

BFTA 2023 REPORT

BRIEF REPORT ON THE BELIEF FUNCTIONS AND THEIR APPLICATIONS SCHOOL 2023

The Belief Functions and Their Applications (BFTA) school is a biennial event organized by the Belief Functions and Applications Society (BFAS), offering a unique opportunity for students and researchers to learn about fundamental and advanced aspects of the theory of belief functions (also referred to as Dempster-Shafer theory, or evidence theory), a formalism for reasoning with uncertainty. BFTA 2023, the sixth edition of the school, was held in a hybrid mode at the Japan Advanced Institute of Science and Technology (JAIST) in Ishikawa, Japan, from October 27–31, 2023.¹



Student poster session.

The school gathered 40 attendees who were lecturers, students, and senior researchers from 17 universities, research institutes, or companies from nine countries. The success of this event was greatly due to the ISIF, which covered some of the lecturer travel fees, as well as to BFAS, who awarded grants covering registration fees for four students from Singapore, China, Vietnam and France.

Twelve lectures and other activities were organized over four days. On 28 October, the school started with the lecture by Thierry Denoeux (University of Technology of Compiègne, France) on “Introduction to the Theory of Belief Functions,” which presented fundamental concepts and issues in the theory. The second lecture by Prakash Shenoy (School of Business, University of Kansas, USA) presented “Graphical Belief Function

Van-Nam Huynh

Japan Advanced Institute of
Science and Technology
Ishikawa, Japan
huynh@jaist.ac.jp

Thierry Denoeux

University of Technology of Compiègne
Compiègne, France
thierry.denoeux@utc.fr

Anne-Laure Josselme

CS Group Research Lab, France
anne-laure.josselme@csgroup.eu

Frédéric Pichon

David Mercier

Université d'Artois, France
frederic.pichon@univ-artois.fr
david.mercier@univ-artois.fr



Participants and lecturers of the BFTA 2023 school.

¹ <https://bfasociety.org/BFTA2023/>

Models: Theory, Computation and Applications,” introducing Dempster-Shafer theory (DST) of belief functions from the perspective of the so-called Valuation-based Systems, an abstract framework for several uncertainty calculi including belief function theory, probability theory, possibility theory, propositional calculus, with its local computational mechanism and applications. In his lecture on “Information Fusion in the Theory of Evidence,” Frédéric Pichon (University of Artois, France) comprehensively explored the problem of combining multiple pieces of evidence represented by belief functions, with an in-depth discussion of Dempster’s rule of combination and a jungle of alternative combination rules, as well as the issue of combination rule selection when reliability and/or independence of the evidence sources are not guaranteed. At the end of the day, a poster session was arranged to provide an opportunity for student participants to present their work and exchange with other school participants and lecturers.

The second day, 29 October, began with Thierry Denoeux lecturing on “Evidential Clustering,” which addressed the issue of quantifying clustering uncertainty using DST and discussed several evidential clustering algorithms recently developed. Anne-Laure Jousselme (CS Group Research Lab, France) lectured on “Measuring Inconsistency in Evidence Theory,” providing a survey on internal and external measures of inconsistency including entropy, specificity, conflict and distance measures and their applications. The afternoon was a break time for visiting local sights and the city of Kanazawa.

The third day, 30 October, started with the lecture by Chunlai Zhou (Renmin University of China) on “Differential Privacy for Belief Functions,” which for the first time introduced new definitions of differential privacy corresponding to Shafer’s semantics as randomly encoded messages and Walley’s interpretation as imprecise-probabilities for belief functions and provided a hypothesis-testing framework for these definitions. Then from Raleigh, North Carolina, Ryan Martin (North Carolina State University, USA) remotely lectured on “Old and New



Lecture by Prof. Chunlai Zhou, Renmin University of China.

Developments in (Consonant) Belief Functions for Statistical Inference,” providing a general imprecise-probabilistic framework for statistical inference. Hieu-Chi Dam (JAIST) presented “Applications of Belief Functions for Exploring Novel Materials” to introduce a novel application of the Dempster-Shafer theory to materials science in materials modeling and discovery. From the city of Xi’an, China, Zhunga Liu (Northwestern Polytechnical University) closed the day by remotely presenting his lecture on “Pattern Classification with Belief Functions” that thoroughly discussed evidential models for pattern classification with multi-source and heterogeneous data.

On the last day, 31 October, Thierry Denoeux presented his third lecture “Epistemic Random Fuzzy Sets: Theory and Application to Machine Learning,” introducing a more general theoretical framework unifying DST and fuzzy set theory for modeling uncertainty and demonstrating its application to machine learning. Van-Nam Huynh (JAIST) presented “Application of Dempster-Shafer Theory to Ensemble Classification and User Preferences,” examining how DST could be applied in ensemble classification, recommendation and user preference modeling.

The afternoon began with a BFAS information meeting. During this meeting, Thierry Denoeux presented the society to new members and announced the next BELIEF conference to be held in Belfast, UK September 4-6, 2024.² Masahiro Inuiguchi (Osaka University, Japan) concluded the school with his lecture on “Application of Possibility Theory to Optimization and Decision Making.” In the end of the day a live Q&A session and open discussion was organized, allowing the students to receive guidance from the lecturers about their research topics.

Videos of some of the lectures are available on the BFAS YouTube channel at https://www.youtube.com/@bfas_channel.



Tour of Kanazawa for the social event.

²<https://bfasociety.org/Belief2024/>