12th Symposium Sensor Data Fusion: Trends, Solutions, and Applications

Technical Program

Prior to its technological realization or the scientific reflection on it, sensor data fusion, a branch of Artificial Intelligence, is an omnipresent capability. Fusion algorithms provide informational elements for situation pictures, the basis of appropriate action. SDF 2018, the 12th consecutive annual symposium, addresses numerous application aspects of sensor data fusion, as well as methodologically oriented topics. Its 22 presentations are grouped into 7 sessions. Particular emphasis is placed on advances in estimation and tracking theory, emitter localization, ground surveillance, resource management, selected aspects of higher-level fusion, and even ethical aspects of data fusion. The contributions from industry, academia, and research institutions let us expect an exchange of ideas, lively discussions, and mutual cross-fertilization. For more detailed information see: www.fkie.fraunhofer.de/sdf2018.

Location: Universitätsclub Bonn e.V., Konviktstr. 9, 53113 Bonn, Germany. www.uniclub-bonn.de

Organisation

Executive Chairs:
Wolfgang Koch, Fraunhofer FKIE and University of Bonn.
Peter Willett, University of Connecticut, USA.
Stefano Coraluppi, Systems and Technology Research (STR), USA.

Technical Program Chair:
Felix Govaers, Fraunhofer FKIE, Germany.

Technical Program Committee

Marcus BAUM, University of Göttingen, GER; Jürgen BEYERER, Fraunhofer IOSB, GER; Chee CHONG, Consultant, CA, USA; Stefano CORALUPPI, STO, MA, USA; Daniel CREMERS, Technical University Munich, GER; Klaus DIETMAYER, University of Ulm, GER; Darin DUNHAM, Lockheed Martin, USA; Bharanidhar DURAIASAMY, Daimler, GER; Murat EFE, Ankara University, TK; Frank EHLLERS, FWG, GER; Dietrich FRÄNKEN, Airbus Defence and Space, GER; Jesus GARCIA, University Carlos III, Madrid, ES; Fredrik GUSTAFSSON, Linköping University, SW; Uwe D. HANEBECK, Karlsruhe Institute of Technology KIT, GER; Dann LANEUVILLE, DCNS, FR; Henry LEUNG, University of Calgary, CA; Lyudmila MIHAYLOVA, University of Sheffield, UK; Gee Wah NG, DSO, SGP; Umut ORGUNER, University of Ankara, TR; Stefan REUTER, Robert Bosch GmbH, GER; Eicke RUTHOTTO, Atlas, GER; Lauro SNIDARO, University of Udine, IT; Roy L. STREIT, Metron Inc., USA; Jörn THIELECKE, Universität Erlangen, GER; Reiner THOMÄ, Technical University Ilmenau, GER; Martin ULMKE, Fraunhofer FKIE, GER; Anthony WEISS, Tel Aviv University, IS; Alexander YAROVOY, TU Delft, NL.
## Day 1: Tuesday October 9th

### Start of SDF Symposium

<table>
<thead>
<tr>
<th>Time</th>
<th>Event Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0900</td>
<td>Registration</td>
</tr>
<tr>
<td>1000</td>
<td><strong>Tutorial: Wolfgang Koch</strong>&lt;br&gt;A Tutorial Introduction to Sensor Data Fusion and AI Applications</td>
</tr>
<tr>
<td>1330</td>
<td><strong>Session #1 – Estimation Theory and Target Tracking I</strong>&lt;br&gt;Thomas Kropfreiter and Franz Hlawatsch&lt;br&gt;<em>Multiobject Tracking with Track Continuity: An Efficient Random Finite Set Based Algorithm</em></td>
</tr>
<tr>
<td>1400</td>
<td>Kristian A. Ruud, Edmund F. Brekke, and Jo Eidsvik&lt;br&gt;<em>LIDAR Extended Object Tracking of a Maritime Vessel Using an Ellipsoidal Contour Model</em></td>
</tr>
<tr>
<td>1430</td>
<td>Rui Liu, Klaus Greve, and Nan Jiang, and Ming Xu&lt;br&gt;<em>Task-Oriented Path Planning Algorithm Considering POIs and Dynamic Collaborative Targets Distribution</em></td>
</tr>
<tr>
<td>1530</td>
<td><strong>Session #2 – Automotive Applications I</strong>&lt;br&gt;Markus Horn, Ole Schumann, Markus Hahn, Jürgen Dickmann, and Klaus Dietmayer&lt;br&gt;<em>Motion Classification and Height Estimation of Pedestrians Using Sparse Radar Data</em></td>
</tr>
<tr>
<td>1600</td>
<td>Andreas Tollkühn, Florian Particke, and Jörn Thielecke&lt;br&gt;<em>Gaussian State Estimation with Non-Gaussian Measurement Noise</em></td>
</tr>
<tr>
<td>1630</td>
<td>Stefan Haag, Bharanidhar Duraisamy, Wolfgang Koch, and Jürgen Dickmann&lt;br&gt;<em>Classification Assisted Tracking for Autonomous Driving Domain</em></td>
</tr>
<tr>
<td>1730</td>
<td><strong>Guided Tour</strong>&lt;br&gt;Guided tour through the city of Bonn to the icebreaker reception at Brewery Machold at Heerstraße 52.</td>
</tr>
<tr>
<td>1830</td>
<td><strong>Icebreaker Reception</strong>&lt;br&gt;Brewery Machold</td>
</tr>
</tbody>
</table>
Day 2: Wednesday October 10th

**Keynote Talk: Chee Y. Chong**

*Integrating Learning and Knowledge for Robust Sensor Data Fusion*

**Session #3 – Navigation and Localization**

- **Kailai Li, Daniel Frisch, Susanne Radtke, Benjamin Noack, and Uwe D. Hanebeck**
  
  **11:00 - 11:30**
  
  *Wavefront Orientation Estimation Based on Progressive Bingham Filtering*

- **Dietrich Fränken**

  **11:30 - 12:00**

  *An Approximate Maximum-Likelihood Estimator for Localisation using Bistatic Measurements*

- **Christian Steffes, Clemens Allmann, and Marc Oispuu**

  **12:00 - 12:30**

  *Fused Single Sensor Emitter Localization Using Time-Multiplex AOA and S4TDOA Measurements*

**Session #4 – Deep Learning and Tensor based Data Fusion**

- **Youngjoo Kim, Peng Wang, Yifei Zhu, and Lyudmila Mihaylova**

  **13:30 - 14:00**

  *A Capsule Network for Traffic Speed Prediction in Complex Road Networks*

- **Kaeye Dästner, Susie Brunessaux, Elke Schmid, Bastian von Haßler zu Roseneck-Köhler, and Felix Opitz**

  **14:00 - 14:30**

  *Classification of Military Aircraft in Real-time Radar Systems based on Supervised Machine Learning with Labelled ADS-B Data*

- **Fahrettin Gökgüz, Piro Lena**

  **14:30 - 15:00**

  *Anomaly Detection using GANs in OpenSky Network*

- **Felix Govaers**

  **15:00 - 15:30**

  *On a Multivariate Gaussian CPD Decomposition*

**Session #5 – Navigation and Localization II**

- **Marcus Baum and Kolja Thormann**

  **16:00 - 16:30**

  *On Kalman Filter-based Approaches for Elliptic Extended Target Tracking: RHM-EKF vs. MEM-EKF*

- **Peng Wang, Youngjoo Kim, Lubos Vaci, Hoaze Yang, and Lyudmila Mihaylova**

  **16:30 - 17:00**

  *Short-Term Traffic Prediction with Vicinity Gaussian Process in the Presence of Missing Data*

**Get together**

*Piano Recital and Dinner*
Day 3: Thursday October 11th

Session #6 – Automotive Applications II

0900 - 1000

Invited Talk: Daniel Svensson, and Altamash M. Khan
Sensor Fusion Challenges Within Advanced Driver-Assistance Systems and Autonomous Driving

1030 - 1100

Hosam Alqaderi and Raymond Schulz
Enhancement of LiDAR Data Association and Fusion using Imaging Radar Grid-Maps for Advanced Automotive Environment Perception

Session #7 – Advanced Methodology and Ethical Aspects

1100 - 1130

Martin Ulmke
Quantum Field Theory and Tracking of Indistinguishable Targets

1130 - 1200

Martin Ulmke
Sequential Quantum Monte-Carlo for Tracking of Indistinguishable Targets

1200 - 1230

Wolfgang Koch
On Ethics in Sensor Data Fusion

1230

End of SDF Symposium 2018