

Proceedings of the 21st Australasian Joint Conference on Artificial Intelligence: Advances in Artificial Intelligence

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[Stereo-Vision-Support for Intelligent Vehicles - The Need for Quantified Evidence](#)

[Reinhard Klette](#)

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doi>[10.1007/978-3-540-89378-3_1](https://doi.org/10.1007/978-3-540-89378-3_1)

Vision-based driver assistance in modern cars has to perform automated real-time understanding or modeling of traffic environments based on multiple sensor inputs, using 'normal' or specialized (such as night vision) stereo cameras as default input devices. ...

Vision-based driver assistance in modern cars has to perform automated real-time understanding or modeling of traffic environments based on multiple sensor inputs, using 'normal' or specialized (such as night vision) stereo cameras as default input devices. Distance measurement, lane-departure warning, traffic sign recognition, or trajectory calculation are examples of current developments in the field, contributing to the design of intelligent vehicles.

The considered application scenario is as follows: two or more cameras are installed in a vehicle (typically a car, but possibly also a boat, a wheelchair, a forklift, and so forth), and the operation of this vehicle (by a driver) is supported by analyzing in real-time video sequences recorded by those cameras. Possibly, further sensor data (e.g., GPS, radar) are also analyzed in an integrated system.

Performance evaluation is of eminent importance in car production. Crash tests follow international standards, defining exactly conditions under which a test has to take place. Camera technology became recently an integral part of modern cars. In consequence, perfectly specified and standardized tests ('camera crash tests') are needed very soon for the international car industry to identify parameters of stereo or motion analysis, or of further vision-based components.

This paper reports about current performance evaluation activities in the *enpeda* project at The University of Auckland. Test data are so far rectified stereo sequences (provided by Daimler A.G., Germany, in 2007), and stereo sequences recorded with a test vehicle on New Zealand's roads.

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Section: **Knowledge Representation**

[Introspective Forgetting](#)

[Hans Ditmarsch](#), [Andreas Herzig](#), [Jérôme Lang](#), [Pierre Marquis](#)

Pages: 18 - 29

doi>[10.1007/978-3-540-89378-3_2](https://doi.org/10.1007/978-3-540-89378-3_2)

We model the forgetting of propositional variables in a modal logical context where agents become ignorant and are aware of each others' or their own resulting ignorance. The resulting logic is sound and complete. It can be compared to variable-forgetting ...

We model the forgetting of propositional variables in a modal logical context where agents become ignorant and are aware of each others' or their own resulting ignorance. The resulting logic is sound and complete. It can be compared to variable-forgetting as abstraction from information, wherein agents become unaware of certain variables: by employing elementary

results for bisimulation, it follows that beliefs not involving the forgotten atom(s) remain true.

[expand](#)

[A Fixed-Point Property of Logic-Based Bargaining Solution](#)

[Dongmo Zhang](#)

Pages: 30 - 41

doi>[10.1007/978-3-540-89378-3_3](#)

This paper presents a logic-based bargaining solution based on Zhang and Zhang's framework. It is shown that if the demand sets of players are logically closed, the solution satisfies a fixed-point property, which says that the outcome of bargaining ...

This paper presents a logic-based bargaining solution based on Zhang and Zhang's framework. It is shown that if the demand sets of players are logically closed, the solution satisfies a fixed-point property, which says that the outcome of bargaining is the result of mutual belief revision. The result is interesting not only because it presents a desirable logical property of bargaining solution but also establishes a link between bargaining theory and multi-agent belief revision.

[expand](#)

[Re-representation in a Logic-Based Model for Analogy Making](#)

[Ulf Krumnack](#), [Helmar Gust](#), [Kai-Uwe Kühnberger](#), [Angela Schwering](#)

Pages: 42 - 48

doi>[10.1007/978-3-540-89378-3_4](#)

Analogical reasoning plays an important role for cognitively demanding tasks. A major challenge in computing analogies concerns the problem of adapting the representation of the domains in a way that the analogous structures become obvious, i.e. finding ...

Analogical reasoning plays an important role for cognitively demanding tasks. A major challenge in computing analogies concerns the problem of adapting the representation of the domains in a way that the analogous structures become obvious, i.e. finding and, in certain circumstances, generating appropriate representations that allow for computing an analogical relation. We propose to resolve this re-representation problem of analogy making in a logical framework based on the anti-unification of logical theories. The approach is exemplified using examples from qualitative reasoning (naive physics) and mathematics.

[expand](#)

[Knowledge Generation for Improving Simulations in UCT for General Game Playing](#)

[Shiven Sharma](#), [Ziad Kobti](#), [Scott Goodwin](#)

Pages: 49 - 55

doi>[10.1007/978-3-540-89378-3_5](#)

General Game Playing (GGP) aims at developing game playing agents that are able to play a variety of games and, in the absence of pre-programmed game specific knowledge, become proficient players. Most GGP players have used standard tree-search techniques ...

General Game Playing (GGP) aims at developing game playing agents that are able to play a variety of games and, in the absence of pre-programmed game specific knowledge, become proficient players. Most GGP players have used standard tree-search techniques enhanced by automatic heuristic learning. The UCT algorithm, a simulation-based tree search, is a new approach and has been used successfully in GGP. However, it relies heavily on random simulations to assign values to unvisited nodes and selecting nodes for descending down a tree. This can lead to slower convergence times in UCT. In this paper, we discuss the generation and

evolution of domain-independent knowledge using both state and move patterns. This is then used to guide the simulations in UCT. In order to test the improvements, we create matches between a player using standard the UCT algorithm and one using UCT enhanced with knowledge.

[expand](#)

[Propositional Automata and Cell Automata: Representational Frameworks for Discrete Dynamic Systems](#)

[Eric Schkufza](#), [Nathaniel Love](#), [Michael Genesereth](#)

Pages: 56 - 66

doi>[10.1007/978-3-540-89378-3_6](#)

This paper describes and compares two simple, powerful models for formalizing the behavior of discrete dynamic systems: Propositional and Cell Automata. Propositional Automata encode state in terms of boolean propositions, and behavior in terms of boolean ...

This paper describes and compares two simple, powerful models for formalizing the behavior of discrete dynamic systems: Propositional and Cell Automata. Propositional Automata encode state in terms of boolean propositions, and behavior in terms of boolean gates and latches. Cell Automata generalize the propositional model by encoding state in terms of multi-valued cells, and behavior in terms of comparators and selectors that respond to cell values. While the models are equally expressive, Cell Automata are computationally more efficient than Propositional Automata. Additionally, arbitrary Propositional Automata can be converted to optimal Cell Automata with identical behavioral properties, and Cell Automata can be encoded as a Propositional Automata with only logarithmic increase in size.

[expand](#)

[Constructing Web Corpora through Topical Web Partitioning for Term Recognition](#)

[Wilson Wong](#), [Wei Liu](#), [Mohammed Bennamoun](#)

Pages: 67 - 78

doi>[10.1007/978-3-540-89378-3_7](#)

The need for on-demand discovery of very large, incremental text corpora for unrestricted range of domains for term recognition in ontology learning is becoming more and more pressing. In this paper, we introduce a new 3-phase web partitioning approach ...

The need for on-demand discovery of very large, incremental text corpora for unrestricted range of domains for term recognition in ontology learning is becoming more and more pressing. In this paper, we introduce a new 3-phase web partitioning approach for automatically constructing web corpora to support term recognition. An evaluation of the web corpora constructed using our web partitioning approach demonstrated high precision in the context of term recognition, a result comparable to the use of manually-created local corpora.

[expand](#)

[An Ontology Formalization of Relation Type Hierarchy in Conceptual Structure Theory](#)

[Philip H. Nguyen](#), [Ken Kaneiwa](#), [Dan R. Corbett](#), [Minh-Quang Nguyen](#)

Pages: 79 - 85

doi>[10.1007/978-3-540-89378-3_8](#)

This paper presents an enhancement to ontology formalization, combining previous work in Conceptual Structure Theory and Order-Sorted Logic. In particular, the relation type hierarchy of the former theory is a subset of the predicate hierarchy of the ...

This paper presents an enhancement to ontology formalization, combining previous work in Conceptual Structure Theory and Order-Sorted Logic. In particular, the relation type hierarchy of the former theory is a subset of the predicate hierarchy of the latter. Most existing ontology formalisms place greater importance on concept types, but this paper focuses more on relation types, which are in essence predicates on concept types. New notions are introduced and new properties identified with the aim of completing missing arguments in relation types. The end result is a new ontology, that we call the closure of the original ontology, on which automated inference could be more easily produced (e.g., a query-answering system for legal knowledge).

[expand](#)

[Exploiting Ontological Structure for Complex Preference Assembly](#)

[Gil Chamiel](#), [Maurice Pagnucco](#)

Pages: 86 - 92

doi>[10.1007/978-3-540-89378-3_9](#)

When a user is looking for a product recommendation they usually lack expert knowledge regarding the items they are looking for. Ontologies on the other hand are crafted by experts and therefore provide a rich source of information for enhancing preferences. ...

When a user is looking for a product recommendation they usually lack expert knowledge regarding the items they are looking for. Ontologies on the other hand are crafted by experts and therefore provide a rich source of information for enhancing preferences. In this paper we significantly extend previous work on exploiting ontological information by allowing the user to specify preferences in a more expressive manner. Rather than allowing for only one preferred target concept, we allow a 'chain' of user preferences. Furthermore, we treat information from the underlying ontology of the domain as a secondary preference structure. We then show how to assemble these two preference structures (user and ontology) into a preference over items.

[expand](#)

Section: **Constraints**

[A Refutation Approach to Neighborhood Interchangeability in CSPs](#)

[Chavalit Likitvivanavong](#), [Roland H. Yap](#)

Pages: 93 - 103

doi>[10.1007/978-3-540-89378-3_10](#)

The concept of Interchangeability was developed to deal with redundancy of values in the same domain. Conventional algorithms for detecting Neighborhood Interchangeability work by gradually establishing relationships between values from scratch. We propose ...

The concept of Interchangeability was developed to deal with redundancy of values in the same domain. Conventional algorithms for detecting Neighborhood Interchangeability work by gradually establishing relationships between values from scratch. We propose the opposite strategy: start by assuming everything is interchangeable and disprove certain relations as more information arises. Our refutation-based algorithms have much better lower bounds whereas the lower bound and the upper bound of the traditional algorithms are asymptotically identical.

[expand](#)

[Infeasibility Driven Evolutionary Algorithm \(IDEA\) for Engineering Design Optimization](#)

[Hemant K. Singh](#), [Amitay Isaacs](#), [Tapabrata Ray](#), [Warren Smith](#)

Pages: 104 - 115

doi>[10.1007/978-3-540-89378-3_11](#)

Engineering design often requires solutions to constrained optimization problems with highly nonlinear objective and constraint functions. The optimal solutions of most design problems lie on the constraint boundary. In this paper, Infeasibility Driven ...

Engineering design often requires solutions to constrained optimization problems with highly nonlinear objective and constraint functions. The optimal solutions of most design problems lie on the constraint boundary. In this paper, Infeasibility Driven Evolutionary Algorithm (IDEA) is presented that searches for optimum solutions near the constraint boundary. IDEA explicitly maintains and evolves a small proportion of infeasible solutions. This behavior is fundamentally different from the current state of the art evolutionary algorithms, which rank the feasible solutions higher than the infeasible solutions and in the process approach the constraint boundary from the feasible side of the design space. In IDEA, the original constrained minimization problem with k objectives is reformulated as an unconstrained minimization problem with $k + 1$ objectives, where the additional objective is calculated based on the relative amount of constraint violation among the population members. The presence of infeasible solutions in IDEA leads to an improved rate of convergence as the solutions approach the constraint boundary from both feasible and infeasible regions of the search space. As an added benefit, IDEA provides a set of marginally infeasible solutions for trade-off studies. The performance of IDEA is compared with Non-dominated Sorting Genetic Algorithm II (NSGA-II) [1] on a set of single and multi-objective mathematical and engineering optimization problems to highlight the benefits.

[expand](#)

[Constraint-Based Multi-agent Path Planning](#)

[Malcolm Ryan](#)

Pages: 116 - 127

doi>[10.1007/978-3-540-89378-3_12](https://doi.org/10.1007/978-3-540-89378-3_12)

Planning collision-free paths for multiple robots traversing a shared space is a problem that grows combinatorially with the number of robots. The naive centralised approach soon becomes intractable for even a moderate number of robots. Decentralised ...

Planning collision-free paths for multiple robots traversing a shared space is a problem that grows combinatorially with the number of robots. The naive centralised approach soon becomes intractable for even a moderate number of robots. Decentralised approaches, such as priority planning, are much faster but lack completeness.

Previously I have demonstrated that the search can be significantly reduced by adding a level of abstraction [1]. I first partition the map into subgraphs of particular known structures, such as *cliques* , *halls* and *rings* , and then build abstract plans which describe the transitions of robots between the subgraphs. These plans are constrained by the structural properties of the subgraphs used. When an abstract plan is found, it can easily be resolved into a complete concrete plan without further search.

In this paper, I show how this method of planning can be implemented as a constraint satisfaction problem (CSP). Constraint propagation and intelligent search ordering further reduces the size of the search problem and allows us to solve large problems significantly more quickly, as I demonstrate this in a realistic planning problem based on a map of the Patrick Port Brisbane yard. This implementation also opens up opportunities for the application of a number of other search reduction and optimisation techniques, as I will discuss.

[expand](#)

Section: **Planning**

[An Optimality Principle for Concurrent Systems](#)

[Langford B. White, Sarah L. Hickmott](#)

Pages: 128 - 137

doi>[10.1007/978-3-540-89378-3_13](https://doi.org/10.1007/978-3-540-89378-3_13)

This paper presents a formulation of an optimality principle for a new class of concurrent decision systems formed by products of deterministic Markov decision processes (MDPs). For a single MDP, the optimality principle reduces to the usual Bellman's ...

This paper presents a formulation of an optimality principle for a new class of concurrent decision systems formed by products of deterministic Markov decision processes (MDPs). For a single MDP, the optimality principle reduces to the usual Bellman's equation. The formulation is significant because it provides a basis for the development of optimisation algorithms for decentralised decision systems including a recently proposed method based on Petri Net unfoldings.

[expand](#)

[Partial Order Hierarchical Reinforcement Learning](#)

[Bernhard Hengst](#)

Pages: 138 - 149

doi>[10.1007/978-3-540-89378-3_14](https://doi.org/10.1007/978-3-540-89378-3_14)

In this paper the notion of a partial-order plan is extended to task-hierarchies. We introduce the concept of a partial-order task-hierarchy that decomposes a problem using multi-tasking actions. We go further and show how a problem can be automatically ...

In this paper the notion of a partial-order plan is extended to task-hierarchies. We introduce the concept of a partial-order task-hierarchy that decomposes a problem using multi-tasking actions. We go further and show how a problem can be automatically decomposed into a partial-order task-hierarchy, and solved using hierarchical reinforcement learning. The problem structure determines the reduction in memory requirements and learning time.

[expand](#)

[Optimal Global Path Planning in Time Varying Environments Based on a Cost Evaluation Function](#)

[Om K. Gupta, Ray A. Jarvis](#)

Pages: 150 - 156

doi>[10.1007/978-3-540-89378-3_15](https://doi.org/10.1007/978-3-540-89378-3_15)

This paper describes a unique and optimal method for real-time global path planning and collision avoidance for navigation of a mobile robot in complex time varying environments. Occupancy based 3D grid map and Gaussian distribution model based obstacle ...

This paper describes a unique and optimal method for real-time global path planning and collision avoidance for navigation of a mobile robot in complex time varying environments. Occupancy based 3D grid map and Gaussian distribution model based obstacle prediction are employed to represent the dynamic environment. Path planning and obstacle avoidance are performed by applying a cost-evaluation function on time-space Distance Transforms to uniquely produce the optimal path at the time of planning. Experimental results are presented verifying the effectiveness and versatility of the algorithm in both predictable and imperfectly predictable time varying environments.

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Section: **Grammar and Language Processing**

[Using Probabilistic Feature Matching to Understand Spoken Descriptions](#)

[Ingrid Zukerman, Enes Makalic, Michael Niemann](#)

Pages: 157 - 167

doi>[10.1007/978-3-540-89378-3_16](https://doi.org/10.1007/978-3-540-89378-3_16)

We describe a probabilistic reference disambiguation mechanism developed for a spoken dialogue system mounted on an autonomous robotic agent. Our mechanism performs probabilistic comparisons between features specified in referring expressions (e.g. size ...

We describe a probabilistic reference disambiguation mechanism developed for a spoken dialogue system mounted on an autonomous robotic agent. Our mechanism performs probabilistic comparisons between features specified in referring expressions (e.g. size and colour) and features of objects in the domain. The results of these comparisons are combined using a function weighted on the basis of the specified features. Our evaluation shows high reference resolution accuracy across a range of spoken referring expressions.

[expand](#)

[Working for Two: A Bidirectional Grammar for a Controlled Natural Language](#)

[Rolf Schwitter](#)

Pages: 168 - 179

doi>[10.1007/978-3-540-89378-3_17](https://doi.org/10.1007/978-3-540-89378-3_17)

This paper introduces the controlled natural language PENG Light together with a language processor that is based on a bidirectional grammar. The language processor has the following interesting properties: (a) it translates declarative sentences written ...

This paper introduces the controlled natural language PENG Light together with a language processor that is based on a bidirectional grammar. The language processor has the following interesting properties: (a) it translates declarative sentences written in PENG Light into a first-order logic notation (TPTP); (b) it generates declarative sentences in PENG Light taking syntactically annotated TPTP formulas as input; and (c) it translates questions written in PENG Light into (conjunctive) queries in TPTP notation and uses the TPTP representation of the query as a starting point for generating answers in PENG Light. Moreover, the controlled natural language processor can be interfaced directly with an automated reasoner in order to resolve anaphoric references and to answer questions stated in PENG Light.

[expand](#)

[Improving Metrical Grammar with Grammar Expansion](#)

[Makoto Tanji](#), [Daichi Ando](#), [Hitoshi Iba](#)

Pages: 180 - 191

doi>[10.1007/978-3-540-89378-3_18](https://doi.org/10.1007/978-3-540-89378-3_18)

This paper describes Metrical PCFG Model that represents the metrical structure of music by its derivation. Because the basic grammar of Metrical PCFG model is too simple, we also propose a grammar expansion method that improves the grammar by duplicating ...

This paper describes Metrical PCFG Model that represents the metrical structure of music by its derivation. Because the basic grammar of Metrical PCFG model is too simple, we also propose a grammar expansion method that improves the grammar by duplicating a nonterminal symbol and its rules. At first, a simple PCFG model which that represent the metrical structure by a derivation just like parse tree in natural language processing. The grammar expansion operator duplicates a symbol and its rules in the PCFG model. Then the parameters of PCFG are estimated by EM algorithm. We conducted two experiments. The first one shows the expansion method specialized symbols and rules to adapt to the training data. Rhythmic patterns in a piece were represented by expanded symbols. And in the second experiment, we investigated how the expansion method improves performance of prediction for new pieces with large corpus.

[expand](#)

[FrameNet-Based Fact-Seeking Answer Processing: A Study of Semantic Alignment Techniques](#)

[and Lexical Coverage](#)

[Bahadorreza Ofoghi, John Yearwood, Liping Ma](#)

Pages: 192 - 201

doi>[10.1007/978-3-540-89378-3_19](#)

In this paper, we consider two aspects which affect the performance of factoid FrameNet-based Question Answering (QA): i) the frame semantic-based answer processing technique based on frame semantic alignment between questions and passages to identify ...

In this paper, we consider two aspects which affect the performance of factoid FrameNet-based Question Answering (QA): i) the frame semantic-based answer processing technique based on frame semantic alignment between questions and passages to identify answer candidates and score them, and ii) the lexical coverage of FrameNet over the predicates which represent the main actions in question and passage events. These are studied using a frame semantic-based QA run over the TREC 2004 and TREC 2006 factoid question sets.

[expand](#)

[Learning to Find Relevant Biological Articles without Negative Training Examples](#)

[Keith Noto, Milton H. Saier, Jr., Charles Elkan](#)

Pages: 202 - 213

doi>[10.1007/978-3-540-89378-3_20](#)

Classifiers are traditionally learned using sets of positive and negative training examples. However, often a classifier is required, but for training only an incomplete set of positive examples and a set of unlabeled examples are available. This is ...

Classifiers are traditionally learned using sets of positive and negative training examples. However, often a classifier is required, but for training only an incomplete set of positive examples and a set of unlabeled examples are available. This is the situation, for example, with the Transport Classification Database (TCDB, www.tcdb.org), a repository of information about proteins involved in transmembrane transport. This paper presents and evaluates a method for learning to rank the likely relevance to TCDB of newly published scientific articles, using the articles currently referenced in TCDB as positive training examples. The new method has succeeded in identifying 964 new articles relevant to TCDB in fewer than six months, which is a major practical success. From a general data mining perspective, the contributions of this paper are (i) evaluating two novel approaches that solve the positive-only problem effectively, (ii) applying support vector machines in a state-of-the-art way for recognizing and ranking relevance, and (iii) deploying a system to update a widely-used, real-world biomedical database. Supplementary information including all data sets are publicly available at www.cs.ucsd.edu/users/knoto/pub/ajcai08.

[expand](#)

[Humor Prevails! - Implementing a Joke Generator into a Conversational System](#)

[Pawel Dybala, Michal Ptaszynski, Shinsuke Higuchi, Rafal Rzepka, Kenji Araki](#)

Pages: 214 - 225

doi>[10.1007/978-3-540-89378-3_21](#)

This paper contains the results of evaluation experiments conducted to investigate if implementation of a pun generator into a non-task oriented talking system improves the latter's performance. We constructed a simple joking conversational system and ...

This paper contains the results of evaluation experiments conducted to investigate if implementation of a pun generator into a non-task oriented talking system improves the latter's performance. We constructed a simple joking conversational system and conducted one user evaluation experiment and two third person evaluation experiments. The results showed that

humor does have a positive influence on the dialogue between humans and computers. The implications of this fact and problems that occurred during the research are discussed. We also propose how they can be solved in the future.

[expand](#)

Section: **Statistical Learning**

[Improving Transductive Support Vector Machine by Ensembling](#)

[Tao Li, Yang Zhang](#)

Pages: 226 - 235

doi>[10.1007/978-3-540-89378-3_22](#)

Transductive Support Vector Machine (TSVM) is a method for semi-supervised learning. In order to further improve the classification accuracy and robustness of TSVM, in this paper, we make use of self-training technique to ensemble TSVMs, and classify ...

Transductive Support Vector Machine (TSVM) is a method for semi-supervised learning. In order to further improve the classification accuracy and robustness of TSVM, in this paper, we make use of self-training technique to ensemble TSVMs, and classify testing samples by majority voting. The experiment results on 6 UCI datasets show that the classification accuracy and robustness of TSVM could be improved by our approach.

[expand](#)

[Kernels Based on Distributions of Agreement Subtrees](#)

[Kilho Shin, Tetsuji Kuboyama](#)

Pages: 236 - 246

doi>[10.1007/978-3-540-89378-3_23](#)

The MAST (maximum agreement subtrees) problem has been extensively studied, and the size of the maximum agreement subtrees between two trees represents their similarity. This similarity measure, however, only takes advantage of a very small portion of ...

The MAST (maximum agreement subtrees) problem has been extensively studied, and the size of the maximum agreement subtrees between two trees represents their similarity. This similarity measure, however, only takes advantage of a very small portion of the agreement subtrees, that is, the maximum agreement subtrees, and agreement subtrees of smaller size are neglected at all. On the other hand, it is reasonable to consider that the distributions of the sizes of the agreement subtrees may carry useful information with respect to similarity. Based on the notion of the *size-of-index-structure-distribution kernel* introduced by Shin and Kuboyama, the present paper introduces positive semidefinite tree-kernels, which evaluate distributional features of the sizes of agreement subtrees, and shows efficient dynamic programming algorithms to calculate the kernels. In fact, the algorithms are of $O(|x| \cdot |y|)$ -time for labeled and ordered trees x and y . In addition, the algorithms are designed so that the agreement subtrees have roots and leaves with labels from predetermined sub-domains of an alphabet. This design will be very useful for important applications such as the XML documents.

[expand](#)

[Practical Bias Variance Decomposition](#)

[Remco R. Bouckaert](#)

Pages: 247 - 257

doi>[10.1007/978-3-540-89378-3_24](#)

Bias variance decomposition for classifiers is a useful tool in understanding classifier behavior.

Unfortunately, the literature does not provide consistent guidelines on how to apply a bias variance decomposition. This paper examines the various parameters ...

Bias variance decomposition for classifiers is a useful tool in understanding classifier behavior. Unfortunately, the literature does not provide consistent guidelines on how to apply a bias variance decomposition. This paper examines the various parameters and variants of empirical bias variance decompositions through an extensive simulation study. Based on this study, we recommend to use ten fold cross validation as sampling method and take 100 samples within each fold with a test set size of at least 2000. Only if the learning algorithm is stable, fewer samples, a smaller test set size or lower number of folds may be justified.

[expand](#)

[Using Gaussian Processes to Optimize Expensive Functions](#)

[Marcus Frean](#), [Phillip Boyle](#)

Pages: 258 - 267

doi>[10.1007/978-3-540-89378-3_25](#)

The task of finding the optimum of some function $f(x)$ is commonly accomplished by generating and testing sample solutions iteratively, choosing each new sample x heuristically on the basis of results to date. We use ...

The task of finding the optimum of some function $f(\mathbf{x})$ is commonly accomplished by generating and testing sample solutions iteratively, choosing each new sample \mathbf{x} heuristically on the basis of results to date. We use Gaussian processes to represent predictions and uncertainty about the true function, and describe how to use these predictions to choose where to take each new sample in an optimal way. By doing this we were able to solve a difficult optimization problem - finding weights in a neural network controller to simultaneously balance two vertical poles - using an order of magnitude fewer samples than reported elsewhere.

[expand](#)

[Discriminant Analysis Methods for Microarray Data Classification](#)

[Chuanliang Chen](#), [Yun-Chao Gong](#), [Rongfang Bie](#)

Pages: 268 - 277

doi>[10.1007/978-3-540-89378-3_26](#)

The studies of DNA Microarray technologies have produced high-dimensional data. In order to alleviate the "curse of dimensionality" and better analyze these data, many linear and non-linear dimension reduction methods such as PCA and LLE have been widely ...

The studies of DNA Microarray technologies have produced high-dimensional data. In order to alleviate the "curse of dimensionality" and better analyze these data, many linear and non-linear dimension reduction methods such as PCA and LLE have been widely studied. In this paper, we report our work on microarray data classification with three latest proposed discriminant analysis methods: Locality Sensitive Discriminant Analysis (LSDA), Spectral Regression Discriminant Analysis (SRDA), and Supervised Neighborhood Preserving Embedding (S-NPE). Results of experiments on four data sets show the excellent effectiveness and efficiency of SRDA.

[expand](#)

[Propositionalisation of Profile Hidden Markov Models for Biological Sequence Analysis](#)

[Stefan Mutter](#), [Bernhard Pfahringer](#), [Geoffrey Holmes](#)

Pages: 278 - 288

doi>[10.1007/978-3-540-89378-3_27](#)

Hidden Markov Models are a widely used generative model for analysing sequence data. A variant, Profile Hidden Markov Models are a special case used in Bioinformatics to represent, for example, protein families. In this paper we introduce a simple propositionalisation ...

Hidden Markov Models are a widely used generative model for analysing sequence data. A variant, Profile Hidden Markov Models are a special case used in Bioinformatics to represent, for example, protein families. In this paper we introduce a simple propositionalisation method for Profile Hidden Markov Models. The method allows the use of PHMMs discriminatively in a classification task. Previously, kernel approaches have been proposed to generate a discriminative description for an HMM, but require the explicit definition of a similarity measure for HMMs. Propositionalisation does not need such a measure and allows the use of any propositional learner including kernel-based approaches. We show empirically that using propositionalisation leads to higher accuracies in comparison with PHMMs on benchmark datasets.

[expand](#)

Section: **Machine Learning**

[Improving Promoter Prediction Using Multiple Instance Learning](#)

[P. J. Uren, R. M. Cameron-Jones, A. H. Sale](#)

Pages: 289 - 299

doi>[10.1007/978-3-540-89378-3_28](#)

Promoter prediction is a well known, but challenging problem in the field of computational biology. Eukaryotic promoter prediction, an important step in the elucidation of transcriptional control networks and gene finding, is frustrated by the complex ...

Promoter prediction is a well known, but challenging problem in the field of computational biology. Eukaryotic promoter prediction, an important step in the elucidation of transcriptional control networks and gene finding, is frustrated by the complex nature of promoters themselves. Within this paper we explore a representational scheme that describes promoters based on a variable number of salient binding sites within them. The multiple instance learning paradigm is used to allow these variable length instances to be reasoned about in a supervised learning context. We demonstrate that the procedure performs reasonably on its own, and allows for a significant increase in predictive accuracy when combined with physico-chemical promoter prediction.

[expand](#)

[Revisiting Multiple-Instance Learning Via Embedded Instance Selection](#)

[James Foulds, Eibe Frank](#)

Pages: 300 - 310

doi>[10.1007/978-3-540-89378-3_29](#)

Multiple-Instance Learning via Embedded Instance Selection (MILES) is a recently proposed multiple-instance (MI) classification algorithm that applies a single-instance base learner to a propositionalized version of MI data. However, the original authors ...

Multiple-Instance Learning via Embedded Instance Selection (MILES) is a recently proposed multiple-instance (MI) classification algorithm that applies a single-instance base learner to a propositionalized version of MI data. However, the original authors consider only one single-instance base learner for the algorithm -- the 1-norm SVM. We present an empirical study investigating the efficacy of alternative base learners for MILES, and compare MILES to other MI algorithms. Our results show that boosted decision stumps can in some cases provide better classification accuracy than the 1-norm SVM as a base learner for MILES. Although MILES provides competitive performance when compared to other MI learners, we identify simpler propositionalization methods that require shorter training times while retaining MILES' strong

classification performance on the datasets we tested.

[expand](#)

[Decision Tree Induction from Numeric Data Stream](#)

[Satoru Nishimura](#), [Masahiro Terabe](#), [Kazuo Hashimoto](#)

Pages: 311 - 317

doi>[10.1007/978-3-540-89378-3_30](#)

Hoeffding Tree Algorithm is known as a method to induce decision trees from a data stream. Treatment of numeric attribute on Hoeffding Tree Algorithm has been discussed for stationary input. It has not yet investigated, however, for non-stationary input ...

Hoeffding Tree Algorithm is known as a method to induce decision trees from a data stream. Treatment of numeric attribute on Hoeffding Tree Algorithm has been discussed for stationary input. It has not yet investigated, however, for non-stationary input where the effect of concept drift is apparent. This paper identifies three major approaches to handle numeric values, Exhaustive Method, Gaussian Approximation, and Discretization Method, and through experiment shows the best suited modeling of numeric attributes for Hoeffding Tree Algorithm. This paper also experimentally compares the performance of two known methods for concept drift detection, Hoeffding Bound Based Method and Accuracy Based Method.

[expand](#)

[L1 LASSO Modeling and Its Bayesian Inference](#)

[Junbin Gao](#), [Michael Antolovich](#), [Paul W. Kwan](#)

Pages: 318 - 324

doi>[10.1007/978-3-540-89378-3_31](#)

A new iterative procedure for solving regression problems with the so-called LASSO penalty [1] is proposed by using generative Bayesian modeling and inference. The algorithm produces the anticipated parsimonious or sparse regression models that generalize ...

A new iterative procedure for solving regression problems with the so-called LASSO penalty [1] is proposed by using generative Bayesian modeling and inference. The algorithm produces the anticipated parsimonious or sparse regression models that generalize well on unseen data. The proposed algorithm is quite robust and there is no need to specify any model hyperparameters. A comparison with state-of-the-art methods for constructing sparse regression models such as the relevance vector machine (RVM) and the local regularization assisted orthogonal least squares regression (LROLS) is given.

[expand](#)

[Discriminating Against New Classes: One-class versus Multi-class Classification](#)

[Kathryn Hempstalk](#), [Eibe Frank](#)

Pages: 325 - 336

doi>[10.1007/978-3-540-89378-3_32](#)

Many applications require the ability to identify data that is anomalous with respect to a target group of observations, in the sense of belonging to a new, previously unseen 'attacker' class. One possible approach to this kind of verification problem ...

Many applications require the ability to identify data that is anomalous with respect to a target group of observations, in the sense of belonging to a new, previously unseen 'attacker' class. One possible approach to this kind of verification problem is one-class classification, learning a description of the target class concerned based solely on data from this class. However, if known

non-target classes are available at training time, it is also possible to use standard multi-class or two-class classification, exploiting the negative data to infer a description of the target class. In this paper we assume that this scenario holds and investigate under what conditions multi-class and two-class Naïve Bayes classifiers are preferable to the corresponding one-class model when the aim is to identify examples from a new 'attacker' class. To this end we first identify a way of performing a fair comparison between the techniques concerned and present an adaptation of standard cross-validation. This is one of the main contributions of the paper. Based on the experimental results obtained, we then show under what conditions which group of techniques is likely to be preferable. Our main finding is that multi-class and two-class classification becomes preferable to one-class classification when a sufficiently large number of non-target classes is available.

[expand](#)

[Building a Decision Cluster Classification Model for High Dimensional Data by a Variable Weighting k-Means Method](#)

[Yan Li](#), [Edward Hung](#), [Korris Chung](#), [Joshua Huang](#)

Pages: 337 - 347

doi>[10.1007/978-3-540-89378-3_33](#)

In this paper, a new classification method (ADCC) for high dimensional data is proposed. In this method, a decision cluster classification model (DCC) consists of a set of disjoint decision clusters, each labeled with a dominant class that determines ...

In this paper, a new classification method (ADCC) for high dimensional data is proposed. In this method, a decision cluster classification model (DCC) consists of a set of disjoint decision clusters, each labeled with a dominant class that determines the class of new objects falling in the cluster. A cluster tree is first generated from a training data set by recursively calling a variable weighting k -means algorithm. Then, the DCC model is selected from the tree. Anderson-Darling test is used to determine the stopping condition of the tree growing. A series of experiments on both synthetic and real data sets have shown that the new classification method (ADCC) performed better in accuracy and scalability than the existing methods of k -NN, decision tree and SVM. It is particularly suitable for large, high dimensional data with many classes.

[expand](#)

[Locality Spectral Clustering](#)

[Yun-Chao Gong](#), [Chuanliang Chen](#)

Pages: 348 - 354

doi>[10.1007/978-3-540-89378-3_34](#)

In this paper, we propose a novel spectral clustering algorithm called: Locality Spectral Clustering (Lsc) which assumes that each data point can be linearly reconstructed from its local neighborhoods. ...

In this paper, we propose a novel spectral clustering algorithm called: Locality Spectral Clustering (Lsc) which assumes that each data point can be linearly reconstructed from its local neighborhoods. The Lsc algorithm firstly try to learn a smooth enough manifold structure on the data manifold and then computes the eigenvectors on the smooth manifold structure, then as former spectral clustering methods, we use the eigenvectors to help the k -means algorithm to do clustering. Experiments have been performed on toy data sets and real world data sets and have shown that our algorithm can effectively discover the cluster structure and holds much better clustering accuracy than former methods. It is also worth noting that our algorithm is also much more stable in parameter than former spectral clustering methods.

[expand](#)

[Mining Arbitrarily Large Datasets Using Heuristic k-Nearest Neighbour Search](#)

[Xing Wu](#), [Geoffrey Holmes](#), [Bernhard Pfahringer](#)

Pages: 355 - 361

doi>[10.1007/978-3-540-89378-3_35](#)

Nearest Neighbour Search (NNS) is one of the top ten data mining algorithms. It is simple and effective but has a time complexity that is the product of the number of instances and the number of dimensions. When the number of dimensions is greater than ...

Nearest Neighbour Search (NNS) is one of the top ten data mining algorithms. It is simple and effective but has a time complexity that is the product of the number of instances and the number of dimensions. When the number of dimensions is greater than two there are no known solutions that can guarantee a sublinear retrieval time. This paper describes and evaluates two ways to make NNS efficient for datasets that are arbitrarily large in the number of instances and dimensions. The methods are best described as heuristic as they are neither exact nor approximate. Both stem from recent developments in the field of data stream classification. The first uses Hoeffding Trees, an extension of decision trees to streams and the second is a direct stream extension of NNS. The methods are evaluated in terms of their accuracy and the time taken to find the neighbours. Results show that the methods are competitive with NNS in terms of accuracy but significantly faster.

[expand](#)

[Cross-Domain Knowledge Transfer Using Semi-supervised Classification](#)

[Yi Zhen](#), [Chunping Li](#)

Pages: 362 - 371

doi>[10.1007/978-3-540-89378-3_36](#)

Traditional text classification algorithms are based on a basic assumption: the training and test data should hold the same distribution. However, this identical distribution assumption is always violated in real applications. Due to the distribution ...

Traditional text classification algorithms are based on a basic assumption: the training and test data should hold the same distribution. However, this identical distribution assumption is always violated in real applications. Due to the distribution of test data from target domain and the distribution of training data from auxiliary domain are different, we call this classification problem cross-domain classification. Although most of the training data are drawn from auxiliary domain, we still can obtain a few training data drawn from target domain. To solve the cross-domain classification problem in this situation, we propose a two-stage algorithm which is based on semi-supervised classification. We firstly utilizes labeled data in target domain to filter the support vectors of the auxiliary domain, then uses filtered data and labeled data from target domain to construct a classifier for the target domain. The experimental evaluation on real-world text classification problems demonstrates encouraging results and validates our approach.

[expand](#)

[On the Limitations of Scalarisation for Multi-objective Reinforcement Learning of Pareto Fronts](#)

[Peter Vamplew](#), [John Yearwood](#), [Richard Dazeley](#), [Adam Berry](#)

Pages: 372 - 378

doi>[10.1007/978-3-540-89378-3_37](#)

Multiobjective reinforcement learning (MORL) extends RL to problems with multiple conflicting objectives. This paper argues for designing MORL systems to produce a set of solutions approximating the Pareto front, and shows that the common MORL technique ...

Multiobjective reinforcement learning (MORL) extends RL to problems with multiple conflicting objectives. This paper argues for designing MORL systems to produce a set of solutions approximating the Pareto front, and shows that the common MORL technique of scalarisation has fundamental limitations when used to find Pareto-optimal policies. The work is supported by the presentation of three new MORL benchmarks with known Pareto fronts.

[expand](#)

[An Approach for Generalising Symbolic Knowledge](#)

[Richard Dazeley](#), [Byeong-Ho Kang](#)

Pages: 379 - 385

doi>[10.1007/978-3-540-89378-3_38](#)

Many researchers and developers of knowledge based systems (KBS) have been incorporating the notion of context. However, they generally treat context as a static entity, neglecting many connectionists' work in learning hidden and dynamic contexts, which ...

Many researchers and developers of knowledge based systems (KBS) have been incorporating the notion of context. However, they generally treat context as a static entity, neglecting many connectionists' work in learning hidden and dynamic contexts, which aids generalization. This paper presents a method that models hidden context within a symbolic domain achieving a level of generalisation. Results indicate that the method can learn the information that experts have difficulty providing by generalising the captured knowledge.

[expand](#)

[Single-Cycle Image Recognition Using an Adaptive Granularity Associative Memory Network](#)

[Anang Hudaya Muhamad Amin](#), [Asad I. Khan](#)

Pages: 386 - 392

doi>[10.1007/978-3-540-89378-3_39](#)

Pattern recognition involving large-scale associative memory applications, generally constitutes tightly coupled algorithms and requires substantial computational resources. Thus these schemes do not work well on large coarse grained systems such as ...

Pattern recognition involving large-scale associative memory applications, generally constitutes tightly coupled algorithms and requires substantial computational resources. Thus these schemes do not work well on large coarse grained systems such as computational grids and are invariably unsuited for fine grained environments such as wireless sensor networks (WSN). Distributed Hierarchical Graph Neuron (DHGN) is a single-cycle pattern recognising algorithm, which can be implemented from coarse to fine grained computational networks. In this paper we describe a two-level enhancement to DHGN, which enables it to act as a standard binary image recogniser. This paper demonstrates that our single-cycle learning approach can be successfully applied to denser patterns, such as black and white images. Additionally we are able to load-balance the pattern recognition processes, irrespective of the granularity of the underlying computational network.

[expand](#)

Section: **Data Mining**

[Combined Pattern Mining: From Learned Rules to Actionable Knowledge](#)

[Yanchang Zhao](#), [Huaifeng Zhang](#), [Longbing Cao](#), [Chengqi Zhang](#), [Hans Bohlscheid](#)

Pages: 393 - 403

doi>[10.1007/978-3-540-89378-3_40](#)

Association mining often produces large collections of association rules that are difficult to understand and put into action. In this paper, we have designed a novel notion of *combined patterns* to extract useful and actionable knowledge ...

Association mining often produces large collections of association rules that are difficult to understand and put into action. In this paper, we have designed a novel notion of *combined patterns* to extract useful and actionable knowledge from a large amount of learned rules. We also present definitions of combined patterns, design novel metrics to measure their interestingness and analyze the redundancy in combined patterns. Experimental results on real-life social security data demonstrate the effectiveness and potential of the proposed approach in extracting actionable knowledge from complex data.

[expand](#)

[Efficient Single-Pass Mining of Weighted Interesting Patterns](#)

[Chowdhury Farhan Ahmed](#), [Syed Khairuzzaman Tanbeer](#), [Byeong-Soo Jeong](#), [Young-Koo Lee](#)

Pages: 404 - 415

doi>[10.1007/978-3-540-89378-3_41](#)

Mining weighted interesting patterns (WIP) [5] is an important research issue in data mining and knowledge discovery with broad applications. WIP can detect correlated patterns with a strong weight and/or support affinity. However, it still requires ...

Mining weighted interesting patterns (WIP) [5] is an important research issue in data mining and knowledge discovery with broad applications. WIP can detect correlated patterns with a strong weight and/or support affinity. However, it still requires two database scans which are not applicable for efficient processing of the real-time data like data streams. In this paper, we propose a novel tree structure, called SPWIP-tree (Single-pass Weighted Interesting Pattern tree), that captures database information using a single-pass of database and provides efficient mining performance using a pattern growth mining approach. Extensive experimental results show that our approach outperforms the existing WIP algorithm. Moreover, it is very efficient and scalable for weighted interesting pattern mining with a single database scan.

[expand](#)

[Pattern Taxonomy Mining for Information Filtering](#)

[Xujuan Zhou](#), [Yuefeng Li](#), [Peter Bruza](#), [Yue Xu](#), [Raymond Y. Lau](#)

Pages: 416 - 422

doi>[10.1007/978-3-540-89378-3_42](#)

This paper examines a new approach to information filtering by using data mining method. This new model consists of two components, namely, topic filtering and pattern taxonomy mining. The aim of using topic filtering is to quickly filter out irrelevant ...

This paper examines a new approach to information filtering by using data mining method. This new model consists of two components, namely, topic filtering and pattern taxonomy mining. The aim of using topic filtering is to quickly filter out irrelevant information based on the user profiles. The aim of applying pattern taxonomy mining techniques is to rationalize the data relevance on the reduced data set. Our experiments on Reuters RCV1(Reuters Corpus Volume 1) data collection show that more effective and efficient information access has been achieved by combining the strength of information filtering and data mining method.

[expand](#)

[An AI-Based Causal Strategy for Securing Statistical Databases Using Micro-aggregation](#)

[B. John Oommen](#), [Ebaa Fayyoumi](#)

Pages: 423 - 434

doi>[10.1007/978-3-540-89378-3_43](#)

Although Artificial Intelligent (AI) techniques have been used in various applications, their use in maintaining security in Statistical DataBases (SDBs) has not been reported. This paper presents results, ...

Although Artificial Intelligent (AI) techniques have been used in various applications, their use in maintaining security in Statistical DataBases (SDBs) has not been reported. This paper presents results, that to the best of our knowledge is pioneering, by which concepts from causal networks are used to secure SDBs. We consider the Micro-Aggregation Problem (MAP) in secure SDBs which involves partitioning a set of individual records in a micro-data file into a number of mutually exclusive and exhaustive groups. This problem, which seeks for the best partition of the micro-data file, is known to be NP-hard, and has been tackled using many heuristic solutions. In this paper, we would like to demonstrate that in the process of developing Micro-Aggregation Techniques (MATs), it is expedient to incorporate AI-based causal information about the dependence between the random variables in the micro-data file. This can be achieved by pre-processing the micro-data before invoking any MAT , in order to extract the useful dependence information from the joint probability distribution of the variables in the micro-data file, and then accomplishing the micro-aggregation on the "maximally independent" variables. Our results, on artificial life data sets, show that including such information will enhance the process of determining how many variables are to be used, and which of them should be used in the micro-aggregation process.

[expand](#)

[Additive Regression Applied to a Large-Scale Collaborative Filtering Problem](#)

[Eibe Frank, Mark Hall](#)

Pages: 435 - 446

doi>[10.1007/978-3-540-89378-3_44](#)

The much-publicized Netflix competition has put the spotlight on the application domain of collaborative filtering and has sparked interest in machine learning algorithms that can be applied to this sort of problem. The demanding nature of the Netflix ...

The much-publicized Netflix competition has put the spotlight on the application domain of collaborative filtering and has sparked interest in machine learning algorithms that can be applied to this sort of problem. The demanding nature of the Netflix data has lead to some interesting and ingenious modifications to standard learning methods in the name of efficiency and speed. There are three basic methods that have been applied in most approaches to the Netflix problem so far: stand-alone neighborhood-based methods, latent factor models based on singular-value decomposition, and ensembles consisting of variations of these techniques. In this paper we investigate the application of forward stage-wise additive modeling to the Netflix problem, using two regression schemes as base learners: ensembles of weighted simple linear regressors and k-means clustering--the latter being interpreted as a tool for multi-variate regression in this context. Experimental results show that our methods produce competitive results.

[expand](#)

[A Novel Recommending Algorithm Based on Topical PageRank](#)

[Liyang Zhang, Chunping Li](#)

Pages: 447 - 453

doi>[10.1007/978-3-540-89378-3_45](#)

In this paper, we propose a Topical PageRank based algorithm for recommender systems, which ranks products by analyzing previous user-item relationships, and recommends top-rank items to potentially interested users. In order to rank all the items for ...

In this paper, we propose a Topical PageRank based algorithm for recommender systems, which ranks products by analyzing previous user-item relationships, and recommends top-rank items to potentially interested users. In order to rank all the items for each particular user, we attempt to establish a correlation graph among items, and implement ranking process with our algorithm. We evaluate our algorithm on MovieLens dataset and empirical experiments demonstrate that it outperforms other state-of-the-art recommending algorithms.

[expand](#)

[DynamicWEB: Adapting to Concept Drift and Object Drift in COBWEB](#)

[Joel Scanlan, Jacky Hartnett, Raymond Williams](#)

Pages: 454 - 460

doi>[10.1007/978-3-540-89378-3_46](#)

Examining concepts that change over time has been an active area of research within data mining. This paper presents a new method that functions in contexts where concept drift is present, while also allowing for modification of the instances themselves ...

Examining concepts that change over time has been an active area of research within data mining. This paper presents a new method that functions in contexts where concept drift is present, while also allowing for modification of the instances themselves as they change over time. This method is well suited to domains where subjects of interest are sampled multiple times, and where they may migrate from one resultant concept to another due to Object Drift. The method presented here is an extensive modification to the conceptual clustering algorithm COBWEB, and is titled DynamicWEB.

[expand](#)

Section: **Knowledge Discovery**

[L-Diversity Based Dynamic Update for Large Time-Evolving Microdata](#)

[Xiaoxun Sun, Hua Wang, Jiuyong Li](#)

Pages: 461 - 469

doi>[10.1007/978-3-540-89378-3_47](#)

Data anonymization techniques based on enhanced privacy principles have been the focus of intense research in the last few years. All existing methods achieving privacy principles assume implicitly that the data objects to be anonymized are given once ...

Data anonymization techniques based on enhanced privacy principles have been the focus of intense research in the last few years. All existing methods achieving privacy principles assume implicitly that the data objects to be anonymized are given once and fixed, which makes it unsuitable for time evolving data. However, in many applications, the real world data sources are dynamic. In such dynamic environments, the current techniques may suffer from poor data quality and/or vulnerability to inference. In this paper, we investigate the problem of updating large time-evolving microdata based on the sophisticated l -diversity model, in which it requires that every group of indistinguishable records contains at least l distinct sensitive attribute values; thereby the risk of attribute disclosure is kept under $1/l$. We analyze how to maintain the l -diversity against time evolving updating. The experimental results show that the updating technique is very efficient in terms of effectiveness and data quality.

[expand](#)

[Knowledge Discovery from Honeypot Data for Monitoring Malicious Attacks](#)

[Huidong Jin, Olivier Vel, Ke Zhang, Nianjun Liu](#)

Pages: 470 - 481

doi>[10.1007/978-3-540-89378-3_48](https://doi.org/10.1007/978-3-540-89378-3_48)

Owing to the spread of worms and botnets, cyber attacks have significantly increased in volume, coordination and sophistication. Cheap rentable botnet services, e.g., have resulted in sophisticated botnets becoming an effective and popular tool for committing ...

Owing to the spread of worms and botnets, cyber attacks have significantly increased in volume, coordination and sophistication. Cheap rentable botnet services, e.g., have resulted in sophisticated botnets becoming an effective and popular tool for committing online crime these days. Honeypots, as information system traps, are monitoring or deflecting malicious attacks on the Internet. To understand the attack patterns generated by botnets by virtue of the analysis of the data collected by honeypots, we propose an approach that integrates a clustering structure visualisation technique with outlier detection techniques. These techniques complement each other and provide end users both a big-picture view and actionable knowledge of high-dimensional data. We introduce KNOF (K-nearest Neighbours Outlier Factor) as the outlier definition technique to reach a trade-off between global and local outlier definitions, i.e., K -Nearest Neighbour (KNN) and Local Outlier Factor (LOF) respectively. We propose an algorithm to discover the most significant KNOF outliers. We implement these techniques in our hpdAnalyzer tool. The tool is successfully used to comprehend honeypot data. A series of experiments show that our proposed KNOF technique substantially outperforms LOF and, to a lesser degree, KNN for real-world honeypot data.

[expand](#)

[Detecting the Knowledge Boundary with Prudence Analysis](#)

[Richard Dazeley, Byeong-Ho Kang](#)

Pages: 482 - 488

doi>[10.1007/978-3-540-89378-3_49](https://doi.org/10.1007/978-3-540-89378-3_49)

Prudence analysis (PA) is a relatively new, practical and highly innovative approach to solving the problem of brittleness in knowledge based systems (KBS). PA is essentially an online validation approach, where as each situation or case is presented ...

Prudence analysis (PA) is a relatively new, practical and highly innovative approach to solving the problem of brittleness in knowledge based systems (KBS). PA is essentially an online validation approach, where as each situation or case is presented to the KBS for inferencing the result is simultaneously validated. This paper introduces a new approach to PA that analyses the structure of knowledge rather than the comparing cases with archived situations. This new approach is positively compared against earlier systems for PA, strongly indicating the viability of the approach.

[expand](#)

Section: **Soft Computing**

[Clustering with XCS on Complex Structure Dataset](#)

[Liangdong Shi, Yang Gao, Lei Wu, Lin Shang](#)

Pages: 489 - 499

doi>[10.1007/978-3-540-89378-3_50](https://doi.org/10.1007/978-3-540-89378-3_50)

Learning Classifier System (LCS) is an effective tool to solve classification problems. Clustering with XCS (accuracy-based LCS) is a novel approach proposed recently. In this paper, we revise the framework of XCS, and present a complete framework of ...

Learning Classifier System (LCS) is an effective tool to solve classification problems. Clustering with XCS (accuracy-based LCS) is a novel approach proposed recently. In this paper, we revise the framework of XCS, and present a complete framework of clustering with XCS. XCS consists of two major modules: reinforcement learning and genetic algorithm. After the learning process, the

learnt rules are always redundant and the large ruleset is incomprehensive. We adopt the revised compact rule algorithm to compress the ruleset, and propose a new rule merging algorithm to merge rules for generating genuine clustering results without knowing of the number of clusters. The experiment results on several complex structure datasets show that our approach performs well on challenging synthetic datasets.

[expand](#)

[Evolution of Multiple Tree Structured Patterns from Tree-Structured Data Using Clustering](#)
[Masatoshi Nagamine](#), [Tetsuhiro Miyahara](#), [Tetsuji Kuboyama](#), [Hiroaki Ueda](#), [Kenichi Takahashi](#)
Pages: 500 - 511

doi>[10.1007/978-3-540-89378-3_51](#)

We propose a new genetic programming approach to extraction of multiple tree structured patterns from tree-structured data using clustering. As a combined pattern we use a set of tree structured patterns, called tag tree patterns. A structured variable ...

We propose a new genetic programming approach to extraction of multiple tree structured patterns from tree-structured data using clustering. As a combined pattern we use a set of tree structured patterns, called tag tree patterns. A structured variable in a tag tree pattern can be substituted by an arbitrary tree. A set of tag tree patterns matches a tree, if at least one of the set of patterns matches the tree. By clustering positive data and running GP subprocesses on each cluster with negative data, we make a combined pattern which consists of best individuals in GP subprocesses. The experiments on some glycan data show that our proposed method has a higher support of about 0.8 while the previous method for evolving single patterns has a lower support of about 0.5.

[expand](#)

[Application of a Memetic Algorithm to the Portfolio Optimization Problem](#)
[Claus Aranha](#), [Hitoshi Iba](#)

Pages: 512 - 521

doi>[10.1007/978-3-540-89378-3_52](#)

We use local search to improve the performance of Genetic Algorithms applied the problem of Financial Portfolio Selection and Optimization. Our work describes the Tree based Genetic Algorithm for Portfolio Optimization. To improve this evolutionary system, ...

We use local search to improve the performance of Genetic Algorithms applied the problem of Financial Portfolio Selection and Optimization. Our work describes the Tree based Genetic Algorithm for Portfolio Optimization. To improve this evolutionary system, we introduce a new guided crossover operator, which we call the BWS, and add a local optimization step. The performance of the system increases noticeably on simulated experiments with historical data.

[expand](#)

[Predicting Trading Signals of Stock Market Indices Using Neural Networks](#)
[Chandima D. Tilakaratne](#), [Musa A. Mammadov](#), [Sidney A. Morris](#)

Pages: 522 - 531

doi>[10.1007/978-3-540-89378-3_53](#)

The aim of this paper is to develop new neural network algorithms to predict trading signals: buy, hold and sell, of stock market indices. Most commonly used classification techniques are not suitable to predict trading signals when the distribution ...

The aim of this paper is to develop new neural network algorithms to predict trading signals:

buy, hold and sell, of stock market indices. Most commonly used classification techniques are not suitable to predict trading signals when the distribution of the actual trading signals, among these three classes, is imbalanced. In this paper, new algorithms were developed based on the structure of feedforward neural networks and a modified Ordinary Least Squares (OLS) error function. An adjustment relating to the contribution from the historical data used for training the networks, and the penalization of incorrectly classified trading signals were accounted for when modifying the OLS function. A global optimization algorithm was employed to train these networks. The algorithms developed in this study were employed to predict the trading signals of day ($t + 1$) of the Australian All Ordinary Index. The algorithms with the modified error functions introduced by this study produced better predictions.

[expand](#)

[A Fuzzy Decision Support System for Garment New Product Development](#)

[Jie Lu](#), [Yijun Zhu](#), [Xianyi Zeng](#), [Ludovic Koehl](#), [Jun Ma](#), [Guangquan Zhang](#)

Pages: 532 - 543

doi>[10.1007/978-3-540-89378-3_54](https://doi.org/10.1007/978-3-540-89378-3_54)

Garment new product development (NPD) evaluation requires considering multiple criteria under a hierarchical structure. The evaluation process often involves uncertainty and fuzziness in both the relationships between criteria and the judgments of evaluators. ...

Garment new product development (NPD) evaluation requires considering multiple criteria under a hierarchical structure. The evaluation process often involves uncertainty and fuzziness in both the relationships between criteria and the judgments of evaluators. This study first presents a garment NPD evaluation model under a well-being concept. It then proposes a fuzzy multi-criteria group decision-making (FMCGDM) method to evaluate garment NPD. The advantages of the FMCGDM method include handling criteria in a hierarchical structure, dealing with three kinds of uncertainties simultaneously, and using suitable types of fuzzy numbers to describe linguistic terms. A fuzzy multi-criteria group decision support system (FMCGDSS) is developed to implement the proposed method. Finally a garment NPD evaluation case study demonstrates the proposed method and software system.

[expand](#)

[A Hybrid Nonlinear-Discriminant Analysis Feature Projection Technique](#)

[Rami N. Khushaba](#), [Ahmed Al-Ani](#), [Adel Al-Jumaily](#), [Hung T. Nguyen](#)

Pages: 544 - 550

doi>[10.1007/978-3-540-89378-3_55](https://doi.org/10.1007/978-3-540-89378-3_55)

Feature set dimensionality reduction via Discriminant Analysis (DA) is one of the most sought after approaches in many applications. In this paper, a novel nonlinear DA technique is presented based on a hybrid of Artificial Neural Networks (ANN) and ...

Feature set dimensionality reduction via Discriminant Analysis (DA) is one of the most sought after approaches in many applications. In this paper, a novel nonlinear DA technique is presented based on a hybrid of Artificial Neural Networks (ANN) and the Uncorrelated Linear Discriminant Analysis (ULDA). Although dimensionality reduction via ULDA can present a set of statistically uncorrelated features, but similar to the existing DA's it assumes that the original data set is linearly separable, which is not the case with most real world problems. In order to overcome this problem, a one layer feed-forward ANN trained with a Differential Evolution (DE) optimization technique is combined with ULDA to implement a nonlinear feature projection technique. This combination acts as nonlinear discriminant analysis. The proposed approach is validated on a Brain Computer Interface (BCI) problem and compared with other techniques.

[expand](#)

Section: **Vision and Image Processing**

[Learning Object Representations Using Sequential Patterns](#)

[Nobuyuki Morioka](#)

Pages: 551 - 561

doi>[10.1007/978-3-540-89378-3_56](#)

This paper explores the use of alternating sequential patterns of local features and saccading actions to learn robust and compact object representations. The temporal encoding represents the spatial relations between local features. We view the problem ...

This paper explores the use of alternating sequential patterns of local features and saccading actions to learn robust and compact object representations. The temporal encoding represents the spatial relations between local features. We view the problem of object recognition as a sequential prediction task. Our method uses a Discriminative Variable Memory Markov (DVMM) model that precisely captures underlying characteristics of multiple statistical sources that generate sequential patterns in a stochastic manner. By pruning out long sequential patterns when there is no further information gain over shorter and discriminative ones, the DVMM model is able to represent multiple objects succinctly. Experimental results show that the DVMM model performs significantly better compared to various other supervised learning algorithms that use a bag-of-features approach.

[expand](#)

[Character Recognition Using Hierarchical Vector Quantization and Temporal Pooling](#)

[John Thornton, Jolon Faichney, Michael Blumenstein, Trevor Hine](#)

Pages: 562 - 572

doi>[10.1007/978-3-540-89378-3_57](#)

In recent years, there has been a cross-fertilization of ideas between computational neuroscience models of the operation of the neocortex and artificial intelligence models of machine learning. Much of this work has focussed on the mammalian visual ...

In recent years, there has been a cross-fertilization of ideas between computational neuroscience models of the operation of the neocortex and artificial intelligence models of machine learning. Much of this work has focussed on the mammalian visual cortex, treating it as a hierarchically-structured pattern recognition machine that exploits statistical regularities in retinal input. It has further been proposed that the neocortex represents sensory information probabilistically, using some form of Bayesian inference to disambiguate noisy data.

In the current paper, we focus on a particular model of the neocortex developed by Hawkins, known as hierarchical temporal memory (HTM). Our aim is to evaluate an important and recently implemented aspect of this model, namely its ability to represent temporal sequences of input within a hierarchically structured vector quantization algorithm. We test this *temporal pooling* feature of HTM on a benchmark of cursive handwriting recognition problems and compare it to a current state-of-the-art support vector machine implementation. We also examine whether two pre-processing techniques can enhance the temporal pooling algorithm's performance. Our results show that a relatively simple temporal pooling approach can produce recognition rates that approach the current state-of-the-art without the need for extensive tuning of parameters. We also show that temporal pooling performance is surprisingly unaffected by the use of preprocessing techniques.

[expand](#)

[Learning a Generative Model for Structural Representations](#)

[Andrea Torsello, David L. Dowe](#)

Pages: 573 - 583

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Graph-based representations have been used with considerable success in computer vision in the abstraction and recognition of object shape and scene structure. Despite this, the methodology available for learning structural representations from sets of training examples is relatively limited. This paper addresses the problem of learning archetypal structural models from examples. To this end we define a generative model for graphs where the distribution of observed nodes and edges is governed by a set of independent Bernoulli trials with parameters to be estimated from data in a situation where the correspondences between the nodes in the data graphs and the nodes in the model are not known *ab initio* and must be estimated from local structure. This results in an EM-like approach where we alternate the estimation of the node correspondences with the estimation of the model parameters. The former estimation is cast as an instance of graph matching, while the latter estimation, together with model order selection, is addressed within a Minimum Message Length (MML) framework. Experiments on a shape recognition task show the effectiveness of the proposed learning approach.

[expand](#)

Section: **AI Applications**

[Using Stereotypes to Improve Early-Match Poker Play](#)

[Robert Layton](#), [Peter Vamplew](#), [Chris Turville](#)

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[expand](#)

[CASPER: A Case-Based Poker-Bot](#)

[Ian Watson](#), [Jonathan Rubin](#)

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This paper investigates the use of the case-based reasoning methodology applied to the game of Texas hold'em poker. The development of a CASE-based Poker playER (CASPER) is described. CASPER uses knowledge of previous poker scenarios to inform its betting decisions. CASPER improves upon previous case-based reasoning approaches to poker and is able to play evenly against the University of Alberta's Pokibots and Simbots, from which it acquired its case-bases

and updates previously published research by showing that CASPER plays profitably against human online competitors for play money. However, against online players for real money CASPER is not profitable. The reasons for this are briefly discussed.

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[A Generalized Joint Inference Approach for Citation Matching](#)

[Zhihua Liao, Zili Zhang](#)

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Citation matching is the problem of extracting bibliographic records from citation lists in technical papers, and merging records that represent the same publication. Generally, there are three types of data- sets in citation matching, i.e., sparse, dense and hybrid types. Typical approaches for citation matching are Joint Segmentation (Jnt-Seg) and Joint Segmentation Entity Resolution (Jnt-Seg-ER). Jnt-Seg method is effective at processing sparse type datasets, but often produces many errors when applied to dense type datasets. On the contrary, Jnt-Seg-ER method is good at dealing with dense type datasets, but insufficient when sparse type datasets are presented. In this paper we propose an alternative *joint inference* approach---Generalized Joint Segmentation (Generalized-Jnt-Seg). It can effectively deal with the situation when the dataset type is unknown. Especially, in hybrid type datasets analysis there is often no a priori information for choosing Jnt-Seg method or Jnt-Seg-ER method to process segmentation and entity resolution. Both methods may produce many errors. Fortunately, our method can effectively avoid error of segmentation and produce well field boundaries. Experimental results on both types of citation datasets show that our method outperforms many alternative approaches for citation matching.

[expand](#)

[Agent-Based Collaborative System and Case-Based Conflict Resolution Process in Preliminary Ship Design](#)

[Kyung Ho Lee, Jae Joon Lee, Young Soo Han, Jung Min Lee, Byung Hak Lee](#)

Pages: 608 - 614

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Recently, the shipbuilding companies are assigning design and production environments around the world in different areas. Therefore, the concept of simultaneous engineering and concurrent design becomes very significant. In this paper, a basic architecture of an agent system is proposed to support the exchange and sharing of design information by means of ACL (Agent Communication Language) in preliminary ship design. Above all, the conflicts that occur in the middle of knowledge sharing in the system must be resolved. One approach is to adopt a case-based conflict resolution strategy formulated to resolve current conflict on the basis of previous resolved similar cases in agent-based collaborative design system environments. In addition, conflict resolution handler located in the facilitator which is an agent to control other sub-agents, is developed to treat conflict problems effectively.

[expand](#)

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