

FUSION CONFERENCE AWARDS

FUSION 2019 BEST PAPER AWARDS

The 22nd International Conference on Information Fusion (FUSION 2019) was held in July 2019 at the Shaw Centre in Ottawa, Canada. FUSION is the flagship event of the International Society of Information Fusion (ISIF), and the conference is well established as the premiere forum to present and discuss research progress and initiatives in information fusion. This year, there were 403 attendees from around the world, with active participation from industry, government, and academia. The full report is available at <http://isif.org/conferences/isif-conference-information>.

Since its inception, ISIF has promoted a high-quality technical program at FUSION. 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 2019 Awards Cochairs were Erik Blasch, Stefano Coraluppi, Ivan Kadar, and Mahendra Mallick. They began the selection process by examining the reviews of 266 papers by the Technical Program Committee led by the Technical Cochairs Anne-Laure Joussetme, Thia Kirubarajan, Henry Leung, Rakesh Nagi, and Roy Streit. To avoid the possibility of conflicts of interest, all papers coauthored by any FUSION 2019 Organizing Committee member were excluded from further consideration. Based on reviewer scores, the Awards Co-chairs selected 15 regular and 15 student papers for detailed assessment. They conducted a thorough review and quantitative

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Stefano Coraluppi describes the awards selection process and announces the winners (photo by Josephine Ding).



On behalf of Huajie Shao, Lance Kaplan receives the third-place best student paper award from Erik Blasch (photo by Josephine Ding).

JEAN-PIERRE LE CADRE AWARD

Vikram Krishnamurthy and Muralidhar Rangaswamy, “How to Calibrate Your Enemy’s Capabilities? Inverse Filtering for Counter-Autonomous Systems”

Abstract—We consider the following adversarial Bayesian signal processing problem involving “us” and the “enemy”: an enemy observes our state in noise, updates its posterior distribution of the state, and then chooses an action based on this posterior. Given knowledge of “our” state and sequence of enemy’s actions observed in noise, we consider two problems: (i) How can the enemy’s posterior distribution be estimated? Estimating the posterior is an inverse filtering problem involving a random measure. We formulate and solve several versions of this problem in a Bayesian setting. (ii) How can the enemy’s observation likelihood be estimated? This tells us how accurate the enemy’s sensors are. We compute the maximum likelihood estimator for the enemy’s observation likelihood given our measurements of the enemy’s actions, where the enemy’s actions are in response to estimating our state. The above questions are motivated by the design of counter-autonomous systems: given measurements of the actions of a sophisticated autonomous enemy, how can a counter-autonomous system estimate the underlying belief of the enemy, predict future actions, and therefore guard against these actions.

scoring of these papers, leading to a set of seven regular and seven student papers for further analysis.

Subsequently, the Awards Cochairs defined two committees to examine the papers. Six committee members (Sanjeev Arulampalam, Daniel Clark, Mark Coates, Fredrik Gustafsson, Gustaf Hendeby, and Ruixin Niu) were asked to rank the seven regular papers. Similarly, six committee members (David Crouse, Ondřej Straka, Ángel García-Fernández, Qi Cheng, Pramod Varshney, and Suman Chakravorty) were asked to rank the seven student papers. No committee members were coauthors 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 Cochairs.

The best regular papers were the following:

- ▶ First place: Vikram Krishnamurthy and Muralidhar Rangaswamy, “How to Calibrate Your Enemy’s Capabilities? Inverse Filtering for Counter-Autonomous Systems” (See text box for the paper’s abstract.)
- ▶ Second place: David Crouse, “Particle Flow Filters: Biases and Bias Avoidance”
- ▶ Third place: Ángel García-Fernández and Lennart Svensson, “Spooky Effect in Optimal OSPA Estimation and How GOSPA Solves It”



David Crouse receives the second-place best paper award (photo by Josephine Ding).



Ángel García-Fernández receives the third-place best paper award (photo by Josephine Ding).

The best student papers were the following:

- ▶ First place: Benjamin Naujoks, Patrick Burger, and Hans-Joachim Wuensche, “Combining Deep Learning and Model-Based Methods for Robust Real-Time Semantic Landmark Detection” (See text box for the paper’s abstract.)
- ▶ Second place: Erik Wilthil, Yaakov Bar-Shalom, Peter Willett, and Edmund Brekke, “Estimation of Target Detectability for Maritime Target Tracking in the PDA Framework”
- ▶ Third place: Huajie Shao, Shuochao Yao, Yiran Zhao, Lu Su, Zhibo Wang, Dongxin Liu, Shengzhong Liu, Lance Kaplan, and Tarek Abdelzaher, “Unsupervised Fact-Finding with Multi-Modal Data in Social Sensing”

These papers were recognized during the FUSION 2019 banquet dinner. Erik Blasch and Stefano Coraluppi announced the winners and presented award certificates.

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!

TAMMY L. BLAIR AWARD

Benjamin Naujoks, Patrick Burger, and Hans-Joachim Wuensche, “Combining Deep Learning and Model-Based Methods for Robust Real-Time Semantic Landmark Detection”

Abstract—Compared to abstract features, significant objects, so-called landmarks, are a more natural means for vehicle localization and navigation, especially in challenging unstructured environments. The major challenge is to recognize landmarks in various lighting conditions and changing environment (growing vegetation) while only having few training samples available. We propose a new method which leverages Deep Learning as well as model-based methods to overcome the need of a large data set. Using red, green, blue (RGB) images and light detection and ranging (LiDAR) point clouds, our approach combines state-of-the-art classification results of Convolutional Neural Networks (CNN) with robust model-based methods by taking prior knowledge of previous time steps into account. Evaluations on a challenging real-world scenario, with trees and bushes as landmarks, show promising results over pure learning-based state-of-the-art three-dimensional (3D) detectors, while being significantly faster.