Call for Papers:
Information Fusion
by Imprecise Probabilities

Proposal for Special Session at FUSION 2010

One of the main goals in information fusion (IF) is to reduce uncertainty of a phenomenon under consideration by utilizing multiple sources of information, thus improving the decision making process.

This problem is generally discussed in the framework of the Bayesian theory of probability, which nowadays represents one of the most popular and successful approaches to IF. Yet, in situations where the epistemic uncertainty (i.e., that due to lack of knowledge and not to the intrinsic randomness of the phenomenon) is too pervasive, inference and decision making based on Bayesian approaches can be too dependent on the modelling assumptions and, thus, not reliable.

In these cases, the theory of imprecise probabilities can provide a sound mathematical framework for a more reliable modelling of epistemic uncertainty. The key idea there is to employ sets of probability distributions, instead of a single distribution as in the Bayesian theory, in order to provide a better model of uncertainty.

In order to clarify the difference between the two approaches, it is worth to consider a special case of IF, the state estimation problem.

In the classical Bayesian estimation, a typical assumption is that the models for prior and likelihood are completely known. However, in many cases, due to a lack of information about the system to be modelled, it may not be possible to characterize prior and/or likelihood with a single distribution. For example, in the Gaussian case, one may only know that the mean of the Gaussian distribution lies in an interval or, in more general cases, we may only be able to state that the distribution of the prior/likelihood belongs to some set. In this context, a more systematic approach to estimation can be obtained by means of imprecise probabilities. The basic idea is to solve the estimation problem by dealing with all elements of the set of distributions characterizing the prior and the likelihood. The inferences will be therefore less dependent on the model assumptions and, thus, intrinsically more robust and reliable.

Imprecise probability is still an open area of research. The purpose of this Special Session is to give to the IF community an opportunity to share ideas on these topics and to develop, evaluate and apply novel robust/reliable methods for information fusion based on imprecise probabilities.

Contributions to this Special Session are expected from the following research fields:

- imprecise probabilities,
- sets of probability density functions, credal sets,
- credal networks,
- interval probabilities,
- Dirichlet processes,
- hierarchical Bayesian models,
- random sets,
- rough sets,
- stochastic orders,
- combined set-theoretic and statistical estimation,

and related approaches. Of particular interest is the application of these techniques to state estimation, filtering, and, in general, information fusion problems.

This Special Session is intended to be part of the *13th International Conference on Information Fusion* (www.fusion2010.org) in Edinburgh, UK on 26 - 29 July 2010.

The session is co-organized by Uwe D. Hanebeck, Vesa Klumpp, and Benjamin Noack from the Intelligent Sensor-Actuator-Systems Laboratory (isas.uka.de) at the Karlsruhe Institute of Technology (KIT) and Alessio Benavoli and Alessandro Antonucci from the Dalle Molle Institute for Artificial Intelligence (www.idsia.ch).

Please contact Vesa Klumpp (Vesa.Klumpp@kit.edu) if you wish to submit a paper and participate at the Special Session. In order to ease planning, please respond early, preferably until **8 February 2010**.

Submission of full–length papers (6 to 8 pages) is due **16 March 2010**. Accepted papers will be included in the regular proceedings of the conference. Please visit www.fusion2010.org for details.