

Impressions of the 9th IEEE AESS Workshop "Sensor Data Fusion – Trends, Solutions, Applications" (SDF 2014), October 8-9, 2014, Bonn, Germany

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Before any thoughts of technical realization or scientific reflections on it, all living creatures perform Sensor Data Fusion: They combine sensations from mutually complementary sense organs with their past experiences and the communications they receive from other creatures. By doing so, they generate "situation pictures" of their particular environment, the very basis for behaving appropriately to reach certain goals or to avoid harm.

As a branch of Aerospace and Electronics Systems engineering, Sensor Data Fusion tries to understand "natural orientation" of creatures in their environment, to automate the generation of situation pictures as far as possible, and to extend them far beyond "natural" capabilities.¹ The megatrends towards miniaturized sensors, autonomously operating mobile platforms as well as navigation, communication and computing are technological driving factors for developing advanced algorithms for Sensor Data Fusion. These algorithms enable the design of "cognitive tools" for enhancing our mental capabilities to understand vast sensor data streams in analogy to mechanical tools that enlarge our physical strengths. Needless to say, Sensor Data Fusion is a key technology in many defence and civil applications.

The IEEE Workshop "Sensor Data Fusion – Trends, Solutions, Applications" (SDF 2014) took place on October 8-10, 2014 at the University of Bonn, Germany, and was the 9th in a row of workshops that have been technically co-sponsored by the IEEE Aerospace and Electronics Systems Society (AESS) and the International Society of Information Fusion (ISIF). AIRBUS Defence & Space supported the event as an industrial sponsor. Designed as a small scale annual workshop with a very personal atmosphere, it is complementary to the large International Conferences on Information Fusion, where the global fusion community regularly meets at varying locations.

The SDF Workshop wishes to reach four goals: With 22 peer-reviewed, high-quality oral presentations with a large time slot of 30 minutes, it firstly provides insight into most recent developments in Sensor Data Fusion, addressing methodological advances as well as innovative applications and fostering discussions. Secondly, a key-note lecture enables more comprehensive understanding of upcoming topics. At SDF 2014, Peter Willett from the University of Connecticut, USA, a leading researcher in Sensor Data Fusion, delivered a highly inspiring and enthusiastically presented lecture on *Maximum-Likelihood Methods in Target Tracking and Fundamental Results on Trackability*. The workshop thirdly offers a "step-in" for newcomers in the area of Sensor Data Fusion by a two-hour tutorial on the morning of the first day (*A tutorial introduction to advanced methods and applications in sensor data fusion* by Wolfgang Koch). Last but not least, the SDF Workshop is a sort of "family meeting" of "fusionaries" stimulating networking and personal intercourse by an "ice breaker" dinner in a traditional German beer-house on the first day and a workshop dinner at the second day, which is traditionally opened by a musical event.

¹ See e.g.: W. Koch. *Target Tracking and Sensor Data Fusion – Methodological Framework and Selected Applications*. Springer Mathematical Engineering Series (2014)

SDF 2014 was jointly organized by Wolfgang Koch, Fraunhofer FKIE / University of Bonn, and Peter Willett, University of Connecticut, acting as executive co-chairs. Technical Program Chair was Felix Govaers, Fraunhofer FKIE, while Stefano Coraluppi, Systems and Technology Research, USA, served as a Publicity Chair. Seven technical sessions addressed *Advances in Methodology, Indoor Tracking and Navigation, Pattern Recognition and Context Fusion, Emitter Localization and Tracking, Multi-Sensor Fusion and Applications, Advances in Estimation Theory and Tracking I/II*.

The “Best Student Paper Award” was won by Antonio Zea, a student of Uwe Hanebeck at KIT, Karlsruhe (*Tracking Extended Objects using Extrusion Random Hypersurface Models*). Felix Govaers, Fraunhofer FKIE, presented a new methodological approach of the filtering problem, where the update equations appear as the Euler-Lagrange equations of a “least action” principle in analogy to classical mechanics (*On the Superposition Principle of Linear Gaussian Estimation – A Physical Analogy*). His insights seem to have a potential to solve complex filtering problems numerically efficiently. Stimulating and opening new ways to systematically deriving filtering algorithms was Roy Streit’s (Metron Inc., USA) presentation by using probability generating functionals (*Generating Function Derivation of the IPDA Filter*). This paper was written jointly with Darko Musicki et al., who unexpectedly died on June 8, 2014, who regularly participated in earlier SDF workshops. Darko’s death leaves a hole in the fusion community. Many more interesting papers have been presented during the workshop.

SDF 2015 will take place on September 30 – October 2, 2015 in Bonn, Germany. It should be noted that SDF is a “low-budget” workshop with quite affordable fees (€ 99 for students and members of public agencies, € 249 for regular registrants). For more information, please contact: Wolfgang Koch, w.koch@ieee.org.

Some pictures:



Peter Willett’s keynote lecture introduced by Felix Govaers, technical program chair.



Antonio Zea from KIT, Karlsruhe: happy winner of the best student's paper award.



Discussions and networking in the coffee breaks between the technical sessions.



Richard Klemm commenting on Mussorgsky's "Pictures of an Exhibition" in fusion terms ...



Personal intercourse and technical exchange in a traditional German beerhouse.