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Contents

DIMITROVA, N. Local Bifurcations in a Nonlinear Model of a Bioreactor (pp. 107–132)

NAKOV, S. Automatic Identification of False Friends in Parallel Corpora: Statistical and Semantic Approach (pp. 133–158)

KURZ, S. Caps in \mathbb{Z}_n^2 (pp. 159–178)

DEMETROVICS, J., A. MOLNÁR, B. THALHEIM. Reasoning Methods for Designing and Surveying Relationships Described by Sets of Functional Constraints (pp. 179–204)

GREENSTEIN, G., N. AHITUV. The Value of Knowing that You Do Not Know (pp. 205–226)

Abstracts

LOCAL BIFURCATIONS IN A NONLINEAR MODEL OF A BIOREACTOR*

Neli Dimitrova

e-mail: nelid@bio.bas.bg

ACM Computing Classification System (1998): G.1.7, I.1.4, J.3.

Key words: Continuously stirred bioreactor, nonlinear model, equilibrium points, transcritical bifurcations, Hopf bifurcations.

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Abstract. We consider a nonlinear model of a continuously stirred bioreactor and study the stability of the equilibrium points with respect to practically important model parameters. We determine regions in the parameter space where the steady states undergo transcritical and Hopf bifurcations. In the latter case, the stability of the emerged limit cycles is also studied. Numerical simulations in the computer algebra system *Maple* are presented to illustrate the theoretical results.

AUTOMATIC IDENTIFICATION OF FALSE FRIENDS IN PARALLEL CORPORA: STATISTICAL AND SEMANTIC APPROACH

Svetlin Nakov

e-mail: nakov@fmi.uni-sofia.bg

ACM Computing Classification System (1998): H.3.3, I.2.7.

Key words: Cognates, false friends, identification of false friends, parallel corpus, cross-lingual semantic similarity, Web as a corpus.

Abstract. False friends are pairs of words in two languages that are perceived as similar but have different meanings. We present an improved algorithm for acquiring false friends from sentence-level aligned parallel corpus based on statistical observations of words occurrences and co-occurrences in the parallel sentences. The results are compared with an entirely semantic measure for cross-lingual similarity between words based on using the Web as a corpus through analyzing the words' local contexts extracted from the text snippets returned by searching in Google. The statistical and semantic measures are further combined into an improved algorithm for identification of false friends that achieves almost twice better results than previously known algorithms. The evaluation is performed for identifying cognates between Bulgarian and Russian but the proposed methods could be adopted for other language pairs for which parallel corpora and bilingual glossaries are available.

CAPS IN \mathbb{Z}_n^2

Sascha Kurz

e-mail: sascha.kurz@uni-bayreuth.de

ACM Computing Classification System (1998): F.2.2.

Key words: Caps, arcs, affine geometry, collinearity, integer programming, rings, complete caps.

Abstract. We consider point sets in \mathbb{Z}_n^2 where no three points are on a line – also called caps or arcs. For the determination of caps with maximum cardinality and complete caps with minimum cardinality we provide integer linear programming formulations and identify some values for small n .

REASONING METHODS FOR DESIGNING AND SURVEYING RELATIONSHIPS DESCRIBED BY SETS OF FUNCTIONAL CONSTRAINTS *

János Demetrovics, András Molnár, Bernhard Thalheim

e-mail: demetrovics@sztaki.hu

modras@elte.hu

thalheim@is.informatik.uni-kiel.de

*ACM Computing Classification System (1998):*E.1.

Key words: Database schema, functional dependency, Entity-Relationship model, functional constraint, reasoning method

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Abstract. Current methods of database schema design are usually based on modeling the real world as entity (or object) classes with relationships among them. Properties of relationships can be described by semantical database constraints. One of them is functional dependency, which has a key role in traditional database design. The three basic types of binary relationships that can be described by functional dependencies are one-to-one, one-to-many and many-to-many. They can also be expressed by common graphical languages like the Entity-Relationship (ER) graph. However, relationships defined among more than two entity classes (ternary, quaternary, etc.) are usually not investigated and the common graphical tools lack expressive power regarding them. We show that the variety of relationship types is rich for higher arities and propose a simplified formalism for functional constraints as well as graphical and spreadsheet reasoning methods for handling sets of functional constraints that also help by relationship design.

THE VALUE OF KNOWING THAT YOU DO NOT KNOW

Gil Greenstein, Niv Ahituv

e-mail: gilgr@hit.ac.il

ahituv@post.tau.ac.il

ACM Computing Classification System (1998): H.4.2, H.3.3.

Key words: Information Economics, Information Structures, Blackwell Theorem, Knowledge Management, Data Retrieval, System Accessibility, Data Availability.

Abstract. The value of knowing about data availability and system accessibility is analyzed through theoretical models of Information Economics. When a user places an inquiry for information, it is important for the user to learn whether the system is not accessible or the data is not available, rather than not have any response. In reality, various outcomes can be provided by the system: nothing will be displayed to the user (e.g., a traffic light that does not operate, a browser that keeps browsing, a telephone that does not answer); a random noise will be displayed (e.g., a traffic light that displays random signals, a browser that provides disorderly results, an automatic voice message that does not clarify the situation); a special signal indicating that the system is not operating (e.g., a blinking amber indicating that the traffic light is down, a browser responding that the site is unavailable, a voice message regretting to tell that the service is not available). This article develops a model to assess the value of the information for the user in such situations by employing the information structure model prevailing in Information Economics. Examples related to data accessibility in centralized and in distributed systems are provided for illustration.

The results of the analysis indicate that there is a direct relationship between the knowledge about systems accessibility or data availability and its informativeness. The addition of a signal indicating system inaccessibility or data unavailability increases the expected value of information derived from the system. The article proves a theorem related to the research question and discusses the theoretical and practical interpretation of the results.