doi:10.1093/comjnl/bxl054

Capsule Reviews

FAIROUZ KAMAREDDINE

The Capsule Reviews are intended to provide a short succinct review of each paper in the issue in order to bring the content to a wider readership. The Capsule Reviews were compiled by Fairouz Kamareddine. Professor Kamareddine is an Associate Editor of *The Computer Journal* and is based in the Department of Mathematical and Computer Sciences at Heriot-Watt University, Edinburgh, UK.

A Document-Oriented Paradigm for the Construction of Content-Intensive Applications. JOSÉ LUIS SIERRA, ALFREDO FERNÁNDEZ-VALMAYOR AND BALTASAR FERNÁNDEZ-MANJÓN

Content-intensive applications integrate collections of highly structured documents authored by experts. Maintaining and updating these collections is a costly operation which depends on efficient communication between the 'domain experts' which develop the content and the 'software developers' who build, maintain and update the final application. The paper argues that descriptive markup technologies allow the representation of the content as human-readable documents which can, at the same time, be understood by the domain experts and be manipulated by the software developers. The authors have applied this document-oriented paradigm to a number of hypermedia and educational applications. These experiences led the authors to systematize the paradigm with:

(i) The Approach to Document-based Development of Software (ADDS) which is a generic approach to document-oriented development which relies on the selection of the markup languages for the particular application in question.
(ii) The DSML Provision in ADDS (PADDS) which is a technique for the use of such languages.
(iii) The operationalization in ADDS (OADDS) which regulates the modular construction.

The paper presents this systematization and outlines a qualitative evaluation. The authors discuss the strengths and weaknesses of the approach. The main strength being the better communication between domain experts and software developers and the possibilities that allow the developers to automatically derive an application by processing marked documents which have both informational content and operational aspects.

The $L(h, k)$-Labelling Problem: an Annotated Bibliography. TIZIANA CALAMONERI

Graph colorings have many useful applications. This paper concentrates on a specific graph coloring generalization that arose from a channel assignment problem in radio networks: the $L(h, k)$-labelling problem which aims to minimize the difference between the largest and smallest used colors. This problem has been used to model several problems in the literature and has a number of variants. Based on the huge interest in this problem, the paper provides an annotated bibliography of this problem with a graph algorithmic approach. The case $k = 0$ is not considered (since it is the classic vertex coloring problem). Instead, emphasis is placed on cases $h = k$ (which is equivalent to the problem of optimally coloring the square of the input graph) and $h = 2k$. The paper provides a very useful collection of results on a number of aspects related to this problem. These results range from NP-completeness, to lower and upper bounds, to graph classes.

The Stepwise Dimensionality Increasing (SDI) Index for high-dimensional data. ALEXANDER THOMASIAN AND LIJUAN ZHANG

This article deals with content-based image retrieval in image and multimedia databases, and with similarity matching in time series databases. For these purposes, objects are usually represented by high-dimensional feature vectors and object similarity is given by processing the k-nearest neighbour (k-NN) queries on the feature vectors space. Unfortunately, current methods face disadvantages especially with respect to CPU and elapsed time and the effectiveness of search. To overcome these disadvantages, this paper proposes a stepwise dimensionality increasing (SDI)-tree indexing structure where objects are categorized into a few broad classes in the first instance but where the classification is open to further refinement in a stepwise fashion. The SDI tree and its nearest neighbour algorithm are defined and followed by performance evaluation which demonstrates that SDI-trees are suitable for high-dimensional data and that they out-perform earlier methods.

Fuzzifying P Systems. APOSTOLOS SYROPOULOS

A P system is a new model of computation built around the new nested compartments surrounded by porous membranes.

Intuitively, a compartment is a multiset of objects. During computation, components exchange objects according to the multiset processing rules associated with each component. Computation terminates when no rules are applicable any longer. In fuzzy set theory, an element of a fuzzy subset belongs to it to a degree (between 0 and 1). Since rigid mathematical models employed in biology are not completely adequate for the interpretation of biological information, the fuzzification (i.e. the softening of the rigid categorization) of P systems is desired. A fuzzy multiset introduced by Yager) is a structure that consists of multiple copies of objects that belong to the fuzzy multiset to a different degree. This paper introduces a slightly different notation to that of Yager, called multi-fuzzy set. Multi-fuzzy set operations (like union, intersection, sum, difference, etc.) are first defined and then the paper presents the theory of fuzzy grammars and the concept of a fuzzy rewriting rule. With all the necessary ingredients needed to fuzzify P systems given, the paper shows how P systems with fuzzy data can be built and shows that such systems can compute any positive real number and argues that they may be a promising step toward real hypercomputation. The paper then moves to the introduction of P systems with fuzzy multiset rewriting rules where the micro-step process is fuzzified through a truth degree. These truth degrees are used to estimate the truth degree of the computation. The paper shows that for every P system with fuzzy multiset rewriting rules there is a fuzzy Turing machine that computes exactly the same numbers.