

ISIF-SPONSORED EVENTS AND WORKSHOPS

BELIEF FUNCTIONS AND APPLICATIONS SOCIETY

RECENT EVENTS: CONFERENCES AND SCHOOLS

The Belief Functions and Applications Society (BFAS) organizes biennial events alternating between conferences on even years and schools on odd years. The first edition of the conference was held in Brest, France in 2010, where both Glenn Shafer and Arthur Dempster in their respective keynote speeches were looking back on the origins and foundations of their now famous theory, also referred to as Dempster-Shafer theory, or evidence theory. Since then, the annual BFAS events gather between 30 and 80 researchers and practitioners of belief functions.

The biennial BELIEF conferences are a forum for the confrontation of ideas, the reporting of recent achievements, and the presentation of the wide range of applications of this theory. Since the first edition in Brest in 2010, the conference was held successively in Compiègne, France in 2012, in Oxford, UK in 2014, in Prague, Czech Republic in 2016, and in Compiègne, France in 2018.



BELIEF 2018: Conference attendees prior to the banquet at the Abbaye Royale du Moncel, Compiègne, France.

The biennial BELIEF schools offer a unique opportunity for students and researchers to learn about fundamental and advanced aspects of the theory of belief functions. The school is organized around a set of lectures by prominent researchers who gradually tackle basic to more advanced theoretical concepts and offer complementary tutorial sessions focused on the practical use and implementation of belief functions. The lectures also highlight the links with other uncertainty theories such as imprecise probabilities, random sets, or rough sets, and present some of the belief functions applications in various domains including, notably, information fusion, inference, and machine learning. The schools were successively held in Autrans, France in 2011, in Carthage, Tunisia in 2013, in Stella Plage, France in 2015, and finally in Xi'an, China in 2017. This last location and dates were chosen so that the event would be held in conjunction with the FUSION conference the week prior in a nearby venue to facilitate attendance to both events.

The fifth editions of the conference and school were held respectively in Compiègne, France in 2018 and in Siena, Italy in 2019. Their outcomes are reported below.

BELIEF 2018—5TH INTERNATIONAL CONFERENCE ON BELIEF FUNCTIONS

BELIEF 2018 was held in the Innovation Centre of the Université de technologie de Compiègne (UTC) in France from September 17–21, 2018. This fifth edition of the series of conferences on the theory and application of belief functions was the first edition to be held jointly with the International Conference on Soft Methods in Probability and Statistics (SMPS). This was the occasion to connect with another community and to discuss common problems and differences between the approaches privileged by each of them.

To foster and reinforce this connection between BELIEF and SMPS and truly have a joint event, a unique program committee was set up for all papers, and reviewers of both commu-

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nities were encouraged to select and bid on papers irrespective of the venue to which they were submitted. This resulted in a program committee of over 55 people. Also, except for the most specific papers, all papers were presented in a single session, with papers from both conferences mixed in the same session. Participants really appreciated this initiative, especially when they could not tell which paper was from which conference.

The BELIEF conference alone received 39 submissions, of which 32 were accepted. Authors who submitted papers to the joint event were from 23 countries, most notably France (36), China (17), Spain (13), Italy (10), Belgium (9), Tunisia (8), and Czech Republic (8). Seventy (70) participants registered for the joint conference.

In the spirit of the joint event, tutorials and plenary talks were chosen to connect the different communities present. The first day of the conference was devoted to invited tutorials: “Statistics with Interval Data” by Scott Ferson, “Imprecise Markov Chains” by Jasper de Bock and Thomas Krak, and “Random Fuzzy Sets and Statistics with Imprecise-valued Data” by Maria Gil.

The plenary talks were the following: “On Statistical Modelling with Imprecise Probabilities” by Thomas Augustin, “Non-Laplacian Uncertainty: Practical Consequences of an Ugly Paradigm Shift about How We Handle Not Knowing” by Scott Ferson, and “Belief Functions and Valid Statistical Inference” by Ryan Martin. This last talk was given by an overseas invited speaker who was sponsored thanks to the ISIF grant. It provided an overview of very recent results showing that belief functions and confidence bands were ideal tools to deliver statistically guaranteed results, providing solutions to some of the issues of Fisher pivotal methods.

Awards for best papers were given during the banquet, which was the occasion for participants to discuss in a relaxed and playful atmosphere, with wooden games available. A shortlist of seven candidate papers, all from young researchers (as

this was the first criterion to receive the award), was prepared by the Program Chairs on the basis of the reviewers’ scores and assessments. This list was later submitted to the BFAS Board of Directors for the selection of the best paper awards.

The awards, sponsored by Elsevier and the *International Journal of Approximate Reasoning*, went to the papers “Outer Approximations of Coherent Lower Probabilities Using Belief Functions” by Ignacio Montes, Enrique Miranda, and Paolo Vicig, and “An Evidential K-Nearest Neighbor Classifier Based on Contextual Discounting and Likelihood Maximization” by Orakanya Kanjanatarakul, Siwarat Kuson, and Thierry Denoëux. The first paper studies how sets of probabilities could be approximated by belief functions, while the second one revisits K-Nearest Neighbor classifiers under the light of likelihood estimation.

BELIEF 2018’s proceedings are published by Springer’s Lecture Notes in Artificial Intelligence/Lecture Notes in Computer Science series, Volume 11069.

BFTA 2019—5TH SCHOOL ON BELIEF FUNCTIONS AND THEIR APPLICATIONS

The fifth school on Belief Functions and Their Applications (BFTA) was held at the Certosa di Pontignano, in the vicinity of Siena, in the province of Tuscany in Italy, from October 27–31, 2019.¹

Thirteen lectures, accompanied with exercises provided by ten lecturers, succeeded each other over five days. The school opened with the talk of Thierry Denoëux on the “Introduction of Belief Functions”, providing basics of the theory. This was followed by a perspective on “Belief Functions and Boolean Inference” by Sébastien Destercke, addressing the basic combination of propositional logic and belief functions, together with computational challenges illustrated on some applications.

¹ bfasociety.org/BFTA2019



BFTA school 2019: School participants during the social event, after the visit of the Azienda Agricola Losi Querciavalle, Tuscany, Italy.

The second day started with the now famous lecture of Didier Dubois “Positioning Belief Functions among Uncertainty Theories”, which illustrates the limited expressiveness of probabilities and provides an overview of alternative uncertainty theories, such as imprecise probabilities, belief functions and random sets, and possibility theory. Davide Ciucci complemented the portrait presenting the links between “Rough Sets and Belief Functions”. Thierry Denoeux presented rational approaches for modeling evidence with belief functions in real world applications with “Methods for Building Belief Functions”, capturing either expert opinions or statistical information. Frédéric Pichon gave the last lecture of Day 2 on “Information Correction and Fusion Using Belief Functions”, tackling the specific problem of the consideration of meta-information on source quality (typically the reliability) in the combination of information from multiple sources. The second day closed with a poster session during which students had the opportunity to present their work and exchange with other school participants and lecturers. The posters were displayed until the end of the school, which stimulated discussions outside specific poster sessions and during breaks.

Day 3 initiated with the third lecture by Thierry Denoeux on “Classification and Clustering Using Belief Functions”, which provided an overview of evidential classifiers illustrated with results on several applications. The practical session of Arnaud Martin on the “Implementation of Belief Functions” concluded the lectures of this short day, allowing the tutees to experience basic and advanced calculus with belief functions using the R library. The afternoon was a break and included social events, during which the group first had a guided visit of the vineyard farm close by, followed by a free visit to the city of Siena.

On Day 4, Prakash Shenoy presented “Graphical Models for Belief Functions”, looking back at his work on Valuation-Based Systems, a generic framework abstracting several uncertainty *calculi* including belief function theory, probability theory, possibility theory, propositional calculus, and making the fusion process efficiently implemented thanks to local computation. Anne-Laure Josselme then surveyed “Distances and Conflict between Belief Functions”, highlighting the specific properties distinguishing between the two types of measures. Didier Dubois presented his second lecture on “Prejudiced Information Fusion Using Belief Functions”, revisiting Philippe Smets’ decomposition of belief functions to define an approach based on “diffidence” functions, as opposed to upper and lower

BELIEF 2018 ORGANIZING COMMITTEE

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probabilities. The last day, Barbara Vantaggi presented the use of “Belief Functions in Decision Theory” and Jean Dezert concluded the school with recent results on “Multi-Criteria Decision-Making Support with Belief Functions”.

The BFAS general assembly was held at the end of the 4th day after a panel discussion, during which several ideas on how to render the material on belief functions more accessible were proposed, including a forum for discussion, recorded talks from lecturers, and short videos teaching basic and advanced calculus on belief functions. The next BELIEF conference was announced by Thierry Denoeux and will be held in be Shanghai, China in 2021, co-located with the 1st International Conference on Cognitive Analytics, Granular Computing, and Three-Way Decisions, cosponsored by the International Rough Set Society.²

The school gathered 34 attendees including lecturers, students, and senior researchers from 14 universities, research institutes, or companies from eight countries. The success of this event was greatly due to the ISIF, which covered lecturers’ travel fees, as well as to the BFAS, who awarded grants covering registration fees, helping seven students travel from India, USA, Tunisia, Morocco, and France to attend the school.

² <https://www.lgi2a.univ-artois.fr/events/belief2020/>