–843.
- [783] Mourikis, Anastasios I, and Roumeliotis, Stergios I. 2007. A multi-state constraint Kalman filter for vision-aided inertial navigation. Pages 3565–3572 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*. IEEE.
- [784] Mueggler, Elias, Rebecq, Henri, Gallego, Guillermo, Delbruck, Tobi, and Scaramuzza, Davide. 2017. The Event-Camera Dataset and Simulator: Event-based Data for Pose Estimation, Visual Odometry, and SLAM. *Intl. J. of Robotics Research*, **36**(2), 142–149.
- [785] Mueggler, Elias, Gallego, Guillermo, Rebecq, Henri, and Scaramuzza, Davide. 2018. Continuous-Time Visual-Inertial Odometry for Event Cameras. *IEEE Trans. Robotics*, **34**(6), 1425–1440.
- [786] Mühlfellner, Peter, Bürki, Mathias, Bosse, Michael, Derendarz, Wojciech, Philippsen, Roland, and Furgale, Paul. 2016. Summary maps for lifelong visual localization. *J. of Field Robotics*, **33**(5), 561–590.
- [787] Mullane, J., Vo, B-N., Adams, M., and Vo, B-T. 2011. A Random-Finite-Set Approach to Bayesian SLAM. *IEEE Trans. Robotics*, **27**(2), 268–282.
- [788] Mullane, John, Adams, Martin D, and Wijesoma, Wijerupage Sardha. 2006.



- Evidential versus Bayesian estimation for radar map building. Pages 1–8 of: *Intl. Conf. on Control, Automation, Robotics and Vision (ICARCV)*. IEEE.
- [789] Mullane, John, Jose, Ebi, Adams, Martin D, and Wijesoma, Wijerupage Sardha. 2007. Including probabilistic target detection attributes into map representations. *J. on Robotics and Autonomous Systems (RAS)*, **55**(1), 72–85.
  - [790] Müller, Thomas, Evans, Alex, Schied, Christoph, and Keller, Alexander. 2022. Instant neural graphics primitives with a multiresolution hash encoding. *ACM transactions on graphics (TOG)*, **41**(4), 1–15.
  - [791] Mur-Artal, Raul, and Tardós, Juan D. 2017a. Orb-slam2: An open-source slam system for monocular, stereo, and rgb-d cameras. *IEEE Trans. Robotics*, **33**(5), 1255–1262.
  - [792] Mur-Artal, Raúl, and Tardós, Juan D. 2017b. Visual-inertial monocular SLAM with map reuse. *IEEE Robotics and Automation Letters*, **2**(2), 796–803.
  - [793] Mur-Artal, Raul, Montiel, Jose Maria Martinez, and Tardos, Juan D. 2015. ORB-SLAM: A versatile and accurate monocular SLAM system. *IEEE Trans. Robotics*, **31**(5), 1147–1163.
  - [794] Murai, R., Ortiz, J., Saeedi, S., Kelly, P. H. J., and Davison, A. J. 2023. A robot web for distributed many-device localisation. *IEEE Trans. Robotics*.
  - [795] Murai, Riku, Dexheimer, Eric, and Davison, Andrew J. 2025. MAST3R-SLAM: Real-Time Dense SLAM with 3D Reconstruction Priors. In: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
  - [796] Murray, R.M., Li, Z., and Sastry, S. 1994. *A Mathematical Introduction to Robotic Manipulation*. CRC Press.
  - [797] Museth, Ken. 2021. NanoVDB: A GPU-Friendly and Portable VDB Data Structure For Real-Time Rendering And Simulation. In: *ACM SIGGRAPH 2021 Talks*. SIGGRAPH '21. ACM.
  - [798] Museth, Ken, Lait, Jeff, Johanson, John, Budsberg, Jeff, Henderson, Ron, Alden, Mihai, Cucka, Peter, Hill, David, and Pearce, Andrew. 2013. Open-VDB: an open-source data structure and toolkit for high-resolution volumes. In: *ACM SIGGRAPH 2013 Courses*. SIGGRAPH '13. ACM.
  - [799] Nabarro, S., van der Wilk, M., and Davison, A. J. 2024. Learning in Deep Factor Graphs with Gaussian Belief Propagation. In: *Intl. Conf. on Machine Learning (ICML)*.
  - [800] Nam, Hyunwoo, Xu, Qing, and Hong, Dennis. 2020. A Reliable Low-Cost Foot Contact Sensor for Legged Robots. Pages 219–224 of: *Intl. Conf. on Ubiquitous Robots (UR)*.
  - [801] Nardi, L., Bodin, B., Zia, M. Z., Mawer, J., Nisbet, A., Kelly, P. H.J., Davison, A. J., Lujan, M., OBoyle, M. F.P., Riley, G., Topham, N., and Furber, S. 2015. Introducing SLAMBench, a performance and accuracy benchmarking methodology for SLAM. In: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
  - [802] Nardi, L., Bodin, B., Saeedi, S., Vespa, E., Davison, A. J., and Kelly, P. H. J. 2017. Algorithmic Performance-Accuracy Trade-off in 3D Vision Applications Using HyperMapper. *arXiv preprint arXiv:1702.00505*.
  - [803] Neira, J., and Tardos, J.D. 2001. Data association in stochastic mapping using the joint compatibility test. *IEEE Trans. Robotics*, **17**(6), 890–897.

- [804] Nematollahi, Iman, DeMoss, Branton, Chandra, Akshay L, Hawes, Nick, Burgard, Wolfram, and Posner, Ingmar. 2025. LUMOS: Language-Conditioned Imitation Learning with World Models. In: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [805] Newcombe, R. A. 2012. *Dense Visual SLAM*. Ph.D. thesis, Imperial College London.
- [806] Newcombe, Richard A, Lovegrove, Steven J, and Davison, Andrew J. 2011a. DTAM: Dense tracking and mapping in real-time. Pages 2320–2327 of: *Intl. Conf. on Computer Vision (ICCV)*. IEEE.
- [807] Newcombe, Richard A, Izadi, Shahram, Hilliges, Otmar, Molyneaux, David, Kim, David, Davison, Andrew J, Kohi, Pushmeet, Shotton, Jamie, Hodges, Steve, and Fitzgibbon, Andrew. 2011b. Kinectfusion: Real-time dense surface mapping and tracking. Pages 127–136 of: *IEEE and ACM Intl. Sym. on Mixed and Augmented Reality (ISMAR)*. Ieee.
- [808] Newcombe, Richard A, Fox, Dieter, and Seitz, Steven M. 2015. Dynamicfusion: Reconstruction and tracking of non-rigid scenes in real-time. Pages 343–352 of: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [809] Ng, Yin Zhi, Choi, Benjamin, Tan, Robby, and Heng, Lionel. 2021. Continuous-time Radar-inertial Odometry for Automotive Radars. Pages 323–330 of: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*.
- [810] Ngo, Dat Tien, Östlund, Jonas, and Fua, Pascal. 2016. Template-based monocular 3D shape recovery using Laplacian meshes. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, **38**(1), 172–187.
- [811] Nicholson, Lachlan, Milford, Michael, and Sünderhauf, Niko. 2019. Quadric-SLAM: Dual Quadrics From Object Detections as Landmarks in Object-Oriented SLAM. *IEEE Robotics and Automation Letters*, **4**(1), 1–8.
- [812] Nie, Jiawang. 2014. Optimality conditions and finite convergence of Lasserre’s hierarchy. *Mathematical programming*, **146**(1-2), 97–121.
- [813] Niemeyer, Michael, Mescheder, Lars, Oechsle, Michael, and Geiger, Andreas. 2020. Differentiable Volumetric Rendering: Learning Implicit 3D Representations without 3D Supervision. Pages 3501 – 3512 of: *2020 IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR 2020)*. Piscataway, NJ: IEEE.
- [814] Nießner, Matthias, Zollhöfer, Michael, Izadi, Shahram, and Stamminger, Marc. 2013. Real-time 3D reconstruction at scale using voxel hashing. *ACM Transactions on Graphics (ToG)*, **32**(6), 1–11.
- [815] Nieto, J., Guivant, H., Nebot, E., and Thrun, S. 2003. Real Time Data Association for FastSLAM. In: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [816] Nistér, D. 2003. An Efficient Solution to the Five-Point Relative Pose Problem. In: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [817] Nitzberg, Ramon. 1972. Constant-false-alarm-rate signal processors for several types of interference. *IEEE Trans. Aerosp. Electron. Syst.*, 27–34.
- [818] Niu, Junkai, Zhong, Sheng, Lu, Xiuyuan, Shen, Shaojie, Gallego, Guillermo, and Zhou, Yi. 2025. ESVO2: Direct Visual-Inertial Odometry with Stereo Event Cameras. *IEEE Trans. Robotics*.

- [819] Niu, Xiaoji, Wu, Yibin, and Kuang, Jian. 2021. Wheel-INS: A Wheel-Mounted MEMS IMU-Based Dead Reckoning System. *IEEE Transactions on Vehicular Technology*, **70**(10), 9814–9825.
- [820] Nocedal, Jorge, and Wright, Stephen J. 1999. *Numerical Optimization*. Springer Series in Operations Research. Springer-Verlag.
- [821] Nuss, Dominik, Reuter, Stephan, Thom, Markus, Yuan, Ting, Krehl, Gunther, Maile, Michael, Gern, Axel, and Dietmayer, Klaus. 2018. A random finite set approach for dynamic occupancy grid maps with real-time application. *Intl. J. of Robotics Research*, **37**(8), 841–866.
- [822] O’Callaghan, Simon T, and Ramos, Fabio T. 2012. Gaussian process occupancy maps. *Intl. J. of Robotics Research*, **31**(1), 42–62.
- [823] Ochs, Peter, Dosovitskiy, Alexey, Brox, Thomas, and Pock, Thomas. 2015. On iteratively reweighted algorithms for nonsmooth nonconvex optimization in computer vision. *SIAM Journal on Imaging Sciences*, **8**(1), 331–372.
- [824] Octo Model Team, Ghosh, Dibya, Walke, Homer, Pertsch, Karl, Black, Kevin, Mees, Oier, Dasari, Sudeep, Hejna, Joey, Xu, Charles, Luo, Jianlan, Kreiman, Tobias, Tan, You Liang, Chen, Lawrence Yunliang, Sanketi, Pannag, Vuong, Quan, Xiao, Ted, Sadigh, Dorsa, Finn, Chelsea, and Levine, Sergey. 2024. Octo: An Open-Source Generalist Robot Policy. In: *Proceedings of Robotics: Science and Systems*.
- [825] Oechsle, Michael, Peng, Songyou, and Geiger, Andreas. 2021. Unisurf: Unifying neural implicit surfaces and radiance fields for multi-view reconstruction. Pages 5589–5599 of: *Proceedings of the IEEE/CVF International Conference on Computer Vision*.
- [826] Ogayar-Anguita, C. J., Lopez-Ruiz, A., Rueda-Ruiz, A. J., and Segura-Sanchez, Rafael J. 2023. Nested spatial data structures for optimal indexing of LiDAR data. *ISPRS J. of Photogrammetry and Remote Sensing (JPRS)*, **195**, 287–297.
- [827] Ok, Kyel, Liu, Katherine, Frey, Kris, How, Jonathan P., and Roy, Nicholas. 2019. Robust Object-based SLAM for High-speed Autonomous Navigation. Pages 669–675 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [828] Oleynikova, Helen, Taylor, Zachary, Fehr, Marius, Siegwart, Roland, and Nieto, Juan. 2017. Voxblox: Incremental 3d euclidean signed distance fields for on-board mav planning. Pages 1366–1373 of: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*. IEEE.
- [829] Oliphant, Travis E. 2006. *A guide to NumPy*. Vol. 1. Trelgol Publishing USA.
- [830] Olson, E., Leonard, J., and Teller, S. 2006 (May). Fast Iterative Alignment of Pose Graphs with Poor Initial Estimates. Pages 2262–2269 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [831] Olson, Edwin. 2009. Real-Time Correlative Scan Matching. Pages 4387–4393 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [832] Olson, Edwin. 2015. M3RSM: Many-to-many multi-resolution scan matching. Pages 5815–5821 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*. IEEE.
- [833] Olson, Edwin, and Agarwal, Pratik. 2012 (July). Inference on networks of mixtures for robust robot mapping. In: *Robotics: Science and Systems (RSS)*.

- [834] Olson, Edwin, Strom, Johannes, Morton, Ryan, Richardson, Andrew, Ranganathan, Pradeep, Goeddel, Robert, Bulic, Mihai, Crossman, Jacob, and Marinier, Bob. 2012. Progress toward multi-robot reconnaissance and the MAGIC 2010 competition. *Journal of Field Robotics*, **29**(5), 762–792.
- [835] Ong, Dexter, Tao, Yuezhan, Murali, Varun, Spasojevic, Igor, Kumar, Vijay, and Chaudhari, Pratik. 2025. ATLAS Navigator: Active Task-driven LAnguage-embedded Gaussian Splatting. In: *arxiv preprint: 2502.20386*.
- [836] Open, NN. 2016. An open source neural networks c++ library. URL: <http://opennn.cimne.com> (2016).
- [837] Oquab, Maxime, Darcet, Timothée, Moutakanni, Théo, Vo, Huy V., Szafraniec, Marc, Khalidov, Vasil, Fernandez, Pierre, HAZIZA, Daniel, Massa, Francisco, El-Nouby, Alaaeldin, Assran, Mido, Ballas, Nicolas, Galuba, Wojciech, Howes, Russell, Huang, Po-Yao, Li, Shang-Wen, Misra, Ishan, Rabbat, Michael, Sharma, Vasu, Synnaeve, Gabriel, Xu, Hu, Jegou, Herve, Mairal, Julien, Labatut, Patrick, Joulin, Armand, and Bojanowski, Piotr. 2024. DINOv2: Learning Robust Visual Features without Supervision. *Transactions on Machine Learning Research*. Featured Certification.
- [838] Ortiz, J., Pupilli, M., Leutenegger, S., and Davison, A. J. 2020. Bundle Adjustment on a Graph Processor. In: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [839] Ortiz, J., Evans, T., and Davison, A. J. 2021. A visual introduction to Gaussian Belief Propagation. *arXiv preprint arXiv:2107.02308*.
- [840] Ortiz, Joseph, Clegg, Alexander, Dong, Jing, Sucar, Edgar, Novotny, David, Zollhoefer, Michael, and Mukadam, Mustafa. 2022. iSDF: Real-time neural signed distance fields for robot perception. In: *Robotics: Science and Systems (RSS)*.
- [841] Ozden, Kemal E., Schindler, Konrad, and Van Gool, Luc. 2010. Multibody Structure-from-Motion in Practice. *IEEE Trans. Pattern Anal. Machine Intell.*, **32**(6), 1134–1141.
- [842] Paek, Dong-Hee, KONG, SEUNG-HYUN, and Wijaya, Kevin Tirta. 2022. K-Radar: 4D Radar Object Detection for Autonomous Driving in Various Weather Conditions. Pages 3819–3829 of: *Advances in Neural Information Processing Systems (NIPS)*, vol. 35.
- [843] Paladini, Marco, Del Bue, Alessio, Stosic, Marko, Dodig, Marija, Xavier, Joao, and Agapito, Lourdes. 2009. Factorization for non-rigid and articulated structure using metric projections. In: *CVPR*.
- [844] Palieri, Matteo, Morrell, Benjamin, Thakur, Abhishek, Ebadi, Kamak, Nash, Jeremy, Chatterjee, Arghya, Kanellakis, Christoforos, Carlone, Luca, Guaragnella, Cataldo, and Agha-mohammadi, Ali-akbar. 2021. LOCUS: A Multi-Sensor Lidar-Centric Solution for High-Precision Odometry and 3D Mapping in Real-Time. *IEEE Robotics and Automation Letters*, **6**(1), 421–428.
- [845] Pan, Yue, Xiao, Pengchuan, He, Yujie, Shao, Zhenlei, and Li, Zesong. 2021. MULLS: Versatile LiDAR SLAM via multi-metric linear least square. Pages 11633–11640 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*. IEEE.
- [846] Papalia, A., Fishberg, A., O’Neill, B., How, J., Rosen, D., and Leonard, J. 2024a. Certifiably correct range-aided SLAM. *IEEE Trans. Robotics*.

- [847] Papalia, Alan, Tian, Yulun, Rosen, David M., How, Jonathan P., and Leonard, John J. 2024b. An Overview of the Burer-Monteiro Method for Certifiable Robot Perception. *ArXiv*, **abs/2410.00117**.
- [848] Parameshwara, Chethan M, Hari, Gokul, Fermüller, Cornelia, Sanket, Nitin J, and Aloimonos, Yiannis. 2022. DiffPoseNet: Direct differentiable camera pose estimation. Pages 6845–6854 of: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [849] Parashar, Shaifali, Pizarro, Daniel, and Bartoli, Adrien. 2017. Isometric Non-Rigid Shape-from-Motion with Riemannian Geometry Solved in Linear Time. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, **40**(10), 2442–2454.
- [850] Parashar, Shaifali, Pizarro, Daniel, and Bartoli, Adrien. 2021. Robust isometric non-rigid structure-from-motion. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, **44**(10), 6409–6423.
- [851] Paredes-Vallés, Federico, Hagenaars, Jesse, Dupeyroux, Julien, Stroobants, Stein, Xu, Yingfu, and de Croon, Guido C. H. E. 2024. Fully neuromorphic vision and control for autonomous drone flight. *Science Robotics*, **9**(90), eadi0591.
- [852] Park, C., Moghadam, P., Kim, S., Elfes, A., Fookes, C., and Sridharan, S. 2018. Elastic LiDAR Fusion: Dense Map-Centric Continuous-Time SLAM. In: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [853] Park, Jeong Joon, Florence, Peter, Straub, Julian, Newcombe, Richard, and Lovegrove, Steven. 2019. DeepSDF: Learning Continuous Signed Distance Functions for Shape Representation. In: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [854] Park, Yeong Sang, Shin, Young-Sik, and Kim, Ayoung. 2020. PhaRaO: Direct Radar Odometry using Phase Correlation. Pages 2617–2623 of: *2020 IEEE International Conference on Robotics and Automation (ICRA)*.
- [855] Paskin, M.A. 2003. Thin Junction Tree Filters for Simultaneous Localization and Mapping. In: *Intl. Joint Conf. on AI (IJCAI)*.
- [856] Paszke, Adam, Gross, Sam, Massa, Francisco, Lerer, Adam, Bradbury, James, Chanan, Gregory, Killeen, Trevor, Lin, Zeming, Gimelshein, Natalia, Antiga, Luca, et al. 2019. Pytorch: An imperative style, high-performance deep learning library. *Advances in neural information processing systems*, **32**.
- [857] Patel, Maithili, and Chernova, Sonia. 2022. Proactive robot assistance via spatio-temporal object modeling. *Conf. on Robot Learning (CoRL)*.
- [858] Paton, Michael, MacTavish, Kirk, Warren, Michael, and Barfoot, Timothy D. 2016. Bridging the appearance gap: Multi-experience localization for long-term visual teach and repeat. Pages 1918–1925 of: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*. IEEE.
- [859] Pattabiraman, Bharath, Patwary, Md. Mostofa Ali, Gebremedhin, Assefaw H., keng Liao, Wei, and Choudhary, Alok. 2015. Fast Algorithms for the Maximum Clique Problem on Massive Graphs with Applications to Overlapping Community Detection. *Internet Mathematics*, **11**(4-5), 421–448.
- [860] Pavlakos, G., Zhou, X., Chan, A., Derpanis, K., and Daniilidis, K. 2017a. 6-DoF Object Pose from Semantic Keypoints. In: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.

- [861] Pavlakos, Georgios, Zhou, Xiaowei, Chan, Aaron, Derpanis, Konstantinos G, and Daniilidis, Kostas. 2017b. 6-DoF Object Pose from Semantic Keypoints. In: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [862] Pavlakos, Georgios, Zhu, Luyang, Zhou, Xiaowei, and Daniilidis, Kostas. 2018. Learning to Estimate 3D Human Pose and Shape from a Single Color Image. In: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [863] Pearl, J. 2017. *Theoretical Impediments to Machine Learning, With Seven Sparks from the Causal Revolution*. Tech. rept. University of California, Los Angeles. Technical Report R-275.
- [864] Pearlmutter, Barak A, and Siskind, Jeffrey Mark. 2008. Reverse-mode AD in a functional framework: Lambda the ultimate backpropagator. *ACM Transactions on Programming Languages and Systems (TOPLAS)*, **30**(2), 1–36.
- [865] Peng, Guohao, Li, Heshan, Zhao, Yangyang, Zhang, Jun, Wu, Zhenyu, Zheng, Pengyu, and Wang, Danwei. 2024a (6). TransLoc4D: Transformer-based 4D Radar Place Recognition. Pages 17595–17605 of: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [866] Peng, Liangzu, Fazlyab, Mahyar, and Vidal, René. 2022. *Towards Understanding The Semidefinite Relaxations of Truncated Least-Squares in Robust Rotation Search*.
- [867] Peng, Liangzu, Kümmerle, Christian, and Vidal, René. 2023a. On the Convergence of IRLS and Its Variants in Outlier-Robust Estimation. Pages 17808–17818 of: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [868] Peng, Shihan, Zhou, Hanyu, Dong, Hao, Shi, Zhiwei, Liu, Haoyue, Duan, Yuxing, Chang, Yi, and Yan, Luxin. 2024b. CoSEC: A Coaxial Stereo Event Camera Dataset for Autonomous Driving. *arXiv preprint*.
- [869] Peng, Songyou, Niemeyer, Michael, Mescheder, Lars, Pollefeys, Marc, and Geiger, Andreas. 2020. Convolutional occupancy networks. In: *European Conf. on Computer Vision (ECCV)*.
- [870] Peng, Songyou, Genova, Kyle, Jiang, Chiyu, Tagliasacchi, Andrea, Pollefeys, Marc, Funkhouser, Thomas, et al. 2023b. Openscene: 3d scene understanding with open vocabularies. Pages 815–824 of: *Proceedings of the IEEE/CVF conference on computer vision and pattern recognition*.
- [871] Peng, Xiongfeng, Liu, Zhihua, Li, Weiming, Tan, Ping, Cho, SoonYong, and Wang, Qiang. 2023c. DVI-SLAM: A dual visual inertial SLAM network. *arXiv preprint arXiv:2309.13814*.
- [872] Peng, Yuxiang, Chen, Chuchu, and Huang, Guoquan. 2024c (May). Quantized Visual-Inertial Odometry. In: *Proc. International Conference on Robotics and Automation*.
- [873] Peng, Yuxiang, Chen, Chuchu, and Huang, Guoquan. 2024d (May). Ultra-fast Square-Root Filter-based VINS. In: *Proc. InternationalConference on Robotics and Automation*.
- [874] Peng, Yuxiang, Chen, Chuchu, and Huang, Guoquan. 2025 (May). QVIO2: Quantized MAP-based Visual-Inertial Odometry. In: *Proc. International-Conference on Robotics and Automation*.

- [875] Peng, Zhexi, Shao, Tianjia, Yong, Liu, Zhou, Jingke, Yang, Yin, Wang, Jingdong, and Zhou, Kun. 2024e. RTG-SLAM: Real-time 3D Reconstruction at Scale using Gaussian Splatting. *ACM SIGGRAPH Conference Proceedings*.
- [876] Perera, Samunda, and Barnes, Nick. 2012. Maximal cliques based rigid body motion segmentation with a RGB-D camera. Pages 120–133 of: *Asian Conf. on Computer Vision*. Springer.
- [877] Pfister, H., Zwickler, M., v. Baar, J., and Gross, M. 2000. Surfels: surface elements as rendering primitives. In: *Intl. Conf. on Computer Graphics and Interactive Techniques (SIGGRAPH)*.
- [878] Pfreundschuh, Patrick, Hendrikx, Hubertus FC, Reijgwart, Victor, Dubé, Renaud, Siegwart, Roland, and Cramariuc, Andrei. 2021. Dynamic object aware lidar slam based on automatic generation of training data. Pages 11641–11647 of: *2021 IEEE International Conference on Robotics and Automation (ICRA)*. IEEE.
- [879] P.H.S. Torr, A. Zisserman. 2000. *MLESAC: A New Robust Estimator with Application to Estimating Image Geometry*. Tech. rept. MSR-TR-99-60. MSR.
- [880] Pineda, Luis, Fan, Taosha, Monge, Maurizio, Venkataraman, Shobha, Sodhi, Paloma, Chen, Ricky TQ, Ortiz, Joseph, DeTone, Daniel, Wang, Austin, Anderson, Stuart, et al. 2022. Theseus: A library for differentiable nonlinear optimization. *Conf. Neural Information Processing Systems (NIPS)*, **35**, 3801–3818.
- [881] Piperakis, Stylianos, and Trahanias, Panos E. 2016. Non-linear ZMP based state estimation for humanoid robot locomotion. Pages 202–209 of: *IEEE Intl. Conf. on Humanoid Robots*.
- [882] Pizzoli, Matia, Forster, Christian, and Scaramuzza, Davide. 2014. REMODE: Probabilistic, monocular dense reconstruction in real time. Pages 2609–2616 of: *2014 IEEE international conference on robotics and automation (ICRA)*. IEEE.
- [883] Placed, J.A., Strader, J., Carrillo, H., Atanasov, N., Indelman, V., Carlone, L., and Castellanos, J.A. 2023. A Survey on Active Simultaneous Localization and Mapping: State of the Art and New Frontiers. *IEEE Trans. Robotics*, **39**(3), 1686–1705. arXiv preprint: 2207.00254, .
- [884] Placed, Julio A, and Castellanos, José A. 2022. A general relationship between optimality criteria and connectivity indices for active graph-SLAM. *IEEE Robotics and Automation Letters*, **8**(2), 816–823.
- [885] Plastria, Frank. 2011. *The Weiszfeld Algorithm: Proof, Amendments, and Extensions*. Springer US. Pages 357–389.
- [886] Pock, T. 2008. *Fast Total Variation for Computer Vision*. Ph.D. thesis, Graz University of Technology.
- [887] Pock, T., Grabner, M., and Bischof, H. 2007. Real-time Computation of Variational Methods on Graphics Hardware. In: *Proceedings of the Computer Vision Winter Workshop*.
- [888] Pomerleau, Dean A. 1989. *ALVINN: an autonomous land vehicle in a neural network*. San Francisco, CA, USA: Morgan Kaufmann Publishers Inc. Page 305–313.
- [889] Pomerleau, François, Krüsi, Philipp, Colas, Francis, Furgale, Paul, and Siegwart, Roland. 2014. Long-term 3D map maintenance in dynamic environ-

- ments. Pages 3712–3719 of: *2014 IEEE International Conference on Robotics and Automation (ICRA)*. IEEE.
- [890] Posch, Christoph, Matolin, Daniel, and Wohlgenannt, Rainer. 2011. A QVGA 143 dB Dynamic Range Frame-Free PWM Image Sensor With Lossless Pixel-Level Video Compression and Time-Domain CDS. *IEEE J. Solid-State Circuits*, **46**(1), 259–275.
  - [891] Posch, Christoph, Serrano-Gotarredona, Teresa, Linares-Barranco, Bernabe, and Delbruck, Tobi. 2014. Retinomorph Event-Based Vision Sensors: Bioinspired Cameras With Spiking Output. *Proc. IEEE*, **102**(10), 1470–1484.
  - [892] Powell, M.J.D. 1970. A New Algorithm for Unconstrained Optimization. Pages 31–65 of: Rosen, J., Mangasarian, O., and Ritter, K. (eds), *Nonlinear Programming*. Academic Press.
  - [893] Premachandra, H. A. G. C., Liu, Ran, Yuen, Chau, and Tan, U-Xuan. 2023. UWB Radar SLAM: An Anchorless Approach in Vision Denied Indoor Environments. *IEEE Robotics and Automation Letters*, **8**(9), 5299–5306.
  - [894] Proudman, Alexander, Ramezani, Milad, Digumarti, Sundara Tejaswi, Chebrolu, Nived, and Fallon, Maurice. 2022. Towards real-time forest inventory using handheld LiDAR. *Robotics and Autonomous Systems*, **157**, 104240.
  - [895] Pütz, Sebastian, Wiemann, Thomas, Kleine Piening, Malte, and Hertzberg, Joachim. 2021. Continuous Shortest Path Vector Field Navigation on 3D Triangular Meshes for Mobile Robots. In: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
  - [896] Qadri, M., Manchester, Z., and Kaess, M. 2023. *Learning Covariances for Estimation with Constrained Bilevel Optimization*.
  - [897] Qi, Charles R, Su, Hao, Mo, Kaichun, and Guibas, Leonidas J. 2017. Pointnet: Deep learning on point sets for 3d classification and segmentation. Pages 652–660 of: *Proceedings of the IEEE conference on computer vision and pattern recognition*.
  - [898] Qian, Jingxing, Chatrath, Veronica, Yang, Jun, Servos, James, Schoellig, Angela P, and Waslander, Steven L. 2022. Pocd: Probabilistic object-level change detection and volumetric mapping in semi-static scenes. *Robotics: Science and Systems (RSS)*.
  - [899] Qian, Jingxing, Chatrath, Veronica, Servos, James, Mavrinac, Aaron, Burgard, Wolfram, Waslander, Steven L, and Schoellig, Angela P. 2023. Povslam: Probabilistic object-aware variational slam in semi-static environments. *Robotics: Science and Systems (RSS)*.
  - [900] Qian, Long, Wu, Jie Ying, DiMaio, Simon P, Navab, Nassir, and Kazanzides, Peter. 2019. A review of augmented reality in robotic-assisted surgery. *IEEE Transactions on Medical Robotics and Bionics*, **2**(1), 1–16.
  - [901] Qin, Chao, Ye, Haoyang, Pranata, Christian E, Han, Jun, Zhang, Shuyang, and Liu, Ming. 2020. LINS: A Lidar-Inertial State Estimator for Robust and Efficient Navigation. In: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
  - [902] Qin, Minghan, Li, Wanhua, Zhou, Jiawei, Wang, Haoqian, and Pfister, Hanspeter. 2024. Langsplat: 3d language gaussian splatting. Pages 20051–20060 of: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.



- [903] Qin, Tong, Li, Peiliang, and Shen, Shaojie. 2018. Vins-mono: A robust and versatile monocular visual-inertial state estimator. *IEEE Trans. Robotics*, **34**(4), 1004–1020.
- [904] Qiu, Yuheng, Wang, Chen, Wang, Wenshan, Henein, Mina, and Scherer, Sebastian. 2022. AirDOS: Dynamic SLAM benefits from articulated objects. Pages 8047–8053 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*. IEEE.
- [905] Qiu, Yuheng, Wang, Chen, Xu, Can, Chen, Yutian, Zhou, Xunfei, Xia, Youjie, and Scherer, Sebastian. 2024 (May). *AirIMU: Learning Uncertainty Propagation for Inertial Odometry*.
- [906] Radford, Alec, Kim, Jong Wook, Hallacy, Chris, Ramesh, Aditya, Goh, Gabriel, Agarwal, Sandhini, Sastry, Girish, Askell, Amanda, Mishkin, Pamela, Clark, Jack, et al. 2021. Learning transferable visual models from natural language supervision. Pages 8748–8763 of: *International conference on machine learning*. PMLR.
- [907] Radke, Richard J, Andra, Srinivas, Al-Kofahi, Omar, and Roysam, Badrinath. 2005. Image change detection algorithms: a systematic survey. *IEEE transactions on image processing*, **14**(3), 294–307.
- [908] Rahimi, Ali, and Recht, Benjamin. 2007. Random features for large-scale kernel machines. In: *Advances in Neural Information Processing Systems (NIPS)*, vol. 20.
- [909] Raibert, Marc H. 1986. *Legged robots that balance*. MIT press.
- [910] Ramezani, Milad, Khosoussi, Kasra, Catt, Gavin, Moghadam, Peyman, Williams, Jason, Borges, Paulo, Pauling, Fred, and Kottege, Navinda. 2022. Wildcat: Online continuous-time 3d lidar-inertial slam. *arXiv preprint arXiv:2205.12595*.
- [911] Ramos, Fabio, and Ott, Lionel. 2016. Hilbert maps: Scalable continuous occupancy mapping with stochastic gradient descent. *Intl. J. of Robotics Research*, **35**(14), 1717–1730.
- [912] Rana, Krishan, Haviland, Jesse, Garg, Sourav, Abou-Chakra, Jad, Reid, Ian, and Suenderhauf, Niko. 2023. SayPlan: Grounding Large Language Models using 3D Scene Graphs for Scalable Task Planning. Pages 23–72 of: *Conf. on Robot Learning (CoRL)*.
- [913] Ranganathan, A., Kaess, M., and Dellaert, F. 2007. Loopy SAM. In: *Intl. Joint Conf. on AI (IJCAI)*.
- [914] Ranjan, Anurag, and Black, Michael J. 2017. Optical flow estimation using a spatial pyramid network. Pages 4161–4170 of: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [915] Rapp, Matthias, Dietmayer, Klaus, Hahn, Markus, Schuster, Frank, Lombacher, Jakob, and Dickmann, Jürgen. 2016. FSCD and BASD: Robust landmark detection and description on radar-based grids. Pages 1–4 of: *2016 IEEE MTT-S International Conference on Microwaves for Intelligent Mobility (ICMIM)*.
- [916] Rasmussen, Carl Edward, and Williams, Christopher KI. 2006. *Gaussian Processes for Machine Learning*. Cambridge, Mass.: MIT Press.
- [917] Ratliff, Nathan D., Silver, David, and Bagnell, J. Andrew. 2009. Learning to search: Functional gradient techniques for imitation learning. *Autonomous Robots*, **27**, 25–53.

- [918] Ravi, Nikhila, Gabeur, Valentin, Hu, Yuan-Ting, Hu, Ronghang, Ryali, Chaitanya, Ma, Tengyu, Khedr, Haitham, Rädle, Roman, Rolland, Chloe, Gustafson, Laura, et al. 2024. Sam 2: Segment anything in images and videos. *arXiv preprint arXiv:2408.00714*.
- [919] Ravichandran, Z., Peng, L., Hughes, N., Griffith, J.D., and Carlone, L. 2022. Hierarchical Representations and Explicit Memory: Learning Effective Navigation Policies on 3D Scene Graphs using Graph Neural Networks. In: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*. .
- [920] Ray, Aaron, Bradley, Christopher, Carlone, Luca, and Roy, Nicholas. 2024. Task and Motion Planning in Hierarchical 3D Scene Graphs. In: *Intl. Symp. of Robotics Research (ISRR)*.
- [921] Rebecq, Henri, Horstschäfer, Timo, Gallego, Guillermo, and Scaramuzza, Davide. 2017a. EVO: A Geometric Approach to Event-based 6-DOF Parallel Tracking and Mapping in Real-Time. *IEEE Robotics and Automation Letters*, **2**(2), 593–600.
- [922] Rebecq, Henri, Horstschaefer, Timo, and Scaramuzza, Davide. 2017b. Real-time Visual-Inertial Odometry for Event Cameras using Keyframe-based Nonlinear Optimization. In: *British Machine Vision Conf. (BMVC)*.
- [923] Rebecq, Henri, Gallego, Guillermo, Mueggler, Elias, and Scaramuzza, Davide. 2018a. EMVS: Event-based Multi-View Stereo—3D Reconstruction with an Event Camera in Real-Time. *Intl. J. of Computer Vision*, **126**(12), 1394–1414.
- [924] Rebecq, Henri, Gehrig, Daniel, and Scaramuzza, Davide. 2018b. ESIM: an Open Event Camera Simulator. Pages 969–982 of: *Conf. on Robot Learning (CoRL)*. Proc. Machine Learning Research, vol. 87. PMLR.
- [925] Rebecq, Henri, Ranftl, René, Koltun, Vladlen, and Scaramuzza, Davide. 2021. High Speed and High Dynamic Range Video with an Event Camera. *IEEE Trans. Pattern Anal. Machine Intell.*, **43**(6), 1964–1980.
- [926] Redmon, Joseph, Divvala, Santosh, Girshick, Ross, and Farhadi, Ali. 2016. You Only Look Once: Unified, Real-Time Object Detection. In: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [927] Reed, Scott, Zolna, Konrad, Parisotto, Emilio, Colmenarejo, Sergio Gómez, Novikov, Alexander, Barth-maroon, Gabriel, Giménez, Mai, Sulsky, Yury, Kay, Jackie, Springenberg, Jost Tobias, Eccles, Tom, Bruce, Jake, Razavi, Ali, Edwards, Ashley, Heess, Nicolas, Chen, Yutian, Hadsell, Raia, Vinyals, Oriol, Bordbar, Mahyar, and de Freitas, Nando. 2022. A Generalist Agent. *Transactions on Machine Learning Research*. Featured Certification, Outstanding Certification.
- [928] Reijgwart, V., Millane, A., Oleynikova, H., Siegwart, R., Cadena, C., and Nieto, J. 2020. Voxgraph: Globally Consistent, Volumetric Mapping Using Signed Distance Function Submaps. *IEEE Robotics and Automation Letters*.
- [929] Reijgwart, Victor, Cadena, Cesar, Siegwart, Roland, and Ott, Lionel. 2023-07. Efficient volumetric mapping of multi-scale environments using wavelet-based compression. In: *Robotics: Science and Systems (RSS)*.
- [930] Reimers, Nils, and Gurevych, Iryna. 2019. Sentence-BERT: Sentence Embeddings using Siamese BERT-Networks. In: *Proceedings of the 2019 Conference on Empirical Methods in Natural Language Processing*. Association for Computational Linguistics.

- [931] Reinbacher, Christian, Munda, Gottfried, and Pock, Thomas. 2017. Real-Time Panoramic Tracking for Event Cameras. Pages 1–9 of: *IEEE Int. Conf. Comput. Photography (ICCP)*.
- [932] Reinstein, Michal, and Hoffmann, Matej. 2011. Dead reckoning in a dynamic quadruped robot: Inertial navigation system aided by a legged odometer. Pages 617–624 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [933] Ren, Yifei, Xu, Binbin, Choi, Christopher L, and Leutenegger, Stefan. 2022. Visual-inertial multi-instance dynamic SLAM with object-level relocalisation. Pages 11055–11062 of: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*. IEEE.
- [934] Revels, Jarrett, Lubin, Miles, and Papamarkou, Theodore. 2016. Forward-mode automatic differentiation in Julia. *arXiv preprint arXiv:1607.07892*.
- [935] Riegler, Gernot, Osman Ulusoy, Ali, and Geiger, Andreas. 2017. Octnet: Learning deep 3d representations at high resolutions. In: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [936] Robbins, Herbert, and Monro, Sutton. 1951. A stochastic approximation method. *The annals of mathematical statistics*, 400–407.
- [937] Rodrigues, Rômulo T., Tsiogkas, Nikolaos, Pascoal, António, and Aguiar, A. Pedro. 2021. Online Range-Based SLAM Using B-Spline Surfaces. *IEEE Robotics and Automation Letters*, **6**(2), 1958–1965.
- [938] Rodríguez, Juan J. Gómez, Montiel, J.M.M., and Tardós, Juan D. 2024. NR-SLAM: Nonrigid Monocular SLAM. *IEEE Transactions on Robotics*, **40**, 4252–4264.
- [939] Ronneberger, O., Fischer, P., and Brox, T. 2015a. U-Net: Convolutional Networks for Biomedical Image Segmentation.
- [940] Ronneberger, Olaf, Fischer, Philipp, and Brox, Thomas. 2015b. U-Net: Convolutional networks for biomedical image segmentation. Pages 234–241 of: *Intl. Conf. Medical Image Computing and Computer-Assisted Intervention*.
- [941] Roriz, Ricardo, Cabral, Jorge, and Gomes, Tiago. 2021. Automotive LiDAR technology: A survey. *IEEE Trans. on Intelligent Transportation Systems (TITS)*, **23**(7), 6282–6297.
- [942] Rosen, David M, Mason, Julian, and Leonard, John J. 2016a. Towards lifelong feature-based mapping in semi-static environments. Pages 1063–1070 of: *2016 IEEE International conference on robotics and automation (ICRA)*. IEEE.
- [943] Rosen, David M., Carlone, Luca, Bandeira, Afonso S., and Leonard, John J. 2019. SE-Sync: A Certifiably Correct Algorithm for Synchronization over the Special Euclidean Group. *Intl. J. of Robotics Research*, **38**(2–3), 95–125.
- [944] Rosen, David M., Doherty, Kevin J., Terán Espinoza, Antonio, and Leonard, John J. 2021. Advances in Inference and Representation for Simultaneous Localization and Mapping. *Annual Review of Control, Robotics, and Autonomous Systems*, **4**, 215–242.
- [945] Rosen, D.M., Carlone, L., Bandeira, A.S., and Leonard, J.J. 2016b (December). SE-Sync: A Certifiably Correct Algorithm for Synchronization over the Special Euclidean Group. In: *Intl. Workshop on the Algorithmic Foundations of Robotics (WAFR)*. extended arxiv preprint: 1611.00128, .
- [946] Rosinol, Antoni, Gupta, Arjun, Abate, Marcus, Shi, Jingnan, and Carlone, Luca. 2020a. 3D dynamic scene graphs: Actionable spatial perception with places, objects, and humans. *Robotics: Science and Systems (RSS)*.

- [947] Rosinol, Antoni, Abate, Marcus, Chang, Yun, and Carlone, Luca. 2020b. Kimera: an open-source library for real-time metric-semantic localization and mapping. Pages 1689–1696 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*. IEEE.
- [948] Rosinol, Antoni, Violette, Andrew, Abate, Marcus, Hughes, Nathan, Chang, Yun, Shi, Jingnan, Gupta, Arjun, and Carlone, Luca. 2021. Kimera: From SLAM to spatial perception with 3D dynamic scene graphs. *Intl. J. of Robotics Research*, **40**(12-14), 1510–1546.
- [949] Rosinol Vidal, Antoni, Rebecq, Henri, Horstschafer, Timo, and Scaramuzza, Davide. 2018. Ultimate SLAM? Combining Events, Images, and IMU for Robust Visual SLAM in HDR and High Speed Scenarios. *IEEE Robotics and Automation Letters*, **3**(2), 994–1001.
- [950] Ross, Stephane, Gordon, Geoffrey, and Bagnell, Drew. 2011 (11–13 Apr). A Reduction of Imitation Learning and Structured Prediction to No-Regret Online Learning. Pages 627–635 of: *Proceedings of the Fourteenth International Conference on Artificial Intelligence and Statistics*. Proceedings of Machine Learning Research, vol. 15.
- [951] Rosten, E., and Drummond, T. 2006. Machine learning for high-speed corner detection. In: *European Conf. on Computer Vision (ECCV)*.
- [952] Roston, G.P., and Krotkov, E.P. 1992. Dead Reckoning Navigation For Walking Robots. Pages 607–612 of: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*, vol. 1.
- [953] Rotella, Nicholas, Bloesch, Michael, Righetti, Ludovic, and Schaal, Stefan. 2014. State estimation for a humanoid robot. Pages 952–958 of: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*.
- [954] Rotella, Nicholas, Schaal, Stefan, and Righetti, Ludovic. 2018. Unsupervised Contact Learning for Humanoid Estimation and Control. Pages 411–417 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [955] Rouveure, R., Faure, P., and Monod, M. 2010. Radar-based SLAM without odometric sensor. In: *ROBOTICS2010 : International workshop of Mobile Robotics for environment/agriculture*.
- [956] Rowell, Joseph, Zhang, Lintong, and Fallon, Maurice. 2024. LiSTA: Geometric Object-Based Change Detection in Cluttered Environments. Pages 3632–3638 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*. IEEE.
- [957] Rubino, Cosimo, Crocco, Marco, and Del Bue, Alessio. 2018. 3D Object Localisation from Multi-View Image Detections. *IEEE Trans. Pattern Anal. Machine Intell.*, **40**(6), 1281–1294.
- [958] Rublee, Ethan, Rabaud, Vincent, Konolige, Kurt, and Bradski, Gary. 2011. ORB: An efficient alternative to SIFT or SURF. Pages 2564–2571 of: *Intl. Conf. on Computer Vision (ICCV)*. Ieee.
- [959] Rückert, Darius, Franke, Linus, and Stamminger, Marc. 2022. Adop: Approximate differentiable one-pixel point rendering. *ACM Transactions on Graphics (ToG)*, **41**(4), 1–14.
- [960] Rueckauer, Bodo, and Delbruck, Tobi. 2016. Evaluation of Event-Based Algorithms for Optical Flow with Ground-Truth from Inertial Measurement Sensor. *Front. Neurosci.*, **10**(176).
- [961] Ruiz-Sarmiento, Jose-Raul, Galindo, Cipriano, and Gonzalez-Jimenez, Javier. 2017. Building Multiversal Semantic Maps for Mobile Robot Operation. *Knowledge-Based Systems*, **119**, 257–272.

- [962] Rünz, M., and Agapito, L. 2017. Co-Fusion: Real-time Segmentation, Tracking and Fusion of Multiple Objects. In: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [963] Runz, Martin, Buffier, Maud, and Agapito, Lourdes. 2018. Maskfusion: Real-time recognition, tracking and reconstruction of multiple moving objects. Pages 10–20 of: *IEEE and ACM Intl. Sym. on Mixed and Augmented Reality (ISMAR)*. IEEE.
- [964] Rusinkiewicz, S., and Levoy, M. 2001. Efficient variants of the ICP algorithm. In: *Proc. of Intl. Conf. on 3-D Digital Imaging and Modeling*.
- [965] Rusu, Radu Bogdan, Blodow, Nico, and Beetz, Michael. 2009. Fast point feature histograms (FPFH) for 3D registration. Pages 3212–3217 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*. IEEE.
- [966] Rusu, Radu Bogdan, Bradski, Gary, Thibaux, Romain, and Hsu, John. 2010. Fast 3d recognition and pose using the viewpoint feature histogram. Pages 2155–2162 of: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*. IEEE.
- [967] Rünz, Martin, and Agapito, Lourdes. 2017. Co-fusion: Real-time segmentation, tracking and fusion of multiple objects. Pages 4471–4478 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [968] Saftescu, Stefan, Gadd, Matthew, De Martini, Daniele, Barnes, Dan, and Newman, Paul. 2020. Kidnapped Radar: Topological Radar Localisation using Rotationally-Invariant Metric Learning. Pages 4358–4364 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [969] Salas-Moreno, R. F., Newcombe, R. A., Strasdat, H., Kelly, P. H. J., and Davison, A. J. 2013. SLAM++: Simultaneous Localisation and Mapping at the Level of Objects. In: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [970] Salti, Samuele, Tombari, Federico, and Di Stefano, Luigi. 2014. SHOT: Unique signatures of histograms for surface and texture description. *Comput. Vis. Image Underst.*, **125**, 251–264.
- [971] Salzmann, Mathieu, and Fua, Pascal. 2011. Linear local models for monocular reconstruction of deformable surfaces. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, **33**(5), 931–944.
- [972] San Segundo, Pablo, and Artieda, Jorge. 2015. A novel clique formulation for the visual feature matching problem. *Appl. Intelligence*, **43**(2), 325–342.
- [973] Sandström, Erik, Li, Yue, Van Gool, Luc, and Oswald, Martin R. 2023. Point-slam: Dense neural point cloud-based slam. In: *Intl. Conf. on Computer Vision (ICCV)*.
- [974] Särkkä, Simo. 2011. Linear Operators and Stochastic Partial Differential Equations in Gaussian Process Regression. Pages 151–158 of: *International Conference on Artificial Neural Networks and Machine Learning*.
- [975] Sarlin, Paul-Edouard, Cadena, Cesar, Siegwart, Roland, and Dymczyk, Marcin. 2019. From Coarse to Fine: Robust Hierarchical Localization at Large Scale. In: *IEEE Conference in Computer Vision and Pattern Recognition (CVPR)*.
- [976] Sarlin, Paul-Edouard, DeTone, Daniel, Malisiewicz, Tomasz, and Rabinovich, Andrew. 2020. Superglue: Learning feature matching with graph neural networks. Pages 4938–4947 of: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.

- [977] Saunderson, J., Parrilo, P.A., and Willsky, A. 2014 (May). Semidefinite relaxations for optimization problems over rotation matrices. In: *IEEE Conf. on Decision and Control (CDC)*.
- [978] Schauer, Johannes, and Nüchter, Andreas. 2018. The peopleremover—removing dynamic objects from 3-d point cloud data by traversing a voxel occupancy grid. *IEEE robotics and automation letters*, **3**(3), 1679–1686.
- [979] Schmid, Lukas, Delmerico, Jeffrey, Schönberger, Johannes L, Nieto, Juan, Pollefeys, Marc, Siegwart, Roland, and Cadena, Cesar. 2022. Panoptic multi-tdfs: a flexible representation for online multi-resolution volumetric mapping and long-term dynamic scene consistency. Pages 8018–8024 of: *2022 International Conference on Robotics and Automation (ICRA)*. IEEE.
- [980] Schmid, Lukas, Andersson, Olov, Sulser, Aurelio, Pfreundschuh, Patrick, and Siegwart, Roland. 2023. Dynablox: Real-time detection of diverse dynamic objects in complex environments. *IEEE Robotics and Automation Letters*.
- [981] Schmid, Lukas, Abate, Marcus, Chang, Yun, and Carlone, Luca. 2024. Khronos: A unified approach for spatio-temporal metric-semantic slam in dynamic environments. In: *Robotics: Science and Systems (RSS)*.
- [982] Schmidt, Tanner, Newcombe, Richard A, and Fox, Dieter. 2014. DART: Dense Articulated Real-Time Tracking. Pages 1–9 of: *Robotics: Science and Systems (RSS)*, vol. 2. Berkeley, CA.
- [983] Schonberger, Johannes L, and Frahm, Jan-Michael. 2016. Structure-from-motion revisited. Pages 4104–4113 of: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [984] Schouten, Girmi, and Steckel, Jan. 2017. RadarSLAM: Biomimetic SLAM using ultra-wideband pulse-echo radar. Pages 1–8 of: *2017 International Conference on Indoor Positioning and Indoor Navigation (IPIN)*.
- [985] Schubert, D., Demmel, N., Usenko, V., Stueckler, J., and Cremers, D. 2018 (September). Direct Sparse Odometry With Rolling Shutter. In: *European Conference on Computer Vision (ECCV)*.
- [986] Schubert, D., Demmel, N., von Stumberg, L., Usenko, V., and Cremers, D. 2019 (November). Rolling-Shutter Modelling for Visual-Inertial Odometry. In: *International Conference on Intelligent Robots and Systems (IROS)*.
- [987] Schumann, Ole, Hahn, Markus, Scheiner, Nicolas, Weishaupt, Fabio, Tilly, Julius F, Dickmann, Jürgen, and Wöhler, Christian. 2021. RadarScenes: A real-world radar point cloud data set for automotive applications. Pages 1–8 of: *Intl. Conf. on Information Fusion (FUSION)*.
- [988] Schuster, Frank, Keller, Christoph Gustav, Rapp, Matthias, Hauéis, Martin, and Curio, Cristóbal. 2016. Landmark based radar SLAM using graph optimization. Pages 2559–2564 of: *IEEE Intl. Conf. on Intelligent Transportation Systems (ITSC)*. IEEE.
- [989] Scona, Raluca, Jaimez, Mariano, Petillot, Yvan R, Fallon, Maurice, and Cremers, Daniel. 2018. StaticFusion: Background reconstruction for dense rgb-d slam in dynamic environments. Pages 3849–3856 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*. IEEE.
- [990] Segal, Aleksandr, Haehnel, Dirk, and Thrun, Sebastian. 2009. Generalized-icp. Page 435 of: *Robotics: Science and Systems (RSS)*, vol. 2. Seattle, WA.

- [991] Seidenschwarz, Jenny, Zhou, Qunjie, Duisterhof, Bardienus Pieter, Ramanan, Deva, and Leal-Taixé, Laura. 2025. DynOMo: Online Point Tracking by Dynamic Online Monocular Gaussian Reconstruction. *Intl. Conf. on 3D Vision (3DV)*.
- [992] Semini, C, Tsagarakis, N G, Guglielmino, E, Focchi, M, Cannella, F, and Caldwell, D G. 2011. Design of HyQ – a hydraulically and electrically actuated quadruped robot. *Proceedings of the Institution of Mechanical Engineers, Part I: Journal of Systems and Control Engineering*, **225**(6), 831–849.
- [993] Semini, Claudio, and Wieber, Pierre-Brice. 2020. *Legged Robots*. Berlin, Heidelberg: Springer Berlin Heidelberg. Pages 1–8.
- [994] Sengupta, Agniva, and Bartoli, Adrien. 2024. ToTem NRS f M: Object-Wise Non-rigid Structure-from-Motion with a Topological Template. *International Journal of Computer Vision*, **132**(6), 2135–2176.
- [995] Sethi, Ishwar K., and Jain, Ramesh C. 1987. Finding Trajectories of Feature Points in a Monocular Image Sequence. *IEEE Trans. Pattern Anal. Machine Intell.*, **9**(1), 56–73.
- [996] Sethian, James Albert. 1996. Level set methods: Evolving interfaces in geometry, fluid mechanics, computer vision, and materials science. *Cambridge monographs on applied and computational mathematics*, **3**.
- [997] Shaban, Amirreza, Cheng, Ching-An, Hatch, Nathan, and Boots, Byron. 2019. Truncated back-propagation for bilevel optimization. Pages 1723–1732 of: *The 22nd International Conference on Artificial Intelligence and Statistics*. PMLR.
- [998] Shafiullah, Nur Muhammad Mahi, Cui, Zichen Jeff, Altanzaya, Ariuntuya, and Pinto, Lerrel. 2022. Behavior Transformers: Cloning  $k$  modes with one stone. In: *Thirty-Sixth Conference on Neural Information Processing Systems*.
- [999] Shaikewitz, Lorenzo, Ubellacker, Samuel, and Carlone, Luca. 2024. A certifiable algorithm for simultaneous shape estimation and object tracking. *IEEE Robotics and Automation Letters*.
- [1000] Shan, M., Feng, Q., and Atanasov, N. 2020a. Object residual constrained Visual-Inertial Odometry. Pages 5104–5111 of: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*.
- [1001] Shan, Mo, Feng, Qiaojun, and Atanasov, Nikolay. 2020b. OrcVIO: Object residual constrained Visual-Inertial Odometry. In: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*.
- [1002] Shan, Mo, Feng, Qiaojun, Jau, Youyi, and Atanasov, Nikolay. 2021a. ELLIPSDf: Joint Object Pose and Shape Optimization with a Bi-level Ellipsoid and Signed Distance Function Description. In: *Intl. Conf. on Computer Vision (ICCV)*.
- [1003] Shan, Qi, Curless, Brian, Furukawa, Yasutaka, Hernandez, Carlos, and Seitz, Steven M. 2014. Occluding contours for multi-view stereo. Pages 4002–4009 of: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [1004] Shan, Tixiao, and Englot, Brendan. 2018. LeGO-LOAM: Lightweight and Ground-Optimized Lidar Odometry and Mapping on Variable Terrain. In: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*.
- [1005] Shan, Tixiao, Englot, Brendan, Meyers, Drew, Wang, Wei, Ratti, Carlo, and Rus, Daniela. 2020c. Lio-sam: Tightly-coupled lidar inertial odometry via

- smoothing and mapping. Pages 5135–5142 of: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*. IEEE.
- [1006] Shan, Tixiao, Englot, Brendan, Duarte, Fábio, Ratti, Carlo, and Rus, Daniela. 2021b. Robust place recognition using an imaging lidar. Pages 5469–5475 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*. IEEE.
  - [1007] Sheeny, Marcel, De Pellegrin, Emanuele, Mukherjee, Saptarshi, Ahrabian, Alireza, Wang, Sen, and Wallace, Andrew. 2021. RADIATE: A radar dataset for automotive perception in bad weather. Pages 1–7 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
  - [1008] Shen, Chen, O'Brien, James F., and Shewchuk, Jonathan Richard. 2004. Interpolating and Approximating Implicit Surfaces from Polygon Soup. *Intl. Conf. on Computer Graphics and Interactive Techniques (SIGGRAPH)*, 9.
  - [1009] Shi, Guowei, Yao, Chen, Liu, Xin, Zhao, Yuntian, Zhu, Zheng, and Jia, Zhenzhong. 2024. Foot Vision: A Vision-Based Multi-Functional Sensorized Foot for Quadruped Robots. *IEEE Robotics and Automation Letters*, **9**(7), 6720–6727.
  - [1010] Shi, J., and Tomasi, C. 1994. Good features to track. Pages 593–600 of: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
  - [1011] Shi, J., Yang, H., and Carlone, L. 2021. ROBIN: a Graph-Theoretic Approach to Reject Outliers in Robust Estimation using Invariants. In: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*. arXiv preprint: 2011.03659, .
  - [1012] Shi, Jingnan, Yang, Heng, and Carlone, Luca. 2023a. Optimal and Robust Category-Level Perception: Object Pose and Shape Estimation From 2-D and 3-D Semantic Keypoints. *IEEE Trans. Robotics*, **39**(5), 4131–4151.
  - [1013] Shi, Pengcheng, Zhang, Yongjun, and Li, Jiayuan. 2023b. Lidar-based place recognition for autonomous driving: A survey. *arXiv preprint*.
  - [1014] Shi, Xuesong, Li, Dongjiang, Zhao, Pengpeng, Tian, Qinbin, Tian, Yuxin, Long, Qiwei, Zhu, Chunhao, Song, Jingwei, Qiao, Fei, Song, Le, et al. 2020. Are we ready for service robots? the openloris-scene datasets for lifelong slam. Pages 3139–3145 of: *2020 IEEE international conference on robotics and automation (ICRA)*. IEEE.
  - [1015] Shiba, Shintaro, Aoki, Yoshimitsu, and Gallego, Guillermo. 2022. Event Collapse in Contrast Maximization Frameworks. *Sensors*, **22**(14), 1–20.
  - [1016] Shiba, Shintaro, Klose, Yannick, Aoki, Yoshimitsu, and Gallego, Guillermo. 2024. Secrets of Event-based Optical Flow, Depth, and Ego-Motion by Contrast Maximization. *IEEE Trans. Pattern Anal. Machine Intell.*, **46**(12), 7742–7759.
  - [1017] Shor, N.Z. 1987. Quadratic optimization problems. *Izv. Akad. Nauk SSSR Tekhn. Kibernet.*, **1**, 128–139.
  - [1018] Siciliano, Bruno, Sciavicco, Lorenzo, Villani, Luigi, and Oriolo, Giuseppe. 2008. *Robotics: Modelling, Planning and Control*. 1st edn. Springer Publishing Company, Incorporated. Chap. 5.
  - [1019] Sim, R., Elinas, P., Griffin, M., Shyr, A., and Little, J.J. 2006 (Jun). Design and Analysis of a Framework for Real-time Vision-based SLAM using Rao-Blackwellised Particle Filters. In: *Proc. of the 3rd Canadian Conf. on Computer and Robotic Vision (CRV)*.
  - [1020] Singer, A. 2010. Angular synchronization by eigenvectors and semidefinite programming. *Appl. Comput. Harmon. Anal.*, **30**, 20–36.



- [1021] Sitzmann, Vincent, Zollhöfer, Michael, and Wetzstein, Gordon. 2019. Scene Representation Networks: Continuous 3D-Structure-Aware Neural Scene Representations. In: *Advances in Neural Information Processing Systems (NIPS)*.
- [1022] Slavcheva, Miroslava, Baust, Maximilian, Cremers, Daniel, and Ilic, Slobodan. 2017. KillingFusion: Non-rigid 3D reconstruction without correspondences. Pages 1386–1395 of: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [1023] Slonim, Noam, and Tishby, Naftali. 1999. Agglomerative Information Bottleneck. Pages 617–623 of: *Conf. Neural Information Processing Systems (NIPS)*. NIPS’99.
- [1024] Smith, R., and Cheeseman, P. 1987. On the representation and estimation of spatial uncertainty. *Intl. J. of Robotics Research*, **5**(4), 56–68.
- [1025] Soatto, Stefano, and Chiuso, Alessandro. 2016. Visual Representations: Defining Properties and Deep Approximations. In: *Intl. Conf. on Learning Representations (ICLR)*.
- [1026] Sodhi, P., Dexheimer, E., Mukadam, M., Anderson, S., and Kaess, M. 2021. LEO: Learning energy-based models in factor graph optimization. In: *Conf. on Robot Learning (CoRL)*.
- [1027] Sola, Joan, Vidal-Calleja, Teresa, Civera, Javier, and Montiel, J. 2012. Impact of Landmark Parametrization on Monocular EKF-SLAM with Points and Lines. *International Journal of Computer Vision*, 05.
- [1028] Sola, Joan, Deray, Jeremie, and Atchuthan, Dinesh. 2018. A micro Lie theory for state estimation in robotics. *arXiv preprint arXiv:1812.01537*.
- [1029] Song, Jingwei, Wang, Jun, Zhao, Liang, Huang, Shoudong, and Dissanayake, Gamini. 2018. Mis-slam: Real-time large-scale dense deformable slam system in minimal invasive surgery based on heterogeneous computing. *IEEE Robotics and Automation Letters*, **3**(4), 4068–4075.
- [1030] Song, Seungwon, Lim, Hyungtae, Lee, Alex Junho, and Myung, Hyun. 2022. DynaVINS: A visual-inertial SLAM for dynamic environments. *IEEE Robotics and Automation Letters*, **7**(4), 11523–11530.
- [1031] Sorkine, Olga, and Alexa, Marc. 2007. As-rigid-as-possible surface modeling. Pages 109–116 of: *Proceedings of the fifth Eurographics symposium on Geometry processing*.
- [1032] Speciale, P., Paudel, D. P., Oswald, M. R., Kroeger, T., Gool, L. V., and Pollefeys, M. 2017 (July). Consensus Maximization with Linear Matrix Inequality Constraints. Pages 5048–5056 of: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [1033] Stadie, Bradley, Zhang, Lunjun, and Ba, Jimmy. 2020. Learning intrinsic rewards as a bi-level optimization problem. Pages 111–120 of: *Conference on Uncertainty in Artificial Intelligence*. PMLR.
- [1034] Stathouloupoulos, Nikolaos, Lindqvist, Björn, Koval, Anton, akbar Aghamohammadi, Ali, and Nikolakopoulos, George. 2024. FRAME: A Modular Framework for Autonomous Map-merging: Advancements in the Field. *IEEE Trans. Field Robotics*, Apr.
- [1035] Steinbruecker, F., Sturm, J., and Cremers, D. 2011. Real-Time Visual Odometry from Dense RGB-D Images. In: *Workshop on Live Dense Reconstruction with Moving Cameras at the Intl. Conf. on Computer Vision (ICCV)*.

- [1036] Steinbruecker, F., Kerl, C., Sturm, J., and Cremers, D. 2013. Large-Scale Multi-Resolution Surface Reconstruction from RGB-D Sequences. In: *IEEE International Conference on Computer Vision (ICCV)*.
- [1037] Steinbruecker, F., Sturm, J., and Cremers, D. 2014. Volumetric 3D Mapping in Real-Time on a CPU. In: *International Conference on Robotics and Automation (ICRA)*.
- [1038] Steinke, Tim, Büchner, Martin, Vödisch, Niclas, and Valada, Abhinav. 2025. Collaborative Dynamic 3D Scene Graphs for Open-Vocabulary Urban Scene Understanding. *arXiv preprint arXiv:2503.08474*.
- [1039] Stillwell, J. 2008. *Naive Lie Theory*. Springer.
- [1040] Stork, Johannes A, and Stoyanov, Todor. 2020. Ensemble of Sparse Gaussian Process Experts for Implicit Surface Mapping with Streaming Data. *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [1041] Stoyanov, T., Saarinen, J.P., Andreasson, H., and Lilienthal, A.J. 2013. Normal Distributions Transform Occupancy Map Fusion: Simultaneous Mapping and Tracking in Large Scale Dynamic Environments. In: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*.
- [1042] Strader, Jared, Hughes, Nathan, Chen, William, Speranzon, Alberto, and Carbone, Luca. 2024. Indoor and Outdoor 3D Scene Graph Generation via Language-Enabled Spatial Ontologies. *IEEE Robotics and Automation Letters*, **9**(6), 4886–4893.
- [1043] Strasdat, H., Davison, A. J., Montiel, José M. M., and Konolige, K. 2011. Double window optimisation for constant time visual SLAM. Pages 2352–2359 of: *Intl. Conf. on Computer Vision (ICCV)*.
- [1044] Strasdat, H., Montiel, Jose M. M., and Davison, A. J. 2012. Visual SLAM: Why filter? *Image and Vision Computing*, **30**(2), 65–77.
- [1045] Straub, Julian, Whelan, Thomas, Ma, Lingni, Chen, Yufan, Wijmans, Erik, Green, Simon, Engel, Jakob J, Mur-Artal, Raul, Ren, Carl, Verma, Shobhit, et al. 2019. The Replica dataset: A digital replica of indoor spaces. *arXiv preprint arXiv:1906.05797*.
- [1046] Stückler, J., and Behnke, S. 2014. Multi-Resolution Surfel Maps for Efficient Dense 3D Modeling and Tracking. *J. of Visual Communication and Image Representation*, **25**(1), 137–147.
- [1047] Stueckler, J., and Behnke, S. 2014. Efficient Deformable Registration of Multi-Resolution Surfel Maps for Object Manipulation Skill Transfer. In: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [1048] Stumberg, Lukas von, and Cremers, Daniel. 2022. DM-VIO: Delayed Marginalization Visual-Inertial Odometry. *IEEE Robotics and Automation Letters*, **7**(2), 1408–1415.
- [1049] Sturm, J., Bylow, E., Kahl, F., and Cremers, D. 2013 (September). CopyMe3D: Scanning and Printing Persons in 3D. In: *German Conference on Pattern Recognition (GCPR)*.
- [1050] Sturm, Jürgen, Engelhard, Nikolas, Endres, Felix, Burgard, Wolfram, and Cremers, Daniel. 2012. A benchmark for the evaluation of RGB-D SLAM systems. Pages 573–580 of: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*. IEEE.
- [1051] Stühmer, J., Gumhold, S., and Cremers, D. 2010 (September). Real-Time Dense Geometry from a Handheld Camera. Pages 11–20 of: *Pattern Recognition (Proc. DAGM)*.

- [1052] Sucar, Edgar, Liu, Shikun, Ortiz, Joseph, and Davison, Andrew J. 2021. imap: Implicit mapping and positioning in real-time. In: *Intl. Conf. on Computer Vision (ICCV)*.
- [1053] Suleiman, A., Zhang, Z., Carlone, L., Karaman, S., and Sze, V. 2018. Navion: A Fully Integrated Energy-Efficient Visual-Inertial Odometry Accelerator for Autonomous Navigation of Nano Drones. In: *IEEE Symposium on VLSI Circuits (VLSI-Circuits)*. , , highlighted in the MIT News: other media coverage: .
- [1054] Sumner, Robert W, Schmid, Johannes, and Pauly, Mark. 2007. Embedded deformation for shape manipulation. Pages 80–es of: *Intl. Conf. on Computer Graphics and Interactive Techniques (SIGGRAPH)*.
- [1055] Sun, Cheng, Sun, Min, and Chen, Hwann-Tzong. 2022. Direct voxel grid optimization: Super-fast convergence for radiance fields reconstruction. In: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [1056] Sun, Deqing, Yang, Xiaodong, Liu, Ming-Yu, and Kautz, Jan. 2018. Pwc-net: Cnns for optical flow using pyramid, warping, and cost volume. Pages 8934–8943 of: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [1057] Sun, Jiaming, Shen, Zehong, Wang, Yuang, Bao, Hujun, and Zhou, Xiaowei. 2021a. LoFTR: Detector-free local feature matching with transformers. Pages 8922–8931 of: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [1058] Sun, L., and Deng, Z. 2020. Certifiably Optimal and Robust Camera Pose Estimation from Points and Lines. *IEEE Access*.
- [1059] Sun, Lisong C., Bhatt, Neel P., Liu, Jonathan C., Fan, Zhiwen, Wang, Zhangyang, Humphreys, Todd E., and Topcu, Ufuk. 2024a. MM3DGS SLAM: Multi-modal 3D Gaussian Splatting for SLAM Using Vision, Depth, and Inertial Measurements. *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*.
- [1060] Sun, Scott, Melamed, Dennis, and Kitani, Kris. 2021b. IDOL: Inertial deep orientation-estimation and localization. Pages 6128–6137 of: *Proceedings of the AAAI Conference on Artificial Intelligence*, vol. 35.
- [1061] Sun, Shuo, Miele, Malcolm, Lilienthal, Achim J., and Magnusson, Martin. 2024b. 3QFP: Efficient neural implicit surface reconstruction using Tri-Quadrees and Fourier feature Positional encoding. Pages 4036–4044 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [1062] Sun, Tao, Hao, Yan, Huang, Shengyu, Savarese, Silvio, Schindler, Konrad, Pollefeys, Marc, and Armeni, Iro. 2025. Nothing stands still: A spatiotemporal benchmark on 3d point cloud registration under large geometric and temporal change. *ISPRS Journal of Photogrammetry and Remote Sensing*, **220**, 799–823.
- [1063] Sünderhauf, N., and Protzel, P. 2012. Towards a robust back-end for pose graph SLAM. Pages 1254–1261 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*. IEEE.
- [1064] Sünderhauf, Niko, and Protzel, Peter. 2012. Switchable constraints for robust pose graph SLAM. Pages 1879–1884 of: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*. IEEE.
- [1065] Sünderhauf, Niko, and Protzel, Peter. 2013. Switchable constraints vs. max-mixture models vs. RRR—a comparison of three approaches to robust pose

- graph SLAM. Pages 5198–5203 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*. IEEE.
- [1066] Sünderhauf, Niko, Dayoub, Feras, McMahon, Sean, Eich, Markus, Upcroft, Ben, and Milford, Michael. 2015. SLAM—quo vadis? In Support of Object Oriented and Semantic SLAM. In: *In Proceedings of the RSS 2015 Workshop – The problem of mobile sensors: Setting future goals and indicators of progress for SLAM*. <http://ylatif.github.io/movingsensors/>.
  - [1067] Sutter, H. 2011. *Welcome to the Jungle*. URL <https://herbsutter.com/welcome-to-the-jungle>.
  - [1068] Sutton, R. 2019. *The Bitter Lesson*. URL <http://www.incompleteideas.net/IncIdeas/BitterLesson.html>.
  - [1069] Suzuki, Taro, Kitamura, Mitsunori, Amano, Yoshiharu, and Hashizume, Takumi. 2010. 6-DOF Localization for a Mobile Robot Using Outdoor 3D Voxel Maps. Pages 5737–5743 of: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*.
  - [1070] Takeuchi, Eijiro, Elfes, Alberto, and Roberts, Jonathan. 2015. *Localization and Place Recognition Using an Ultra-Wide Band (UWB) Radar*. Cham: Springer International Publishing. Pages 275–288.
  - [1071] Takmaz, Ayça, Fedele, Elisabetta, Sumner, Robert W, Pollefeys, Marc, Tombari, Federico, and Engelmann, Francis. 2023. Openmask3d: Open-vocabulary 3d instance segmentation. *arXiv preprint arXiv:2306.13631*.
  - [1072] Tang, Chengzhou, and Tan, Ping. 2019. Ba-net: Dense bundle adjustment network. *Intl. Conf. on Learning Representations (ICLR)*.
  - [1073] Tang, Tim Yuqing, De Martini, Daniele, Barnes, Dan, and Newman, Paul. 2020. RSL-Net: Localising in Satellite Images From a Radar on the Ground. *IEEE Robotics and Automation Letters*, **5**(2), 1087–1094.
  - [1074] Tang, Yijie, Zhang, Jiazhao, Yu, Zhinan, Wang, He, and Xu, Kai. 2023. Mips-fusion: Multi-implicit-submaps for scalable and robust online neural rgb-d reconstruction. *ACM Transactions on Graphics (TOG)*, **42**(6), 1–16.
  - [1075] Tanner, Michael, Piniés, Pedro, Paz, Lina María, and Newman, Paul. 2016. What lies behind: Recovering hidden shape in dense mapping.
  - [1076] Tao, Yifu, Ángel Muñoz-Bañón, Miguel, Zhang, Lintong, Wang, Jiahao, Fu, Lanke Frank Tarimo, and Fallon, Maurice. 2025. *The Oxford Spires Dataset: Benchmarking Large-Scale LiDAR-Visual Localisation, Reconstruction and Radiance Field Methods*.
  - [1077] Tardós, Juan D., Neira, José, Newman, Paul M., and Leonard, John J. 2002. Robust Mapping and Localization in Indoor Environments Using Sonar Data. *Intl. J. of Robotics Research*, **21**(4), 311–330.
  - [1078] Taverni, Gemma, Moeys, Diederik Paul, Li, Chenghan, Cavaco, Celso, Motsonyi, Vasyl, Bello, David San Segundo, and Delbruck, Tobi. 2018. Front and Back Illuminated Dynamic and Active Pixel Vision Sensors Comparison. *IEEE Trans. Circuits Syst. II (TCSII)*, **65**(5), 677–681.
  - [1079] Tavish, K. Mac, and Barfoot, T. D. 2015. At all costs: A comparison of robust cost functions for camera correspondence outliers. Pages 62–69 of: *Conf. Computer and Robot Vision*. IEEE.
  - [1080] Taylor, Jonathan, Jepson, Allan D, and Kutulakos, Kiriakos N. 2010. Non-rigid structure from locally-rigid motion. In: *CVPR*.
  - [1081] Team, ALOHA 2, Aldaco, Jorge, Armstrong, Travis, Baruch, Robert, Bingham, Jeff, Chan, Sanky, Draper, Kenneth, Dwibedi, Debidatta, Finn,

- Chelsea, Florence, Pete, Goodrich, Spencer, Gramlich, Wayne, Hage, Torr, Herzog, Alexander, Hoech, Jonathan, Nguyen, Thinh, Storz, Ian, Tabanpour, Baruch, Takayama, Leila, Tompson, Jonathan, Wahid, Ayzaan, Wahrburg, Ted, Xu, Sichun, Yaroshenko, Sergey, Zakka, Kevin, and Zhao, Tony Z. 2024. *ALOHA 2: An Enhanced Low-Cost Hardware for Bimanual Teleoperation*.
- [1082] Team, Gemini, Anil, Rohan, Borgeaud, Sebastian, Alayrac, Jean-Baptiste, Yu, Jiahui, Soricut, Radu, Schalkwyk, Johan, Dai, Andrew M, Hauth, Anja, Millican, Katie, et al. 2023. Gemini: a family of highly capable multimodal models. *arXiv preprint arXiv:2312.11805*.
- [1083] Tedrake, Russ, and the Drake Development Team. 2019. *Drake: Model-based design and verification for robotics*.
- [1084] Teed, Zachary, and Deng, Jia. 2018. Deepv2d: Video to depth with differentiable structure from motion. *arXiv preprint arXiv:1812.04605*.
- [1085] Teed, Zachary, and Deng, Jia. 2020. RAFT: Recurrent All-Pairs Field Transforms for Optical Flow. *ArXiv*, **abs/2003.12039**.
- [1086] Teed, Zachary, and Deng, Jia. 2021a. Droid-slam: Deep visual slam for monocular, stereo, and rgb-d cameras. *Advances in Neural Information Processing Systems (NIPS)*, **34**, 16558–16569.
- [1087] Teed, Zachary, and Deng, Jia. 2021b. Tangent space backpropagation for 3d transformation groups. Pages 10338–10347 of: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [1088] Teed, Zachary, Lipson, Lahav, and Deng, Jia. 2023. Deep patch visual odometry. *Advances in Neural Information Processing Systems (NIPS)*, **36**, 39033–39051.
- [1089] Teng, Sangli, Mueller, Mark Wilfried, and Sreenath, Koushil. 2021. Legged Robot State Estimation in Slippery Environments Using Invariant Extended Kalman Filter with Velocity Update. Pages 3104–3110 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [1090] Thomas, Hugues, Sivapurapu, Mouli, and Zhang, Jian. 2024. Embedding Pose Graph, Enabling 3D Foundation Model Capabilities with a Compact Representation. *arXiv preprint arXiv:2403.13777*.
- [1091] Thrun, S., Liu, Y., Koller, D., Ng, A.Y., Ghahramani, Z., and Durrant-Whyte, H. 2004. Simultaneous Localization and Mapping With Sparse Extended Information Filters. *Intl. J. of Robotics Research*, **23**(7-8), 693–716.
- [1092] Thrun, S., Burgard, W., and Fox, D. 2005. *Probabilistic Robotics*. MIT Press Cambridge.
- [1093] Thrun, Sebastian. 2003. Learning occupancy grid maps with forward sensor models. *Autonomous robots*, **15**, 111–127.
- [1094] Thrun, Sebastian, Gutmann, Jens-Steffen, Fox, Dieter, Burgard, Wolfram, and Kuipers, Benjamin. 1998. Integrating Topological And Metric Maps For Mobile Robot Navigation: A Statistical Approach. Pages 989–995 of: *National Conf. on Artificial Intelligence (AAAI)*, vol. 9.
- [1095] Thrun, Sebastian, et al. 2002. Robotic mapping: A survey. *Exploring artificial intelligence in the new millennium*, **1**(1-35), 1.
- [1096] Tian, Y., Chang, Y., Quang, L., Schang, A., Nieto-Granda, C., How, J.P., and Carlone, L. 2023. Resilient and Distributed Multi-Robot Visual SLAM: Datasets, Experiments, and Lessons Learned. In: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*.

- [1097] Tian, Yulun, Khosoussi, Kasra, and How, Jonathan P. 2019. Block-Coordinate Descent on the Riemannian Staircase for Certifiably Correct Distributed Rotation and Pose Synchronization. *Intl. J. of Robotics Research*.
- [1098] Tian, Yulun, Khosoussi, Kasra, and How, Jonathan P. 2021. A resource-aware approach to collaborative loop-closure detection with provable performance guarantees. *Intl. J. of Robotics Research*, **40**(10-11), 1212–1233.
- [1099] Tian, Yulun, Chang, Yun, Arias, Fernando Herrera, Nieto-Granda, Carlos, How, Jonathan P, and Carlone, Luca. 2022. Kimera-multi: Robust, distributed, dense metric-semantic slam for multi-robot systems. *IEEE Trans. Robotics*, **38**(4).
- [1100] Tipaldi, Gian Diego, and Arras, Kai O. 2010. Flirt-interest regions for 2d range data. Pages 3616–3622 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*. IEEE.
- [1101] Tirado-Garin, J., and Civera, J. 2025. From Correspondences to Pose: Non-minimal Certifiably Optimal Relative Pose without Disambiguation. In: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [1102] Tishby, Naftali, Pereira, Fernando, and Bialek, William. 2001. The Information Bottleneck Method. *Proc. of the Allerton Conference on Communication, Control and Computation*, **49**(07).
- [1103] Titterton, D., and Weston, J. 2005. *Strapdown Inertial Navigation Technology*. second edn. The Institution of Engineering and Technology.
- [1104] Todd, D. J. 1985. *A brief history of walking machines*. Boston, MA: Springer US. Pages 169–177.
- [1105] Tokui, Seiya, Oono, Kenta, Hido, Shohei, and Clayton, Justin. 2015. Chainer: a next-generation open source framework for deep learning. Pages 1–6 of: *Proceedings of workshop on machine learning systems (LearningSys) in the twenty-ninth annual conference on neural information processing systems (NIPS)*, vol. 5.
- [1106] Tomasi, Carlo, and Kanade, Takeo. 1992. Shape and motion from image streams under orthography: a factorization method. *Intl. J. of Computer Vision*, **9**(2), 137–154.
- [1107] Tombari, Federico, Salti, Samuele, and Di Stefano, Luigi. 2011. A combined texture-shape descriptor for enhanced 3D feature matching. Pages 809–812 of: *Intl. Conf. on Image Processing (ICIP)*. IEEE.
- [1108] Touvron, Hugo, Lavril, Thibaut, Izacard, Gautier, Martinet, Xavier, Lachaux, Marie-Anne, Lacroix, Timothée, Rozière, Baptiste, Goyal, Naman, Hambro, Eric, Azhar, Faisal, et al. 2023. Llama: Open and efficient foundation language models. *arXiv preprint arXiv:2302.13971*.
- [1109] Trawny, N., and Roumeliotis, S.I. 2005. Indirect Kalman Filter for 3D Attitude Estimation. *Mars Lab, Technical Report Number 2005-002, Rev. 57*.
- [1110] Trevor, Alexander J. B., Rogers, John G., and Christensen, Henrik I. 2012. Planar surface SLAM with 3D and 2D sensors. Pages 3041–3048 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [1111] Triggs, Bill, McLauchlan, Philip F, Hartley, Richard I, and Fitzgibbon, Andrew W. 2000. Bundle adjustment—a modern synthesis. Pages 298–372 of: *Vision Algorithms: Theory and Practice: International Workshop on Vision Algorithms Corfu, Greece, September 21–22, 1999 Proceedings*. Springer.

- [1112] Tron, R., Rosen, D., and Carlone, L. 2015. On the Inclusion of Determinant Constraints in Lagrangian Duality for 3D SLAM. In: *Robotics: Science and Systems (RSS), Workshop "The problem of mobile sensors: Setting future goals and indicators of progress for SLAM"*. .
- [1113] Trulls, E., Jin, Y., Yi, K.M., Mishkin, D., and Matas, J. 2022. *Image matching challenge*. <https://www.kaggle.com/competitions/image-matching-challenge-2022>. Accessed: 2022.
- [1114] Tsardoulis, Emmanouil G, Iliakopoulou, A, Kargakos, Andreas, and Petrou, Loukas. 2016. A review of global path planning methods for occupancy grid maps regardless of obstacle density. *J. of Intelligent and Robotic Systems*, **84**(1), 829–858.
- [1115] Tschernezki, Vadim, Laina, Iro, Larlus, Diane, and Vedaldi, Andrea. 2022. Neural Feature Fusion Fields: 3D Distillation of Self-Supervised 2D Image Representations. In: *Proceedings of the International Conference on 3D Vision (3DV)*.
- [1116] Tseng, Paul. 2001. Convergence of a block coordinate descent method for nondifferentiable minimization. *Journal of optimization theory and applications*, **109**, 475–494.
- [1117] Tunstall, Lewis, Von Werra, Leandro, and Wolf, Thomas. 2022. *Natural language processing with transformers*. " O'Reilly Media, Inc."
- [1118] Ummenhofer, Benjamin, Zhou, Huizhong, Uhrig, Jonas, Mayer, Nikolaus, Ilg, Eddy, Dosovitskiy, Alexey, and Brox, Thomas. 2017. Demon: Depth and motion network for learning monocular stereo. Pages 5038–5047 of: *Proceedings of the IEEE conference on computer vision and pattern recognition*.
- [1119] Urmson, C., Anhalt, J., Bagnell, D., Baker, C., Bittner, R., Clark, M. N., Dolan, J., Duggins, D., Galatali, T., Geyer, C., Gittleman, M., Harbaugh, S., Hebert, M., Howard, T. M., Kolski, S., Kelly, A., Likhachev, M., McNaughton, M., Miller, N., Peterson, K., Pilnick, B., Rajkumar, R., Rybski, P., Salesky, B., Seo, Y., Singh, S., Snider, J., Stentz, A., Whittaker, W., Wolkowicki, Z., Ziglar, J., Bae, H., Brown, T., Demitrish, D., Litkouhi, B., Nickolaou, J., Sadekar, V., Zhang, W., Struble, J., Taylor, M., Darms, M., and Ferguson, D. 2008. Autonomous Driving in Urban Environments: Boss and the Urban Challenge. *J. of Field Robotics*, **25**(8), 425–426.
- [1120] Usenko, Vladyslav, Engel, Jakob, Stücker, Jörg, and Cremers, Daniel. 2016. Direct visual-inertial odometry with stereo cameras. Pages 1885–1892 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*. IEEE.
- [1121] Usenko, Vladyslav, Demmel, Nikolaus, and Cremers, Daniel. 2018. The double sphere camera model. Pages 552–560 of: *2018 International Conference on 3D Vision (3DV)*. IEEE.
- [1122] Usenko, Vladyslav, Demmel, Nikolaus, Schubert, David, Stücker, Jörg, and Cremers, Daniel. 2019. Visual-inertial mapping with non-linear factor recovery. *IEEE Robotics and Automation Letters*, **5**(2), 422–429.
- [1123] Uy, Mikaela Angelina, and Lee, Gim Hee. 2018. Pointnetvlad: Deep point cloud based retrieval for large-scale place recognition. Pages 4470–4479 of: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [1124] van den Oord, Aaron, Li, Yazhe, and Vinyals, Oriol. 2018. Representation Learning with Contrastive Predictive Coding. *arXiv preprint arXiv:1807.03748*.

- [1125] Varghese, Rejin, and M., Sambath. 2024. YOLOv8: A Novel Object Detection Algorithm with Enhanced Performance and Robustness. In: *International Conference on Advances in Data Engineering and Intelligent Computing Systems (ADICS)*.
- [1126] Vasudevan, Shrihari, Ramos, Fabio, Nettleton, Eric, and Durrant-Whyte, Hugh. 2009. Gaussian process modeling of large-scale terrain. Pages 812–840 of: *J. of Field Robotics*, vol. 26.
- [1127] Vaswani, Ashish, Shazeer, Noam, Parmar, Niki, Uszkoreit, Jakob, Jones, Llion, Gomez, Aidan N, Kaiser, Lukasz, and Polosukhin, Illia. 2017. Attention is all you need. *Advances in Neural Information Processing Systems (NIPS)*, **30**.
- [1128] Vespa, E., Nikolov, N., Grimm, M., Nardi, L., Kelly, P. H.J., and Leutenegger, S. 2018. Efficient Octree-based Volumetric SLAM Supporting Signed-distance and Occupancy Mapping. *IEEE Robotics and Automation Letters*, **3**(2), 1144–1151.
- [1129] Vespa, Emanuele, Funk, Nils, Kelly, Paul HJ, and Leutenegger, Stefan. 2019. Adaptive-resolution octree-based volumetric SLAM. Pages 654–662 of: *Intl. Conf. on 3D Vision (3DV)*.
- [1130] Vial, Pau, Solà, Joan, Palomeras, Narcís, and Carreras, Marc. 2024. On Lie group IMU and linear velocity preintegration for autonomous navigation considering the Earth rotation compensation. *IEEE Trans. Robotics*, 1–18.
- [1131] Vicente, Sara, and Agapito, Lourdes. 2012. Soft inextensibility constraints for template-free non-rigid reconstruction. In: *ECCV*.
- [1132] Vigne, Matthieu, Khoury, Antonio El, Pétriaux, Marine, Meglio, Florent Di, and Petit, Nicolas. 2022. MOVIE: A Velocity-Aided IMU Attitude Estimator for Observing and Controlling Multiple Deformations on Legged Robots. *IEEE Robotics and Automation Letters*, **7**(2), 3969–3976.
- [1133] Vijayanarasimhan, Sudheendra, Ricco, Susanna, Schmid, Cordelia, Sukthankar, Rahul, and Fragkiadaki, Katerina. 2017. Sfm-net: Learning of structure and motion from video. *arXiv preprint arXiv:1704.07804*.
- [1134] Virgolino Soares, João Carlos, Medeiros, Vivian Suzano, Abati, Gabriel Fischer, Becker, Marcelo, Caurin, Glauco, Gattass, Marcelo, and Meggiolaro, Marco Antonio. 2023. Visual localization and mapping in dynamic and changing environments. *J. of Intelligent and Robotic Systems*, **109**(4), 95.
- [1135] Vizzo, I., Chen, X., Chebrolu, N., Behley, J., and Stachniss, C. 2021. Poisson Surface Reconstruction for LiDAR Odometry and Mapping. In: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [1136] Vizzo, Ignacio, Guadagnino, Tiziano, Behley, Jens, and Stachniss, Cyrill. 2022. VDBFusion: Flexible and Efficient TSDF Integration of Range Sensor Data. *IEEE Sensors*, **22**(3).
- [1137] Vizzo, Ignacio, Guadagnino, Tiziano, Mersch, Benedikt, Wiesmann, Louis, Behley, Jens, and Stachniss, Cyrill. 2023. KISS-ICP: In Defense of Point-to-Point ICP – Simple, Accurate, and Robust Registration If Done the Right Way. *IEEE Robotics and Automation Letters*, **8**(2), 1029–1036.
- [1138] Vödisch, Niclas, Cattaneo, Daniele, Burgard, Wolfram, and Valada, Abhinav. 2022. Continual slam: Beyond lifelong simultaneous localization and mapping through continual learning. Pages 19–35 of: *The International Symposium of Robotics Research*. Springer.



- [1139] von Stumberg, L., and Cremers, D. 2022. DM-VIO: Delayed Marginalization Visual-Inertial Odometry. *IEEE Robotics and Automation Letters (RA-L) and International Conference on Robotics and Automation (ICRA)*, **7**(2), 1408–1415.
- [1140] Von Stumberg, Lukas, Usenko, Vladyslav, and Cremers, Daniel. 2018. Direct sparse visual-inertial odometry using dynamic marginalization. Pages 2510–2517 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*. IEEE.
- [1141] Von Stumberg, Lukas, Wenzel, Patrick, Khan, Qadeer, and Cremers, Daniel. 2020a. Gn-net: The gauss-newton loss for multi-weather relocalization. *IEEE Robotics and Automation Letters*, **5**(2), 890–897.
- [1142] Von Stumberg, Lukas, Wenzel, Patrick, Yang, Nan, and Cremers, Daniel. 2020b. Lm-reloc: Levenberg-marquardt based direct visual relocalization. Pages 968–977 of: *Intl. Conf. on 3D Vision (3DV)*. IEEE.
- [1143] Wächter, Andreas, and Biegler, Lorenz T. 2006. On the implementation of an interior-point filter line-search algorithm for large-scale nonlinear programming. *Mathematical programming*, **106**(1), 25–57.
- [1144] Wald, Johanna, Avetisyan, Armen, Navab, Nassir, Tombari, Federico, and Nießner, Matthias. 2019. Rio: 3d object instance re-localization in changing indoor environments. Pages 7658–7667 of: *Proceedings of the IEEE/CVF International Conference on Computer Vision*.
- [1145] Wald, Johanna, Dharmo, Helisa, Navab, Nassir, and Tombari, Federico. 2020. Learning 3D Semantic Scene Graphs from 3D Indoor Reconstructions. Pages 3961–3970 of: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [1146] Walke, Homer, Black, Kevin, Lee, Abraham, Kim, Moo Jin, Du, Max, Zheng, Chongyi, Zhao, Tony, Hansen-Estruch, Philippe, Vuong, Quan, He, Andre, Myers, Vivek, Fang, Kuan, Finn, Chelsea, and Levine, Sergey. 2023. Bridge-Data V2: A Dataset for Robot Learning at Scale. In: *Conference on Robot Learning (CoRL)*.
- [1147] Wang, Chen, Gao, Dasong, Xu, Kuan, Geng, Junyi, Hu, Yaoyu, Qiu, Yuheng, Li, Bowen, Yang, Fan, Moon, Brady, Pandey, Abhinav, Aryan, Xu, Jiahe, Wu, Tianhao, He, Haonan, Huang, Daning, Ren, Zhongqiang, Zhao, Shibo, Fu, Taimeng, Reddy, Pranay, Lin, Xiao, Wang, Wenshan, Shi, Jingnan, Talak, Rajat, Cao, Kun, Du, Yi, Wang, Han, Yu, Huai, Wang, Shanzhao, Chen, Siyu, Kashyap, Ananth, Bandaru, Rohan, Dantu, Karthik, Wu, Jiajun, Xie, Lihua, Carlone, Luca, Hutter, Marco, and Scherer, Sebastian. 2023a. PyPose: A Library for Robot Learning with Physics-based Optimization. In: *IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)*.
- [1148] Wang, Chen, Ji, Kaiyi, Geng, Junyi, Ren, Zhongqiang, Fu, Taimeng, Yang, Fan, Guo, Yifan, He, Haonan, Chen, Xiangyu, Zhan, Zitong, Du, Qiwei, Su, Shaoshu, Li, Bowen, Qiu, Yuheng, Lin, Xiao, Du, Yi, Li, Qihang, and Zhao, Zhipeng. 2024a. Imperative Learning: A Self-supervised Neural-Symbolic Learning Framework for Robot Autonomy. *arXiv preprint*.
- [1149] Wang, Chieh-Chih, Thorpe, Charles, Thrun, Sebastian, Hebert, Martial, and Durrant-Whyte, Hugh. 2007. Simultaneous Localization, Mapping and Moving Object Tracking. *Intl. J. of Robotics Research*, **26**(9), 889–916.
- [1150] Wang, H., Wang, C., Chen, C., and Xie, L. 2021a. F-LOAM: Fast LiDAR

- Odometry and Mapping. In: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*.
- [1151] Wang, Han, Wang, Chen, and Xie, Lihua. 2020a. Intensity scan context: Coding intensity and geometry relations for loop closure detection. Pages 2095–2101 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*. IEEE.
  - [1152] Wang, He, Sridhar, Srinath, Huang, Jingwei, Valentin, Julien, Song, Shuran, and Guibas, Leonidas J. 2019a. Normalized Object Coordinate Space for Category-Level 6D Object Pose and Size Estimation. In: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
  - [1153] Wang, Hengyi, Wang, Jingwen, and Agapito, Lourdes. 2023b. Co-slam: Joint coordinate and sparse parametric encodings for neural real-time slam. In: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
  - [1154] Wang, Jianeng, and Gammell, Jonathan D. 2023. Event-Based Stereo Visual Odometry With Native Temporal Resolution via Continuous-Time Gaussian Process Regression. *IEEE Robotics and Automation Letters*, **8**(10), 6707–6714.
  - [1155] Wang, Jinkun, and Englot, Brendan. 2016. Fast, accurate gaussian process occupancy maps via test-data octrees and nested Bayesian fusion. Pages 1003–1010 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
  - [1156] Wang, K., Gao, F., and Shen, S. 2019b. Real-Time Scalable Dense Surfel Mapping. In: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
  - [1157] Wang, Peng, Liu, Lingjie, Liu, Yuan, Theobalt, Christian, Komura, Taku, and Wang, Wenping. 2021b. Neus: Learning neural implicit surfaces by volume rendering for multi-view reconstruction. In: *Advances in Neural Information Processing Systems (NIPS)*.
  - [1158] Wang, R., Schwörer, M., and Cremers, D. 2017a (October). Stereo DSO: Large-Scale Direct Sparse Visual Odometry with Stereo Cameras. In: *Intl. Conf. on Computer Vision (ICCV)*.
  - [1159] Wang, Rui, Yang, Nan, Stückler, Jörg, and Cremers, Daniel. 2020b. DirectShape: Photometric Alignment of Shape Priors for Visual Vehicle Pose and Shape Estimation. In: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
  - [1160] Wang, Ruicheng, Xu, Sicheng, Dai, Cassie, Xiang, Jianfeng, Deng, Yu, Tong, Xin, and Yang, Jiaolong. 2025. Moge: Unlocking accurate monocular geometry estimation for open-domain images with optimal training supervision. *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
  - [1161] Wang, Sen, Clark, Ronald, Wen, Hongkai, and Trigoni, Niki. 2017b. Deepvo: Towards end-to-end visual odometry with deep recurrent convolutional neural networks. Pages 2043–2050 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*. IEEE.
  - [1162] Wang, Shuzhe, Leroy, Vincent, Cabon, Yohann, Chidlovskii, Boris, and Revaud, Jerome. 2024b. Dust3r: Geometric 3d vision made easy. Pages 20697–20709 of: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
  - [1163] Wang, T., Dhiman, V., and Atanasov, N. 2023c. Inverse Reinforcement Learning for Autonomous Navigation via Differentiable Semantic Mapping and Planning. *Autonomous Robots*, **47**(6), 809–830.
  - [1164] Wang, Wenshan, Zhu, DeLong, Wang, Xiangwei, Hu, Yaoyu, Qiu, Yuheng,

- Wang, Chen, Hu, Yafei, Kapoor, Ashish, and Scherer, Sebastian. 2020c. Tartanair: A dataset to push the limits of visual slam. Pages 4909–4916 of: *2020 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. IEEE.
- [1165] Wang, Wenshan, Hu, Yaoyu, and Scherer, Sebastian. 2021c. Tartanvo: A generalizable learning-based vo. Pages 1761–1772 of: *Conference on Robot Learning*. PMLR.
- [1166] Wang, Y., Duan, J., Fox, D., and Srinivasa, S. 2023d. NEWTON: Are Large Language Models Capable of Physical Reasoning?
- [1167] Warburg, Frederik, Hauberg, Soren, Lopez-Antequera, Manuel, Gargallo, Pau, Kuang, Yubin, and Civera, Javier. 2020. Mapillary street-level sequences: A dataset for lifelong place recognition. Pages 2626–2635 of: *Proceedings of the IEEE/CVF conference on computer vision and pattern recognition*.
- [1168] Weber, S, Demmel, N, and Cremers, D. 2021. Multidirectional Conjugate Gradients for Scalable Bundle Adjustment. In: *German Conference on Pattern Recognition (GCPR)*.
- [1169] Weber, S, Demmel, N, Chan, T Chon, and Cremers, D. 2023. Power Bundle Adjustment for Large-Scale 3D Reconstruction. In: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [1170] Weber, S, Hong, JH, and Cremers, D. 2024. Power Variable Projection for Initialization-Free Large-Scale Bundle Adjustment. In: *European Conference on Computer Vision (ECCV)*.
- [1171] Wei, Peng, Hua, Guoliang, Huang, Weibo, Meng, Fanyang, and Liu, Hong. 2021. Unsupervised monocular visual-inertial odometry network. Pages 2347–2354 of: *Proceedings of the Twenty-Ninth International Conference on International Joint Conferences on Artificial Intelligence*.
- [1172] Wei, T., Patel, Y., Shekhovtsov, A., Matas, J., and Barath, D. 2023. Generalized differentiable RANSAC. In: *Intl. Conf. on Computer Vision (ICCV)*.
- [1173] Weikersdorfer, David, Hoffmann, Raoul, and Conradt, Jörg. 2013. Simultaneous Localization and Mapping for event-based Vision Systems. Pages 133–142 of: *Int. Conf. Comput. Vis. Syst. (ICVS)*.
- [1174] Weikersdorfer, David, Adrian, David B., Cremers, Daniel, and Conradt, Jörg. 2014. Event-based 3D SLAM with a depth-augmented dynamic vision sensor. Pages 359–364 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [1175] Weitkamp, Claus. 2006. *Lidar: range-resolved optical remote sensing of the atmosphere*. Vol. 102. Springer Verlag.
- [1176] Wen, Bowen, and Bekris, Kostas. 2021. Bundletrack: 6d pose tracking for novel objects without instance or category-level 3d models. Pages 8067–8074 of: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*. IEEE.
- [1177] Wendel, Andreas, Maurer, Michael, Graber, Gottfried, Pock, Thomas, and Bischof, Horst. 2012. Dense reconstruction on-the-fly. Pages 1450–1457 of: *2012 IEEE Conference on Computer Vision and Pattern Recognition*. IEEE.
- [1178] Wenzel, P., Wang, R., Yang, N., Cheng, Q., Khan, Q., von Stumberg, L., Zeller, N., and Cremers, D. 2020. 4Seasons: A Cross-Season Dataset for Multi-Weather SLAM in Autonomous Driving. In: *Proceedings of the German Conference on Pattern Recognition (GCPR)*.

- [1179] Werby, Abdelrhman, Huang, Chenguang, Büchner, Martin, Valada, Abhinav, and Burgard, Wolfram. 2024. Hierarchical Open-Vocabulary 3D Scene Graphs for Language-Grounded Robot Navigation. *Robotics: Science and Systems (RSS)*.
- [1180] Whelan, Thomas, Kaess, Michael, Fallon, Maurice, Johannsson, Hordur, Leonard, John, and McDonald, John. 2012 (July). Kintinuous: Spatially extended kinectfusion. In: *Robotics: Science and Systems Workshop*.
- [1181] Whelan, Thomas, Leutenegger, Stefan, Salas-Moreno, Renato F, Glocker, Ben, and Davison, Andrew J. 2015. ElasticFusion: Dense SLAM without a pose graph. Page 3 of: *Robotics: Science and Systems (RSS)*, vol. 11. Rome.
- [1182] Williams, Christopher, and Seeger, Matthias. 2000. Using the Nyström method to speed up kernel machines. In: *Advances in Neural Information Processing Systems (NIPS)*, vol. 13.
- [1183] Williams, Oliver, and Fitzgibbon, Andrew. 2007. *Gaussian Process Implicit Surfaces*.
- [1184] Wimbauer, Felix, Yang, Nan, Von Stumberg, Lukas, Zeller, Niclas, and Cremers, Daniel. 2021. Monorec: Semi-supervised dense reconstruction in dynamic environments from a single moving camera. Pages 6112–6122 of: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [1185] Wimbauer, Felix, Yang, Nan, Rupprecht, Christian, and Cremers, Daniel. 2023. Behind the scenes: Density fields for single view reconstruction. Pages 9076–9086 of: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [1186] Wimbauer, Felix, Chen, Weirong, Muhle, Dominik, Rupprecht, Christian, and Cremers, Daniel. 2025. AnyCam: Learning to Recover Camera Poses and Intrinsic from Casual Videos. In: *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition*.
- [1187] Wisth, David, Camurri, Marco, and Fallon, Maurice F. 2020. Preintegrated Velocity Bias Estimation to Overcome Contact Nonlinearities in Legged Robot Odometry. Pages 392–398 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [1188] Wisth, David, Camurri, Marco, and Fallon, Maurice. 2022. Vilens: Visual, inertial, lidar, and leg odometry for all-terrain legged robots. *IEEE Trans. Robotics*, **39**(1), 309–326.
- [1189] Wu, GuanJun, Yi, Taoran, Fang, Jiemin, Xie, Lingxi, Zhang, Xiaopeng, Wei, Wei, Liu, Wenyu, Tian, Qi, and Wang, Xinggang. 2024a. 4d gaussian splatting for real-time dynamic scene rendering. Pages 20310–20320 of: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [1190] Wu, Hao, Sankaranarayanan, Aswin C., and Chellappa, Rama. 2007. In Situ Evaluation of Tracking Algorithms Using Time Reversed Chains. In: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [1191] Wu, Kejian J, Ahmed, Ahmed M, Georgiou, Georgios A, and Roumeliotis, Stergios I. 2015. A square root inverse filter for efficient vision-aided inertial navigation on mobile devices. In: *Robotics: Science and Systems Conference (RSS)*.
- [1192] Wu, Lan, Lee, Ki Myung Brian, Liu, Liyang, and Vidal-Calleja, Teresa. 2021a. Faithful Euclidean distance field from log-Gaussian process implicit surfaces. *IEEE Robotics and Automation Letters*, 2461–2468.

- [1193] Wu, Lan, Lee, Ki Myung Brian, Le Gentil, Cedric, and Vidal-Calleja, Teresa. 2023a. Log-GPIS-MOP: A Unified Representation for Mapping, Odometry, and Planning. *IEEE Trans. Robotics*, **39**(5), 4078–4094.
- [1194] Wu, Qinghua, and Hao, Jin-Kao. 2015. A review on algorithms for maximum clique problems. *European Journal of Operational Research*, **242**(3), 693–709.
- [1195] Wu, Shun-Cheng, Wald, Johanna, Tateno, Keisuke, Navab, Nassir, and Tombari, Federico. 2021b. SceneGraphFusion: Incremental 3D Scene Graph Prediction from RGB-D Sequences. Pages 7515–7525 of: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [1196] Wu, Xiaoyi, Chen, Yushuai, Li, Zhan, Hong, Ziyang, and Hu, Liang. 2024b. EFEAR-4D: Ego-Velocity Filtering for Efficient and Accurate 4D Radar Odometry. *IEEE Robotics and Automation Letters*, **9**(11), 9828–9835.
- [1197] Wu, Yibin, Kuang, Jian, Niu, Xiaoji, Behley, Jens, Klingbeil, Lasse, and Kuhlmann, Heiner. 2023b. Wheel-SLAM: Simultaneous Localization and Terrain Mapping Using One Wheel-Mounted IMU. *IEEE Robotics and Automation Letters*, **8**(1), 280–287.
- [1198] Wu, Yuchen, Yoon, David J., Burnett, Keenan, Kammel, Soeren, Chen, Yi, Vhavle, Heethesh, and Barfoot, Timothy D. 2023c. Picking Up Speed: Continuous-Time Lidar-Only Odometry using Doppler Velocity Measurements. In: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [1199] Xie, Yiheng, Takikawa, Towaki, Saito, Shunsuke, Litany, Or, Yan, Shiqin, Khan, Numair, Tombari, Federico, Tompkin, James, Sitzmann, Vincent, and Sridhar, Srinath. 2022. Neural fields in visual computing and beyond. Pages 641–676 of: *Computer Graphics Forum*, vol. 41. Wiley Online Library.
- [1200] Xinjilefu, X., Feng, Siyuan, Huang, Weiwei, and Atkeson, Christopher G. 2014a. Decoupled state estimation for humanoids using full-body dynamics. Pages 195–201 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [1201] Xinjilefu, X., Feng, Siyuan, and Atkeson, Christopher G. 2014b. Dynamic state estimation using Quadratic Programming. Pages 989–994 of: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*.
- [1202] Xinjilefu, X., Feng, Siyuan, and Atkeson, Christopher G. 2016. A distributed MEMS gyro network for joint velocity estimation. Pages 1879–1884 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [1203] Xu, Binbin, Li, Wenbin, Tzoumanikas, Dimos, Bloesch, Michael, Davison, Andrew, and Leutenegger, Stefan. 2019. Mid-fusion: Octree-based object-level multi-instance dynamic slam. Pages 5231–5237 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*. IEEE.
- [1204] Xu, Binbin, Davison, Andrew J, and Leutenegger, Stefan. 2022a. Learning to complete object shapes for object-level mapping in dynamic scenes. Pages 2257–2264 of: *2022 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. IEEE.
- [1205] Xu, Qiangeng, Xu, Zexiang, Philip, Julien, Bi, Sai, Shu, Zhixin, Sunkavalli, Kalyan, and Neumann, Ulrich. 2022b. Point-nerf: Point-based neural radiance fields. In: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [1206] Xu, R., Dong, W., Sharma, A., and Kaess, M. 2022c (Oct.). Learned Depth Estimation of 3D Imaging Radar for Indoor Mapping. In: *Proc. IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*.

- [1207] Xu, Wei, Cai, Yixi, He, Dongjiao, Lin, Jiarong, and Zhang, Fu. 2022d. Fastlio2: Fast direct lidar-inertial odometry. *IEEE Trans. Robotics*, **38**(4), 2053–2073.
- [1208] Xu, Xuecheng, Lu, Sha, Wu, Jun, Lu, Haojian, Zhu, Qiuguo, Liao, Yiyi, Xiong, Rong, and Wang, Yue. 2023. Ring++: Roto-translation-invariant gram for global localization on a sparse scan map. *IEEE Trans. Robotics*.
- [1209] Yamazaki, Kashu, Hanyu, Taisei, Vo, Khoa, Pham, Thang, Tran, Minh, Doretto, Gianfranco, Nguyen, Anh, and Le, Ngan. 2024. Open-fusion: Real-time open-vocabulary 3d mapping and queryable scene representation. Pages 9411–9417 of: *2024 IEEE International Conference on Robotics and Automation (ICRA)*. IEEE.
- [1210] Yan, Chi, Qu, Delin, Xu, Dan, Zhao, Bin, Wang, Zhigang, Wang, Dong, and Li, Xuelong. 2024. Gs-slam: Dense visual slam with 3d gaussian splatting. In: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [1211] Yan, Hang, Shan, Qi, and Furukawa, Yasutaka. 2018. RIDI: Robust IMU double integration. Pages 621–636 of: *Proceedings of the European conference on computer vision (ECCV)*.
- [1212] Yang, Fan, Wang, Chen, Cadena, Cesar, and Hutter, Marco. 2023a. iPlanner: Imperative Path Planning. In: *Robotics: Science and Systems (RSS)*.
- [1213] Yang, H., and Carlone, L. 2019a. A Polynomial-time Solution for Robust Registration with Extreme Outlier Rates. In: *Robotics: Science and Systems (RSS)*.
- [1214] Yang, H., and Carlone, L. 2019b. A Quaternion-based Certifiably Optimal Solution to the Wahba Problem with Outliers. In: *Intl. Conf. on Computer Vision (ICCV)*. (Oral Presentation, accept rate: 4%), Arxiv version: 1905.12536, .
- [1215] Yang, H., and Carlone, L. 2020. One Ring to Rule Them All: Certifiably Robust Geometric Perception with Outliers. Pages 18846–18859 of: *Advances in Neural Information Processing Systems (NIPS)*, vol. 33. .
- [1216] Yang, H., Liang, L., Carlone, L., and Toh, K. 2022a. An Inexact Projected Gradient Method with Rounding and Lifting by Nonlinear Programming for Solving Rank-One Semidefinite Relaxation of Polynomial Optimization. *Mathematical Programming (MAPR)*. .
- [1217] Yang, Heng, and Carlone, Luca. 2022. Certifiably optimal outlier-robust geometric perception: Semidefinite relaxations and scalable global optimization. *IEEE Trans. Pattern Anal. Machine Intell.*, **45**(3), 2816–2834.
- [1218] Yang, Heng, Antonante, Pasquale, Tzoumas, Vasileios, and Carlone, Luca. 2020a. Graduated non-convexity for robust spatial perception: From non-minimal solvers to global outlier rejection. *IEEE Robotics and Automation Letters*, **5**(2), 1127–1134.
- [1219] Yang, Heng, Shi, Jingnan, and Carlone, Luca. 2020b. Teaser: Fast and certifiable point cloud registration. *IEEE Trans. Robotics*, **37**(2), 314–333.
- [1220] Yang, J., Li, H., Campbell, D., and Jia, Y. 2016. Go-ICP: A Globally Optimal Solution to 3D ICP Point-Set Registration. *IEEE Trans. Pattern Anal. Machine Intell.*, **38**(11), 2241–2254.
- [1221] Yang, Jiaolong, Li, Hongdong, and Jia, Yunde. 2014. Optimal essential matrix estimation via inlier-set maximization. Pages 111–126 of: *European Conf. on Computer Vision (ECCV)*. Springer.

- [1222] Yang, N., Wang, R., Gao, X., and Cremers, D. 2018a. Challenges in Monocular Visual Odometry: Photometric Calibration, Motion Bias and Rolling Shutter Effect. *In IEEE Robotics and Automation Letters (RA-L) and Int. Conference on Intelligent Robots and Systems (IROS)*, **3**(Oct), 2878–2885.
- [1223] Yang, Nan, Wang, Rui, Stuckler, Jorg, and Cremers, Daniel. 2018b. Deep virtual stereo odometry: Leveraging deep depth prediction for monocular direct sparse odometry. Pages 817–833 of: *European Conf. on Computer Vision (ECCV)*.
- [1224] Yang, Nan, Stumberg, Lukas von, Wang, Rui, and Cremers, Daniel. 2020c. D3vo: Deep depth, deep pose and deep uncertainty for monocular visual odometry. Pages 1281–1292 of: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [1225] Yang, Shuo, Zhang, Zixin, Bokser, Benjamin, and Manchester, Zachary. 2023b. Multi-IMU Proprioceptive Odometry for Legged Robots. Pages 774–779 of: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*.
- [1226] Yang, Wen, Gong, Zheng, Huang, Baifu, and Hong, Xiaoping. 2022b. Lidar With Velocity: Correcting Moving Objects Point Cloud Distortion From Oscillating Scanning Lidars by Fusion With Camera. *IEEE Robotics and Automation Letters*, **7**(3).
- [1227] Yang, Xingrui, Li, Hai, Zhai, Hongjia, Ming, Yuhang, Liu, Yuqian, and Zhang, Guofeng. 2022c. Vox-fusion: Dense tracking and mapping with voxel-based neural implicit representation. Pages 499–507 of: *2022 IEEE International Symposium on Mixed and Augmented Reality (ISMAR)*. IEEE.
- [1228] Yang, Yulin. 2024. *Aided Inertial Navigation System: Analysis and Algorithms*. phdthesis, University of Delaware.
- [1229] Yang, Yulin, and Huang, Guoquan. 2019. Observability Analysis of Aided INS with Heterogeneous Features of Points, Lines and Planes. *IEEE Transactions on Robotics*, **35**(6), 399–1418.
- [1230] Yang, Yulin, Geneva, Patrick, Ekenhoff, Kevin, and Huang, Guoquan. 2019a. Degenerate Motion Analysis for Aided INS with Online Spatial and Temporal Calibration. *IEEE Robotics and Automation Letters (RA-L)*, **4**(2), 2070–2077.
- [1231] Yang, Yulin, Geneva, Patrick, Zuo, Xingxing, Ekenhoff, Kevin, Liu, Yong, and Huang, Guoquan. 2019b (May). Tightly-Coupled Aided Inertial Navigation with Point and Plane Features. In: *Proc. International Conference on Robotics and Automation*.
- [1232] Yang, Yulin, Geneva, Patrick, Zuo, Xingxing, and Huang, Guoquan. 2023c. Online Self-Calibration for Visual-Inertial Navigation Systems: Models, Analysis and Degeneracy. *IEEE Transactions on Robotics*, May.
- [1233] Yang, Zheyu, Wang, Taoyi, Lin, Yihan, Chen, Yuguo, Zeng, Hui, Pei, Jing, Wang, Jiazheng, Liu, Xue, Zhou, Yichun, Zhang, Jianqiang, Wang, Xin, Lv, Xinhao, Zhao, Rong, and Shi, Luping. 2024. A vision chip with complementary pathways for open-world sensing. *Nature*, **629**(8014), 1027–1033.
- [1234] Yannakakis, M. 1981. Computing the minimum fill-in is NP-complete. *SIAM J. Algebraic Discrete Methods*, **2**.
- [1235] Yao, Shanliang, Guan, Runwei, Peng, Zitian, Xu, Chenhang, Shi, Yilu, Ding, Weiping, Lim, Eng Gee, Yue, Yong, Seo, Hyungjoon, Man, Ka Lok, Ma, Jieming, Zhu, Xiaohui, and Yue, Yutao. 2025. Exploring Radar Data

- Representations in Autonomous Driving: A Comprehensive Review. *IEEE Trans. on Intelligent Transportation Systems (TITS)*, 1–25.
- [1236] Yariv, Lior, Gu, Jiatao, Kasten, Yoni, and Lipman, Yaron. 2021. Volume rendering of neural implicit surfaces. *Advances in Neural Information Processing Systems (NIPS)*.
  - [1237] Ye, Botao, Liu, Sifei, Xu, Haoifei, Xueting, Li, Pollefeys, Marc, Yang, Ming-Hsuan, and Songyou, Peng. 2025. No Pose, No Problem: Surprisingly Simple 3D Gaussian Splats from Sparse Unposed Images. *Intl. Conf. on Learning Representations (ICLR)*.
  - [1238] Ye, Chengxi, Mitrokhin, Anton, Parameshwara, Chethan, Fermüller, Cornelia, Yorke, James A., and Aloimonos, Yiannis. 2020. Unsupervised Learning of Dense Optical Flow, Depth and Egomotion with Event-Based Sensors. Pages 5831–5838 of: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*.
  - [1239] Yi, Brent, Lee, Michelle A, Kloss, Alina, Martín-Martín, Roberto, and Bohg, Jeannette. 2021. Differentiable factor graph optimization for learning smoothers. Pages 1339–1345 of: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*. IEEE.
  - [1240] Yi, Kwang Moo, Verdie, Yannick, Lepetit, Vincent, and Fua, Pascal. 2016. LIFT: Learned Invariant Feature Transform. In: *European Conf. on Computer Vision (ECCV)*.
  - [1241] Yilmaz, Alper, Javed, Omar, and Shah, Mubarak. 2006. Object tracking: A survey. *Acm computing surveys (CSUR)*, **38**(4), 13–es.
  - [1242] Yin, Huan, Xu, Xuecheng, Wang, Yue, and Xiong, Rong. 2021a. Radar-to-Lidar: Heterogeneous Place Recognition via Joint Learning. *Frontiers in Robotics and AI*, **8**.
  - [1243] Yin, Huan, Chen, Runjian, Wang, Yue, and Xiong, Rong. 2021b. Rall: end-to-end radar localization on lidar map using differentiable measurement model. *IEEE Trans. on Intelligent Transportation Systems (TITS)*, **23**(7), 6737–6750.
  - [1244] Yin, Huan, Xu, Xuecheng, Lu, Sha, Chen, Xieyuanli, Xiong, Rong, Shen, Shaojie, Stachniss, Cyrill, and Wang, Yue. 2024. A Survey on Global LiDAR Localization: Challenges, Advances and Open Problems. *Intl. J. of Computer Vision*, 1–33.
  - [1245] Yin, Jie, Li, Ang, Li, Tao, Yu, Wenxian, and Zou, Danping. 2022. M2DGR: A Multi-Sensor and Multi-Scenario SLAM Dataset for Ground Robots. *IEEE Robotics and Automation Letters*, **7**(2), 2266–2273.
  - [1246] Yin, Peng, Zhao, Shiqi, Lai, Haowen, Ge, Ruohai, Zhang, Ji, Choset, Howie, and Scherer, Sebastian. 2023. Automerger: A framework for map assembling and smoothing in city-scale environments. *IEEE Trans. Robotics*.
  - [1247] Yokoyama, N., Ha, S., Batra, D., Wang, J., and Bucher, B. 2024. VLFM: Vision-Language Frontier Maps for Zero-Shot Semantic Navigation. In: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
  - [1248] Yokozuka, M., Koide, K., Oishi, S., and Banno, A. 2021. LiTAMIN2: Ultra Light LiDAR-Based SLAM Using Geometric Approximation Applied with KL-Divergence. In: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
  - [1249] Yoon, David, Tang, Tim, and Barfoot, Timothy. 2019. Mapless online detection of dynamic objects in 3d lidar. Pages 113–120 of: *2019 16th Conference on Computer and Robot Vision (CRV)*. IEEE.



- [1250] Youm, Donghoon, Oh, Hyunsik, Choi, Suyoung, Kim, Hyeongjun, and Hwangbo, Jemin. 2024. Legged Robot State Estimation With Invariant Extended Kalman Filter Using Neural Measurement Network. *arXiv preprint*.
- [1251] Yu, X., and Yang, H. 2024. SIM-Sync: From Certifiably Optimal Synchronization Over the 3D Similarity Group to Scene Reconstruction With Learned Depth. *IEEE Robotics and Automation Letters*, **9**(5), 4471–4478.
- [1252] Yu, Z., Feng, C., Liu, M., and Ramalingam, S. 2017. CASENet: Deep Category-Aware Semantic Edge Detection. In: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [1253] Yuan, Chongjian, Lin, Jiarong, Zou, Zuhao, Hong, Xiaoping, and Zhang, Fu. 2023. STD: Stable triangle descriptor for 3d place recognition. Pages 1897–1903 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*. IEEE.
- [1254] Yuan, Chongjian, Lin, Jiarong, Liu, Zheng, Wei, Hairuo, Hong, Xiaoping, and Zhang, Fu. 2024. BTC: A Binary and Triangle Combined Descriptor for 3D Place Recognition. *IEEE Trans. Robotics*, **40**, 1580–1599.
- [1255] Yuan, Wenzhen, and Ramalingam, Srikumar. 2016. Fast Localization and Tracking using Event Sensors. Pages 4564–4571 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [1256] Yugay, Vladimir, Li, Yue, Gevers, Theo, and Oswald, Martin R. 2023. Gaussian-SLAM: Photo-realistic Dense SLAM with Gaussian Splatting. *arXiv preprint*.
- [1257] Yun, Seungsang, Jung, Minwoo, Kim, Jeongyun, Jung, Sangwoo, Cho, Younghun, Jeon, Myung-Hwan, Kim, Giseop, and Kim, Ayoung. 2022. STheReO: Stereo Thermal Dataset for Research in Odometry and Mapping. In: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*. IEEE.
- [1258] Zaganidis, A., Sun, L., Duckett, T., and Cielniak, G. 2018. Integrating deep semantic segmentation into 3-d point cloud registration. *IEEE Robotics and Automation Letters*, **3**(4), 2942–2949.
- [1259] Zang, Yuhang, Li, Wei, Zhou, Kaiyang, Huang, Chen, and Loy, Chen Change. 2022. Open-Vocabulary DETR with Conditional Matching. Pages 106–122 of: Avidan, Shai, Brostow, Gabriel, Cissé, Moustapha, Farinella, Giovanni Maria, and Hassner, Tal (eds), *ECCV 2022*.
- [1260] Ze, Yanjie, Yan, Ge, Wu, Yueh-Hua, Macaluso, Annabella, Ge, Yuying, Ye, Jianglong, Hansen, Nicklas, Li, Li Erran, and Wang, Xiaolong. 2023. Multi-Task Real Robot Learning with Generalizable Neural Feature Fields.
- [1261] Zender, Hendrik, Mozos, Óscar Martínez, Jensfelt, Patric, Kruijff, Geert Jan M, and Burgard, Wolfram. 2008. Conceptual spatial representations for indoor mobile robots. *Robotics and Autonomous Systems*, **56**(6), 493–502.
- [1262] Zhan, Zitong, Gao, Dasong, Lin, Yun-Jou, Xia, Youjie, and Wang, Chen. 2024. iMatching: Imperative Correspondence Learning. In: *European Conference on Computer Vision (ECCV)*.
- [1263] Zhang, C., Delitzas, A., Wang, F., Zhang, R., Ji, X., Pollefeys, M., and Engelmann, F. 2025a. Open-Vocabulary Functional 3D Scene Graphs for Real-World Indoor Spaces. In: *arxiv preprint: 2503.19199*.
- [1264] Zhang, J., and Singh, S. 2014. LOAM: Lidar Odometry and Mapping in Real-time. In: *Robotics: Science and Systems (RSS)*.

- [1265] Zhang, Jun, Henein, Mina, Mahony, Robert, and Ila, Viorela. 2020. VDO-SLAM: A visual dynamic object-aware SLAM system. *arXiv preprint arXiv:2005.11052*.
- [1266] Zhang, Jun, Zhuge, Huayang, Wu, Zhenyu, Peng, Guohao, Wen, Mingxing, Liu, Yiyao, and Wang, Danwei. 2023a. 4DRadarSLAM: A 4D Imaging Radar SLAM System for Large-scale Environments based on Pose Graph Optimization. Pages 8333–8340 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [1267] Zhang, Jun, Xiao, Renxiang, Li, Heshan, Liu, Yiyao, Suo, Xudong, Hong, Chaoyu, Lin, Zhongxu, and Wang, Danwei. 2023b. 4DRT-SLAM: Robust SLAM in Smoke Environments using 4D Radar and Thermal Camera based on Dense Deep Learnt Features. Pages 19–24 of: *2023 IEEE International Conference on Cybernetics and Intelligent Systems (CIS) and IEEE Conference on Robotics, Automation and Mechatronics (RAM)*.
- [1268] Zhang, Jun, Zhuge, Huayang, Liu, Yiyao, Peng, Guohao, Wu, Zhenyu, Zhang, Haoyuan, Lyu, Qiyang, Li, Heshan, Zhao, Chunyang, Kircali, Dogan, et al. 2023c. Ntu4dradlm: 4d radar-centric multi-modal dataset for localization and mapping. Pages 4291–4296 of: *IEEE Intl. Conf. on Intelligent Transportation Systems (ITSC)*. IEEE.
- [1269] Zhang, Lintong, Digumarti, Tejaswi, Tinchev, Georgi, and Fallon, Maurice. 2023d. InstaLoc: One-shot Global Lidar Localisation in Indoor Environments through Instance Learning. In: *Robotics: Science and Systems (RSS)*.
- [1270] Zhang, Mike, Qu, Kaixian, Patil, Vaishakh, Cadena, Cesar, and Hutter, Marco. 2025b. Tag Map: A Text-Based Map for Spatial Reasoning and Navigation with Large Language Models. Pages 2120–2146 of: Agrawal, Pulkit, Kroemer, Oliver, and Burgard, Wolfram (eds), *Proceedings of The 8th Conference on Robot Learning*. Proceedings of Machine Learning Research, vol. 270. PMLR.
- [1271] Zhang, Ming, Zhang, Mingming, Chen, Yiming, and Li, Mingyang. 2021a. IMU Data Processing For Inertial Aided Navigation: A Recurrent Neural Network Based Approach. Pages 3992–3998 of: *2021 IEEE International Conference on Robotics and Automation (ICRA)*.
- [1272] Zhang, Tingrui, Wang, Jingping, Xu, Chao, Gao, Alan, and Gao, Fei. 2023e. Continuous Implicit SDF Based Any-Shape Robot Trajectory Optimization. Pages 282–289 of: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*.
- [1273] Zhang, Xiaoshuai, Kundu, Abhijit, Funkhouser, Thomas, Guibas, Leonidas, Su, Hao, and Genova, Kyle. 2023f. Nerflets: Local Radiance Fields for Efficient Structure-Aware 3D Scene Representation from 2D Supervision. In: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [1274] Zhang, Z., Suleiman, A., Carlone, L., Sze, V., and Karaman, S. 2017. Visual-Inertial Odometry on Chip: An Algorithm-and-Hardware Co-design Approach. In: *Robotics: Science and Systems (RSS)*. , highlighted in the MIT News: .
- [1275] Zhang, Zelin, Yezzi, Anthony, and Gallego, Guillermo. 2023g. Formulating Event-based Image Reconstruction as a Linear Inverse Problem with Deep Regularization using Optical Flow. *IEEE Trans. Pattern Anal. Machine Intell.*, **45**(7), 8372–8389.

- [1276] Zhang, Zhengyou. 1994. Iterative point matching for registration of free-form curves and surfaces. *Intl. J. of Computer Vision*, **13**, 119–152.
- [1277] Zhang, Zhongyang, Cui, Shuyang, Chai, Kaidong, Yu, Haowen, Dasgupta, Subhasis, Mahbub, Upal, and Rahman, Tauhidur. 2024. V2CE: Video to Continuous Events Simulator. Pages 12455–12461 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*.
- [1278] Zhang, Zichao, and Scaramuzza, Davide. 2018. A Tutorial on Quantitative Trajectory Evaluation for Visual(-Inertial) Odometry. Pages 7244–7251 of: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*.
- [1279] Zhang, Zichao, Sattler, Torsten, and Scaramuzza, Davide. 2021b. Reference Pose Generation for Long-term Visual Localization via Learned Features and View Synthesis. *Intl. J. of Computer Vision*, **129**(4), 821–844.
- [1280] Zhao, Ji, Xu, Wanting, and Kneip, Laurent. 2020a. A Certifiably Globally Optimal Solution to Generalized Essential Matrix Estimation. In: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [1281] Zhao, Shibo, Wang, Peng, Zhang, Hengrui, Fang, Zheng, and Scherer, Sebastian. 2020b. Tp-tio: A robust thermal-inertial odometry with deep thermalpoint. Pages 4505–4512 of: *2020 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. IEEE.
- [1282] Zhao, Shibo, Zhang, Hengrui, Wang, Peng, Nogueira, Lucas, and Scherer, Sebastian. 2021. Super odometry: Imu-centric lidar-visual-inertial estimator for challenging environments. Pages 8729–8736 of: *IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS)*. IEEE.
- [1283] Zhao, Shibo, Gao, Yuanjun, Wu, Tianhao, Singh, Damanpreet, Jiang, Rushan, Sun, Haoxiang, Sarawata, Mansi, Qiu, Yuheng, Whittaker, Warren, Higgins, Ian, Du, Yi, Su, Shaoshu, Xu, Can, Keller, John, Karhade, Jay, Nogueira, Lucas, Saha, Sourojit, Zhang, Ji, Wang, Wenshan, Wang, Chen, and Scherer, Sebastian. 2023. *SubT-MRS Dataset: Pushing SLAM Towards All-weather Environments*.
- [1284] Zheng, Jianhao, Zhu, Zihan, Bieri, Valentin, Pollefeys, Marc, Peng, Songyou, and Iro, Armeni. 2025. WildGS-SLAM: Monocular Gaussian Splatting SLAM in Dynamic Environments. In: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [1285] Zheng, Y., Sugimoto, S., and Okutomi, M. 2011. Deterministically maximizing feasible subsystem for robust model fitting with unit norm constraint. Pages 1825–1832 of: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
- [1286] Zhi, Shuaifeng, Laidlow, Tristan, Leutenegger, Stefan, and Davison, Andrew J. 2021. In-place scene labelling and understanding with implicit scene representation. In: *Intl. Conf. on Computer Vision (ICCV)*.
- [1287] Zhi, Shuaifeng, Sucar, Edgar, Mouton, Andre, Haughton, Iain, Laidlow, Tristan, and Davison, Andrew J. 2022. ilabel: Revealing objects in neural fields. *IEEE Robotics and Automation Letters*, **8**(2), 832–839.
- [1288] Zhong, Xingguang, Pan, Yue, Behley, Jens, and Stachniss, Cyrill. 2023. Shine-mapping: Large-scale 3d mapping using sparse hierarchical implicit neural representations. Pages 8371–8377 of: *IEEE Intl. Conf. on Robotics and Automation (ICRA)*. IEEE.
- [1289] Zhou, Haoyin, and Jayender, Jagadeesan. 2021. EMDQ-SLAM: Real-time

- high-resolution reconstruction of soft tissue surface from stereo laparoscopy videos. Pages 331–340 of: *MICCAI*. Springer.
- [1290] Zhou, Kun, Hou, Qiming, Wang, Rui, and Guo, Baining. 2008. Real-time kd-tree construction on graphics hardware. *ACM Transactions on Graphics (TOG)*, **27**(5), 1–11.
  - [1291] Zhou, Qian-Yi, and Koltun, Vladlen. 2013. Dense scene reconstruction with points of interest. *ACM Trans. on Graphics*, **32**(4).
  - [1292] Zhou, Q.Y., Park, J., and Koltun, V. 2016. Fast global registration. Pages 766–782 of: *European Conf. on Computer Vision (ECCV)*. Springer.
  - [1293] Zhou, Shenghao, Katragadda, Saimouli, and Huang, Guoquan. 2025 (May). Learning IMU Bias with Diffusion Model. In: *Proc. International Conference on Robotics and Automation*.
  - [1294] Zhou, Tinghui, Brown, Matthew, Snaveley, Noah, and Lowe, David G. 2017. Unsupervised learning of depth and ego-motion from video.
  - [1295] Zhou, Xingyi, Karpur, Arjun, Luo, Linjie, and Huang, Qixing. 2018a. StarMap for Category-Agnostic Keypoint and Viewpoint Estimation.
  - [1296] Zhou, Yi, Gallego, Guillermo, Rebecq, Henri, Kneip, Laurent, Li, Hongdong, and Scaramuzza, Davide. 2018b. Semi-Dense 3D Reconstruction with a Stereo Event Camera. Pages 242–258 of: *European Conf. on Computer Vision (ECCV)*.
  - [1297] Zhou, Yi, Gallego, Guillermo, and Shen, Shaojie. 2021. Event-based Stereo Visual Odometry. *IEEE Trans. Robotics*, **37**(5), 1433–1450.
  - [1298] Zhu, Alex Zihao, Atanasov, Nikolay, and Daniilidis, Kostas. 2017. Event-based Visual Inertial Odometry. Pages 5816–5824 of: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
  - [1299] Zhu, Alex Zihao, Thakur, Dinesh, Ozaslan, Tolga, Pfrommer, Bernd, Kumar, Vijay, and Daniilidis, Kostas. 2018. The Multivehicle Stereo Event Camera Dataset: An Event Camera Dataset for 3D Perception. *IEEE Robotics and Automation Letters*, **3**(3), 2032–2039.
  - [1300] Zhu, Alex Zihao, Yuan, Liangzhe, Chaney, Kenneth, and Daniilidis, Kostas. 2019. Unsupervised Event-based Learning of Optical Flow, Depth, and Ego-motion. Pages 989–997 of: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
  - [1301] Zhu, Alex Zihao, Wang, Ziyun, Khant, Kaung, and Daniilidis, Kostas. 2021. EventGAN: Leveraging Large Scale Image Datasets for Event Cameras. Pages 1–11 of: *IEEE Int. Conf. Comput. Photography (ICCP)*.
  - [1302] Zhu, Liyuan, Huang, Shengyu, Schindler, Konrad, and Armeni, Iro. 2024. Living scenes: Multi-object relocalization and reconstruction in changing 3d environments. Pages 28014–28024 of: *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition*.
  - [1303] Zhu, Liyuan, Li, Yue, Sandström, Erik, Huang, Shengyu, Schindler, Konrad, and Armeni, Iro. 2025. LoopSplat: Loop Closure by Registering 3D Gaussian Splats. In: *International Conference on 3D Vision (3DV)*.
  - [1304] Zhu, Zihan, Peng, Songyou, Larsson, Viktor, Xu, Weiwei, Bao, Hujun, Cui, Zhaopeng, Oswald, Martin R., and Pollefeys, Marc. 2022. NICE-SLAM: Neural Implicit Scalable Encoding for SLAM. In: *IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*.
  - [1305] Zhuang, Yuan, Wang, Binliang, Huai, Jianzhu, and Li, Miao. 2023a. 4D

- iRIOM: 4D Imaging Radar Inertial Odometry and Mapping. *IEEE Robotics and Automation Letters*, **8**(6), 3246–3253.
- [1306] Zhuang, Ziwen, Fu, Zipeng, Wang, Jianren, Atkeson, Christopher G., Schwertfeger, Sören, Finn, Chelsea, and Zhao, Hang. 2023b. Robot Parkour Learning. Pages 73–92 of: Tan, Jie, Toussaint, Marc, and Darvish, Kourosh (eds), *Conf. on Robot Learning (CoRL)*. Proceedings of Machine Learning Research, vol. 229. PMLR.
- [1307] Zou, Xueyan, Yang, Jianwei, Zhang, Hao, Li, Feng, Li, Linjie, Wang, Jianfeng, Wang, Lijuan, Gao, Jianfeng, and Lee, Yong Jae. 2023. Segment everything everywhere all at once. In: *Proceedings of the 37th International Conference on Neural Information Processing Systems*.
- [1308] Zou, Xueyan, Song, Yuchen, Qiu, Ri-Zhao, Peng, Xuanbin, Ye, Jianglong, Liu, Sifei, and Wang, Xiaolong. 2025. 3D-Spatial MultiModel Memory. In: *Intl. Conf. on Learning Representations (ICLR)*.
- [1309] Zuckerman, David. 2006 (May). Linear degree extractors and the inapproximability of max clique and chromatic number. Pages 681–690 of: *ACM Symp. on Theory of Computing (STOC)*.
- [1310] Zuo, X., Xie, J., Liu, Y., and Huang, Guoquan. 2017 (Sept.). Robust Visual SLAM with Point and Line Features. Pages 1775–1782 of: *Proc. of the IEEE/RSJ International Conference on Intelligent Robots and Systems*.
- [1311] Zuo, Xingxing, Samangouei, Pouya, Zhou, Yunwen, Di, Yan, and Li, Mingyang. 2024a. Fmgs: Foundation model embedded 3d gaussian splatting for holistic 3d scene understanding. *Intl. J. of Computer Vision*.
- [1312] Zuo, Yi-Fan, Xu, Wanting, Wang, Xia, Wang, Yifu, and Kneip, Laurent. 2024b. Cross-Modal Semidense 6-DOF Tracking of an Event Camera in Challenging Conditions. *IEEE Trans. Robotics*, **40**, 1600–1616.
- [1313] Zwicker, Matthias, Pfister, Hanspeter, van Baar, Jeroen, and Gross, Markus. 2001. Surface Splatting. In: *Intl. Conf. on Computer Graphics and Interactive Techniques (SIGGRAPH)*.
- [1314] Zwicker, Matthias, Pfister, Hanspeter, Van Baar, Jeroen, and Gross, Markus. 2002. EWA splatting. *IEEE Transactions on Visualization and Computer Graphics*, **8**(3), 223–238.
- [1315] Żywanowski, Kamil, Banaszczyk, Adam, Nowicki, Michał R., and Komorowski, Jacek. 2022. MinkLoc3D-SI: 3D LiDAR Place Recognition With Sparse Convolutions, Spherical Coordinates, and Intensity. *IEEE Robotics and Automation Letters*, **7**(2), 1079–1086.