Záznamy vložené do ASEP za UI (1.4. – 31. 5. 2021)

Cabessa, Jérémie - Hernault, H. - Kim, H. - Lamonato, Y. - Levy, Y. Z.
Efficient Text Classification with Echo State Networks (Accepted 05/2021).
IJCNN 2021 Proceedings. 2021.
[IJCNN 2021: The International Joint Conference on Neural Networks /34./. Virtual (US), 18.07.2021-22.07.2021]

We consider echo state networks (ESNs) for text classification. More specifically, we investigate the learning capabilities of ESNs with pre-trained word embedding as input features, trained on the IMDb and TREC sentiment and question classification datasets, respectively. First, we introduce a customized training paradigm for the processing of multiple input time series (the inputs texts) associated with categorical targets (their corresponding classes). For sentiment tasks, we use an additional frozen attention mechanism which is based on an external lexicon, and hence requires only negligible computational cost. Within this paradigm, ESNs can be trained in tens of seconds on a GPU. We show that ESNs significantly outperform their Ridge regression baselines provided with the same embedded features. ESNs also compete with classical Bi-LSTM networks while keeping a training time of up to 23 times faster. These results show that ESNs can be considered as robust, efficient and fast candidates for text classification tasks. Overall, this study falls within the context of light and fast-to-train models for NLP.
Trvalý link: http://hdl.handle.net/11104/0319682

Savický, Petr - Wegener, I.
Efficient algorithms for the transformation between different types of binary decision diagrams.
Foundation of Software Technology and Theoretical Computer Science. Berlin: Springer, 1994 - (Brauer, W.; Hartmanis, J.; Stoler, J.), s. 390-401. Lecture Notes in Computer Science, 880. ISBN 978-3-540-58715-6.
[FSTTCS 1994 /14./. Madras (IN), 15.12.1994-19.12.1994]
DOI: 10.1007/3-540-58715-2_140
Trvalý link: http://hdl.handle.net/11104/0319366

Savický, Petr
Random Boolean formulas representing any Boolean function with asymptotically equal probability.
Mathematical Foundations of Computer Science. Berlin: Springer, 1988 - (Chytil, M.; Koubek, V.; Janiga, L.), s. 512-517. Lecture Notes in Computer Science, 324. ISBN 978-3-540-50110-7. ISSN 0302-9743.
[MFCS 1988 /13./. Karlovy Vary (CS), 29.08.1988-02.09.1988]
DOI: 10.1007/BFb0017174
Trvalý link: http://hdl.handle.net/11104/0319365

Brabec, Marek - Craciun, A. - Dumitrescu, A.
Hybrid Numerical Models for Wind Speed Forecasting.
Journal of Atmospheric and Solar-Terrestrial Physics. Roč. 220, September 2021 (2021), č. článku 105669. ISSN 1364-6826

Wind speed is involved in multiple scales physical phenomena and depends on specific features, that are not always easy to simulate numerically. Alternative solution that combines the physical advantages provided by numerical weather prediction (NWP) simulations and statistical models is investigated for wind speed forecast. Several aspects that influence the wind speed forecast error at synoptic stations in Romania were identified, such as discrepancy between model and true topography, urbanicity or distance to the Black Sea. Calibration models in the framework of Generalized Additive Models (GAM) are developed for the proposed endeavour. A set of models applied to limited area model ALARO were introduced and evaluated. Results showed improved statistical scores compared to raw ALARO output and simple regression model: a decrease of up to 23% for the RMSE score, or 94% for the bias was observed for the model which performed best in terms of annual bias and RMSE. Different impact of terms involved in the calibration model is found. Most important effects in the model are associated with wind speed observations from the 24 past hours and simulated wind speed effect in relation to altitude.
Trvalý link: http://hdl.handle.net/11104/0320157

Dropka, N. - Ecklebe, S. - Holeňa, Martin
Real Time Predictions of VGF-GaAs Growth Dynamics by LSTM Neural Networks.

The aim of this study was to assess the aptitude of the recurrent Long Short-Term Memory (LSTM) neural networks for fast and accurate predictions of process dynamics in vertical-gradient-freeze growth of gallium arsenide crystals (VGF-GaAs) using datasets generated by numerical transient simulations. Real time predictions of the temperatures and solid–liquid interface position in GaAs are crucial for control applications and for process visualization, i.e., for generation of digital twins. In the reported study, an LSTM network was trained on 1950 datasets with 2 external inputs and 6 outputs. Based on network performance criteria and training results, LSTMs showed the very accurate predictions of the VGF-GaAs growth process with median root-mean-square-error (RMSE) values of $2 \times 10-3$. This deep learning method achieved a superior predictive accuracy and timeliness compared with more traditional Nonlinear AutoRegressive eXogenous (NARX) recurrent networks.
Trvalý link: http://hdl.handle.net/11104/0319303

Erosheva, E. - Martinková, Patrícia - Lee, C. J.
When Zero May not be Zero: A Cautionary Note on the use of Inter-rater Reliability in Evaluating Grant Peer Review.

Considerable attention has focused on studying reviewer agreement via inter-rater reliability (IRR) as a way to assess the quality of the peer review process. Inspired by a recent study that reported an IRR of zero in the mock peer review of top-quality grant proposals, we use real data from a complete range of submissions to the National Institutes of Health and to the American Institute of Biological Sciences to bring awareness to two important issues with using IRR for assessing peer review quality. First, we demonstrate that estimating local IRR from subsets of restricted-quality proposals will likely result in zero estimates under many scenarios. In both data sets, we find that zero local IRR estimates are more likely when subsets of top-quality proposals rather than bottom-quality proposals are considered. However, zero estimates from range-restricted data should not be interpreted as

indicating arbitrariness in peer review. On the contrary, despite different scoring scales used by the two agencies, when complete ranges of proposals are considered, IRR estimates are above 0.6 which indicates good reviewer agreement. Furthermore, we demonstrate that, with a small number of reviewers per proposal, zero estimates of IRR are possible even when the true value is not zero.
Trvalý link: http://hdl.handle.net/11104/0319384

0542818 - ÚI 2022 RIV CH eng J - Článek v odborném periodiku
Gupta, Kajari - Paluš, Milan
Cross-Scale Causality and Information Transfer in Simulated Epileptic Seizures.
Entropy. Roč. 23, č. 5 (2021), č. článku 526. ISSN 1099-4300
Grant CEP: GA ČR(CZ) GA19-16066S
Klíčová slova: multiscale dynamics * interactions * Granger causality * information transfer * epilepsy model
Impakt faktor: 2.494, rok: 2019
http://hdl.handle.net/11104/0320153
 DOI: 10.3390/e23050526

An information-theoretic approach for detecting causality and information transfer was applied to phases and amplitudes of oscillatory components related to different time scales and obtained using the wavelet transform from a time series generated by the Epileptor model. Three main time scales and their causal interactions were identified in the simulated epileptic seizures, in agreement with the interactions of the model variables. An approach consisting of wavelet transform, conditional mutual information estimation, and surrogate data testing applied to a single time series generated by the model was demonstrated to be successful in the identification of all directional (causal) interactions between the three different time scales described in the model. Thus, the methodology was prepared for the identification of causal cross-frequency phase–phase and phase–amplitude interactions in experimental and clinical neural data.
Trvalý link: http://hdl.handle.net/11104/0320153

0541885 - ÚI 2022 RIV NL eng J - Článek v odborném periodiku
Hůnová, I. - Brabec, Marek - Geletič, Jan - Malý, Marek - Dumitrescu, A.
Statistical Analysis of the Effects of Forests on Fog.
Science of the Total Environment. Roč. 781, 10 August 2021 (2021), č. článku 146675. ISSN 0048-9697
Grant CEP: GA TA ČR(CZ) SS02030031
Institucionální podpora: RVO:67985807
Klíčová slova: Fog * Forest * Generalised additive model * Penalised spline * Semiparametric model * Romania * 1981–2017
Kód oboru RIV: BB - Aplikovaná statistika, operační výzkum
Obor OECD: Statistics and probability
Impakt faktor: 6.551, rok: 2019
 DOI: 10.1016/j.scitotenv.2021.146675

Fog is influenced by numerous factors, including forests. The aim of our study was to examine in detail the extent to which forests affect fog. We hypothesised that: (i) fog incidence is affected by forests, (ii) the forested area in the station's neighbourhood is a factor influencing fog incidence, (iii) the influence on fog differs between coniferous and broad-leaved forests and (iv) the effect of forests on fog occurrence differs with altitude. For this, we used long-term records of fog incidence measured in 1981–2017 at 56 professional meteorological stations in Romania, GIS-derived information on forested areas in the neighbourhood of these stations, and land-use data on the types of these forests. The analyses are based on a semiparametric generalised additive logistic model for the probability of fog occurrence with potentially nonlinear, smooth effects modelled via penalised splines. Our results indicated that forests do affect fog incidence significantly, though their effect is considerably lower than the effect of dominant factors we studied previously, such as seasonality and altitude. It was indicated that forested areas in the neighbourhood of these stations are a factor significantly influencing fog incidence, even when forest is not the dominant land-use factor. In this respect, a radius of 3 km was the most effective when considering the forested area in a circle around the meteorological station. Our model showed that the influence on fog occurrence differs between coniferous and broad-leaved forests, and the effect of forests on fog occurrence is modified by altitude. The hypotheses propounded were confirmed and the hypothesised effects were quantified. Our findings, relevant at least for temperate forests, will enhance further considerations related to fog formation and wet atmospheric deposition. Moreover, our study opens a new challenge for further

research of water balance as related to deforestation in catchment areas.
Trvalý link: http://hdl.handle.net/11104/0319381

0542348 - ÚI 2022 RIV eng J - Článek v odborném periodiku
Imran, M. A. - Xu, J. - Sultan, M. - Shamshiri, R. R. - Ahmed, N. - Javed, Q. - Asfahan, H. M. - Latif, Yasir - Usman, M. - Ahmad, R.
Free Discharge of Subsurface Drainage Effluent: An Alternate Design of the Surface Drain System in Pakistan.
Sustainability. Roč. 13, č. 7 (2021), č. článku 4080. ISSN 2071-1050
Institucionální podpora: RVO:67985807
Klíčová slova: surface drain system * design * drainage effluent * Pakistan
Impakt faktor: 2.576, rok: 2019
http://hdl.handle.net/11104/0319778
DOI: 10.3390/su13074080

In Pakistan, many subsurface (SS) drainage projects were launched by the Salinity Control and Reclamation Project (SCARP) to deal with twin problems (waterlogging and salinity). In some cases, sump pumps were installed for the disposal of SS effluent into surface drainage channels. Presently, sump pumps have become dysfunctional due to social and financial constraints. This study evaluates the alternate design of the Paharang drainage system that could permit the discharge of the SS drainage system in the response of gravity. The proposed design was completed after many successive trials in terms of lowering the bed level and decreasing the channel bed slope. Interconnected MS-Excel worksheets were developed to design the L-section and X-section. Design continuity of the drainage system was achieved by ensuring the bed and water levels of the receiving drain were lower than the outfalling drain. The drain cross-section was set within the present row with a few changes on the service roadside. The channel side slope was taken as 1:1.5 and the spoil bank inner and outer slopes were kept as 1:2 for the entire design. The earthwork was calculated in terms of excavation for lowering the bed level and increasing the drain section to place the excavated materials in a specific manner. The study showed that modification in the design of the Paharang drainage system is technically admissible and allows for the continuous discharge of SS drainage effluent from the area.
Trvalý link: http://hdl.handle.net/11104/0319778

0541777 - ÚI 2022 SG eng J - Článek v odborném periodiku
Kalina, Jan - Neoral, Aleš - Vidnerová, Petra
Effective Automatic Method Selection for Nonlinear Regression Modeling.
International Journal of Neural Systems. Online (2021). ISSN 0129-0657
Grant CEP: GA ČR(CZ) GA19-05704S; GA ČR(CZ) GA18-23827S
Institucionální podpora: RVO:67985807
Klíčová slova: metalearning * nonlinear regression * robust statistical estimation * feature selection * AutoML
Kód oboru RIV: IN - Informatika
Obor OECD: Computer sciences, information science, bioinformathics (hardware development to be 2.2, social aspect to be 5.8)
Impakt faktor: 5.604, rok: 2019
DOI: 10.1142/S0129065721500209

Metalearning, an important part of artificial intelligence, represents a promising approach for the task of automatic selection of appropriate methods or algorithms. This paper is interested in recommending a suitable estimator for nonlinear regression modeling, particularly in recommending either the standard nonlinear least squares estimator or one of such available alternative estimators, which is highly robust with respect to the presence of outliers in the data. The authors hold the opinion that theoretical considerations will never be able to formulate such recommendations for the nonlinear regression context. Instead, metalearning is explored here as an original approach suitable for this task. In this paper, four different approaches for automatic method selection for nonlinear regression are proposed and computations over a training database of 643 real publicly available datasets are performed. Particularly, while the metalearning results may be harmed by the imbalanced number of groups, an effective approach yields much improved results, performing a novel combination of supervised feature selection by random forest and oversampling by synthetic minority oversampling technique (SMOTE). As a by-product, the computations bring arguments in favor of the very recent nonlinear least weighted squares estimator, which turns out to outperform other (and much more renowned) estimators in a quite large percentage of datasets.

0541918 - ÚI 2022 RIV CH eng J - Článek v odborném periodiku
Kathpalia, Aditi - Nagaraj, N.
Time-Reversibility, Causality and Compression-Complexity.
Entropy. Roč. 23, č. 3 (2021), s. 1-21, č. článku 327. ISSN 1099-4300
Grant CEP: GA ČR(CZ) GA19-16066S
Institucionální podpora: RVO:67985807
Klíčová slova: time-reversibility * time-irreversibility * temporal asymmetry * compression-complexity * effort-to-compress * compressive potential * interventional causality * heart period variability asymmetry * sunspot numbers
Kód oboru RIV: BA - Obecná matematika
Obor OECD: Applied mathematics
Impakt faktor: 2.494, rok: 2019
http://hdl.handle.net/11104/0319416
DOI: 10.3390/e23030327

Detection of the temporal reversibility of a given process is an interesting time series analysis scheme that enables the useful characterisation of processes and offers an insight into the underlying processes generating the time series. Reversibility detection measures have been widely employed in the study of ecological, epidemiological and physiological time series. Further, the time reversal of given data provides a promising tool for analysis of causality measures as well as studying the causal properties of processes. In this work, the recently proposed Compression-Complexity Causality (CCC) measure (by the authors) is shown to be free of the assumption that the "cause precedes the effect", making it a promising tool for causal analysis of reversible processes. CCC is a data-driven interventional measure of causality (second rung on the Ladder of Causation) that is based on Effort-to-Compress (ETC), a well-established robust method to characterize the complexity of time series for analysis and classification. For the detection of the temporal reversibility of processes, we propose a novel measure called the Compressive Potential based Asymmetry Measure. This asymmetry measure compares the probability of the occurrence of patterns at different scales between the forward-time and time-reversed process using ETC. We test the performance of the measure on a number of simulated processes and demonstrate its effectiveness in determining the asymmetry of real-world time series of sunspot numbers, digits of the transcedental number π and heart interbeat interval variability.
Trvalý link: http://hdl.handle.net/11104/0319416

0542813 - ÚI 2022 eng J - Článek v odborném periodiku
Katina, Stanislav - Vittert, L. - Bowman, A. W.
Functional Data Analysis and Visualisation of Three-Dimensional Surface Shape.
JOURNAL OF THE ROYAL STATISTICAL SOCIETY SERIES C-APPLIED STATISTICS. Online 06 May 2021 (2021). E-ISSN 1467-9876
Institucionální podpora: RVO:67985807
Klíčová slova: asymmetry * functional data * human faces * shape * surface data * visualisation
Kód oboru RIV: BB - Aplikovaná statistika, operační výzkum
Obor OECD: Statistics and probability
DOI: 10.1111/rssc.12482

The advent of high-resolution imaging has made data on surface shape widespread. Methods for the analysis of shape based on landmarks are well established but high-resolution data require a functional approach. The starting point is a systematic and consistent description of each surface shape and a method for creating this is described. Three innovative forms of analysis are then introduced. The first uses surface integration to address issues of registration, principal component analysis and the measurement of asymmetry, all in functional form. Computational issues are handled through discrete approximations to integrals, based in this case on appropriate surface area weighted sums. The second innovation is to focus on sub-spaces where interesting behaviour such as group differences are exhibited, rather than on individual principal components. The third innovation concerns the comparison of individual shapes with a relevant control set, where the concept of a normal range is extended to the highly multivariate setting of surface shape. This has particularly strong applications to medical contexts where the assessment of individual patients is very important. All of these ideas are developed and illustrated in the important context of human facial shape, with a strong emphasis on the effective visual communication of effects of interest.
Trvalý link: http://hdl.handle.net/11104/0320151

Kudláček, Jan - Chvojka, Jan - Kumpošt, Vojtěch - Heřmanovská, Barbora - Pošusta, Antonín - Jefferys, J. G. R. - Maturana, M. I. - Novák, O. - Cook, M. J. - Otáhal, Jakub - Hlinka, Jaroslav - Jiruška, Přemysl
Long-term seizure dynamics are determined by the nature of seizures and the mutual interactions between them.

The seemingly random and unpredictable nature of seizures is a major debilitating factor for people with epilepsy. An increasing body of evidence demonstrates that the epileptic brain exhibits long-term fluctuations in seizure susceptibility, and seizure emergence seems to be a consequence of processes operating over multiple temporal scales. A deeper insight into the mechanisms responsible for long-term seizure fluctuations may provide important information for understanding the complex nature of seizure genesis. In this study, we explored the long-term dynamics of seizures in the tetanus toxin model of temporal lobe epilepsy. The results demonstrate the existence of long-term fluctuations in seizure probability, where seizures form clusters in time and are then followed by seizure-free periods. Within each cluster, seizure distribution is non-Poissonian, as demonstrated by the progressively increasing inter-seizure interval (ISI), which marks the approaching cluster termination. The lengthening of ISIs is paralleled by: increasing behavioral seizure severity, the occurrence of convulsive seizures, recruitment of extra-hippocampal structures and the spread of electrographic epileptiform activity outside of the limbic system. The results suggest that repeated non-convulsive seizures obey the 'seizures-beget-seizures' principle, leading to the occurrence of convulsive seizures, which decrease the probability of a subsequent seizure and, thus, increase the following ISI. The cumulative effect of repeated convulsive seizures leads to cluster termination, followed by a long inter-cluster period. We propose that seizures themselves are an endogenous factor that contributes to long-term fluctuations in seizure susceptibility and their mutual interaction determines the future evolution of disease activity.
Trvalý link: http://hdl.handle.net/11104/0320018

Lehnert, M. - Savić, S. - Milošević, D. - Dunjić, J. - Geletič, Jan
Mapping Local Climate Zones and Their Applications in European Urban Environments: A Systematic Literature Review and Future Development Trends.

In the light of climate change and burgeoning urbanization, heat loads in urban areas have emerged as serious issues, affecting the well-being of the population and the environment. In response to a pressing need for more standardised and communicable research into urban climate, the concept of local climate zones (LCZs) has been created. This concept aims to define the morphological types of (urban) surface with respect to the formation of local climatic conditions, largely thermal. This systematic review paper analyses studies that have applied the concept of LCZs to European urban areas. The methodology utilized pre-determined keywords and five steps of literature selection. A total

of 91 studies were found eligible for analysis. The results show that the concept of LCZs has been increasingly employed and become well established in European urban climate research. Dozens of measurements, satellite observations, and modelling outcomes have demonstrated the characteristic thermal responses of LCZs in European cities. However, a substantial number of the studies have concentrated on the methodological development of the classification process, generating a degree of inconsistency in the delineation of LCZs. Recent trends indicate an increasing prevalence of the accessible remote-sensing based approach over accurate GIS-based methods in the delineation of LCZs. In this context, applications of the concept in fine-scale modelling appear limited. Nevertheless, the concept of the LCZ has proven appropriate and valuable to the provision of metadata for urban stations, (surface) urban heat island analysis, and the assessment of outdoor thermal comfort and heat risk. Any further development of LCZ mapping appears to require a standardised objective approach that may be globally applicable.
Trvalý link: http://hdl.handle.net/11104/0319668

The mechanisms underlying the emergence of seizures are one of the most important unresolved issues in epilepsy research. In this paper, we study how perturbations, exogenous or endogenous, may promote or delay seizure emergence. To this aim, due to the increasingly adopted view of epileptic dynamics in terms of slow-fast systems, we perform a theoretical analysis of the phase response of a generic relaxation oscillator. As relaxation oscillators are effectively bistable systems at the fast time scale, it is intuitive that perturbations of the non-seizing state with a suitable direction and amplitude may cause an immediate transition to seizure. By contrast, and perhaps less intuitively, smaller amplitude perturbations have been found to delay the spontaneous seizure initiation. By studying the isochrons of relaxation oscillators, we show that this is a generic phenomenon, with the size of such delay depending on the slow flow component. Therefore, depending on perturbation amplitudes, frequency and timing, a train of perturbations causes an occurrence increase, decrease or complete suppression of seizures. This dependence lends itself to analysis and mechanistic understanding through methods outlined in this paper. We illustrate this methodology by computing the isochrons, phase response curves and the response to perturbations in several epileptic models possessing different slow vector fields. While our theoretical results are applicable to any planar relaxation oscillator, in the motivating context of epilepsy they elucidate mechanisms of triggering and abating seizures, thus suggesting stimulation strategies with effects ranging from mere delaying to full suppression of seizures.
Trvalý link: http://hdl.handle.net/11104/0319363

We study the lattice of extensions of four-valued Belnap-Dunn logic, called super-Belnap logics by analogy with superintuitionistic logics. We describe the global structure of this lattice by splitting it into several subintervals, and prove some new completeness theorems for super-Belnap logics. The crucial technical tool for this purpose will be the so-called antiaxiomatic (or explosive) part operator.

The antiaxiomatic (or explosive) extensions of Belnap-Dunn logic turn out to be of particular interest owing to their connection to graph theory: the lattice of finitary antiaxiomatic extensions of Belnap-Dunn logic is isomorphic to the lattice of upsets in the homomorphism order on finite graphs (with loops allowed). In particular, there is a continuum of finitary super Belnap logics. Moreover, a non-finitary super-Belnap logic can be constructed with the help of this isomorphism. As algebraic corollaries we obtain the existence of a continuum of antivarieties of De Morgan algebras and the existence of a prevariety of De Morgan algebras which is not a quasivariety.
Trvalý link: http://hdl.handle.net/11104/0319795

Punčochář, Vít - Sedlár, Igor
Epistemic Extensions of Substructural Inquisitive Logics.

In this paper, we study the epistemic extensions of distributive substructural inquisitive logics. Substructural inquisitive logics are logics of questions based on substructural logics of declarative sentences. They generalize basic inquisitive logic which is based on the classical logic of declaratives. We show that if the underlying substructural logic is distributive, the generalization can be extended to embrace also the epistemic modalities 'knowing whether' and 'wondering whether' that are applicable to questions. We construct a semantic framework for a language of propositional substructural logics enriched with a question-forming operator (inquisitive disjunction) and epistemic modalities. We show that within this framework, one can define a canonical model with suitable properties for any (syntactically defined) epistemic inquisitive logic. This leads to a general approach to completeness proofs for such logics. A deductive system for the weakest epistemic inquisitive logic is described and completeness proved for this special case using the general method.
Trvalý link: http://hdl.handle.net/11104/0320152

Selingerová, I. - Katina, Stanislav - Horová, I.
Comparison of Parametric and Semiparametric Survival Regression Models with Kernel Estimation.

The modelling of censored survival data is based on different estimations of the conditional hazard function. When survival time follows a known distribution, parametric models are useful. This strong assumption is replaced by a weaker in the case of semiparametric models. For instance, the frequently used model suggested by Cox is based on the proportionality of hazards. These models use non-parametric methods to estimate some baseline hazard and parametric methods to estimate the influence of a covariate. An alternative approach is to use smoothing that is more flexible. In this paper, two types of kernel smoothing and some bandwidth selection techniques are introduced. Application to real data shows different interpretations for each approach. The extensive simulation study is aimed at comparing different approaches and assessing their benefits. Kernel estimation is demonstrated to be very helpful for verifying assumptions of parametric or semiparametric models and is able to capture changes in the hazard function in both time and covariate directions.
Trvalý link: http://hdl.handle.net/11104/0319382

Kalina, Jan
Mental Health Clinical Decision Support Exploiting Big Data.

The complexity of clinical decision-making is immensely increasing with the advent of big data with a clinical relevance. Clinical decision systems represent useful e-health tools applicable to various tasks within the clinical decision-making process. This chapter is devoted to basic principles of clinical decision support systems and their benefits for healthcare and patient safety. Big data is crucial input for clinical decision support systems and is helpful in the task to find the diagnosis, prognosis, and therapy. Statistical challenges of analyzing big data in psychiatry are overviewed, with a particular interest for psychiatry. Various barriers preventing telemedicine tools from expanding to the field of mental health are discussed. The development of decision support systems is claimed here to play a key role in the development of information-based medicine, particularly in psychiatry. Information technology will be ultimately able to combine various information sources including big data to present and enforce a holistic information-based approach to psychiatric care.
Trvalý link: http://hdl.handle.net/11104/0319676

0542208 - ÚI 2022 CZ cze N - Článek v novinách
Resler, Jaroslav - Eben, Kryštof - Geletič, Jan - Krč, Pavel - Lehnert, Michal
Jak zachovat správné víry.
Vesmír. Online 28. 4. 2021 (2021). ISSN 0042-4544
https://vesmir.cz/cz/on-line-clanky/2021/04/jak-zachovat-spravne-viry.html

Kdo někdy strávil alespoň část života ve městě, ví, že je v něm oproti okolí většinou tepleji. Navíc ulice jsou rušné a exhalace z průmyslových podniků a automobilové dopravy všudypřítomné. Jak mají urbanisté měnit města, aby je s blížící se globální změnou klimatu učinili příjemnějšími místy k životu, než jsou dnes? Pomoci může nový numerický model, který umožňuje odhalit, jak například tvary domů, barvy fasád nebo stromy v ulicích ovlivní tepelnou pohodu i čistotu ovzduší.
Trvalý link: http://hdl.handle.net/11104/0319679

0541945 - ÚI 2022 CZ eng V - Výzkumná zpráva
Turčičová, Marie - Mandel, J. - Eben, Kryštof
Score matching filters for Gaussian Markov random fields with a linear model of the precision matrix.
Prague: ICS CAS, 2021. 30 s. Technical Report, V-1284.

We present an ensemble filter that provides a rigorous covariance regularization when the underlying random field is Gaussian Markov. We use a linear model for the precision matrix (inverse of covariance) and estimate its parameters together with the analysis mean by the Score Matching method. This procedure provides an explicit expression for parameter estimators. The resulting analysis step formula is the same as in the traditional ensemble Kalman filter.
Trvalý link: http://hdl.handle.net/11104/0319459

0542822 - ÚI 2022 US eng A - Abstrakt
Krč, Pavel - Resler, Jaroslav
Modeling 3-D Radiative Fluxes within the PALM-4U Microscale Urban Climate Model.
Program of 15th Symposium on the Urban Environment. Boston: AMS, 2020.
[AMS Annual Meeting /100./. 12.01.2020-16.01.2020, Boston]
https://ams.confex.com/ams/2020Annual/meetingapp.cgi/Paper/370890

Modeling radiative fluxes explicitly in microscale atmospheric simulations, especially in complex urban environments, presents new algorithmic challenges, which are not encountered in mesoscale modeling of radiative fluxes. The presence of mutually visible surfaces separated by large horizontal distances means that there are direct radiative interactions among arbitrary parts of the modeling domain, which deviates from a traditional parallelization scheme, where the modeling domain is divided horizontally into subdomains and most of the interaction and consequently data exchanges happen between adjacent subdomains. This problem is further emphasized when plant canopy is modeled as fully three-dimensional semi-transparent objects. The Radiative Transfer Model (RTM) in the PALM-4U microscale urban modeling system represents individual surface elements (faces), for which the radiative fluxes and other processes are modelled, using linearized arrays within the memory of the process that models the respective subdomain. The radiative fluxes between mutually visible face pairs are determined using view factors, which represent the fraction of view from each face occupied by other individual faces. The remaining fraction of view, which is necessary for modeling directional and diffuse solar irradiance together with longwave irradiance from the sky and longwave radiation emitted towards the sky, is called the sky view factor. The RTM models plant canopy explicitly within the 3-D grid: the grid cells occupied by plant canopy cause partial absorption of the passing shortwave and longwave radiation depending on their leaf area density (LAD), and they also emit longwave radiation depending on their temperature. These processes are quantified using so-called canopy view factors. The mutual visibility among faces and the values of the view factors, sky view factors and canopy view factors are determined using a specially designed raytracing algorithm. This process is not only computationally expensive, it also requires a lot of interprocess communication in a highly parallelized setup. Because the geometry of terrain, buildings and other obstacles is modelled as constant in time, it is possible to perform the raytracing in advance during model initialization. The application of the precomputed view factors on actual radiative fluxes within time-stepping is then straightforward with much lower demands for CPU time and interprocess data transfer. RTM version 3.0 offers two schemes for discretization of each face's view. The legacy per-face discretization scheme performs raytracing and establishes view factors individually for each pair of mutually visible faces with optional limitation by distance and viewing angle. This scheme works well for small to medium setups, but it does not scale well for large domains and/or high resolution simulations with horizontal grid dimensions in the order of thousands of grid points. The current angular discretization scheme, available since RTM version 2.5, discretizes view from each face using a constant set of azimuth and elevation angles, limiting the spatial resolution of mutual radiative exchange only among the surfaces that are very distant or under shallow angles, i.e. which do not represent a large portion of each other's view. This scheme scales well even in the largest setups allowed by the atmospheric model, without any noticeable drop in accuracy. (In fact, accuracy actually improves for near faces due to better representation of angular sizes.) Since the maximum amount of view factors per face is constant under this scheme, the total amount of surface view factors grows with $O(n^2)$ and the total number of canopy view factors grows with $O(n^3)$ if the size of the grid is increased by a factor of n in each dimension, therefore it scales in pair with other processes in the PALM-4U model. The angular scheme also uses a newly optimized raytracing algorithm, which traces all the rays directed in one azimuth concurrently, bringing much better granularity of interprocess data exchange, improved memory access patterns and more efficient computation overall. Both raytracing algorithms in RTM utilize MPI one-sided communication with passive target synchronization. This advanced MPI feature allows a process that traces rays passing through some other process' subdomain to query data (e.g. 3-D arrays with LAD of plant canopy) from that process' memory without its synchronized cooperation. Optimizing the algorithms for different domain sizes and different amounts of parallel processes leads to different implementations of certain sub-tasks. In currently used scenarios, it is often not possible to fit any domain-sized 3-D structure in the memory of each parallel process, however this is still possible with the domain-sized 2-D terrain elevation array and with the global linearized arrays of per-face values. This property is utilized both in the raytracing algorithms to significantly decrease the amount of interprocess data exchange, and also in the time-stepping code where a potentially more optimized data exchange pattern may be utilized at the expense of higher memory consumption. An extension is currently being prepared for the extremely large cases where even the domain-sized 2-D arrays could not be stored in each parallel process.
Trvalý link: http://hdl.handle.net/11104/0320154