physics:quantum computer speed limits

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1 Research on pinches driven by SPPED 2 generator : hard X-ray and neutron emission in plasma focus configuration

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Metadata

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physics.plasm-ph :: 12th International Congress on Plasma Physics, 25-29 October 2004, Nice (France)

Summary

SPEED2 is a generator based on Marx technology and was designed in the University of Dusseldorf. SPEED2 consists on 40 +/- Marx modules connected in parallel (4.1 mF equivalent Marx generator capacity, 300 kV, 4 MA in short circuit, 187 kJ, 400 ns rise time, dI/dt 1013 A/s). Currently the SPEED2 is operating at the Comision Chilena de Energia Nuclear, CCHEN, Chile, being the most powerful and energetic device for dense transient plasma in the Southern Hemisphere. Most of the previous works developed in SPEED2 at Dusseldorf were done in a plasma focus configuration for soft X-ray emission and the neutron emission from SPEED2 was not completely studied. The research program at CCHEN considers experiments in different pinch configurations (plasma focus, gas puffed plasma focus, gas embedded Z-pinch, wire arrays) at current of hundred of kiloamperes to mega-amperes, using the SPEED2 generator. The Chilean operation has begun implementing and developing diagnostics in a conventional plasma focus configuration operating in deuterium in order to characterize the neutron emission and the hard X-ray production. Silver activation counters, plastics CR39 and scintillator-photomultiplier detectors are used to characterize the neutron emission. Images of metallic plates with different thickness are obtained on commercial radiographic film, Agfa Curix ST-G2, in order to characterize an effective energy of the hard X-ray outside of the discharge .

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2 Fast Localization of Facial Landmark Points

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Metadata

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cs.CV ::

Summary

Localization of salient facial landmark points, such as eye corners or the tip of the nose, is still considered a challenging computer vision problem despite recent efforts. This is especially evident in unconstrained environments, i.e., in the presence of background clutter and large head pose variations. Most methods that achieve state-of-the-art accuracy are slow, and, thus, have limited applications. We describe a method that can accurately estimate the positions of relevant facial landmarks in real-time even on hardware with limited processing power, such as mobile devices. This is achieved with a sequence of estimators based on ensembles of regression trees. The trees use simple pixel intensity comparisons in their internal nodes and

this makes them able to process image regions very fast. We test the developed system on several publicly available datasets and analyse its processing speed on various devices. Experimental results show that our method has practical value.

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3 The Statistical Mechanics of the Self-Gravitating Gas: Equation of State and Fractal Dimension

H. J. de Vega, N. S'anchez

Metadata

ID: http://arxiv.org/abs/hep-th/9903236v3
UPDATED: 2000-08-17T13:59:47Z
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hep-th :: LaTex, 7 pages, 2 .ps figures, minor improvements, to appear in Physics Letters B

Summary

We provide a complete picture of the self-gravitating non-relativistic gas at thermal equilibrium using Monte Carlo simulations (MC), analytic mean field methods (MF) and low density expansions. The system is shown to possess an infinite volume limit, both in the canonical (CE) and in the microcanonical ensemble (MCE) when N, V $\to \infty, keeping N/V^{1/3} fixed. We$ **compute** $the equation$ $linear differential equation of Abel type. The MF gives an accurate picture in agreement with the MC simulations both in the CE and MCE.$ 3.

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4 SPEED+: Next-Generation Dataset for Spacecraft Pose Estimation across Domain Gap

Tae Ha Park, Marcus Märtens, Gurvan Lecuyer, Dario Izzo, Simone D'Amico

Metadata

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cs.CV ::

Summary

Autonomous vision-based spaceborne navigation is an enabling technology for future on-orbit servicing and space logistics missions. While computer vision in general has benefited from Machine Learning (ML), training and validating spaceborne ML models are extremely challenging due to the impracticality of acquiring a large-scale labeled dataset of images of the intended target in the space environment. Existing datasets, such as Spacecraft PosE Estimation Dataset (SPEED), have so far mostly relied on synthetic images for both training and validation, which are easy to mass-produce but fail to resemble the visual features and illumination variability inherent to the target spaceborne images. In order to bridge the gap between the current practices and the intended applications in future space missions, this paper introduces SPEED+: the next generation spacecraft pose estimation dataset with specific emphasis on domain gap. In addition to 60,000 synthetic images for training, SPEED+ includes 9,531 hardware-in-the-loop images of a spacecraft mockup model captured from the Testbed for Rendezvous and Optical Navigation (TRON) facility. TRON is a first-of-a-kind robotic testbed capable of capturing an arbitrary number of target images with accurate and maximally diverse pose labels and high-fidelity spaceborne illumination conditions. SPEED+ is used in the second international Satellite Pose Estimation Challenge co-hosted by SLAB and the Advanced Concepts Team of the European Space Agency to evaluate and compare the robustness of spaceborne ML models trained on synthetic images.

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5 Imitation of Life: A Search Engine for Biologically Inspired Design

Hen Emuna, Nadav Borenstein, Xin Qian, Hyeonsu Kang, Joel Chan, Aniket Kittur, Dafna Shahaf

Metadata

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cs.CL :: To be published in the AAAI 2024 Proceedings Main Track

Summary

Biologically Inspired Design (BID), or Biomimicry, is a problem-solving methodology that applies analogies from nature to solve engineering challenges. For example, Speedo engineers designed swimsuits based on shark skin. Finding relevant biological solutions for real-world problems poses significant challenges, both due to the limited biological knowledge engineers and designers typically possess and to the limited BID resources. Existing BID datasets are hand-curated and small, and scaling them up requires costly human annotations. In this paper, we introduce BARcode (Biological Analogy Retriever), a search engine for automatically mining bio-inspirations from the web at scale. Using advances in natural language understanding and data programming, BARcode identifies potential inspirations for engineering challenges. Our experiments demonstrate that BARcode can retrieve inspirations that are valuable to engineers and designers tackling real-world problems, as well as recover famous historical BID examples. We release data and code; we view BARcode as a step towards addressing the challenges that have historically hindered the practical application of BID to engineering innovation.

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6 Validity of Web-based, Self-directed, NeuroCognitive Performance Test in MCI

P. Murali Doraiswamy, Terry E. Goldberg, Min Qian, Alexandra R. Linares, Adaora Nwosu, Izael Nino, Jessica D'Antonio, Julia Phillips, Charlie Ndouli, Caroline Hellegers, Andrew M. Michael, Jeffrey R. Petrella, Howards Andrews, Joel Sneed, Davangere P. Devanand

Metadata

ID: http://arxiv.org/abs/2208.04841v1
UPDATED: 2022-07-11T17:01:33Z
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q-bio.NC :: 17 Pages

Summary

Digital cognitive tests offer several potential advantages over established paper-pencil tests but have not yet been fully evaluated for the clinical evaluation of mild cognitive impairment. The NeuroCognitive Performance Test (NCPT) is a web-based, self-directed, modular battery intended for repeated assessments of multiple cognitive domains. Our objective was to examine its relationship with the ADAS-Cog and MMSE as well as with established paper-pencil tests of cognition and daily functioning in MCI. We used Spearman correlations, regressions and principal components analysis followed by a factor analysis (varimax rotated) to examine our objectives. In MCI subjects, the NCPT composite is significantly correlated with both a composite measure of established tests (r=0.78, p¡0.0001) as well as with the ADAS-Cog (r=0.55, p¡0.0001). Both NCPT and paper-pencil test batteries had a similar factor structure that included a large g component with a high eigenvalue. The correlation for the analogous tests (e.g. Trails A and B, learning memory tests) were significant (p¡0.0001). Further, both the NCPT and established tests significantly (p¡ 0.01) predicted the University of California San Diego Performance-Based Skills Assessment and Functional Activities Questionnaire, measures of daily functioning. The NCPT, a web-based, self-directed, computerized test, shows high concurrent validity with established tests and hence offers promise for use as a research or clinical tool in MCI. Despite limitations such as a relatively small sample, absence of control group and cross-sectional nature, these findings are consistent with the growing literature on the promise of self-directed, web-based cognitive assessments for MCI.

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7 Interference effects in dilepton resonance searches for Z' bosons and dark matter mediators

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Metadata

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hep-ph :: v2 matches version accepted by JHEP. 14 pages + appendices, 9 figures + 1 table, ZPEED code to calculate dilepton likelihoods available at http://github.com/kahlhoefer/ZPEED

Summary

New Z' gauge bosons arise in many extensions of the Standard Model and predict resonances in the dilepton invariant mass spectrum. Searches for such resonances therefore provide important constraints on many models of new physics, but the resulting bounds are often calculated without interference effects. In this work we show that the effect of interference is significant and cannot be neglected whenever the Z' width is large (for example because of an invisible contribution). To illustrate this point, we implement and validate the most recent 139 fb^{-1} dilepton search from ATLAS and obtain exclusion limits on general Z' models as well as on simplified dark matter models with spin-1 mediators. We find that interference can substantially strengthen the bound on the Z' couplings and push exclusion limits for dark matter simplified models to higher values of the Z' mass. Together with this study we release the open-source code ZPEED, which provides fast likelihoods and exclusion bounds for general Z' models.

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8 Evaluation of imaging protocol for ECT based on CS image reconstruction algorithm

Xiaolin Zhou, Minkai Yun, Xuexiang Cao, Shuangquan Liu, Lu Wang, Xianchao Huang, Long Wei

Metadata

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physics.med-ph :: 6 pages, 5 figures

Summary

SPECT (Single-photon Emission Computerized Tomography) and PET (Positron Emission Tomography) are essential medical imaging tools, for which the sampling angle number, scan time should be chosen carefully to compromise between image quality and the radiopharmaceutical dose. In this study, the image quality of different acquisition protocol was evaluated via varied angle number and count number per angle with Monte Carlo simulation data. It was shown that when similar imaging counts were used, the factor of acquisition counts was more important than that of the sampling number in ECT (Emission Computerized Tomography). To further reduce the activity requirement and the scan duration, an iterative image reconstruction algorithm for limited-view and low-dose tomography based on compressed sensing theory has been developed. The total variation regulation was added in the reconstruction process to improve SNR (Signal to Noise Ratio) and reduce the artifacts caused by the limited angle sampling. Maximization of maximum likelihood of the estimated image and the measured data and minimization of the total variation of the image are alternative implemented. By using this advanced algorithm, the reconstruction process is able to achieve image quality matching or exceeding that of normal scan with only half of the injection radiopharmaceutical dose.

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9 SpeedNet: Learning the Speediness in Videos

Sagie Benaim, Ariel Ephrat, Oran Lang, Inbar Mosseri, William T. Freeman, Michael Rubinstein, Michal Irani, Tali Dekel

Metadata

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cs.CV :: Accepted to CVPR 2020 (oral). Project webpage: http://speednet-cvpr20.github.io

Summary

We wish to automatically predict the "speediness" of moving objects in videos—whether they move faster, at, or slower than their "natural" speed. The core component in our approach is SpeedNet—a novel deep network trained to detect if a video is playing at normal rate, or if it is sped up. SpeedNet is trained on a large corpus of natural videos in a self-supervised manner, without requiring any manual annotations. We show how this single, binary classification network can be used to detect arbitrary rates of speediness of objects. We demonstrate prediction results by SpeedNet on a wide range of videos containing complex natural motions, and examine the visual cues it utilizes for making those predictions. Importantly, we show that through predicting the speed of videos, the model learns a powerful and meaningful space-time representation that goes beyond simple motion cues. We demonstrate how those learned features can boost the performance of self-supervised action recognition, and can be used for video retrieval. Furthermore, we also apply SpeedNet for generating time-varying, adaptive video speedups, which can allow viewers to watch videos faster, but with less of the jittery, unnatural motions typical to videos that are sped up uniformly.

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10 A class of regularizations based on nonlinear isotropic diffusion for inverse problems

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Metadata

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math.NA ::

Summary

Building on the well-known total-variation (TV), this paper develops a general regularization technique based on nonlinear isotropic diffusion (NID) for inverse problems with piecewise smooth solutions. The novelty of our approach is to be adaptive (we speak of A-NID) i.e. the regularization varies during the iterates in order to incorporate prior information on the edges, deal with the evolution of the reconstruction and circumvent the limitations due to the non-convexity of the proposed functionals. After a detailed analysis of the convergence and well-posedness of the method, this latter is validated by simulations perfomed on computerized tomography (CT).
