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CIS Publication Spotlight

IEEE Transactions on Neural Networks and Learning Systems

Maintaining the Integrity of Sources in Complex Learning Systems: Intraference and the Correlation Preserving Transform, by C.C. Took, S.C. Douglas, and D.P. Mandic, *IEEE Transactions on Neural Networks and Learning Systems*, Vol. 26, No. 3, March 2015, pp. 500–509.

Digital Object Identifier: 10.1109/TNNLS.2014.2316175

"The correlation preserving transform (CPT) is introduced to perform bivariate component analysis via decorrelating matrix decompositions, while at the same time preserving the integrity of original bivariate sources. Specifically, unlike existing bivariate uncorrelating matrix decomposition techniques, CPT is designed to preserve both the order of the data channels within every bivariate source and their mutual correlation properties. The notion of intraference is introduced to quantify the effects of interchannel mixing artifacts within recovered bivariate sources, and it is shown that the integrity of separated sources is compromised when not accounting for the intrinsic correlations within bivariate sources, as is the case with current bivariate matrix decompositions. The CPT is based on augmented complex statistics and involves finding the correct conjugate eigenvectors associated with the pseudocovariance matrix, making it possible to maintain the physical meaning of the separated sources. The benefits of CPT are illustrated in the source separation and clustering scenarios, for both synthetic and real–world data."

IMAGE LICENSED BY GRAPHIC STOCK

Multiple Actor–Critic Structures for Continuous-Time Optimal Control Using Input–Output Data, by R. Song, F. Lewis, Q. Wei, H. Zhang, Z. Jiang, and D. Levine, *IEEE Transactions on Neural Networks and Learning Systems*, Vol. 26, No. 4, April 2015, pp. 851–865.

Digital Object Identifier: 10.1109/TNNLS.2015.2399020

"In industrial process control, there may be multiple performance objectives, depending on salient features of the input–output data. Aiming at this situation, this paper proposes multiple actor–critic structures to obtain the optimal control via input–output data for unknown nonlinear systems. The shunting inhibitory artificial neural network (SIANN) is used to classify the input–output data into one of several categories. Different performance measure functions may be defined for disparate categories. The approximate dynamic programming algorithm, which contains model module, critic network, and action network, is used to establish the optimal control in each category. A recurrent neural network (RNN) model is used to reconstruct the unknown system dynamics using input–output data. NNs are used to approximate the critic and action networks, respectively. It is proven that the model error and the closed unknown system are uniformly ultimately bounded. Simulation results demonstrate the performance of the proposed optimal control scheme for the unknown nonlinear system."

IEEE Transactions on Fuzzy Systems

Linguistic Descriptions for Automatic Generation of Textual Short-Term Weather Forecasts on Real Prediction Data, by A. Ramos-Soto, A.J. Bugarín, S. Barro, and J. Taboada, *IEEE Transactions on Fuzzy Systems*, Vol. 23, No. 1, February 2015, pp. 44–57.

Digital Object Identifier: 10.1109/TFUZZ.2014.2328011

"In this paper, the authors present an innovative way computing with perceptions techniques and strategies for linguistic description of data, together with a natural language generations (NLG) system practical application, to deal with real-life applications that can automatically generate textual short-term weather forecasts for every municipality in Galicia.

Furthermore, the automatically generated textual forecasts were thoroughly evaluated by a meteorologist in order to assess the quality of their contents and to check whether his expert knowledge was included correctly. The real data is obtained from the Galician Meteorology Agency (MeteoGalicia), and then, the application, which is named GALiWeather, extracts relevant information into intermediate descriptions using linguistic variables and temporal references. The obtained results show that the textual forecasts fulfill the expert's requirements in a very high degree (4.83 out of 5). Finally, GALiWeather will be released as a real service, offering custom forecasts for a wide public."

"In this study, the authors propose both a design technique and a new partitioning-based clustering algorithm which can be used to assist the data analyst while looking for a set of meaningful clusters. Following an observer metaphor according to which the perception of a group of objects depends on the observer position—the closer an observer is from an image more details (s)he perceives—the authors resort to shrinkage to incorporate a regularization term, accounting for the observation point, within the objective function of an otherwise unbiased clustering algorithm. This technique allows the resulting biased algorithm to generate a set of reasonable partitions. Experimental studies on both synthetic and real data are included to illustrate the usefulness of the approach. In addition, and as a convenient side effect of using shrinkage, the experimental results suggest that the proposed biased algorithm not only seems to scale better than the successive runs of the unbiased one but on the average, seems to produce clusters exhibiting higher validity index values as well."

IEEE Transactions on Evolutionary Computation

"More than a decade after the first extensive overview on parameter control, the authors revisit the field and present a survey of the state-of-the-art. They briefly summarize the development of the field and discuss existing work related to each major parameter or component of an evolutionary algorithm. Based on this overview, they observe trends in the area, identify some (methodological) shortcomings, and give recommendations for future research."

"This paper examines the behavior of three classes of evolutionary multiobjective optimization (EMO) algorithms on many-objective knapsack problems. They are Pareto dominance-based, scalarizing function-based, and hypervolume-based algorithms. The NSGA-II, MOEA/D, SMS-EMOA and HypE are examined using knapsack problems with 2-10 objectives. Experimental results on randomly generated many-objective knapsack problems are consistent with well-known performance deterioration of Pareto dominance-based algorithms. That is, the NSGA-II is outperformed by the other algorithms. However, it is also shown that NSGA-II outperforms the other algorithms when objectives are highly correlated. The MOEA/D shows totally different search behavior depending on the choice of a scalarizing function and its parameter value. Some MOEA/D vari-

ants work very well only on two-objective problems while others work well on many-objective problems with 4-10 objectives. Interesting observations are also obtained, such as the performance improvement by similar parent recombination and the necessity of diversity improvement for many-objective knapsack problems."

IEEE Transactions on Computational Intelligence and AI in Games

"The game of Amazons is a modern board game with simple rules and nice mathematical properties. It has a high computational complexity. In 2001, the starting position on a 5×5 board was proven to be a first player win. The enhanced Amazons solver presented here extends previous work in the following five ways: by building more powerful endgame databases, including a new type of databases for so-called blocker territories, by improving the rules for computing bounds on complex game positions, by local search to find tighter local bounds, by using ideas from combinatorial game theory to find wins earlier, and by using a df-pn based solver. Using the improved solver, the starting positions for Amazons on the 4×5, 5×4, 4×6, 5×6, and 4×7 boards were shown to be first player wins, while 6×4 is a second player win. The largest proof, for the 5×6 board, is presented in detail."

IEEE Transactions on Autonomous Mental Development

"Vision gives primates a wealth of information useful to manipulate the environment, but at the same time it can easily overwhelm their computational resources. Active vision is a key solution found by nature to solve this problem: a limited fovea actively displaced in space to collect only relevant information. Here the authors highlight that in eco-logical conditions this solution encoun-ters four problems: 1) the agent needs to learn where to look based on its goals; 2) manipulation causes learning feed-back in areas of space possibly outside the attention focus; 3) good visual actions are needed to guide manipula-tion actions, but only these can generate learning feedback; and 4) a limited fovea causes aliasing problems. The authors then propose a computational architec-ture ("BITPIC") to overcome the four problems. The system is tested with a simple simulated camera–arm robot solving a class of search-and-reach tasks. The results show that the architecture solves the problems, and hence the tasks, very efficiently, and highlight how the architecture principles can contribute to a full exploitation of the advantages of active vision in ecological conditions."

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