Miletínová, E. - Piorecký, M. - Koudelka, V. - <u>Jiříček, Stanislav</u> - <u>Tomeček, David</u> - Brunovský, M. - Horáček, J. - Bušková, J.
Alterations of sleep initiation in NREM parasomnia after sleep deprivation – A multimodal pilot study.

OBJECTIVES: NREM parasomnias also known as disorders of arousal (DOA) are characterised by abnormal motor and autonomic activation during arousals primarily from slow wave sleep. Dissociative state between sleep and wake is likely responsible for clinical symptoms of DOA. We therefore investigated potential dissociation outside of parasomnic events by using simultaneous 256-channel EEG (hdEEG) and functional magnetic resonance imaging (fMRI). METHODS: Eight DOA patients (3 women, mean age = 27.8, SD = 4.2) and 8 gender and age matched healthy volunteers (3 women, mean age = 26,5, SD = 4.0) were included into the study. They underwent 30–32 h of sleep deprivation followed by hdEEG and fMRI recording. We determined 2 conditions: falling asleep (FA) and arousal (A), that occurred outside of deep sleep and/or parasomnic event. We used multimodal approach using data obtained from EEG, fMRI and EEG-fMRI integration approach. RESULTS: DOA patients showed increase in delta and beta activity over postcentral gyrus and cuneus during awakening period. This group expressed increased connectivity between motor cortex and cingulate during arousals unrelated to parasomnic events in the beta frequency band. They also showed lower connectivity between different portions of cingulum. In contrast, the greater connectivity was found between thalamus and some cortical areas, such as occipital cortex. CONCLUSION: Our findings suggest a complex alteration in falling asleep and arousal mechanisms at both subcortical and cortical levels in response to sleep deprivation. As this alteration is present also outside of slow wave sleep and/or parasomnic episodes we believe this could be a trait factor of DOA.
Permanent Link: https://hdl.handle.net/11104/0346463

Dropka, N. - <u>Holeňa, Martin</u> - Thieme, C. - Chou, T.-S.
Development of the VGF Crystal Growth Recipe: Intelligent Solutions of Ill-Posed Inverse Problems using Images and Numerical Data.

Method of publishing: Open access

Development of the Vertical Growth Freeze crystal growth process is a typical example of solving the ill-posed inverse problem, which violates one or more of Hadamard's well-posedness criteria of solution existence, uniqueness, and stability. In this study, different data-driven approaches are used to solve inverse problems: Reduced Order Modelling method of Proper Orthogonal Decomposition with Inverse Distance weighting (ROM POD InvD), an approximation method of Kriging and Artificial Neural Networks (ANN) employing images, combination of images and numerical data and solely numerical data, respectively. The ≈200 training data are generated by Computational Fluid Dynamics (CFD) simulations of the forward problem. Numerical input data are related to the temperatures and coordinates in 10 characteristic monitoring points in the melt and crystal, while the image input data are related to the interface shape and position. Using the random mean squared error as a criterion, the Kriging method based on images and numerical data and the ANN method based on numerical data are able to capture the system behavior more accurately, in contrast to the ROM POD InvD method, which is based solely on images.
Permanent Link: https://hdl.handle.net/11104/0345705

Lukáš, M. - Hrubá, V. - Reissigová, Jindra - Černá, K. - Machková, N. - Ďuricová, D. - Kolář, M. - Vlková, K. - Čermáková, L. - Lukáš Jr., M.
Switch from biosimilar infliximab CT-P13 to biosimilar infliximab SB-2 in the long-term maintenance therapy in IBD patients – prospective observational study.
Gastroenterologie a hepatologie. Roč. 77, č. 4 (2023), s. 336-341. ISSN 1804-7874
Institutional support: RVO:67985807
Keywords : inflammatory bowel disease * biosimilar infliximab CT-P13 * biosimilar infliximab SB-2 * therapeutical switch
Method of publishing: Limited access

INTRODUCTION: Therapeutical switch from originator to biosimilar infliximab has been proved as effective and safety procedure. We have a few information about non-medical swich from one biosimilar to the another biosimilar infiximab. Aim: This is a prospective observational study from one tercial IBD center, performed in 2021 and 2022 which was focused on efficacy and safety after switch from infliximab CT-P13 to infliximab SB-2 in patients with IBD. MEtHODS: The cohort group comprised with 287 patients with IBD who have been consecutively treated with infliximab CT-P13 and they were switched to infliximab SB-2. All the recruited patients were in clinical and biological sustained remission at mean for 6 months before the switch. RESULTS: We proved that persistence on infliximab SB-2 therapy after the switch was 86.4% of treated patients, no significant changes in clinical inflammatory activities and biological parameters have been detected after the switch. The therapy termination due to side effects or loss of response in 39 patients (13.9%) has been detected due to lost of clinical response, side effects or lost of follow-up. No higher immunogenicity after the switch was found. CUNCLUSION: Non-medical switch from one biosimilar infliximab (CT-P13) to another one (SB-2) was not associated with higher risks of disease destabilisation or immunogenicity.
Permanent Link: https://hdl.handle.net/11104/0346393

0577159 - ÚI 2024 RIV CZ J - Journal Article
Lukáš, M. - Reissigová, Jindra
Bowel preparation before colonoscopy – comparison of bowel cleansing quality and patient's tolerance of several bowel cleansing devices.
Gastroenterologie a hepatologie. Roč. 77, č. 3 (2023), s. 237-242. ISSN 1804-7874

High quality of bowel preparation before colonoscopy seems to be the most important condition for safety and efficacious investigation of the large bowel. An analysis of 758 patients who underwent colonoscopy in one health care center showed that split preparation is significantly associated with higher quality of the bowel cleansing. Application of drugs with simethicon component significantly reduce the risk of bubbles. Patients prefer small volume laxatives with good palatability.
Permanent Link: https://hdl.handle.net/11104/0346392

0577158 - ÚI 2024 US eng J - Journal Article
Bílková, Marta - Frittella, S. - Kozhemiachenko, D.
Crisp Bi-Gödel modal logic and its paraconsistent expansion.
Logic Journal of the IGPL. Online First 28 September 2023 (2023), č. článku jzad017. ISSN 1367-0751. E-ISSN 1368-9894

In this paper, we provide a Hilbert-style axiomatization for the crisp bi-Gödel modal logic $\textbf{K}\textsf{biG}$. We prove its completeness w.r.t. crisp Kripke models where formulas at each state are evaluated over the standard bi-Gödel algebra on $[0,1]$. We also consider a paraconsistent expansion of $\textbf{K}\textsf{biG}$ with a De Morgan negation $\neg$, which we dub $\textbf{K}\textsf{G}^{2}$. We devise a Hilbert-style calculus for this logic and, as a consequence of a conservative translation from $\textbf{K}\textsf{biG}$ to $\textbf{K}\textsf{G}^{2}$, prove its completeness w.r.t. crisp Kripke models with two valuations over $[0,1]$ connected via $\neg$. For these two logics, we establish that their decidability and validity are $\textsf{PSPACE}$-complete. We also study the semantical properties of $\textbf{K}\textsf{biG}$ and $\textbf{K}\textsf{G}^{2}$. In particular, we show that Glivenko's theorem holds only in finitely branching frames. We also explore the classes of formulas that define the same classes of frames both in $\textbf{K}$ (the classical modal logic) and the crisp Gödel modal logic $\mathfrak{G}\mathfrak{K}^{c}$. We show that, among others, all Sahlqvist formulas and all formulas $\phi \rightarrow \chi$ where ϕ and χ are monotone define the same classes of frames in $\textbf{K}$ and $\mathfrak{G}\mathfrak{K}^{c}$.
Permanent Link: https://hdl.handle.net/11104/0346391

Štěpánek, Lubomír - Dlouhá, Jana - Martinková, Patrícia
Item Difficulty Prediction Using Item Text Features: Comparison of Predictive Performance across Machine-Learning Algorithms.

This work presents a comparative analysis of various machine learning (ML) methods for predicting item difficulty in English reading comprehension tests using text features extracted from item wordings. A wide range of ML algorithms are employed within both the supervised regression and the classification tasks, including regularization methods, support vector machines, trees, random forests, back-propagation neural networks, and Naïve Bayes. Moreover, the ML algorithms are compared to the performance of domain experts. Using f-fold cross-validation and considering the root mean square error (RMSE) as the performance metric, elastic net outperformed other approaches in a continuous item difficulty prediction. Within classifiers, random forests returned the highest extended predictive accuracy. We demonstrate that the ML algorithms implementing item text features can compete with predictions made by domain experts, and we suggest that they should be used to inform and improve these predictions, especially when item pre-testing is limited or unavailable. Future research is needed to study the performance of the ML algorithms using item text features on different item types and respondent populations.
Permanent Link: https://hdl.handle.net/11104/0346365

Brabec, Marek - Constable, P. A. - Thompson, D. A. - Marmolejo-Ramos, F.
Group comparisons of the individual electroretinogram time trajectories for the ascending limb of the b-wave using a raw and registered time series.

OBJECTIVES: The electroretinogram is a clinical test commonly used in the diagnosis of retinal disorders with the peak time and amplitude of the a- and b-waves used as the main indicators of retinal function. However, subtle changes that affect the shape of the electroretinogram waveform may occur in the early stages of disease or in conditions that have a neurodevelopmental or neurodegenerative origin. In such cases, we introduce a statistical approach to mathematically model the shape of the electroretinogram waveform that may aid clinicians and researchers using the electroretinogram or other biological signal recordings to identify morphological features in the waveforms that may not be captured by the time or time–frequency domains of the waveforms. We

present a statistical graphics-based analysis of the ascending limb of the b-wave (AL-b) of the electroretinogram in children with and without a diagnosis of autism spectrum disorder (ASD) with a narrative explanation of the statistical approach to illustrate how different features of the waveform based on location and scale derived from raw and registered time series can reveal subtle differences between the groups. RESULTS: Analysis of the raw time trajectories confirmed findings of previous studies with a reduced and delayed b-wave amplitude in ASD. However, when the individual time trajectories were registered then group differences were visible in the mean amplitude at registered time ~ 0.6 suggesting a novel method to differentiate groups using registration of the ERG waveform.
Permanent Link: https://hdl.handle.net/11104/0346346

One of the interesting aspects of EEG data is the presence of temporally stable and spatially coherent patterns of activity, known as microstates, which have been linked to various cognitive and clinical phenomena. However, there is still no general agreement on the interpretation of microstate analysis. Various clustering algorithms have been used for microstate computation, and multiple studies suggest that the microstate time series may provide insight into the neural activity of the brain in the resting state. This study addresses two gaps in the literature. Firstly, by applying several state-of-the-art microstate algorithms to a large dataset of EEG recordings, we aim to characterise and describe various microstate algorithms. We demonstrate and discuss why the three "classically" used algorithms ((T)AAHC and modified K-Means) yield virtually the same results, while HMM algorithm generates the most dissimilar results. Secondly, we aim to test the hypothesis that dynamical microstate properties might be, to a large extent, determined by the linear characteristics of the underlying EEG signal, in particular, by the cross-covariance and autocorrelation structure of the EEG data. To this end, we generated a Fourier transform surrogate of the EEG signal to compare microstate properties. Here, we found that these are largely similar, thus hinting that microstate properties depend to a very high degree on the linear covariance and autocorrelation structure of the underlying EEG data. Finally, we treated the EEG data as a vector autoregression process, estimated its parameters, and generated surrogate stationary and linear data from fitted VAR. We observed that such a linear model generates microstates highly comparable to those estimated from real EEG data, supporting the conclusion that a linear EEG model can help with the methodological and clinical interpretation of both static and dynamic human brain microstate properties.
Permanent Link: https://hdl.handle.net/11104/0346275
Research data: Supplementary material at publisher, Preprint at BiorXiv.org

Pascucci, M. - Sedlár, Igor
Hyperintensional models for non-congruential modal logics.

In this work, we illustrate applications of a semantic framework for non-congruential modal logic based on hyperintensional models. We start by discussing some philosophical ideas behind the approach; in particular, the difference between the set of possible worlds in which a formula is true (its intension) and the semantic content of a formula (its hyperintension), which is captured in a rigorous way in hyperintensional models. Next, we rigorously specify the approach and provide a fundamental completeness theorem. Moreover, we analyse examples of non-congruential systems that can be semantically characterized within this framework in an elegant and modular way. Finally, we compare the proposed framework with some alternatives available in the literature. In the light of the results obtained, we argue that hyperintensional models constitute a basic, general and unifying semantic framework for (non-congruential) modal logic.
Permanent Link: https://hdl.handle.net/11104/0346343

Martins, M. A. - Sedlár, Igor
Editorial: Special issue from the 3rd International Workshop on Dynamic Logic: New Trends and Applications (DaLí 2020).

This special issue contains extended versions of selected papers presented at the 3rd International Workshop on Dynamic Logic: New Trends and Applications (DaLí 2020). The workshop took place on 9–10 October 2020 online due to the COVID-19 pandemic. The organization of the workshop was based at the Institute of Computer Science of the Czech Academy of Sciences in Prague, Czech Republic. The submissions to DaLí 2020 and to the special issue span across various areas including dynamic logic and dynamic algebra, dynamic logic and public announcement logic and epistemic and modal logic in general. We hope the reader will enjoy the special issue, and we offer a small appetizer in the form of an outline of its contents.
Permanent Link: https://hdl.handle.net/11104/0346272

Hartman, David - Pokorná, Aneta - Valtr, P.
On the connectivity and the diameter of betweenness-uniform graphs.

Betweenness centrality is a centrality measure based on the overall amount of shortest paths passing through a given vertex. A graph is betweenness-uniform if all its vertices have the same betweenness centrality. We study the properties of betweenness-uniform graphs. In particular, we show that every connected betweenness-uniform graph is either a cycle or a 3-connected graph. Also, we show that betweenness uniform graphs of high maximal degree have small diameter.
Permanent Link: https://hdl.handle.net/11104/0346289

AIMS: Heart failure (HF) is a risk factor for major adverse events in atrial fibrillation (AF). Whether this risk persists on non-vitamin K antagonist oral anticoagulants (NOACs) and varies according to left ventricular ejection fraction (LVEF) is debated. METHODS AND RESULTS: We investigated the relation of HF in the ETNA-AF-Europe registry, a prospective, multicentre, observational study with an overall 4-year follow-up of edoxaban-treated AF patients. We report 2-year follow-up for ischaemic stroke/transient ischaemic attack (TIA)/systemic embolic events (SEE), major bleeding, and mortality. Of the 13 133 patients, 1854 (14.1%) had HF. Left ventricular ejection fraction was available for 82.4% of HF patients and was <40% in 671 (43.9%) and ≥40% in 857 (56.1%). Patients with HF were older, more often men, and had more comorbidities. Annualized event rates (AnERs) of any stroke/SEE were 0.86%/year and 0.67%/year in patients with and without HF. Compared with patients without HF, those with HF also had higher AnERs for major bleeding (1.73%/year vs. 0.86%/year) and all-cause death (8.30%/year vs. 3.17%/year). Multivariate Cox proportional models confirmed HF as a significant predictor of major bleeding [hazard ratio (HR) 1.65, 95% confidence interval (CI): 1.20-2.26] and all-cause death [HF with LVEF <40% (HR 2.42, 95% CI: 1.95-3.00) and HF with LVEF ≥40% (HR 1.80, 95% CI: 1.45-2.23)] but not of ischaemic stroke/TIA/SEE. CONCLUSION: Anticoagulated patients with HF at baseline featured higher rates of major bleeding and all-cause death, requiring optimized management and novel preventive strategies. NOAC treatment was similarly effective in reducing risk of ischaemic events in patients with or without concomitant HF.
Permanent Link: https://hdl.handle.net/11104/0346109

0576866 - ÚI 2024 DE eng J - Journal Article
Zámečník, S. - Horová, I. - [Katina, Stanislav](link) - Hasilová, K.
An adaptive method for bandwidth selection in circular kernel density estimation.
Computational Statistics. Online September 2023 (2023). ISSN 0943-4062. E-ISSN 1613-9658

Kernel density estimations of circular data are an effective type of nonparametric estimation. The performance of these estimations depends significantly on a smoothing parameter referred to as bandwidth. Selecting suitable bandwidths for these types of estimation pose fundamental challenges, therefore fixed bandwidth selectors are often the initial choice. The study investigates common bandwidth selection methods and proposes novel methods which adopt the idea from the linear case. The attention is also paid to variable bandwidth selection. Using simulations which incorporate a range of circular distributions that exhibit multimodality, peakedness and skewness, the proposed methods were evaluated and then compared with other bandwidth selectors to determine their potential advantages. Two real datasets, one containing animal movements and the other wind direction data, were applied to illustrate the utility of the proposed methods.
Permanent Link: https://hdl.handle.net/11104/0346269

0576550 - ÚI 2024 RIV US eng J - Journal Article
[Yamashita Rios de Sousa, Arthur Matsuo](link) - [Hlinka, Jaroslav](link)
Sign patterns symbolization and its use in improved dependence test for complex network inference.
Chaos. Roč. 33, č. 8 (2023), č. článku 083131. ISSN 1054-1500. E-ISSN 1089-7682

Inferring the dependence structure of complex networks from the observation of the non-linear dynamics of its components is among the common, yet far from resolved challenges faced when studying real-world complex systems. While a range of methods using the ordinal patterns framework has been proposed to particularly tackle the problem of dependence inference in the presence of non-linearity, they come with important restrictions in the scope of their application. Hereby, we introduce the sign patterns as an extension of the ordinal patterns, arising from a more flexible symbolization which is able to encode longer sequences with lower number of symbols. After transforming time series into sequences of sign patterns, we derive improved estimates for statistical quantities by considering necessary constraints on the probabilities of occurrence of combinations of symbols in a symbolic process with prohibited transitions. We utilize these to design an asymptotic chi-squared test to evaluate dependence between two time series and then apply it to the construction of climate networks, illustrating that the developed method can capture both linear and non-linear dependences, while avoiding bias present in the naive application of the often used Pearson correlation coefficient or mutual information.
Permanent Link: https://hdl.handle.net/11104/0346108

0576548 - ÚI 2024 US eng J - Journal Article
Kopal, Jakub - Hlinka, Jaroslav - Despouy, E. - Valton, L. - Denuelle, M. - Sol, J.-Ch. - Curot, J. - Barbeau, E. J.
Large-scale network dynamics underlying the first few hundred milliseconds after stimulus presentation: An investigation of visual recognition memory using iEEG.

Recognition memory is the ability to recognize previously encountered objects. Even this relatively simple, yet extremely fast, ability requires the coordinated activity of large-scale brain networks. However, little is known about the sub-second dynamics of these networks. The majority of current studies into large-scale network dynamics is primarily based on imaging techniques suffering from either poor temporal or spatial resolution. We investigated the dynamics of large-scale functional brain networks underlying recognition memory at the millisecond scale. Specifically, we analyzed dynamic effective connectivity from intracranial electroencephalography while epileptic subjects (n = 18) performed a fast visual recognition memory task. Our data-driven investigation using Granger causality and the analysis of communities with the Louvain algorithm spotlighted a dynamic interplay of two large-scale networks associated with successful recognition. The first network involved the right visual ventral stream and bilateral frontal regions. It was characterized by early, predominantly bottom-up information flow peaking at 115 ms. It was followed by the involvement of another network with predominantly top-down connectivity peaking at 220 ms, mainly in the left anterior hemisphere. The transition between these two networks was associated with changes in network topology, evolving from a more segregated to a more integrated state. These results highlight that distinct large-scale brain networks involved in visual recognition memory unfold early and quickly, within the first 300 ms after stimulus onset. Our study extends the current understanding of the rapid network changes during rapid cognitive processes.
Permanent Link: https://hdl.handle.net/11104/0346106

0576264 - ÚI 2024 RIV AT eng C - Conference Paper (international conference)
Cerna, David M. - Kutsia, T.
Anti-unification and Generalization: A Survey.

Anti-unification (AU) is a fundamental operation for generalization computation used for inductive inference. It is the dual operation to unification, an operation at the foundation of automated theorem proving. Interest in AU from the AI and related communities is growing, but without a systematic study of the concept nor surveys of existing work, investigations often resort to developing application-specific methods that existing approaches may cover. We provide the first survey of AU research and its applications and a general framework for categorizing existing and future developments.
Permanent Link: https://hdl.handle.net/11104/0345832

0577080 - ÚI 2024 RIV CH eng C - Conference Paper (international conference)
Kalina, Jan - Vidnerová, Petra
Properties of the Weighted and Robust Implicitly Weighted Correlation Coefficients.
Artificial Neural Networks and Machine Learning – ICANN 2023. Proceedings, Part IX. Cham: Springer, 2023 - (Iliadis, L.; Papaleonidas, A.; A, P.; Jayne, C.), s. 200-212. Lecture Notes in Computer Science, 14262. ISBN 978-3-031-44200-1. ISSN 0302-9743.
[ICANN 2023: International Conference on Artificial Neural Networks /32./. Heraklion (GR), 26.09.2023-29.09.2023]
R&D Projects: GA ČR(CZ) GA22-02067S
Institutional support: RVO:67985807
Keywords : Correlation coefficient * Outliers * Robustness * Image analysis * Approximate computing
OECD category: Computer sciences, information science, bioinformathics (hardware development to be 2.2, social aspect to be 5.8)

Pearson product-moment correlation coefficient represents a fundamental measure of similarity between two data vectors. In various applications, it is meaningful to consider its weighted version known as the weighted Pearson correlation coefficient. Its properties are studied in this theoretical paper - these include the robustness to rounding, as it is an important issue in approximate neurocomputing, or specific robustness properties for the context of template matching in image analysis. For a highly robust correlation coefficient inspired by the least weighted estimator, properties are derived and novel hypothesis tests are proposed. This robust measure is recommendable particularly for data contaminated by outliers (not only) in the context of image analysis.
Permanent Link: https://hdl.handle.net/11104/0346342

0577075 - ÚI 2024 RIV CH eng C - Conference Paper (international conference)
Kůrková, Věra
Approximation of Binary-Valued Functions by Networks of Finite VC Dimension.
Artificial Neural Networks and Machine Learning – ICANN 2023. Proceedings, Part I. Cham: Springer, 2023 - (Iliadis, L.; Papaleonidas, A.; Angelov, P.; Jayne, C.), s. 483-490. Lecture Notes in Computer Science, 14254. ISBN 978-3-031-44206-3. ISSN 0302-9743.
[ICANN 2023: International Conference on Artificial Neural Networks /32./. Heraklion (GR), 26.09.2023-29.09.2023]
R&D Projects: GA ČR(CZ) GA22-02067S
Institutional support: RVO:67985807

Keywords : approximation by neural networks * bounds on approximation errors * VC dimension * growth function * high-dimensional probability * concentration inequalities * method of bounded differences
OECD category: Computer sciences, information science, bioinformathics (hardware development to be 2.2, social aspect to be 5.8)

Distributions of errors in approximation of binary-valued functions by networks with sets of input-output functions of finite VC dimension is investigated. Conditions on concentration of approximation errors around their mean values are derived in terms of growth functions of sets of input-output functions. Limitations of approximation capabilities of networks of finite VC dimension are discussed.
Permanent Link: https://hdl.handle.net/11104/0346341

0577167 - ÚI 2024 RIV US eng C - Conference Paper (international conference)
Mushtaq, U. - Cabessa, Jérémie
Argument Mining with Modular BERT and Transfer Learning.
IJCNN 2023 Conference Proceedings. Piscataway: IEEE, 2023, č. článku 191330. ISBN 978-1-6654-8867-9.
[IJCNN 2023: International Joint Conference on Neural Networks /36./. Queensland (AU), 18.06.2023-23.06.2023]
R&D Projects: GA ČR(CZ) GA22-02067S
Institutional support: RVO:67985807
Keywords : Argument Mining * BERT * Features as Text * modular BERT * NLP * Transfer Learning
OECD category: Computer sciences, information science, bioinformathics (hardware development to be 2.2, social aspect to be 5.8)

We introduce BERT-MINUS, a modular, feature-enriched and transfer learning enabled model for Argument Mining. BERT-MINUS consists of: 1) a joint module which embeds the paragraph text, and 2) a dedicated module, consisting of three customized BERT models, which contextualize the argument markers, argument components and additional features given as text, respectively. BERT-MINUS implements two kinds of transfer learning - auto-transfer (transfer from a task to itself) and cross-transfer (classical transfer from one task to another) - via a novel Selective Fine-tuning mechanism. BERT-MINUS achieves state-of-the-art results on the Link Identification task and competitive results on the Argument Type Classification task. The synergy between the Features as Text and Selective Fine-tuning mechanisms significantly improves the performance of the model. Our work reveals the importance and potential of transfer learning via selective fine-tuning for modular Language Models. Moreover, this study dovetails naturally into the Prompt Engineering paradigm in NLP.
Permanent Link: https://hdl.handle.net/11104/0346396

0576268 - ÚI 2024 RIV eng R - Book Review
Holub, M. - Martinková, Patrícia
Supervised Machine Learning for Text Analysis in R.
[HVITFELDT, E.; SILGE, J.: Supervised Machine Learning for Text Analysis in R. Boca Raton, CRC Press, 2022. xix + 381 s.]. *Journal of the American Statistical Association*. Roč. 118, č. 543 (2023), s. 2207-2209. ISSN 0162-1459. E-ISSN 1537-274X

Supervised Machine Learning for Text Analysis in R by Emil Hvitfeldt and Julia Silge is a volume intended mainly for data scientists and analysts who work with natural language texts. This book should serve as a thorough introduction to text processing and advancement of the application of statistical modeling and prediction with texts using R.
Permanent Link: https://hdl.handle.net/11104/0345834

0576329 - ÚI 2024 AU eng A - Abstract
Lehnert, M. - Květoňová, V. - Jurek, M. - Koukalová, A. - Geletič, Jan
Daytime in contrast to night-time effect of blue and green features on thermal exposure in moderate-climate cities.
11th International Conference on Urban Climate. Titles. Sydney: ICUC, 2023, č. článku 76..
[ICUC 2023: International Conference on Urban Climate /11./. 28.08.2023-01.09.2023, Sydney]

Manifestations and projections of future climate change require effective adaptation of the urban environment to heat extremes. Influence of blue and green features on temperature, or more comprehensively on thermal exposure, thermal comfort, and heat stress in urban areas, has been thoroughly investigated in recent years. We also conducted such studies during hot summer days, showing that trees in open public areas of Czech cities lead to a decrease in UTCI (Universal Thermal Climate Index) by 5.0–8.0°C compared to sunlit pavement, maintained lawns in open areas decrease UTCI by 0.0–2.0°C and fountains or misting systems in open areas of the city centre influence UTCI in the range of −2.5°C to +1.0°C. On hot summer nights, when heat extremes have a particularly pronounced negative effect on human health, available biometeorological data are mostly based on model simulations because on-site measurements are rather scarce. In this contribution, we present preliminary results of our recent on-site night-time measurement campaign in Czech cities. Our results show that trees increase UTCI in the extent of 0.3–2.0°C, depending on the character of the tree, whereas shading sails increase UTCI by about 0.5°C. The cooling or warming effect of blue elements during night-time strongly depends on the character of the fountains, spray fountains, and misting systems. More detailed analyses including PET (Physiological Equivalent Temperature) are coming.
Permanent Link: https://hdl.handle.net/11104/0345891

0576328 - ÚI 2024 AU eng A - Abstract
Belda, M. - Resler, Jaroslav - Geletič, Jan - Krč, Pavel - Radović, J. - Bureš, M. - Řezníček, Hynek
Supporting urban planning with the LES model PALM (a case study for Prague, Czech Republic).
11th International Conference on Urban Climate. Titles. Sydney: ICUC, 2023, č. článku 349.

Large-eddy simulation (LES) models have been shown to provide good quality high-resolution information for applications in urban planning, namely when considering possible measures countering urban heat island and air pollution. In this study, we present results of simulations with the LES model PALM for Prague, Czech Republic, performed in the framework of the TURBAN project. In cooperation with the city authorities, several scenarios were designed covering various aspects of the city-specific meteorology and biometeorology. In the first set of scenarios, simple modifications were applied to various surfaces such as buildings and roads. Results of these mainly show the importance of using truly local information when setting internal model parameters. Second, a set of urbanistic scenarios was designed to assess the limits of effects of commonly considered urban-heat-island mitigation measures such as greening of the streets or altering surface materials. The third set analyses the potential impacts of currently planned changes in one of the traffic-heaviest parts of the Prague transport infrastructure. These scenarios cover the proposed completion of the currently non-existent connection of the northern and eastern parts of the city inner and outer ring roads in various variants. The use of an integrated modelling system allowed the analysis of the effects both on biothermal indicators and air quality. When studying possible urban heat island countermeasures, urban greenery is confirmed to be the most effective, especially when considering both physical and biophysical temperature indicators. On the other hand, analysis of air quality, specifically with respect to PM2.5 dispersion, confirmed opposite behaviour to that of thermal indicators; i.e. improved thermal comfort brings deterioration of PM2.5 concentrations.
Permanent Link: https://hdl.handle.net/11104/0345890

Extremes associated with climate change together with the effect of urban heat island expose urban residents to heat stress and worsen their state of mental well-being. These circumstances call for new urban design in order to improve thermal environment. Although human thermal environment and thermal comfort are actual research topics, most of the studies are based only on thermal conditions. Psychophysiological, behavioral and social factors are usually neglected in spite of the fact these are essential for comprehensive understanding and for consecutive planning of effective heat stress reduction measures. In this contribution we introduce outcomes featuring analyses of (geo)participative methods and thermal conditions in three central European cities - Prague, Pilsen and Olomouc. Firstly, a method of mental mapping in comparison with land surface temperature was

implemented in studied cities. As the most thermally unpleasant locations based on mental maps (mental hotspots) were revealed busy streets and city centers. However, locations identified as mental hotspots overlapped with hotspots based on land surface temperature by less than half. In located hotspots were further suggested by respondents heat stress reduction measures, among the most frequent were high greenery and a combination of a greenery and blue elements. Furthermore, we compared long–term thermal experience based on a mental mapping campaign to a different (geo)participative method – mobile application reporting actual thermal sensation vote. Also these outcomes revealed arterial roads and exposed concrete areas as mental hotspots. Nevertheless, some locations were perceived differently in comparison between long–term thermal experience and actual thermal sensation votes. Findings of these studies can contribute to improve our understanding of complex spatiotemporal patterns of human thermal comfort in urban areas and support effective urban planning and mitigation strategies.

Permanent Link: https://hdl.handle.net/11104/0345893

Krč, Pavel - **Resler, Jaroslav** - Bureš, M. - **Geletič, Jan** - Sühring, M.
3-D radiative interactions for non-orthogonal surfaces within a regular grid of a microscale atmospheric model.
11th International Conference on Urban Climate. Titles. Sydney: ICUC, 2023, č. článku 382..
[ICUC 2023: International Conference on Urban Climate /11./. 28.08.2023-01.09.2023, Sydney]
https://virtual.oxfordabstracts.com/#/event/3742/submission/382

Spatial discretization using a regular grid is a standard approach for all kinds of atmospheric models. PALM is an open-source HPC-enabled modular atmospheric modelling system that is able to capture the most relevant physical processes in the complex urban boundary layer. One of the most important urban processes is the radiative interaction among urban surfaces in 3-D. In PALM, these are simulated explicitly by the Radiative transfer model (RTM), which utilises the same discretization by a regular grid and the same data structures and parallelization approach as the model core, and that makes it tightly integrated and highly scalable. However, it can be demonstrated that the discretization of arbitrarily oriented surfaces using only orthogonal grid surface elements may lead to biases that cannot be eliminated by increasing the model resolution. E.g. an idealised street canyon oblique to the grid axes is discretized by artificial steps that increase the total area of the walls by a resolution-independent coefficient. It also introduces artificial reflections among the steps which decrease the effective albedo of the walls. The latest version of RTM introduces a system for representing and modelling radiation among arbitrarily oriented surface elements in such a way that it avoids these biases while preserving its high computational efficiency and scalability. It keeps the discretization by the regular grid and the level of detail corresponding to the grid resolution. It also allows a combination of slanted and orthogonal surface elements without a significant performance penalty to the latter. The presentation will describe the system in detail and demonstrate the results of its performance and scalability testing, as well as validation and sensitivity testing on idealised cases. The research was supported by project TO01000219 "TURBAN" (Norway Grants, Technology Agency of the Czech Republic). HPC support: Czech Ministry of Education, e-INFRA CZ (90140).
Permanent Link: https://hdl.handle.net/11104/0345889

0576326 - ÚI 2024 AU eng A - Abstract

Resler, Jaroslav - Krč, Pavel - Geletič, Jan - Bauerová, P. - Keder, J. - **Šindelářová, A. -
Vlček, O. - Řezníček, Hynek** - Bureš, M. - **Eben, Kryštof** - Belda, M. - **Radović, J.** - Fuka, V. -
Jareš, R. - Sühring, M. - Esau, I. ... Total 18 authors
Utilisation of the sensor network and remote sensing measurements for validation of the LES model
PALM in urban area.
11th International Conference on Urban Climate. Titles. Sydney: ICUC, 2023, č. článku 500..
[ICUC 2023: International Conference on Urban Climate /11./. 28.08.2023-01.09.2023, Sydney]
R&D Projects: GA TA ČR(CZ) TO01000219
Institutional support: RVO:67985807
Keywords : air pollution * measurement * sensor * network
OECD category: Meteorology and atmospheric sciences
https://virtual.oxfordabstracts.com/#/event/3742/submission/500

The LES based modelling system PALM has been widely extended during recent years. A lot of the
development focused on the processes needed for simulation of complex urban environments. Besides
individual validations of the newly developed processes, an evaluation of the complete modelling
system in a real urban environment is necessary to ensure the reliability of modelling results. Earlier
campaigns, e.g. Resler et.al. (2017, 2020), focused mainly on validation of the energy exchange
related processes. The currently running observation campaign is realised within the international
research project TURBAN and it takes place in Prague, Czech Republic. It focuses mainly on evaluation
of the street level dynamical processes by utilisation of a specially built sensor network placed in
heavily polluted street canyons. Twenty air quality sensors are complemented by a doppler lidar,
microwave radiometer profile observations, and by observations from permanent meteorological and
air quality monitoring stations operated by the Czech Hydrometeorological Institute (CHMI). These
data are compared with PALM simulations performed for selected episodes of the year. The PALM
model is configured in two nested domains with resolution of 10 m / 2 m and the extent of 8×8 km /
1.2×1.6 km. A significant challenge to the campaign was the low accuracy and reliability of sensor
observations. The differences in the values of individual sensors as well as their departures from the
referential observations reached tens of percent. Using sufficiently long co-measurement with the
referential monitoring station and advanced statistical methods, sufficiently accurate and reliable data
suitable for model evaluation were obtained. To ensure long-term quality of the observations, two
selected sensors are co-located with a permanent referential CHMI station within the simulation
domain. The presentation shows the details of the observations and their processing as well as the
preliminary results of the model evaluation.
Permanent Link: https://hdl.handle.net/11104/0345888

0576298 - ÚI 2024 AU eng A - Abstract

Geletič, Jan - Belda, M. - Bureš, M. - **Krč, Pavel** - Lehnert, M. - **Resler, Jaroslav - Řezníček,
Hynek** - Krayenhoff, S.
Complex analysis of effects of street tree quantity in pedestrian level using large-eddy simulation
model.
11th International Conference on Urban Climate. Titles. Sydney: ICUC, 2023, č. článku 452..
[ICUC 2023: International Conference on Urban Climate /11./. 28.08.2023-01.09.2023, Sydney]
R&D Projects: GA TA ČR(CZ) TO01000219
Grant - others:AV ČR(CZ) StrategieAV21/23
Program: StrategieAV
Institutional support: RVO:67985807
Keywords : biometeorology * PALM * urban greenery * air pollution
OECD category: Meteorology and atmospheric sciences
https://virtual.oxfordabstracts.com/#/event/3742/submission/452

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) about tens °C, same as related biometeorological indices, e.g. universal thermal climate index (UTCI) or physiological equivalent temperature (PET); maximum decrease is between 10–15 °C. All these decreases are located close to trees, with only a slight effect on their surroundings. Air temperature (T) decrease is typically about several °C, but with a larger effect on surroundings. It is a widely accepted fact by city planners and designers that trees generally optimise the urban canyon cooling at pedestrian level. New studies mostly based on large-eddy simulation principles proved that there are more dependencies as expected; e.g., number of trees planted, distances between trees, tree species, irrigation etc. Moreover, there is still a limited number of studies dealing with the impact of tree planting on wind velocity or air quality. We apply the newly-developed PALM model to quantify the impacts of sidewalk tree coverage on pedestrian ST, MRT, UTCI, PET, T, wind velocity and air quality ($PM10$, NO, $NO2$) during summer for a synthetic domain in a low-rise neighbourhood in a midlatitude city. PALM captures the detailed spatio-temporal variation of direct shading and directional longwave radiation loading on pedestrians resulting from tree shade. We found that a relatively equal distribution of trees among sun-exposed pedestrian routes and sidewalks within a block or neighbourhood avoids mutual shading and therefore optimises outdoor radiative heat reduction per tree during warm conditions. But with growing tree-canopy ratios the concentrations of air pollution in urban canyons increase significantly.
Permanent Link: https://hdl.handle.net/11104/0345869

Lehnert, M. - Jirmus, R. - Květoňová, V. - Jurek, M. - Geletič, Jan - Frajer, J.
Thermal environment of playgrounds in Czech cities: an example of applied measurement campaign in urban areas.
[FAIRNESS 2023: The FAIRNESS Action annual conference - Conference on micrometeorological measurements Urban microclimate monitoring and agricultural meteorology for climate change. Rome, 19.09.2023-21.09.2023]

Playgrounds are traditional urban spaces where children meet, play together, explore and socialize. At the same time, children are particularly vulnerable to heat stress. On that account in this case study we focus on the role of surface type and shading on the thermal exposure on playgrounds during hot summer days in cities of Brno, Olomouc and Prague. The preliminary results suggest that turf does not provide a significant reduction in thermal exposure compared to gravel, paved or rubber surfaces; however further studies are needed for various natural surfaces such as bark mulch. Trees have been in most cases confirmed to be more efficient in reducing thermal exposure than shading sails. This undergoing research can be considered as an illustrative example of the temporary measurement campaign in applied urban climate research.
Permanent Link: https://hdl.handle.net/11104/0346323

0576101 - ÚI 2024 RIV US eng J - Journal Article
Schimmack, U. - Bartoš, František
Estimating the false discovery risk of (randomized) clinical trials in medical journals based on published p-values.
PLoS ONE. Roč. 18, č. 8 (2023), č. článku e0290084. ISSN 1932-6203. E-ISSN 1932-6203
Institutional support: RVO:67985807
Keywords : false discovery * clinical trials * replication studies
OECD category: Statistics and probability
Impact factor: 3.700, year: 2022
Method of publishing: Open access
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DOI: 10.1371/journal.pone.0290084

Many sciences are facing a crisis of confidence in published results [1]. Meta-scientific studies have revealed low replication rates, estimates of low statistical power, and even reports of scientific misconduct [2]. Based on assumptions about the percentage of true hypotheses and statistical power to test them, Ioannidis [3] arrived at the conclusion that most published results are false. It has proven difficult to test this prediction. First, large scale replication attempts [4–6] are inherently expensive and focus only on a limited set of pre-selected findings [7]. Second, studies of meta-analyses have revealed that power is low, but rarely lead to the conclusion that the null-hypothesis is true [8–16] (but see [17, 18]). So far, the most promising attempt to estimate the false discovery rate has been Jager and Leek's [19] investigation of p-values in medical journals. They extracted 5,322 p-values from abstracts of medical journals and found that only 14% of the statistically significant results may be false-positives. This is a sizeable percentage, but it is inconsistent with the claim that most published results are false. Although Jager and Leek's article was based on actual data, the article had a relatively minor impact on discussions about false-positive risks, possibly due to several limitations of their study [20–23]. One problem of their estimation method is the problem to distinguish between true null-hypotheses (i.e., the effect size is exactly zero) and studies with very low power in which the effect size may be very small, but not zero. To avoid this problem, we do not estimate the actual percentage of false positives, but rather the maximum percentage that is consistent with the data. We call this estimate the false discovery risk (FDR). To estimate the FDR, we take advantage of Sorić's [24] insight that the false discovery risk is maximized when power to detect true effects is 100%. In this scenario, the false discovery rate is a simple function of the discovery rate (i.e., the percentage of significant results). Thus, the main challenge for empirical studies of FDR is to estimate the discovery rate when selection bias is present and inflates the observed discovery rate. To address the problem of selection bias, we developed a selection model that can provide an estimate of the discovery rate before selection for significance. The method section provides a detailed account of our method and compares it to Jager and Leek's [19] approach.
Permanent Link: https://hdl.handle.net/11104/0345708

0577156 - ÚI 2024 NL eng A - Abstract
Schmidt, Helmut - Knösche, T. R.
Modelling the effect of ephaptic coupling on spike propagation in peripheral nerve fibres.
Journal of Computational Neuroscience. Roč. 51, Suppl. 1, S58, č. článku S59. ISSN 0929-5313. E-ISSN 1573-6873
Institutional support: RVO:67985807
Permanent Link: https://hdl.handle.net/11104/0346390

0577163 - ÚI 2024 RIV eng A - Abstract
Dudášová, J. - [Valenta, Zdeněk](#) - Sachs, J. R.
Detection of covariate effects on vaccine efficacy using a correlate of protection and logistic regression.
ACoP14 Abstracts. National Harbor: ACoP, 2023.
[ACoP 2023: American Conference on Pharmacometrics /14./. 05.11.2023-08.11.2023, National Harbor]
Institutional support: RVO:67985807
Keywords : vaccine efficacy * correlate of protection * baseline covariates

OBJECTIVES: This work introduces a novel use of correlate of protection (CoP) data to help identify baseline covariates (demographic, clinical and other subject-specific characteristics) affecting vaccine efficacy (VE). A randomized controlled trial can be used to estimate VE even if the primary analysis does not consider baseline covariates because measured and unmeasured covariates will, on average, be balanced between the vaccinated and control groups due to randomization. However, VE may be affected by baseline covariates (for example, it can vary with age) and understanding the effect of covariates on efficacy is key to decisions by vaccine developers and public health authorities. METHODS: Clinical trial simulations (CTSs) are conducted to evaluate, in settings typical for a vaccine phase 3 trial, the impact of CoP data inclusion on logistic regression performance in identifying statistically and clinically significant covariates. The proposed approach uses CoP data and covariate data as predictors of clinical outcome (diseased versus non-diseased) and is compared to logistic regression (without CoP data) to relate vaccination status and covariate data to clinical outcome. RESULTS: CTSs, in which the true relationship between CoP data and clinical outcome probability is a (pre-specified and known) sigmoid function, show that use of CoP data increases the positive predictive value for detection of a covariate effect. If the true relationship is characterized by a decreasing convex function, use of CoP data does not substantially change positive or negative predictive value. In either scenario, vaccine efficacy is estimated accurately and more precisely (i.e., confidence intervals are narrower) in covariate-defined subgroups if CoP data are used, implying that using CoP data increases the ability to determine clinical significance of baseline covariate effects on efficacy. CONCLUSIONS: This study proposed and evaluated a novel approach for assessing baseline covariates potentially affecting VE. Results show that the proposed approach can sensitively and specifically identify potentially important covariates, and provides a method for evaluating their likely clinical significance in terms of predicted impact on vaccine efficacy. It shows further that inclusion of CoP data can enable more precise VE estimation, thus enhancing study power and/or efficiency and providing even better information to support health policy and development decisions.

Permanent Link: https://hdl.handle.net/11104/0346394

0576946 - ÚI 2024 IT eng A - Abstract
Dudášová, J. - [Valenta, Zdeněk](#) - Sachs, J. R.
The effect of immune correlates on the precision of vaccine efficacy evaluation: demographic subgroups.
ISCB44: 44th Annual Conference of the International Society for Clinical Biostatistics: Final Programme & Abstract Book. Milano: ISCB, 2023. s. 310-310.
[ISCB 2023: Annual Conference of the International Society for Clinical Biostatistics /44./. 27.08.2023-31.08.2023, Milano]
Institutional support: RVO:67985807
https://iscb.international/wp-content/uploads/2023/08/Book-of-Abstract-ISCB44_25-AGO-2.pdf

Clinical trials assessing vaccine efficacy typically provide data on binary and time-to-event clinical endpoints along with subjectspecific characteristics such as immune response to vaccination (immunogenicity) and demographics. Immunogenicity measurements often represent an established or a putative correlate of protection. Simulations have previously revealed that the understanding of efficacy in demographic subgroups can be substantially improved by quantifying the relationship betweenimmunogenicity and probability of disease (or of another binary clinical endpoint) and integrating that relationship with observed immunogenicity data to obtain relatively precise estimates of efficacy in subgroups of interest.
Permanent Link: https://hdl.handle.net/11104/0346319

0576941 - ÚI 2024 SI eng A - Abstract
Dudášová, J. - Valenta, Zdeněk - Nieddu, G. T. - Becker, A. D. - Sachs, J. R.
Leveraging immunogenicity data and logistic regression for detection of covariate effects on vaccine efficacy.
PAGE 2022 Abstracts. Ljubljana: PAGE, 2022.
[PAGE 2022: Population Approach Group Europe Meeting /30./. 28.06.2022-01.07.2022, Ljubljana]
Institutional support: RVO:67985807
https://www.page-meeting.org/default.asp?abstract=10095

This work introduces a novel effort to use immune response biomarkers to help identify covariates affecting vaccine efficacy (VE). VE is defined as a proportional reduction in risk of disease for vaccinated subjects compared to control subjects and is often assessed by counting disease cases and non-cases in randomized controlled clinical trials [1]. VE can be affected by "covariates" (demographic characteristics of enrolled subjects), e.g., age or gender. Statistical significance of covariate effects on the binary clinical outcome (diseased versus non-diseased) is typically evaluated by logistic regression. In most efficacy trials, immune response post vaccination (immunogenicity) is measured in addition to the primary clinical endpoint. An immunogenicity biomarker that reliably predicts protection is a correlate of protection (CoP) [2]. It has been shown that CoP-based VE prediction is more precise than the case-count-based VE estimate [3]. Several approaches have been proposed to model the relationship between immunogenicity and probability of disease (PoD) [3-5].
Permanent Link: https://hdl.handle.net/11104/0346317