FUSION Conference Awards

FUSION 2021 BEST PAPER AWARDS

Nageswara Rao
Oak Ridge National Laboratories
Oak Ridge, TN, USA
raons@ornl.gov

The 24th International Conference on Information Fusion (FUSION 2021) was held in hybrid mode (virtual and in person) from November 1–4, 2021. FUSION is the flagship event of the International Society of Information Fusion (ISIF), and the conference is well-established as the premier forum to present and discuss research progress and initiatives in the information fusion areas. There were attendees from around the world, with active participation from industry, government, and academia. The overview of the conference is included in this *Perspectives* issue (see p. 32).

Since its inception, ISIF has promoted a high-quality technical program at each annual FUSION conference. One way to encourage this excellence is to promote the Paper Awards program. Accordingly, each year the conference includes recognition of the best regular papers and the best student papers. Student papers are those for which the lead author is a full-time graduate (or undergraduate) student at an accredited university. As mandated by the ISIF Board of Directors, the best paper receives the Jean Pierre Le Cadre Award. The best student paper receives the Tammy L. Blair Award. These awards honor the efforts and commitment of both Jean-Pierre and Tammy to the international fusion community over many years.

The FUSION 2021 Awards Co-Chairs were Wolfgang Koch, Nageswara Rao, and Pramod Varshney. They began the selection process by examining the reviews of two short lists of papers provided by the Organizing Team of Pieter de Villiers, Alta de Waal, and Fredrik Gustafsson. The short lists consisted of 19 and 14 papers chosen from 58 and 88 candidate papers under the General and Student categories, respectively. To avoid the possibility of conflicts of interest, all papers co-authored by FUSION 2021 Organizing Team, Technical and Program Committee members, and Awards Committee members were excluded from further consideration. Reviews and quantitative scoring of these papers were conducted by Awards Co-Chairs, leading to a set of six regular and six student papers for further analysis. The Awards Co-Chairs formed the Awards Committee consisting of Stefano Coraluppi, Henry Leung, Mahendra Mallick, Ruixin Niu, Xiaojing Shen, Lauro Snidaro, and Jason Williams. All seven committee members separately ranked both sets of six regular and six student papers. No committee members were co-authors on any papers that they evaluated, and no conflicts of interest were identified. The sum of scores led to overall rankings that were ratified by the Awards Co-Chairs.

JEAN PIERRE LE CADRE AWARD

The best regular papers were the following:

- Best Paper: Ossi Kaltiokallio, Yu Ge, Jukka Talvitie, Henk Wymeersch, and Mikko Valkama, "mmWave Simultaneous Localization and Mapping Using a Computationally Efficient EK-PHD Filter"
- First Runner-Up: Angel Garcia-Fernandez, Marcel Hernandez, and Simon Maskell, "An Analysis on Metric-Driven Multi-Target Sensor Management: GOSPA versus OSPA"
- Second Runner-Up: Florian Meyer and Kay L. Gemba, "Acoustic Source Localization in Shallow Water: A Probabilistic Focalization Approach"

BEST PAPER (JEAN PIERRE LE CADRE AWARD)

Ossi Kaltiokallio, Yu Ge, Jukka Talvitie, Henk Wymeersch, and Mikko Valkama, "mmWave Simultaneous Localization and Mapping Using a Computationally Efficient EK-PHD Filter"

Abstract—Future cellular networks that utilize millimeter wave signals provide new opportunities in positioning and situational awareness. Large bandwidths combined with large antenna arrays provide unparalleled delay and angle resolution, allowing high accuracy localization but also building up a map of the environment. Even the most basic filter intended for simultaneous localization and mapping exhibits high computational overhead since the methods rely on sigma point or particle-based approximations. In this paper, a first order Taylor series-based Gaussian approximation of the filtering distribution is used, and it is demonstrated that the developed extended Kalman probability hypothesis density filter is computationally very efficient. In addition, the results imply that efficiency does not come with the expense of estimation accuracy since the method nearly achieves the position error bound.

TAMMY L. BLAIR AWARD

The best student papers were the following:

- Best Paper Award: Juliano Pinto, Georg Hess, William Ljungbergh, Yuxuan Xia, Lennart Svensson, and Henk Wymeersch, "Next Generation Multitarget Trackers: Random Finite Set Methods vs Transformer-based Deep Learning"
- First Runner-Up: Keith LeGrand, Pingping Zhu, and Silvia Ferrari, "A Random Finite Set Sensor Control Approach for Vision-Based Multi-Object Search-While-Tracking"
- Second Runner-Up: Thore Gerlach, Folker Hoffmann, and Alexander Charlish, "Policy Rollout Action Selection with Knowledge Gradient for Sensor Path Planning"

BEST STUDENT PAPER (TAMMY L. BLAIR AWARD)

Juliano Pinto, Georg Hess, William Ljungbergh, Yuxuan Xia, Lennart Svensson, and Henk Wymeersch, "Next Generation Multitarget Trackers: Random Finite Set Methods vs Transformer-based Deep Learning"

Abstract—Multitarget Tracking (MTT) is the problem of tracking the states of an unknown number of objects using noisy measurements, with important applications to autonomous driving, surveillance, robotics, and others. In the model-based Bayesian setting, there are conjugate priors that enable us to express the multi-object posterior in closed form, which could theoretically provide Bayes-optimal estimates. However, the posterior involves a super-exponential growth of the number of hypotheses over time, forcing state-of-the-art methods to resort to approximations for remaining tractable, which can impact their performance in complex scenarios. Model-free methods based on deep-learning provide an attractive alternative, as they can, in principle, learn the optimal filter from data, but to the best of our knowledge were never compared to current state-of-the-art Bayesian filters, specifically not in contexts where accurate models are available. In this paper, we propose a high-performing, deep-learning method for MTT based on the Transformer architecture and compare it to two state-of-the-art Bayesian filters, in a setting where we assume the correct model is provided. Although this gives an edge to the model-based filters, it also allows us to generate unlimited training data. We show that the proposed model outperforms state-of-the-art Bayesian filters in complex scenarios, while matching their performance in simpler cases, which validates the applicability of deep-learning also in the model-based regime. The code for all our implementations is made available at https://github.com/JulianoLagana/MT3.

The authors of these papers were recognized during FUSION 2021. Nageswara Rao announced the winners and award certificates were presented by General Co-Chair Pieter de Villiers. The selection process to decide FUSION paper awards is an important stage that complements the larger paper-review process. The awards selection is conducted with great thoroughness, identifying research of significant value that is deserving of the attention of fusion researchers and practitioners. On behalf of ISIF, congratulations to the authors of all six papers for their hard work and impressive achievement.