0598624 - ÚI 2025 RIV NL eng J - Journal Article
Bujtás, C. - Davoodi, Akbar - Ding, L. - Győri, E. - Tuza, Z. - Yang, D.
Covering the edges of a graph with triangles.
Discrete Mathematics. Roč. 348, č. 1 (2025), č. článku 114226. ISSN 0012-365X. E-ISSN 1872-681X
Institutional support: RVO:67985807
Keywords : Edge-disjoint triangles * Edge clique covering * Nordhaus-Gaddum inequality
Impact factor: 0.7, year: 2023
Method of publishing: Open access
https://doi.org/10.1016/j.disc.2024.114226
https://doi.org/10.1016/j.disc.2024.114226

In a graph G, let $\rho_\triangle(G)$ denote the minimum size of a set of edges and triangles that cover all edges of G, and let $\alpha_1(G)$ be the maximum size of an edge set that contains at most one edge from each triangle. Motivated by a question of Erdős, Gallai, and Tuza, we study the relationship between $\rho_\triangle(G)$ and $\alpha_1(G)$ and establish a sharp upper bound on $\rho_\triangle(G)$. We also prove Nordhaus-Gaddum-type inequalities for the considered invariants.
Permanent Link: https://hdl.handle.net/11104/0356241

0598219 - MÚ 2026 RIV NL eng J - Journal Article
Akbar Tabatabai, Seyed Amirhossein - Jalali Keshavarz, Raheleh
Universal proof theory: Semi-analytic rules and Craig interpolation.
Annals of Pure and Applied Logic. Roč. 176, č. 1 (2025), č. článku 103509. ISSN 0168-0072. E-ISSN 1873-2461
R&D Projects: GA ČR(CZ) GA23-04825S; GA ČR(CZ) GA22-01137S
Institutional support: RVO:67985840 ; RVO:67985807
Keywords : Craig interpolation * linear logics * sequent calculi
OECD category: Pure mathematics
Impact factor: 0.6, year: 2023
Method of publishing: Limited access
https://doi.org/10.1016/j.apal.2024.103509
https://doi.org/10.1016/j.apal.2024.103509

We provide a general and syntactically defined family of sequent calculi, called semi-analytic, to formalize the informal notion of a "nice" sequent calculus. We show that any sufficiently strong (multimodal) substructural logic with a semi-analytic sequent calculus enjoys the Craig Interpolation Property, CIP. As a positive application, our theorem provides a uniform and modular method to prove the CIP for several multimodal substructural logics, including many fragments and variants of linear logic. More interestingly, on the negative side, it employs the lack of the CIP in almost all substructural, superintuitionistic and modal logics to provide a formal proof for the well-known

intuition that almost all logics do not have a "nice" sequent calculus. More precisely, we show that many substructural logics including UL−, MTL, R, Łn (for n⩾3), Gn (for n⩾4), and almost all extensions of IMTL, Ł, BL, RMe, IPC, S4, and Grz (except for at most 1, 1, 3, 8, 7, 37, and 6 of them, respectively) do not have a semi-analytic calculus.
Permanent Link: https://hdl.handle.net/11104/0355944

Većkalov, B. - Geiger, S. J. - Bartoš, František … Total 46 authors
A 27-country test of communicating the scientific consensus on climate change.
Nature Human Behaviour. Online 26 August 2024 (2024). ISSN 2397-3374. E-ISSN 2397-3374

Communicating the scientific consensus that human-caused climate change is real increases climate change beliefs, worry and support for public action in the United States. In this preregistered experiment, we tested two scientific consensus messages, a classic message on the reality of human-caused climate change and an updated message additionally emphasizing scientific agreement that climate change is a crisis. Across online convenience samples from 27 countries (n = 10,527), the classic message substantially reduces misperceptions (d = 0.47, 95% CI (0.41, 0.52)) and slightly increases climate change beliefs (from d = 0.06, 95% CI (0.01, 0.11) to d = 0.10, 95% CI (0.04, 0.15)) and worry (d = 0.05, 95% CI (−0.01, 0.10)) but not support for public action directly. The updated message is equally effective but provides no added value. Both messages are more effective for audiences with lower message familiarity and higher misperceptions, including those with lower trust in climate scientists and right-leaning ideologies. Overall, scientific consensus messaging is an effective, non-polarizing tool for changing misperceptions, beliefs and worry across different audiences.
Permanent Link: https://hdl.handle.net/11104/0355662

Piťhová, P. - Cichrová, Michaela - Kvapil, M. - Hubáček, J. A. - Dlouhá, D. - Piťha, J.
Determinants of vascular impairment in type 1 diabetes–impact of sex and connexin 37 gene polymorphism: A cross-sectional study.
Cardiovascular Diabetology. Roč. 23, č. 1 (2024), s. 1-14, č. článku 309. ISSN 1475-2840. E-ISSN 1475-2840

BACKGROUND. The associations of risk factors with vascular impairment in type 1 diabetes patients seem more complex than that in type 2 diabetes patients. Therefore, we analyzed the associations between traditional and novel cardiovascular risk factors and vascular parameters in individuals with T1D and modifications of these associations according to sex and genetic factors. METHODS. In a cross-sectional study, we analyzed the association of risk factors in T1D individuals younger than 65 years using vascular parameters, such as ankle brachial index (ABI) and toe brachial index (TBI), duplex ultrasound, measuring the presence of plaques in carotid and femoral arteries (Belcaro score) and intima media thickness of carotid arteries (CIMT). We also used photoplethysmography, which measured the interbranch index expressed as the Oliva-Roztocil index (ORI), and analyzed renal parameters, such as urine albumin/creatinine ratio (uACR) and glomerular filtration rate (GFR). We evaluated these associations using multivariate regression analysis, including interactions with sex and the gene for connexin 37 (Cx37) polymorphism (rs1764391). RESULTS. In 235 men and 227 women (mean age 43.6 ± 13.6 years; mean duration of diabetes 22.1 ± 11.3 years), pulse pressure was strongly associated with unfavorable values of most of the vascular parameters under study (ABI, TBI, Belcaro scores, uACR and ORI), whereas plasma lipids, represented by remnant cholesterol (cholesterol – LDL-HDL cholesterol), the atherogenic index of plasma (log (triglycerides/HDL cholesterol) and Lp(a), were associated primarily with renal impairment (uACR, GFR and lipoprotein (a)). Plasma non-HDL cholesterol was not associated with any vascular parameter under study. In contrast to pulse pressure, the associations of lipid factors with kidney and vascular parameters were modified by sex and the Cx37 gene. CONCLUSION. In addition to known information, easily obtainable risk factor, such as pulse pressure, should be considered in individuals with T1D irrespective of sex and genetic background. The associations of plasma lipids with kidney function are complex and associated with sex and genetic factors. The decision of whether pulse pressure, remnant lipoproteins, Lp(a) and other determinants of vascular damage should become treatment targets in T1D should be based on the results of future clinical trials.
Permanent Link: https://hdl.handle.net/11104/0355777

We present a neighbourhood-style semantic framework for modal epistemic logic modelling agents who process information using relevant logic. The distinguishing feature of the framework in comparison to relevant modal logic is that the environment the agent is situated in is assumed to be a classical possible world. This framework generates two-layered logics combining classical logic on the propositional level with relevant logic in the scope of modal operators. Our main technical result is a general soundness and completeness theorem.
Permanent Link: https://hdl.handle.net/11104/0356029

Pitra, Z. - Koza, J. - Tumpach, J. - Holeňa, Martin
Landscape Analysis for Surrogate Models in the Evolutionary Black-Box Context.

Surrogate modeling has become a valuable technique for black-box optimization tasks with expensive evaluation of the objective function. In this paper, we investigate the relationships between the predictive accuracy of surrogate models, their settings, and features of the black-box function landscape during evolutionary optimization by the Covariance Matrix Adaptation Evolution Strategy (CMA-ES) state-of-the-art optimizer for expensive continuous black-box tasks. This study aims to establish the foundation for specific rules and automated methods for selecting and tuning surrogate models by exploring relationships between landscape features and model errors, focusing on the behavior of a specific model within each generation in contrast to selecting a specific algorithm at the outset. We perform a feature analysis process, identifying a significant number of non-robust features and clustering similar landscape features, resulting in the selection of 14 features out of 384, varying with input data selection methods. Our analysis explores the error dependencies of four models across 39 settings, utilizing three methods for input data selection, drawn from surrogate-assisted CMA-ES runs on noiseless benchmarks within the Comparing Continuous Optimizers framework.
Permanent Link: https://hdl.handle.net/11104/0355837

Davoodi, Akbar - Javadi, R. - Kamranian, A. - Raeisi, G.
On a conjecture of Erdős on size Ramsey number of star forests.

Given two graphs F1 and F2, their size Ramsey number, denoted by $\hat{r}(F1, F2)$, is the minimum number of edges of a graph G such that for any edge coloring of G by colors red and blue, G contains either a red copy of F1 or a blue copy of F2. In this paper, we deal with the size Ramsey number of star forests (disjoint union of stars) and following a conjecture by Burr, Erdős, Faudree, Rousseau, and Schelp in 1978, we determine the exact value of $\hat{r}(\sqcup i = 1sK1, ni, \sqcup i = 1tK1, mi)$ in several cases including when either mi's and ni's are odd, or s = 1 or s = 2 and n1 = n2.
Permanent Link: https://hdl.handle.net/11104/0356244

Janků, Zdeněk - Belda, M. - **Bureš, Martin** - **Krč, Pavel** - Lehnert, M. - **Resler, Jaroslav** - **Řezníček, Hynek** - Krayenhoff, E. S. - Krüger, E. - **Geletič, Jan**

Towards climate-responsible tree positioning: Detailed effects of trees on heat exposure in complex urban environments.

Increasing heat in urban environments has recently become one of the most dangerous climate hazards due to its adverse impacts on urban populations. Implementing street-level trees could be an effective strategy to mitigate pedestrian heat exposure, particularly due to their ability to block incoming solar radiation. In this study, the PALM model system was applied to simulate the effects of a tree canopy and its location on heat exposure, as quantified by the Universal Thermal Climate Index (UTCI), during a heat wave, using the example of Prague-Dejvice, Czech Republic. Our results show that trees reduce the UTCI under their canopy by 3.5 degree celsius on average, with the greatest UTCI reduction in open spaces during mornings and afternoons. High spatio-temporal variations in the reduction of UTCI by a tree canopy were observed in the study domain, especially in street canyons and courtyards. The effectiveness of trees in mitigating heat exposure was found to be closely related to their individual location with respect to surrounding buildings, specifically: (i) the distance from the nearest building, (ii) the height of the nearest building, and (iii) the azimuthal angle of the vector from the nearest building towards the tree. Model simulations indicate that a particularly small reduction in UTCI (about 2.5 degree celsius less than the mean) can be found under trees located in the shade of taller buildings that are within a few metres and between southwest and southeast of the trees. Our findings illustrate that tree positioning in cities should be undertaken carefully and thoughtfully so that the presence of trees effectively improves thermal comfort and urban quality of life.
Permanent Link: https://hdl.handle.net/11104/0356256

Wiedermann, Jiří - van Leeuwen, J.

Large Language Models and the Extended Church-Turing Thesis.

The Extended Church-Turing Thesis (ECTT) posits that all effective information processing, including unbounded and non-uniform interactive computations, can be described in terms of interactive Turing machines with advice. Does this assertion also apply to the abilities of contemporary large language models (LLMs)? From a broader perspective, this question calls for an investigation of the computational power of LLMs by the classical means of computability and computational complexity theory, especially the theory of automata. Along these lines, we establish a number of fundamental results. Firstly, we argue that any fixed (non-adaptive) LLM is computationally equivalent to a, possibly very large, deterministic finite-state transducer. This characterizes the base level of LLMs. We extend this to a key result concerning the simulation of space-bounded Turing machines by LLMs. Secondly, we show that lineages of evolving LLMs are computationally equivalent to interactive Turing machines with advice. The latter finding confirms the validity of the ECTT for lineages of LLMs. From a computability viewpoint, it also suggests that lineages of LLMs possess super-Turing computational power. Consequently, in our computational model knowledge generation is in general a non-algorithmic process realized by lineages of LLMs. Finally, we discuss the merits of our findings in the broader context of several related disciplines and philosophies.
Permanent Link: https://hdl.handle.net/11104/0356200
Research data: Preprint - ArXiv.org

Influence of depth of ReLU networks on growth of their non-linearity is studied. Lower bounds on worst-case errors in linear approximation are derived for sets of highly-oscillatory functions that can be exactly represented by ReLU networks. Dependence of these errors on network depth is analyzed.
Permanent Link: https://hdl.handle.net/11104/0355890

0598360 - ÚI 2025 eng A - Abstract
Cerna, David M.
An Introduction to Cut-elimination by Resolution (CERES).
[International Tbilisi Summer School in Logic and Language /18./. Tbilisi, 12.09.2024-15.09.2024]
Method of presentation: Zvaná přednáška
URL events: https://www.logic.at/tbilisi24/
Institutional support: RVO:67985807
Permanent Link: https://hdl.handle.net/11104/0356030

0598632 - ÚI 2025 RIV GB eng A - Abstract
Geletič, Jan - Krč, Pavel - Bureš, Martin - Řezníček, Hynek - Resler, Jaroslav - Belda, M.
The complex role of trees as the most popular heat wave mitigation measure in Czech cities.
35th International Geographical Congress 2024 Abstracts. Acharacle: Oxford Abstracts, 2024.
[The International Geographical Congress 2024 /35./. 24.08.2024-30.08.2024, Dublin]
Grant - others:AV ČR(CZ) StrategieAV21/23
Program: StrategieAV
Institutional support: RVO:67985807
https://virtual.oxfordabstracts.com/event/5117/submission/2106

Generally, trees are widely considered the most effective heat wave mitigation measure in cities. Most of their positive effects are well described and analyzed in detail. Despite that, their effect on their surroundings is not homogeneous. Trees in urban canyons significantly affect the energy balance of horizontal and vertical surfaces. Moreover, they decrease wind velocity and block night-time radiative cooling of horizontal surfaces. The role of trees in the urban canyon is more complex – they can decrease surface temperature (ST) or mean radiant temperature (MRT) by about tens °C, same as related biometeorological indices, e.g. universal thermal climate index (UTCI) or physiological equivalent temperature (PET), maximum decrease can be as high as 10–15 °C. All these decreases are located close to trees, with only a slight effect on their surroundings. Moreover, they strongly vary during the day. New studies based on large-eddy simulation principles proved that there are more dependencies than expected, e.g. that newly planted trees on the north sides of buildings have only a minor effect on MRT, UTCI and PET. There is also a strong dependency between UTCI reduction and building height or distance between tree and building. Finally, the effect of trees is often modeled with optimal soil moisture and health conditions mainly due to a lack of data about trees in urban environments. The modern urban planning tools supported by scientific simulations could support a 'smart city' concept.
Permanent Link: https://hdl.handle.net/11104/0356247

0598635 - ÚI 2025 RIV GB eng A - Abstract
Lehnert, M. - Květoňová, V. - Geletič, Jan - Šimáček, P. - Jurek, M. - Pánek, J.
Thermal walks and participatory mapping as complementary methods for improving human thermal environment in urban areas, using the example of Czech cities.
35th International Geographical Congress 2024 Abstracts. Acharacle: Oxford Abstracts, 2024.
[The International Geographical Congress 2024 /35./. 24.08.2024-30.08.2024, Dublin]
Grant - others:AV ČR(CZ) StrategieAV21/23
Program: StrategieAV
Institutional support: RVO:67985807
https://virtual.oxfordabstracts.com/event/5117/submission/1105
Increasing effects of climate change together with growing urbanisation require efficient solutions in urban planning. Thermal environment in urban areas has been recently researched in hundreds of

studies. However, psychological and social/behavioural factors which seem to substantially affect thermal comfort and the related thermal stress in urban areas remain understudied. On that account, we present the results and experience from our thermal walk and participatory-based cognitive thermal mapping campaigns in Czech cities on hot summer days. On the city scale, mental hotspots tend to concentrate into central locations (i.e. squares and transport hubs with good accessibility), whereas mental coolspots are related to larger parks (several hectares in area) or urban forests including water bodies. The importance of green spaces with the size of a few hectares is particularly pronounced at the neighbourhood scale. Nevertheless, at the street level, more detailed information is obtained from thermal walks, where standardised thermal sensation votes of respondents enable to detect details such as part of the streets with effective/non-effective tree spacing or appropriate/inappropriate building geometry. We expect further valuable information to be obtained from statistical models that analyse the results of thermal walks and participatory mapping in combination with the realistic fine-scale human thermal exposure simulated in the PALM model system.
Permanent Link: https://hdl.handle.net/11104/0356249

0598684 - ÚI 2025 DE eng A - Abstract
Kalina, Jan
Title: Highly robust training of regularized radial basis function networks.
COMPSTAT 2024 Programme. Giessen: IASC, 2024.
[COMPSTAT 2024: International Conference on Computational Statistics /24./. 27.08.2024-30.08.2024, Giessen]
Institutional support: RVO:67985807
https://www.cmstatistics.org/RegistrationsV2/COMPSTAT2024/viewSubmission.php?in=185&token=50o83p8930p98p955no6p39rpqsq2484

Radial basis function (RBF) networks represent established tools for nonlinear regression modeling with numerous applications in various fields. Because their standard training is vulnerable with respect to the presence of outliers in the data, several robust methods for RBF network training have been proposed recently. The focus is on robust regularized RBF networks. A robust inter-quantile version of RBF networks based on trimmed least squares is proposed. Then, a systematic comparison of robust regularized RBF networks follows, which is evaluated over a set of 405 networks trained using various combinations of robustness and regularization types. The experiments proceed with a particular focus on the effect of variable selection, which is performed by means of a backward procedure, on the optimal number of RBF units. The regularized inter-quantile RBF networks based on trimmed least squares turn out to outperform the competing approaches in the experiments if a highly robust prediction error measure is considered.
Permanent Link: https://hdl.handle.net/11104/0356305

0597849 - ÚI 2025 CZ cze V - Research Report
Brabec, Marek - **Juruš, Pavel** - **Malý, Marek** - **Pelikán, Emil** - Šrotýř, M. - **Turčičová, Marie**
Souhrnná zpráva projektu LINE za rok 2023.
Prague: ICS CAS, 2023. 82 s. Technical Report.
Institutional support: RVO:67985807
Tato zpráva byla vytvořena řešitelským týmem Ústavu informatiky AV ČR, v.v.i. v Praze pro potřeby společnosti GasNet, s.r.o. na základě objednávky č. 4500028548. Ve zprávě jsou shrnuty výsledky činností prováděných v roce 2023. Je popsán proces zpracování vstupních dat a jsou řešeny úlohy detekce odlehlých pozorování spotřeby, analýzy bilančních rozdílů a charakterizace vývoje spotřeby plynu v prostoru a čase.
Permanent Link: https://hdl.handle.net/11104/0355664