FUSION 2022 Conference Awards

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Linköping, Sweden welcomed the 25th International Conference on Information Fusion with an increased attendance and paper submission after the COVID-19 period. This year, 156 papers accepted to be published in the proceedings of the conference were in competition for the best paper awards in two categories: student and regular. Compared to previous years, the procedure for the award attribution was slightly updated, allowing any member of the organization committee to be considered, with the exception of the general chairs and the award chairs. The technical chairs first identified a long list of 12 papers in each category. To guarantee the fairness of the process, Joakim Jaldén, a technical chair with no conflict of interest, acted as a screener and helped the award chair to shorten the list. A short list of six papers in each category was then issued, using an objective ranking of papers based on the criteria *average score*, *average score weighted by confidence*, and *award points*, as provided for the reviewing process. The Award Committee was selected by the General Chairs: Chee-Yee Chong, Paulo Costa, Pieter de Villiers, Jean Dezert, and Anne-Laure Jousselme (Chair). The committee members independently reviewed all of the papers and ranked them within each of the two categories. Winners then emerged by a simple summation of the ranks, with a clear consensus. Because *two* student papers achieved the same top ranking, it was agreed that both should receive the Best Paper Award, without the need to further discriminate between them. Six papers were recognized at the gala dinner of the FUSION 2022 conference by General Cochair Gustaf Hendeby and Award Chair Anne-Laure Jousselme. On behalf of the International Society of Information Fusion, congratulations to all candidate papers and an obvious special mention to the winners!

Ive Weygers, Jean-Pierre Le Cadre Best Paper award recipient.

JEAN-PIERRE LE CADRE AWARD

- Best Paper: Daniel Laidig, Ive Weygers, Simon Bachhuber, and Thomas Seel, "VQF: A Milestone in Accuracy and Versatility of 6D and 9D Inertial Orientation Estimation"
- First Runner-up: Kailai Li, Florian Pfaff, and Uwe Hanebeck, "Circular Discrete Reapproximation"
- Second Runner-up: Simon Bachhuber, Daniel Weber, Ive Weygers, and Thomas Seel, "RNN-based Observability Analysis for Magnetometer-Free Sparse Inertial Motion Tracking"

BEST PAPER (JEAN PIERRE LE CADRE AWARD)

Daniel Laidig, Ive Weygers, Simon Bachhuber, and Thomas Seel, "VQF: A Milestone in Accuracy and Versatility of 6D and 9D Inertial Orientation Estimation"

Abstract—We present a novel quaternion-based inertial orientation estimation filter. Inclination drift from gyroscope strapdown integration is corrected from specific force measurements that are low-pass filtered in an almost-inertial frame to effectively compensate for instantaneous accelerations and decelerations. Heading drift is corrected via a scalar heading offset. The resulting decoupled state representation provides simultaneous 6D and 9D orientation estimation. We systematically evaluated the method on a rich orientation estimation benchmark dataset and show that the proposed method clearly outperforms three of the currently most commonly adopted and accurate inertial orientation estimation filters. The filter is available as open-source software, and its parameters are tuned to work well for a wide range of movements and application scenarios. Our fundamentally different filtering approach with a decoupled state representation and novel inclination correction resulted in a new level of accuracy, with a 41% improvement of the total orientation error and doubling the inclination accuracy. This facilitates new and exciting high-precision applications in the field of inertial motion tracking.

TAMMY L. BLAIR AWARD

- Best Student Paper (Tie): Alessandro D'Ortenzio, Costanzo Manes, and Umut Orguner, "A Model Selection Criterion for the Mixture Reduction Problem Based on the Kullback-Leibler Divergence"
- Best Student Paper (Tie): Runze Gan, Qing Li, and Simon Godsill, "A Variational Bayes Association-based Multi-object Tracker under the Non-homogeneous Poisson Measurement Process"
- Runner-Up: Mingchao Liang and Florian Meyer, "Neural Enhanced Belief Propagation for Data Association in Multiobject Tracking"

Alessandro D'Ortenzio, Best Student Paper award recipient (tie).

Qing Li and Runze Gan, Best Student Paper award recipients (tie).

TIE: BEST STUDENT PAPER (TAMMY L. BLAIR AWARD)

Runze Gan, Qing Li, and Simon Godsill, "A Variational Bayes Association-based Multi-object Tracker under the Non-homogeneous Poisson Measurement Process"

Abstract—The non-homogeneous Poisson process (NHPP) has been widely used to model extended object measurements where one target can generate zero or several measurements; it also provides an elegant solution to the computationally demanding data association problem in multiple target tracking. This paper presents an association-based NHPP system, coupled with which we propose a variational Bayes association-based NHPP (VBAbNHPP) tracker that can estimate online the target kinematics and the association variables in parallel. In particular, the VBAbNHPP tracker can be easily extended to include online static parameter learning (e.g., measurement rates) based on a general coordinate ascent variational filtering framework developed here. The results show that the proposed VB-AbNHPP tracker is superior to other competing methods in terms of implementation efficiency and in tracking accuracy.

TIE: BEST STUDENT PAPER (TAMMY L. BLAIR AWARD)

Alessandro D'Ortenzio, Costanzo Manes, and Umut Orguner, "A Model Selection Criterion for the Mixture Reduction Problem Based on the Kullback-Leibler Divergence"

Abstract—In order to be properly addressed, many practical problems require an accurate stochastic characterization of the involved uncertainties. In this regard, a common approach is the use of mixtures of parametric densities which allow, in general, to arbitrarily approximate complex distributions by a sum of simpler elements. Nonetheless, in contexts like target tracking in clutter, where mixture of densities are commonly used to approximate the posterior distribution, the optimal Bayesian recursion leads to a combinatorial explosion in the number of mixture components. For this reason, many mixture reduction algorithms have been proposed in the literature to keep limited the number of hypotheses, but very few of them have addressed the problem of finding a suitable model order for the resulting approximation. The commonly followed approach in those algorithms is to reduce the mixture to a fixed number of components, disregarding its features which may vary over time. In general, finding an optimal number of components is a very difficult task: once a meaningful optimality criterion is identified, potentially burdensome computational procedures must be devised to reach the optimum. In this work, by exploiting the optimal transport theory, an efficient and intuitive model selection criterion for the mixture reduction problem is proposed.