0555605 - ÚI 2022 RIV NL eng J - Článek v odborném periodiku
Keikha, Vahideh - Aghamolaei, S. - Mohades, A. - Ghodsi, M.
Clustering Geometrically-Modeled Points in the Aggregated Uncertainty Model.
Fundamenta Informaticae. Roč. 184, č. 3 (2021), s. 205-231. ISSN 0169-2968. E-ISSN 1875-8681
Grant CEP: GA ČR(CZ) GJ19-06792Y
Institucionální podpora: RVO:67985807
Klíčová slova: k-center * Uncertain data * Approximation algorithms
Obor OECD: Computer sciences, information science, bioinformathics (hardware development to be 2.2, social aspect to be 5.8)
Impakt faktor: 1.333, rok: 2020
Způsob publikování: Omezený přístup
http://dx.doi.org/10.3233/FI-2021-2097
 DOI: 10.3233/FI-2021-2097
The k-center problem is to choose a subset of size k from a set of n points such that the maximum distance from each point to its nearest center is minimized. Let Q = {Q1,... , Qn} be a set of polygons or segments in the region-based uncertainty model, in which each Qi is an uncertain point, where the exact locations of the points in Qi are unknown. The geometric objects such as segments and polygons can be models of a point set. We define the uncertain version of the k-center problem as a generalization in which the objective is to find k points from Q to cover the remaining regions of Q with minimum or maximum radius of the cluster to cover at least one or all exact instances of each Qi, respectively. We modify the region-based model to allow multiple points to be chosen from a region, and call the resulting model the aggregated uncertainty model. All these problems contain the point version as a special case, so they are all NP-hard with a lower bound 1.822 for the approximation factor. We give approximation algorithms for uncertain k-center of a set of segments and polygons. We also have implemented some of our algorithms on a data-set to show our theoretical performance guarantees can be achieved in practice.
Trvalý link: http://hdl.handle.net/11104/0330069

0553293 - ÚI 2023 RIV CH eng J - Článek v odborném periodiku
Yaseen, M. - Latif, Yasir - Waseem, M. - Leta, M. K. - Abbas, S. - Bhatti, H. A.
Contemporary Trends in High and Low River Flows in Upper Indus Basin, Pakistan.
Water. Roč. 14, č. 3 (2022), č. článku 337. E-ISSN 2073-4441
Institucionální podpora: RVO:67985807
Klíčová slova: Upper Indus Basin * streamflows * flow extremes * high and low flows * Mann-Kendall * Jhelum River basin * Kabul River basin * significant trends * climate change
Obor OECD: Hydrology
Impakt faktor: 3.103, rok: 2020
Způsob publikování: Open access
http://dx.doi.org/10.3390/w14030337
 DOI: 10.3390/w14030337

The Upper Indus Basin (UIB) features the high mountain ranges of the Hindukush, Karakoram and Himalaya (HKH). The snow and glacier meltwater contribution feeds 10 major river basins downstream including Astore, Gilgit, Hunza, Jhelum, Kabul, Shyok and Shigar. Climate change is likely to fluctuate the runoff generated from such river basins concerning high and low streamflows. Widening the lens of focus, the present study examines the magnitude and timing of high flows variability as well as trends variability in low streamflows using Sen's slope and the Mann-Kendall test in UIB from 1981 to 2016. The results revealed that the trend in the magnitude of the high flows decreased at most of the sub-basins including the Jhelum, Indus and Kabul River basins. Significantly increased high flows were observed in the glacier regime of UIB at Shigar and Shyok while decreased flows were predominant in Hunza River at Daniyor Bridge. A similar proclivity of predominantly reduced flows was observed in nival and rainfall regimes in terms of significant negative trends in the Jhelum, Kunhar, Neelum and Poonch River basins. The timing of the high flows has not changed radically as magnitude at all gauging stations. For the low flows, decreasing significant trends were detected in the annual flows as well as in other extremes of low flows (1-day, 7-day, 15-day). The more profound and decreasing pattern of low flows was observed in summer at most of the gauging stations; however, such stations exhibited increased low flows in autumn, winter and spring. The decrease in low flows indicates the extension of dry periods particularly in summer. The high-water demand in summer will be compromised due to consistently reducing summer flows; the lower the water availability, the lower will be the crop yield and electricity generation.
Trvalý link: http://hdl.handle.net/11104/0328272

0553671 - ÚI 2023 CH eng J - Článek v odborném periodiku
Aghamolaei, S. - Keikha, Vahideh - Ghodsi, M. - Mohades, A.
Sampling and sparsification for approximating the packedness of trajectories and detecting gatherings.
International Journal of Data Science and Analytics. Online 29 January 2022 (2022). ISSN 2364-415X. E-ISSN 2364-4168

Packedness is a measure defined for curves as the ratio of maximum curve length inside any disk divided by its radius. Sparsification allows us to reduce the number of candidate disks for maximum packedness to a polynomial amount in terms of the number of vertices of the polygonal curve. This gives an exact algorithm for computing packedness. We prove that using a fat shape, such as a square, instead of a disk gives a constant factor approximation for packedness. Further sparsification using well-separated pair decomposition improves the time complexity at the cost of losing some accuracy. By adjusting the ratio of the separation factor and the size of the query, we improve the approximation factor of the existing algorithm for packedness using square queries. Our experiments show that uniform sampling works well for finding the average packedness of trajectories with almost constant speed. The empirical results confirm that the sparsification method approximates the maximum packedness for arbitrary polygonal curves. In big data models such as massively parallel computations, both sampling and sparsification are efficient and take a constant number of rounds. Most existing algorithms use line-sweeping which is sequential in nature. Also, we design two data-structures for computing the length of the curve inside a query shape: an exact data-structure for disks called hierarchical aggregated queries and an approximate data-structure for a given set of square queries. Using our modified segment tree, we achieve a near-linear time approximation algorithm.
Trvalý link: http://hdl.handle.net/11104/0328418

0553149 - BC 2022 RIV DE eng J - Článek v odborném periodiku

Šmejkal, Marek - Bartoň, Daniel - Brabec, Marek - Sajdlová, Zuzana - Souza, Allan T. - Moraes, Karlos Ribeiro de - Soukalová, Kateřina - Blabolil, Petr - Vejřík, Lukáš - Kubečka, Jan

Climbing up the ladder: male reproductive behaviour changes with age in a long-lived fish.

Behavioral Ecology and Sociobiology. Roč. 75, č. 1 (2021), č. článku 22. ISSN 0340-5443. E-ISSN 1432-0762

High reproductive performance is the key attribute of male fitness, especially due to the high reproductive skew among the males of most animal species. Males of long-lived iteroparous species have opportunities to improve upon their previous reproductive attempts with increasing age. We collected individual-specific reproductive behaviour and age data on a cyprinid fish, the asp (Leuciscus aspius), from 2015 to 2019. We tested whether males changed their performance over time using a unique dataset where individual performance was recorded yearly with passive telemetry. Individual fish behaviour was tracked from one to five reproductive seasons at least a year after the tagging. Fish were scored by measures of quality (first arrival time, number of visits and time spent in the reproductive grounds, and encountered proportion of males to all adult fish). In general, fish improved in the first three metrics with age, suggesting a shift towards behaviours likely to enhance reproductive success as individuals aged. A larger size at tagging was predictive of earlier fish arrival on the spawning ground in subsequent years. Our study therefore demonstrates the importance of age as a factor when considering the potential reproductive success of long-lived fish species.
Trvalý link: http://hdl.handle.net/11104/0328154

0554068 - ÚI 2022 RIV US eng J - Článek v odborném periodiku

Cooley, O. - Garbe, F. - Hng, E. K. - Kang, M. - Sanhueza-Matamala, Nicolás - Zalla, J.

Longest Paths in Random Hypergraphs.

SIAM Journal on Discrete Mathematics. Roč. 35, č. 4 (2021), s. 2430-2458. ISSN 0895-4801. E-ISSN 1095-7146

Given integers k, j with $1 < j < k - 1$, we consider the length of the longest j-tight path in the binomial random k-uniform hypergraph $H_k(n, p)$. We show that this length undergoes a phase transition from logarithmic length to linear and determine the critical threshold, as well as proving upper and lower bounds on the length in the subcritical and supercritical ranges. In particular, for the supercritical case we introduce the Pathfinder algorithm, a depth-first search algorithm which discovers j-tight paths in a k-uniform hypergraph. We prove that, in the supercritical case, with high probability this algorithm will find a long j-tight path.
Trvalý link: http://hdl.handle.net/11104/0328687

0553385 - ÚI 2022 RIV CH eng C - Konferenční příspěvek (zahraniční konf.)
Sedlár, Igor
Propositional Dynamic Logic with Quantification over Regular Computation Sequences.
Logical Foundations of Computer Science. International Symposium, LFCS 2022, Deerfield Beach, FL, USA, January 10–13, 2022, Proceedings. Cham: Springer, 2022 - (Artemov, S.; Nerode, A.), s. 301-315. Lecture Notes in Computer Science, 13137. ISBN 978-3-030-93099-8. ISSN 0302-9743.
[LFCS 2022: International Symposium on Logical Foundations of Computer Science. Deerfield Beach / Virtual (US), 10.01.2022-13.01.2022]
Institucionální podpora: RVO:67985807
Klíčová slova: Finite automata * Planning * Propositional dynamic logic * Quantification
Obor OECD: Pure mathematics
http://dx.doi.org/10.1007/978-3-030-93100-1_19
 DOI: 10.1007/978-3-030-93100-1_19
We extend test-free regular propositional dynamic logic with operators expressing combinations of existential and universal quantifiers quantifying over computation sequences represented by a given regular expression and states accessible via these computation sequences. This extended language is able to express that there is a computation sequence represented by a given regular expression that leads only to states where a given formula is satisfied, or that for all computation sequences represented by a given regular expression there is a state accessible via the computation sequence where a given formula is satisfied. Such quantifier combinations are essential in expressing, for instance, that a given non-deterministic finite automaton accepts all words of a given regular language or that there is a specific sequence of actions instantiating a plan expressed by a regular expression that is guaranteed to accomplish a certain goal. The existential-universal quantifier combination is modelled by neighborhood functions. We prove that a rich fragment of our logic is decidable and EXPTIME -complete by embedding the fragment into deterministic propositional dynamic logic.
Trvalý link: http://hdl.handle.net/11104/0328339

0554126 - ÚI 2022 RIV NL eng C - Konferenční příspěvek (zahraniční konf.)
Piga, S. - Sanhueza-Matamala, Nicolás
Codegree conditions for cycle decompositions and Euler tours in 3-uniform hypergraphs.
Procedia Computer Science. Vol. 195. Amsterdam: Elsevier, 2021 - (Ferreira, C.; Lee, O.; Miyazawa, F.), s. 152-162. ISSN 1877-0509.
[LAGOS 2021: Latin and American Algorithms, Graphs and Optimization Symposium /11./. Sao Paulo (BR), 01.05.2021-01.05.2021]
Grant CEP: GA ČR(CZ) GA19-08740S
Institucionální podpora: RVO:67985807
Klíčová slova: Cycles * Decompositions * Euler tours * Hypergraphs
http://dx.doi.org/10.1016/j.procs.2021.11.043
 DOI: 10.1016/j.procs.2021.11.043
We show that 3-graphs whose codegree is at least $(2/3 + o(1))n$ can be decomposed into tight cycles and admit Euler tours, subject to the trivial necessary divisibility conditions. We also provide a construction showing that our bounds are best possible up to the $o(1)$ term. All together, our results answer in the negative some recent questions of Glock, Joos, Kühn and Osthus.
Trvalý link: http://hdl.handle.net/11104/0328760

0553132 - ÚI 2022 RIV CZ eng C - Konferenční příspěvek (zahraniční konf.)
Kalina, Jan - Vidnerová, Petra
Application Of Implicitly Weighted Regression Quantiles: Analysis Of The 2018 Czech Presidential Election.
RELIK 2021. Conference Proceedings. Prague: Prague University of Economics and Business, 2021 - (Langhamrová, J.; Vrabcová, J.), s. 332-341. ISBN 978-80-245-2429-0.
[RELIK 2021: Reproduction of Human Capital - mutual links and connections. Praha (CZ), 04.11.2021-05.11.2021]

Klíčová slova: linear regression * quantile regression * robustness * outliers * elections results
Obor OECD: Political science
https://relik.vse.cz/2021/download/pdf/381-Vidnerova-Petra-paper.pdf

Regression quantiles can be characterized as popular tools for a complex modeling of a continuous response variable conditioning on one or more given independent variables. Because they are however vulnerable to leverage points in the regression model, an alternative approach denoted as implicitly weighted regression quantiles have been proposed. The aim of current work is to apply them to the results of the second round of the 2018 presidential election in the Czech Republic. The election results are modeled as a response of 4 demographic or economic predictors over the 77 Czech counties. The analysis represents the first application of the implicitly weighted regression quantiles to data with more than one regressor. The results reveal the implicitly weighted regression quantiles to be indeed more robust with respect to leverage points compared to standard regression quantiles. If however the model does not contain leverage points, both versions of the regression quantiles yield very similar results. Thus, the election dataset serves here as an illustration of the usefulness of the implicitly weighted regression quantiles.
Trvalý link: http://hdl.handle.net/11104/0328139

0553224 - ÚI 2022 RIV RS eng C - Konferenční příspěvek (zahraniční konf.)
Kalina, Jan
Regression Modelling as a Basis of Clinical Decision Support.
PaKSoM 2021. Proceedings of the 3rd Virtual International Conference Path to a Knowledge Society - Managing Risks and Innovation. Niš: Complex Systems Research Centre and Mathematical Institute of the Serbian Academy of Sciences and Arts, 2021 - (Stanković, M.; Nikolić, V.), s. 97-104. ISBN 978-86-80593-72-2.
[PaKSoM 2021: Virtual International Conference Path to a Knowledge Society - Managing Risks and Innovation /3./. Virtual, 15.11.2021-16.11.2021)]

Klíčová slova: clinical decision making * machine learning * data mining * nonlinear regression * Big Data analytics * predictive analytics * healthcare * medical informatics * COVID-19 pandemic
Obor OECD: Computer sciences, information science, bioinformathics (hardware development to be 2.2, social aspect to be 5.8)
https://paksom.cosrec.org/wp-content/uploads/2022/02/PaKSoM2021.pdf

Clinical decision support systems have established their place as assistive tools helpful in particular decision making tasks related to medical care. This paper is focused on regression modelling applicable to solving clinical decision making tasks. A general overview and selected particular examples of regression applications are presented. The role of medical informatics in the recent combat against the COVID-19 pandemic is discussed as well. The authors also characterize future trends of machine learning tools within clinical decision support systems.
Trvalý link: http://hdl.handle.net/11104/0328218

0553129 - ÚI 2022 RIV CZ eng C - Konferenční příspěvek (zahraniční konf.)

Kalina, Jan

The 2020 Election In The United States: Beta Regression Versus Regression Quantiles.

RELIK 2021. Conference Proceedings. Prague: Prague University of Economics and Business, 2021 - (Langhamrová, J.; Vrabcová, J.), s. 321-331. ISBN 978-80-245-2429-0.

[RELIK 2021: Reproduction of Human Capital - mutual links and connections. Praha (CZ), 04.11.2021-05.11.2021]

Grant CEP: GA ČR GA21-19311S

Institucionální podpora: RVO:67985807

Klíčová slova: elections results * electoral demography * quantile regression * heteroscedasticity * outliers

Obor OECD: Political science

https://relik.vse.cz/2021/download/pdf/380-Kalina-Jan-paper.pdf

The results of the presidential election in the United States in 2020 desire a detailed statistical analysis by advanced statistical tools, as they were much different from the majority of available prognoses as well as from the presented opinion polls. We perform regression modeling for explaining the election results by means of three demographic predictors for individual 50 states: weekly attendance at religious services, percentage of Afroamerican population, and population density. We compare the performance of beta regression with linear regression, while beta regression performs only slightly better in terms of predicting the response. Because the United States population is very heterogeneous and the regression models are heteroscedastic, we focus on regression quantiles in the linear regression model. Particularly, we develop an original quintile regression map; such graphical visualization allows to perform an interesting interpretation of the effect of the demographic predictors on the election outcome on the level of individual states.

Trvalý link: http://hdl.handle.net/11104/0328134

0555404 - ÚI 2022 RIV US eng C - Konferenční příspěvek (zahraniční konf.)

Cerna, David M.

A Special Case of Schematic Syntactic Unification.

2021 23rd International Symposium on Symbolic and Numeric Algorithms for Scientific Computing (SYNASC). Piscataway: IEEE, 2021 - (Schneider, C.; Marin, M.; Negru, V.; Zaharie, D.), s. 75-82. ISBN 978-1-6654-0650-5.

[SYNASC 2021: International Symposium on Symbolic and Numeric Algorithms for Scientific Computing /23./. Timisoara / Virtual (RO), 07.12.2021-10.12.2021]

Institucionální podpora: RVO:67985807

Klíčová slova: Unification * recursion * schema * induction

Obor OECD: Computer sciences, information science, bioinformathics (hardware development to be 2.2, social aspect to be 5.8)

http://dx.doi.org/10.1109/SYNASC54541.2021.00024

 DOI: 10.1109/SYNASC54541.2021.00024

We present a unification problem based on first-order syntactic unification which ask whether every problem in a schematically-defined sequence of unification problems is unifiable, so called loop unification. Alternatively, our problem may be formulated as a recursive procedure calling first-order syntactic unification on certain bindings occurring in the solved form resulting from unification. Loop unification is closely related to Narrowing as the schematic constructions can be seen as a rewrite rule applied during unification, and primal grammars, as we deal with recursive term constructions. However, loop unification relaxes the restrictions put on variables as fresh as well as used extra variables may be introduced by rewriting. In this work we consider an important special case, so called semiloop unification. We provide a sufficient condition for unifiability of the entire sequence based on the structure of a sufficiently long initial segment. It remains an open question whether this condition is also necessary for semiloop unification and how it may be extended to loop unification.

Trvalý link: http://hdl.handle.net/11104/0329925

0555604 - ÚI 2022 RIV DE eng C - Konferenční příspěvek (zahraniční konf.)
Růžička, J. - Koza, J. - Tumpach, J. - Pitra, Z. - Holeňa, Martin
Combining Gaussian Processes with Neural Networks for Active Learning in Optimization.
IAL@ECML PKDD 2021: Workshop on Interactive Adaptive Learning. Proceedings. Aachen: Technical
University & CreateSpace Independent Publishing, 2021 - (Krempl, G.; Lemaire, V.; Kottke, D.;
Holzinger, A.; Hammer, B.), s. 105-120. CEUR Workshop Proceedings, 3079. ISSN 1613-0073.
[IAL 2021: Workshop on Interactive Adaptive Learning /5./. Bilbao / virtual (ES), 13.09.2021-
13.09.2021]
Grant CEP: GA ČR(CZ) GA18-18080S
Grant ostatní: Ministerstvo školství, mládeže a tělovýchovy - GA MŠk(CZ) LM2018140
Institucionální podpora: RVO:67985807
Klíčová slova: active learning * black-box optimization * artificial neural networks * Gaussian
processes * covariance functions
Obor OECD: Computer sciences, information science, bioinformathics (hardware development to be
2.2, social aspect to be 5.8)
http://ceur-ws.org/Vol-3079/ial2021_paper9.pdf
One area where active learning plays an important role is black-box optimization of objective functions
with expensive evaluations. To deal with such evaluations, continuous black-box optimization has
adopted an approach called surrogate modelling or metamodelling, which consists in replacing the
true black-box objective in some of its evaluations with a suitable regression model, the selection of
evaluations for replacement being an active learning task. This paper concerns surrogate modelling in
the context of a surrogate-assisted variant of the continuous black-box optimizer Covariance Matrix
Adaptation Evolution Strategy. It reports the experimental investigation of surrogate models
combining artificial neural networks with Gaussian processes, for which it considers six different
covariance functions. The experiments were performed on the set of 24 noiseless benchmark
functions of the platform Comparing Continuous Optimizers COCO with 5 different dimensionalities.
Their results revealed that the most suitable covariance function for this combined kind of surrogate
models is the rational quadratic followed by the Matérn 25 and squared exponential. Moreover, the
rational quadratic and squared exponential covariances were found interchangeable in the sense that
for no function, no group of functions, no dimension and combination of them, the performance of the
respective surrogate models was significantly different.
Trvalý link: http://hdl.handle.net/11104/0330068

0555418 - ÚI 2022 RIV CZ cze V - Výzkumná zpráva
Brabec, Marek - Malý, Marek - Malá, I. - Hladká, Adéla
DC 5.3 Základní statistický model velkého měřítka.
[DC 5.3 Fundamental large scale statistical model.]
1. - Praha: ICS CAS, 2021. 47 s. ENV/2021/118018 / SS02030031-V94.
Grant CEP: GA TA ČR(CZ) SS02030031
Institucionální podpora: RVO:67985807
Klíčová slova: spatial field of pollutant concentration * geostatistics * GAM * INLA * spatially varying
covariance model * Bayesian modeling
Obor OECD: Statistics and probability
BIBLIOGRAFICKÉ ÚDAJE: Výzkumná zpráva č. SS02030031-V94, evidenční č. ENV/2021/118018.
Praha: ICS CAS, 2021. 47 s. ANOTACE: Obsahem tohoto dokumentu je popis prostorového
statistického modelu velkého měřítka vyvinutého z dosavadních dat poskytnutých ČHMÚ. Prostorový
model bude (po nezbytných aktualizacích a případných modifikacích daných jak časovým vývojem
samotného znečištění, který lze očekávat např. v souvislosti s dopady pandemie covid-19, tak dalším
vývojem statistické metodologie) v dalších letech používán jako podklad pro vývoj algoritmu
prostorové optimalizace umístění měřicích stanic na základě statistického designu. Jde o několik

variantních řešení, která zohledňují různé aspekty statistického chování pole koncentrací vybraných znečišťujících látek.

This document describes suite of fundamental large-scale statistical models developed from data provided by CHMI (Czech Hydrometeorological Institute). The models were constructed in several variants, differing in complexity, detail and computational demands. Spatial models will be, after some further developments and modifications (necessary not only from the natural model evolution but also due to systematic changes brought e.g. by covid outbreak influences) used as the main input for optimization algorithms constructed for selection of measurement stations on the principles of statistical design theory and methods.

Trvalý link: http://hdl.handle.net/11104/0329935

0554060 - ÚI 2022 RIV NL eng A - Abstrakt
Pidnebesna, Anna - Jiříček, Stanislav - Koudelka, V. - Vlček, Kamil - Šanda, Pavel - Hammer, J. - Hlinka, Jaroslav
Detection of visual information processing regions from high-density EEG data.
Journal of Computational Neuroscience. Roč. 49, Suppl. 1 (2021), S89-S90. ISSN 0929-5313. E-ISSN 1573-6873
Grant CEP: GA ČR(CZ) GA19-11753S
Institucionální podpora: RVO:67985807
Obor OECD: Neurosciences (including psychophysiology
Trvalý link: http://hdl.handle.net/11104/0328684

0554062 - ÚI 2022 NL eng A - Abstrakt
Delanois, J. E. - Šanda, Pavel - Bazhenov, M. - Golden, R.
Sleep prevents catastrophic forgetting in spiking neural networks by forming joint synaptic weight representations.
Journal of Computational Neuroscience. Roč. 49, Suppl. 1 (2021), S76-S76. ISSN 0929-5313. E-ISSN 1573-6873
Institucionální podpora: RVO:67985807
Trvalý link: http://hdl.handle.net/11104/0328685