13th Symposium *Sensor Data Fusion: Trends, Solutions, and Applications*

Technical Program

Prior to its technological realization or the scientific reflection on it, sensor data fusion is an omnipresent capability. The result is a mental model of their individual environment, the basis of behaving appropriately. SDF Symposium 2019, the 13th in a row of annual conferences, addresses numerous application aspects of sensor data fusion, as well as methodology oriented topics. Its 23 presentations are grouped into 7 sessions. Particular emphasis is placed on advances in the theory of estimation and tracking, emitter localization, ground surveillance, resource management, and selected aspects of higher-level 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/sdf2019.

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

**Organisation**

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Day 1 – Tuesday October 15th
Start of SDF Symposium 2019

12:30 – 13:30  Registration

Session #1: Automotive Applications

13:30 – 14:00  Daniel Svensson
Derivation of the Discrete-Time Constant Turn Rate and Acceleration Motion Model

14:00 – 14:30  Muhammad A. Khan
Comparison of Track to Track Fusion Methods for Nonlinear Process and Measurement Models

14:30 – 15:00  Stefan Haag, Bharanidhar Duraisamy, Felix Govaers, Wolfgang Koch, Martin Fritzsche, and Jürgen Dickmann
Extended Object Tracking Assisted Adaptive Clustering for Radar in Autonomous Driving Applications

Session #2: Anomaly Detection and Traffic Estimation

15:30 – 16:00  Kennedy J. Ofor, Peng Wang, and Lyudmila Mihaylova
Multi-Model Bayesian Kriging for Urban Traffic State Prediction

16:00 – 16:30  Martina Brötje, Giulia Batistello, and Martin Ulmke
Verification of Sensor Data in a Maritime Multi-Sensor Network

16:30 – 17:00  Yifan Zhou, James Wright, and Simon Maskell
A Generic Anomaly Detection Approach Applied to Mixture-of-Unigrams and Maritime Surveillance Data

Guided Tour

17:30  Guided tour through the city of Bonn to the icebreaker reception at Brewery Machold at Heerstr. 52

Icebreaker Reception

18:30  Brewery Machold
Day 2 – Wednesday October 16th

Session #3: Extended Target Tracking

09:00 – 09:30
Julian Böhler, Tim Baur, Stefan Wirtensohn, and Johannes Reuter
Stochastic Partitioning for Extended Object Probability Hypothesis Density Filters

09:30 – 10:00
Hosam Alqaderi, Felix Govaers, and Raymond Schulz
Spacial Elliptical Model for Extended Target Tracking Using Laser Measurements

10:00 – 10:30
Felix Govaers
On Independent Axes Estimation for Extended Target Tracking

Session #4: Localization Methods and Robust Navigation

11:00 – 11:30
Luisa Still, Macarena Varela, Wulf-Dieter Wirth, and Marc Oispuu
Shooter Localization with a Microphone Array Based on a Linearly Modeled Bullet Speed

Josef Steinbaeck, Norbert Druml, Thomas Herndl, Stefan Loigge, Nadja Marko, Markus Postl, Georg Kail, Reinhard Hladik, Gerhard Hechenberger, Herbert Fuereder, Christian Steger, Eugen Brenner, and Christian Schwarzl
ACTIVE – Autonomous Car to Infrastructure Communication Mastering Adverse Environments

12:00 – 12:30
Markus Krestel, Folker Hoffmann, Hans Schily, Alexander Charlish, and Sven Rau
Passive Emitter Direction Finding Using a Single Antenna and Compressed Sensing

Session #5: Deep Learning for Data Fusion

13:30 – 14:00
Mahed Javed and Lyudmila Mihaylova
Leveraging Uncertainty in Adversarial Learning to Improve Deep Learning Based Segmentation

Karsten Schwalbe, Alexander Groh, Frank Hertwig, and Ullrich Scheunert
Data Fusion Strategy to Improve the Reliability of Machine Learning Based Classifications

14:00 – 14:30
Florian Particke, Jiaren Zhou, Markus Hiller, Christian Hofmann, and Jörn Thielecke
Neural Network Aided Potential Field Approach for Pedestrian Prediction

14:30 – 15:00
Felix Nobis, Maximilian Geisslinger, Markus Weber, Johannes Betz, and Markus Lienkamp
A Deep Learning-Based Radar and Camera Sensor Fusion Architecture for Object Detection
Session #6: E/O Sensors and Video Processing

16:00 – 16:30
Mark Campbell and Daniel E. Clark
Joint Stereo Camera Calibration and Multi-Target Tracking Using the Linear-Complexity Factorial Cumulant Filter

16:30 – 17:00
Peng Wang, Yueda Lin, and Lyudmila Mihaylova
Computer Vision Methods for Automating High Temperature Steel Section Sizing in Thermal Images

17:30
Get Together
Piano recital and Dinner
Day 3 – Thursday October 17th

Keynote Talk

09:00 – 10:30
Fredrik Gustafsson
Fusion Theory for Positive Noise
There is a variety of sensors for distance measurements such as radar, sonar, lidar, UWB and various radio measurements such as round trip times and signal strength decay. They all suffer from multi-path, that causes the signal propagation to get a stochastic delay. In other words, the distance measurement suffers from positive noise. We will overview elementary results from estimation theory for how order statistics improve multiple distance measurements from the same sensor one order of magnitude, compared to classical moment (mean, variance, etc) matching techniques. These results are then applied to sensor data fusion algorithms for localisation and target tracking.

Session #7: Estimation Theory and Target Tracking

11:00 – 11:30
Stefano Coraluppi and Craig Carthel
Track-Oriented MHT with Unresolved Measurements

11:30 – 12:00
Sebastian Thomas Handke and Joshua Gehlen
Randomized Evolution Model for Multihypothesis Kalman Filter

12:00 – 12:30
André Fischer and Wolfgang Konle
Trajectory Generation from Radar Data

12:30 – 13:00
Roy Streit
Future Directions for Analytic Combinatorics in Tracking and High Level Fusion

13:00
End of SDF Symposium 2019