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Introduction

During the past five years, extensive research has been conducted to develop methods for correlating and fusing data from physical sensors (“hard” data) and from human observers (“soft” data). Hard sensor data generally involves signals, images or scalar information related to the location, identification and characterization of entities, e.g., humans and vehicles, while soft data typically involves textual information, e.g., observations, inferences, and comments, from human observers. Modern Information Fusion systems are also exploiting contextual information, e.g., socio-cultural data, much of which is also of a soft type. With the rapid proliferation of mobile communications devices and increased global connectivity, the need to fuse hard and soft data becomes an increasingly ubiquitous problem. Applications involve areas such as environmental monitoring, citizen science, military situation awareness and assessment, and emergency response. There are numerous challenges involved in hard and soft data fusion based on issues such as: the inherent differences in level of abstraction of hard versus soft data (viz., hard data about observed entities represented by signals, images, vectors and scalars versus semantic meta-data based on human observations and inferences); challenges in characterizing the performance of physical sensors versus human observers; differences in data rates; and issues in correlation and association.

The 2014 SPIE Sensing Technology and Applications Conference included the second annual session on the “Next-Generation Analyst”. This conference followed on the model and success of a similarly-themed conference held at SPIE DSS in 2013. The focus this year was on research and advances in hard and soft data fusion. The papers provided an overview and discussion of the state of the art in four sessions: (1) information fusion and analysis, (2) information visualization, (3) big data and information management, and (4) participatory sensing and cognition. Across the four thematic sessions listed, over 20 papers authored by a set of international authors from the USA, the UK, Brazil, and Finland covered top-level research issues toward realizing new capabilities for analysis in very complex environments.

The papers covered a broad range of topics. However, one core theme that emerged was that of the semantic complexities in dealing with language-based data, to include the extensive domain of social media and even data collected by through crowd-sourcing. It was shown for example that for some languages of interest today, even building a capability to recognize a language or dialect of interest can be challenging. Architectural concepts for modern analysis suites included virtual knowledge bases, agent-based approaches, Wiki-based concepts, and user-centric approaches. Visualization ideas and the associated area of human-computer interfacing were also addressed in papers exploring sonification concepts for analyst alerting, multi-functional utilities and visualizations,

and techniques for maintaining user interest and attention. Among other topics, the concern for input quality, especially in open-source and social-media environments was reflected in many papers, and new frameworks for analysis, such as argumentation-based methods, were also discussed.

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