Preface

Information Reuse and Integration addresses the efficient extension and creation of knowledge through the exploitation of Kolmogorov complexity in the extraction and application of domain symmetry. Knowledge, which seems to be novel, can more often than not be recast as the image of a sequence of transformations, which yield symmetric knowledge. When the size of those transformations and/or the length of that sequence of transforms exceeds the size of the image, then that image is said to be novel or random. It may also be that the new knowledge is random in that no such sequence of transforms, which produces it exists, or is at least known.

The study of novel and symmetric knowledge has great implications for automated knowledge acquisition and automated software creation in general. That is, the extraction of such knowledge is necessarily context-sensitive—implying the use of production rules for tractable learning methodologies. In other words, reuse and integration are inexorably linked, whereby knowledge must be integrated to extract its symmetric variants; and, knowledge must be reused to find tractable pathways for its integration. Notice that theoretical reuse and integration cannot be had in the absence of self-reference. A consequence is that there are truths, which cannot be proven—implying that randomness and symmetry are not absolute, but rather heuristic concepts. That is, knowledge can only be categorized relative to specific criterion. For example, a "do-loop" is random in comparison to an assignment statement, but is symmetric in comparison to a "for" statement—just as an assignment statement is symmetric in comparison to a print statement.

The need for heuristics pervades the real world. These are not mere afterthoughts, meant solely to enable scalability, but serve the goals of randomization itself. As a result, any 5th generation programming system, any knowledge acquisition system, and any mechanics for formal representation must embody a heuristic component if it is to be reusable and integrated in a nontrivial way. For example, the need for multiple representations in problem solving implies the use of heuristics. Similarly, the Japanese 5th generation project failed because it failed to incorporate a heuristic mechanism into the back-cut mechanism of the predicate calculus. The authors of the nine papers comprising this volume incorporate symmetry, reuse, and integration as overt operational procedures or as operations built into the formal representations of data and operators employed. Either way, the aforementioned theoretical underpinnings of information reuse and integration are supported.

Chapter "Reuse and Integration of Specification Logics: The Hybridisation Perspective" explores the combination and reuse of logics at the syntactic and the semantic levels. This methodology has application to the specification of reconfigurable software systems, where a distinct logic may be used to describe the local requirements of each system's configuration. Chapter "Test Reactive Systems with Büchi-Automaton-Based Temporal Requirements" proposes a specification-based technique that tests a reactive system for a Buchi automaton. The results validate the strength of their approach for improving the effectiveness and efficiency of testing, where the test cases are generated specifically in satisfaction of temporal requirements.

Chapter "Capturing and Verifying Dynamic Systems Behavior using UML and p-calculus" addresses the need for formal semantics for the validation of UML diagrams. In particular, it presents an approach for capturing and verifying the dynamic behavior of systems using UML diagrams and π-calculus. Chapter "A Real-Time Concurrent Constraint Calculus for Analyzing Avionic Systems Embedded in the IMA Connected Through TTEthernet" presents an approach to model and verify avionic systems embedded in the Integrated Modular Architecture (IMA) connected through the TTEthernet Network, by using TTCC, a real-time concurrent constraint process calculus with an operator to define infinite periodic behaviors specific to IMA and TTEthernet. Both operational and declarative aspects of this calculus are shown to comprise a simple and elegant way to specify the requirements of avionic systems.

Chapter "Case Indexing by Component, Context, and Encapsulation for Knowledge Reuse" proposes to provide representation criterion for concept contextualization and encapsulation for reuse in a case-based reasoning (CBR) system. It is argued that these are appropriate representations for case situations and actions, which can be effectively indexed. Chapter "Intelligent Decision Making for Customer Dynamics Management Based on Rule Mining and Contrast Set Mining" provides a business perspective involving the use of data mining techniques to support intelligent decision-making. Both random and symmetric rules are mined with a goal towards improving the decision-making ability of marketing managers.

Chapter "Is Data Sampling Required When Using Random Forest for Classification on Imbalanced Bioinformatics Data?" presents results for the determination if the inclusion of data sampling will improve the performance of the Random Forest classifier (useful for bioinformatics data). It is shown that, in general, data sampling does improve the classification performance of this classifier; although the improved performance is not statistically significant. Chapter "Concurrent Alignment of Multiple Anonymized Social Networks with Generic Stable Matching" addresses connections between the shared users' accounts in multiple social networks (which are called the anchor links), and the problem is formally defined as the M-NASA (Multiple Anonymized Social Networks

Alignment) problem. A novel two-phase network alignment framework UMA (Unsupervised Multi-network Alignment) is proposed in this chapter. Extensive experiments conducted on multiple real-world partially aligned social networks demonstrate that UMA can perform very well in solving the M-NASA problem.

Finally, Chap. "An Accurate Multi-sensor Multi-target Localization Method for Cooperating Vehicles" proposes a cooperative multi-sensor multi-vehicle localization method with high accuracy for terrestrial consumer vehicles. The problem is formulated in the context of a Bayesian framework; and, vehicle locations as well as their velocities are estimated via a Sequential Monte Carlo Probability Hypothesis Density (SMC-PHD) filter. Results provide good predictions of future vehicle locations.

January 2016 Thouraya Bouabana-Tebibel
Stuart H. Rubin

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