Classification tasks

Soft Industries:

Software Bug Report Classification: Critical, Normal, Minor

1. manual/search.texi in the GNU C Library (aka glibc) before 2.2 lacks a statement about the unspecified tdelete return value upon deletion of a tree's root, which might allow attackers to access a dangling pointer in an application whose developer was unaware of a documentation update from 1999.
2. Denial of service to NT mail servers including Ipswitch, Mdaemon, and Exchange through a buffer overflow in the SMTP HELO command.
3. The LDAP bind function in Exchange 5.5 has a buffer overflow that allows a remote attacker to conduct a denial of service or execute commands.
4. The prompt parsing in bash allows a local user to execute commands as another user by creating a directory with the name of the command to execute.
5. Perl, sh, csh, or other shell interpreters are installed in the cgi-bin directory on a WWW site, which allows remote attackers to execute arbitrary commands.
6. Internet Explorer 5.0 and 5.01 allows remote attackers to modify or execute files via the Import/Export Favorites feature, aka the "ImportExportFavorites" vulnerability.
7. Microsoft Excel does not warn a user when a macro is present in a Symbolic Link (SYLK) format file.
8. The "download behavior" in Internet Explorer 5 allows remote attackers to read arbitrary files via a server-side redirect.
9. Buffer overflow in Internet Mail Service (IMS) for Microsoft Exchange 5.5 and 5.0 allows remote attackers to conduct a denial of service via AUTH or AUTHINFO commands.
10. Internet Explorer 5.01 and earlier allows a remote attacker to create a reference to a client window and use a server-side redirect to access local files via that window, aka "Server-side Page Reference Redirect."
11. Multiple buffer overflows in smbvalid/smbval SMB authentication library, as used in Apache::AuthenSmb and possibly other modules, allows remote attackers to execute arbitrary commands via (1) a long username, (2) a long password, and (3) other unspecified methods.
12. Windows Internet Naming Service (WINS) allows remote attackers to cause a denial of service (connectivity loss) or steal credentials via a 1Ch registration that causes WINS to change the domain controller to point to a malicious server. NOTE: this problem may be limited when Windows 95/98 clients are used, or if the primary domain controller becomes unavailable.
13. Windows NT Autorun executes the autorun.inf file on non-removable media, which allows local attackers to specify an alternate program to execute when other users access a drive.
14. Buffer overflow in Kerberos 4 KDC program allows remote attackers to cause a denial of service via the lastrealm variable in the set\_tgtkey function.
15. Buffer overflow in Kerberos 4 KDC program allows remote attackers to cause a denial of service via the localrealm variable in the process\_v4 function.
16. Buffer overflow in Kerberos 4 KDC program allows remote attackers to cause a denial of service via the e\_msg variable in the kerb\_err\_reply function.
17. DiskCheck script diskcheck.pl in Red Hat Linux 6.2 allows local users to create or overwrite arbitrary files via a symlink attack on a temporary file.
18. The installation of Microsoft Exchange 2000 before Rev. A creates a user account with a known password, which could allow attackers to gain privileges, aka the "Exchange User Account" vulnerability.
19. htsearch program in htDig 3.2 beta, 3.1.6, 3.1.5, and earlier allows remote attackers to determine the physical path of the server by requesting a non-existent configuration file using the config parameter, which generates an error message that includes the full path.
20. Cross site scripting vulnerabilities in Apache 1.3.0 through 1.3.11 allow remote attackers to execute script as other web site visitors via (1) the printenv CGI (printenv.pl), which does not encode its output, (2) pages generated by the ap\_send\_error\_response function such as a default 404, which does not add an explicit charset, or (3) various messages that are generated by certain Apache modules or core code. NOTE: the printenv issue might still exist for web browsers that can render text/plain content types as HTML, such as Internet Explorer, but CVE regards this as a design limitation of those browsers, not Apache. The printenv.pl/acuparam vector, discloser on 20070724, is one such variant.
21. Buffer overflow in portmir for AIX 4.3.0 allows local users to corrupt lock files and gain root privileges via the echo\_error routine.
22. htpasswd and htdigest in Apache 2.0a9, 1.3.14, and others allows local users to overwrite arbitrary files via a symlink attack.
23. Bajie HTTP JServer 0.78, and other versions before 0.80, allows remote attackers to execute arbitrary commands via shell metacharacters in an HTTP request for a CGI program that does not exist.
24. UploadServlet in Bajie HTTP JServer 0.78, and possibly other versions before 0.80, allows remote attackers to execute arbitrary commands by calling the servlet to upload a program, then using a ... (modified ..) to access the file that was created for the program.
25. An interaction between the Outlook Web Access (OWA) service in Microsoft Exchange 2000 Server and Internet Explorer allows attackers to execute malicious script code against a user's mailbox via a message attachment that contains HTML code, which is executed automatically.
26. The default configuration of Norton AntiVirus for Microsoft Exchange 2000 2.x allows remote attackers to identify the recipient's INBOX file path by sending an email with an attachment containing malicious content, which includes the path in the rejection notice.
27. Buffer overflow in MIT Kerberos 5 (krb5) 1.2.2 and earlier allows remote attackers to cause a denial of service and possibly execute arbitrary code via base-64 encoded data, which is not properly handled when the radix\_encode function processes file glob output from the ftpglob function.
28. fetchmailconf in fetchmail before 5.7.4 allows local users to overwrite files of other users via a symlink attack on temporary files.
29. iptables before 1.2.4 does not accurately convert rate limits that are specified on the command line, which could allow attackers or users to generate more or less traffic than intended by the administrator.
30. The log files in Apache web server contain information directly supplied by clients and does not filter or quote control characters, which could allow remote attackers to hide HTTP requests and spoof source IP addresses when logs are viewed with UNIX programs such as cat, tail, and grep.

LOW：0-25points;MEDIUM: 26-50 points; HIGH: 51-75 points; CRITICAL：75-100 points

 Prompt:

Short nl:

You are a robot that determines the severity of software bugs. The assessment criteria are as follows: LOW：0-25points;MEDIUM: 26-50 points; HIGH: 51-75 points; CRITICAL：75-100 points. The output result can only be: 'LOW', 'MEDIUM', 'HIGH' or ’ CRITICAL’.

Long nl:

Criteria for Evaluation (The entire score range is from 0 to 100): LOW：0-25points;MEDIUM: 26-50 points; HIGH: 51-75 points; CRITICAL：75-100 points.

You are a robot that assesses the severity of software errors. You receive user input about the bug and then consider the impact on features, user experience, priority, frequency, and difficulty of reproduction to assign a severity score to the bug. Finally, you judge the severity of the bug based on the above evaluation criteria and output the results. Note: The output can only be one of four words: 'LOW', 'MEDIUM', 'HIGH' or ’ CRITICAL. Do not include intermediate evaluation reasons and procedures in the output.

Output format: 'LOW', 'MEDIUM', 'HIGH' or ’ CRITICAL’.

Example: Input: 'bug: calendar.php in vBulletin before 2.2.0 allows remote attackers to execute arbitrary commands via shell metacharacters in the command parameter.'

Output: 'HIGH'

(End of the example)

Non-Software Engineering:

1，Analyze whether the blog is positive or negative.

1. #fingerprint #Pregnancy Test https://goo.gl/h1MfQV #android #apps #beautiful #cute #health #igers #iphoneonly #iphonesia #iphone
2. Finally a transparant silicon case ^^ Thanks to my uncle :) #yay #Sony #Xperia #S #sonyexperias… http://instagram.com/p/YGEt5JC6JM/
3. We love this! Would you go? #talk #makememories #unplug #relax #iphone #smartphone #wifi #connect... http://fb.me/6N3LsUpCu
4. I'm wired I know I'm George I was made that way ;) #iphone #cute #daventry #home http://instagr.am/p/Li\_5\_ujS4k/
5. What amazing service! Apple won't even talk to me about a question I have unless I pay them $19.95 for their stupid support!
6. iPhone software update fucked up my phone big time Stupid iPhones
7. Happy for us .. #instapic #instadaily #us #sony #xperia #xperiaZ https://instagram.com/p/z9qGfWlvj7/
8. New Type C charger cable #UK http://www.ebay.co.uk/itm/-/112598674021 … #bay #Amazon #etsy New Year #Rob Cross #Toby Young #EVEMUN #McMafia #Taylor #SPECTRE 2018 #NewYear #Starting 2018 #recipes #technology #SamsungGalaxyS9 #iPhoneX pic.twitter.com/PjIwq59WtC
9. Bout to go shopping again listening to music #iphone #justme #music #likeforlike #followforfollow… http://instagr.am/p/Vj6bg5tLql/
10. Photo: #fun #selfie #pool #water #sony #camera #picoftheday #sun #instagood #boy #cute #outdoor... http://tmblr.co/ZAjC0n1ms\_Gp8
11. hey #apple when you make a new ipod dont make it a new color or .2inches thinner make it not crash every five fuckin minite.
12. Ha! Not heavy machinery but it does what I need it to. @Apple really dropped the ball with that design. #drinkyourhaterade
13. Contemplating giving in to the iPhone bandwagon simply because #Cellcom has no new Androids #depressing #IDontWantTo
14. I just made another crazy purchase lol my theory is 'Work hard, Play Hard' Lol #iPad #Apple #Shopping http://instagr.am/p/NUyFHvyE7I/
15. @shaqlockholmes @sam\_louise1991 the battery is so painful! I charge it overnight and by lunchtime battery is dead! #HateOrange.
16. From #DeepEllum towards #downtown #Dallas. #BigD #Saturday #RX100M3 #Sony #summer #urban http://instagram.com/p/pzJoOaQqZ4/
17. Like and Share if you want this 3D Phone Case for Iphone #iphone #s ... https://bestcheapphones.com/index.php/product/2016-new-sweet-3d-mineral-water-bottle-love-ice-cream-phone-case-couples-soft-silicone-rubber-case-for-iphone-7-6-6s-plus-5-5se/ …pic.twitter.com/gFKN0Yec6J
18. Go crazy !! #iphonesia, #iphone, #instagood, #instagram, #photooftheday, #tweegram, ,… http://instagram.com/p/d0R5SqrY5B/
19. The reason I don't have one. #iphone #suck #apple #truth #truthbetold #agree #fact #realitycheck #blackberrypic.twitter.com/zpggd7caZN
20. How is the apple store gunna be out of 5C screens ?!? It's Monday and ur the FUCKING APPLE STORE !!! #fuckingpissed
21. #Apple #Art #Easter #Dear #Friends If you would like to be published on my channel. Design a face on the Easter Bunny and email it to me as a .png thumbnail. My email : mutita.edibleart@gmail.compic.twitter.com/7JhWphfbGT
22. Excuse me, waiter?... There seems to be a pie in my soup! #wife #bake #an #apple #pie #yay http://instagr.am/p/Q8G43JpimN/
23. I've had this new ipod for four days? And this of button on the back broke... I accidentally hit it once
24. when your iPhone screen goes completely black and you keep getting texts all day but you can't FUCKING CHECK THEM #Apple #6thiPhone
25. It's time for new wallpapers #phone #wallpapers #wall #screen #galaxy #samsung #app … https://www.instagram.com/p/BcsKTNNn51c/
26. 1.05 billion for 3 patents where there is prior art = 300 millions each = patent trolls are partying now thanks to Apple #apple
27. $&@\*# my ipod is all messed up and i haven't done nothing to it #$&@\*# #MyLoss ! #Apple
28. My ipod touch is frozen on the apple logo when it starts up. If I lose all of Demi's music & pics I will kill someone! #SoAngry #HATEApple
29. do love a new phone case! #flower #green #diamond #pearls #cute #new #iphone #iphone4s #case… http://instagr.am/p/WeLXEfun-O/
30. Must watch #youtube #subscribe #daily #vlog #twitch #gaming #fun #ps4 #xbox #sony #games #ios #android #$&@\*# https://youtu.be/oaXlm8R5SDANegative: 0-33 points; Neutral: 34-66 points; Positive: 67-100 points.

Prompt:

Short nl:

You are a bot that is good at judging whether blog content is positive or negative. The evaluation criteria are: Negative: 1, Positive: 0. The output result can only be: '0' or '1'

Long nl:

Criteria for Evaluation(The entire score range is from 0 to 100): Negative(51-100points): ‘1’; Positive(0-50points): ‘0’.

You are a bot that is good at judging whether blog content is positive or negative.

You receive blog content input from users, and then assign a negative sentiment score to the blog content, taking into account semantic sentiment vocabulary and expressions. Finally, the criteria for judging the blog according to the above evaluation criteria are output.

Note: The output should only be one of the three words: '0, or '1'. Do not include intermediate assessment reasons and processes in the output.

Output format: '0', or '1'.

Example:

Input: ' Thank you! #samsung #live #laugh #life #food #philippines #instago #instahub #instagram… http://instagram.com/p/YXHUdZhHFb/'

Output: '0'

(End of the example)

2， classify the research papers based on Abstract and Title.

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| 1. Reconstructing Subject-Specific Effect Maps. Predictive models allow subject-specific inference when analyzing disease related alterations in neuroimaging data. Given a subject's data, inference can be made at two levels: global, i.e. identifiying condition presence for the subject, and local, i.e. detecting condition effect on each individual measurement extracted from the subject's data. While global inference is widely used, local inference, which can be used to form subject-specific effect maps, is rarely used because existing models often yield noisy detections composed of dispersed isolated islands. In this article, we propose a reconstruction method, named RSM, to improve subject-specific detections of predictive modeling approaches and in particular, binary classifiers. RSM specifically aims to reduce noise due to sampling error associated with using a finite sample of examples to train classifiers. The proposed method is a wrapper-type algorithm that can be used with different binary classifiers in a diagnostic manner, i.e. without information on condition presence. Reconstruction is posed as a Maximum-A-Posteriori problem with a prior model whose parameters are estimated from training data in a classifier-specific fashion. Experimental evaluation is performed on synthetically generated data and data from the Alzheimer's Disease Neuroimaging Initiative (ADNI) database. Results on synthetic data demonstrate that using RSM yields higher detection accuracy compared to using models directly or with bootstrap averaging. Analyses on the ADNI dataset show that RSM can also improve correlation between subject-specific detections in cortical thickness data and non-imaging markers of Alzheimer's Disease (AD), such as the Mini Mental State Examination Score and Cerebrospinal Fluid amyloid-$\beta$ levels. Further reliability studies on the longitudinal ADNI dataset show improvement on detection reliability when RSM is used. |
| 1. Rotation Invariance Neural Network. Rotation invariance and translation invariance have great values in image recognition tasks. In this paper, we bring a new architecture in convolutional neural network (CNN) named cyclic convolutional layer to achieve rotation invariance in 2-D symbol recognition. We can also get the position and orientation of the 2-D symbol by the network to achieve detection purpose for multiple non-overlap target. Last but not least, this architecture can achieve one-shot learning in some cases using those invariance. |
| 1. Spherical polyharmonics and Poisson kernels for polyharmonic functions. We introduce and develop the notion of spherical polyharmonics, which are a natural generalisation of spherical harmonics. In particular we study the theory of zonal polyharmonics, which allows us, analogously to zonal harmonics, to construct Poisson kernels for polyharmonic functions on the union of rotated balls. We find the representation of Poisson kernels and zonal polyharmonics in terms of the Gegenbauer polynomials. We show the connection between the classical Poisson kernel for harmonic functions on the ball, Poisson kernels for polyharmonic functions on the union of rotated balls, and the Cauchy-Hua kernel for holomorphic functions on the Lie ball. |
| 1. A finite element approximation for the stochastic Maxwell--Landau--Lifshitz--Gilbert system. The stochastic Landau--Lifshitz--Gilbert (LLG) equation coupled with the Maxwell equations (the so called stochastic MLLG system) describes the creation of domain walls and vortices (fundamental objects for the novel nanostructured magnetic memories). We first reformulate the stochastic LLG equation into an equation with time-differentiable solutions. We then propose a convergent $\theta$-linear scheme to approximate the solutions of the reformulated system. As a consequence, we prove convergence of the approximate solutions, with no or minor conditions on time and space steps (depending on the value of $\theta$). Hence, we prove the existence of weak martingale solutions of the stochastic MLLG system. Numerical results are presented to show applicability of the method. |
| 1. Comparative study of Discrete Wavelet Transforms and Wavelet Tensor Train decomposition to feature extraction of FTIR data of medicinal plants. Fourier-transform infra-red (FTIR) spectra of samples from 7 plant species were used to explore the influence of preprocessing and feature extraction on efficiency of machine learning algorithms. Wavelet Tensor Train (WTT) and Discrete Wavelet Transforms (DWT) were compared as feature extraction techniques for FTIR data of medicinal plants. Various combinations of signal processing steps showed different behavior when applied to classification and clustering tasks. Best results for WTT and DWT found through grid search were similar, significantly improving quality of clustering as well as classification accuracy for tuned logistic regression in comparison to original spectra. Unlike DWT, WTT has only one parameter to be tuned (rank), making it a more versatile and easier to use as a data processing tool in various signal processing applications. |
| 1. On maximizing the fundamental frequency of the complement of an obstacle. Let $\Omega \subset \mathbb{R}^n$ be a bounded domain satisfying a Hayman-type asymmetry condition, and let $ D $ be an arbitrary bounded domain referred to as "obstacle". We are interested in the behaviour of the first Dirichlet eigenvalue $ \lambda\_1(\Omega \setminus (x+D)) $. First, we prove an upper bound on $ \lambda\_1(\Omega \setminus (x+D)) $ in terms of the distance of the set $ x+D $ to the set of maximum points $ x\_0 $ of the first Dirichlet ground state $ \phi\_{\lambda\_1} > 0 $ of $ \Omega $. In short, a direct corollary is that if \begin{equation} \mu\_\Omega := \max\_{x}\lambda\_1(\Omega \setminus (x+D)) \end{equation} is large enough in terms of $ \lambda\_1(\Omega) $, then all maximizer sets $ x+D $ of $ \mu\_\Omega $ are close to each maximum point $ x\_0 $ of $ \phi\_{\lambda\_1} $. Second, we discuss the distribution of $ \phi\_{\lambda\_1(\Omega)} $ and the possibility to inscribe wavelength balls at a given point in $ \Omega $. Finally, we specify our observations to convex obstacles $ D $ and show that if $ \mu\_\Omega $ is sufficiently large with respect to $ \lambda\_1(\Omega) $, then all maximizers $ x+D $ of $ \mu\_\Omega $ contain all maximum points $ x\_0 $ of $ \phi\_{\lambda\_1(\Omega)} $. |
| 1. On the rotation period and shape of the hyperbolic asteroid 1I/`Oumuamua (2017) U1 from its lightcurve. We observed the newly discovered hyperbolic minor planet 1I/`Oumuamua (2017 U1) on 2017 October 30 with Lowell Observatory's 4.3-m Discovery Channel Telescope. From these observations, we derived a partial lightcurve with peak-to-trough amplitude of at least 1.2 mag. This lightcurve segment rules out rotation periods less than 3 hr and suggests that the period is at least 5 hr. On the assumption that the variability is due to a changing cross section, the axial ratio is at least 3:1. We saw no evidence for a coma or tail in either individual images or in a stacked image having an equivalent exposure time of 9000 s. |
| 1. Adverse effects of polymer coating on heat transport at solid-liquid interface. The ability of metallic nanoparticles to supply heat to a liquid environment under exposure to an external optical field has attracted growing interest for biomedical applications. Controlling the thermal transport properties at a solid-liquid interface then appears to be particularly relevant. In this work, we address the thermal transport between water and a gold surface coated by a polymer layer. Using molecular dynamics simulations, we demonstrate that increasing the polymer density displaces the domain resisting to the heat flow, while it doesn't affect the final amount of thermal energy released in the liquid. This unexpected behavior results from a trade-off established by the increasing polymer density which couples more efficiently with the solid but initiates a counterbalancing resistance with the liquid. |
| 1. SPH calculations of Mars-scale collisions: the role of the Equation of State, material rheologies, and numerical effects. We model large-scale ($\approx$2000km) impacts on a Mars-like planet using a Smoothed Particle Hydrodynamics code. The effects of material strength and of using different Equations of State on the post-impact material and temperature distributions are investigated. The properties of the ejected material in terms of escaping and disc mass are analysed as well. We also study potential numerical effects in the context of density discontinuities and rigid body rotation. We find that in the large-scale collision regime considered here (with impact velocities of 4km/s), the effect of material strength is substantial for the post-impact distribution of the temperature and the impactor material, while the influence of the Equation of State is more subtle and present only at very high temperatures. |
| 1. $\mathcal{R}\_{0}$ fails to predict the outbreak potential in the presence of natural-boosting immunity. Time varying susceptibility of host at individual level due to waning and boosting immunity is known to induce rich long-term behavior of disease transmission dynamics. Meanwhile, the impact of the time varying heterogeneity of host susceptibility on the shot-term behavior of epidemics is not well-studied, even though the large amount of the available epidemiological data are the short-term epidemics. Here we constructed a parsimonious mathematical model describing the short-term transmission dynamics taking into account natural-boosting immunity by reinfection, and obtained the explicit solution for our model. We found that our system show "the delayed epidemic", the epidemic takes off after negative slope of the epidemic curve at the initial phase of epidemic, in addition to the common classification in the standard SIR model, i.e., "no epidemic" as $\mathcal{R}\_{0}\leq1$ or normal epidemic as $\mathcal{R}\_{0}>1$. Employing the explicit solution we derived the condition for each classification. |
| 1. A global sensitivity analysis and reduced order models for hydraulically-fractured horizontal wells. We present a systematic global sensitivity analysis using the Sobol method which can be utilized to rank the variables that affect two quantity of interests -- pore pressure depletion and stress change -- around a hydraulically-fractured horizontal well based on their degree of importance. These variables include rock properties and stimulation design variables. A fully-coupled poroelastic hydraulic fracture model is used to account for pore pressure and stress changes due to production. To ease the computational cost of a simulator, we also provide reduced order models (ROMs), which can be used to replace the complex numerical model with a rather simple analytical model, for calculating the pore pressure and stresses at different locations around hydraulic fractures. The main findings of this research are: (i) mobility, production pressure, and fracture half-length are the main contributors to the changes in the quantities of interest. The percentage of the contribution of each parameter depends on the location with respect to pre-existing hydraulic fractures and the quantity of interest. (ii) As the time progresses, the effect of mobility decreases and the effect of production pressure increases. (iii) These two variables are also dominant for horizontal stresses at large distances from hydraulic fractures. (iv) At zones close to hydraulic fracture tips or inside the spacing area, other parameters such as fracture spacing and half-length are the dominant factors that affect the minimum horizontal stress. The results of this study will provide useful guidelines for the stimulation design of legacy wells and secondary operations such as refracturing and infill drilling. |
| 1. Role-separating ordering in social dilemmas controlled by topological frustration. "Three is a crowd" is an old proverb that applies as much to social interactions, as it does to frustrated configurations in statistical physics models. Accordingly, social relations within a triangle deserve special attention. With this motivation, we explore the impact of topological frustration on the evolutionary dynamics of the snowdrift game on a triangular lattice. This topology provides an irreconcilable frustration, which prevents anti-coordination of competing strategies that would be needed for an optimal outcome of the game. By using different strategy updating protocols, we observe complex spatial patterns in dependence on payoff values that are reminiscent to a honeycomb-like organization, which helps to minimize the negative consequence of the topological frustration. We relate the emergence of these patterns to the microscopic dynamics of the evolutionary process, both by means of mean-field approximations and Monte Carlo simulations. For comparison, we also consider the same evolutionary dynamics on the square lattice, where of course the topological frustration is absent. However, with the deletion of diagonal links of the triangular lattice, we can gradually bridge the gap to the square lattice. Interestingly, in this case the level of cooperation in the system is a direct indicator of the level of topological frustration, thus providing a method to determine frustration levels in an arbitrary interaction network. |
| 1. Dynamics of exciton magnetic polarons in CdMnSe/CdMgSe quantum wells: the effect of self-localization. We study the exciton magnetic polaron (EMP) formation in (Cd,Mn)Se/(Cd,Mg)Se diluted-magnetic-semiconductor quantum wells using time-resolved photoluminescence (PL). The magnetic field and temperature dependencies of this dynamics allow us to separate the non-magnetic and magnetic contributions to the exciton localization. We deduce the EMP energy of 14 meV, which is in agreement with time-integrated measurements based on selective excitation and the magnetic field dependence of the PL circular polarization degree. The polaron formation time of 500 ps is significantly longer than the corresponding values reported earlier. We propose that this behavior is related to strong self-localization of the EMP, accompanied with a squeezing of the heavy-hole envelope wavefunction. This conclusion is also supported by the decrease of the exciton lifetime from 600 ps to 200 - 400 ps with increasing magnetic field and temperature. |
| 1. On Varieties of Ordered Automata. The classical Eilenberg correspondence, based on the concept of the syntactic monoid, relates varieties of regular languages with pseudovarieties of finite monoids. Various modifications of this correspondence appeared, with more general classes of regular languages on one hand and classes of more complex algebraic structures on the other hand. For example, classes of languages need not be closed under complementation or all preimages under homomorphisms, while monoids can be equipped with a compatible order or they can have a distinguished set of generators. Such generalized varieties and pseudovarieties also have natural counterparts formed by classes of finite (ordered) automata. In this paper the previous approaches are combined. The notion of positive $\mathcal C$-varieties of ordered semiautomata (i.e. no initial and final states are specified) is introduced and their correspondence with positive $\mathcal C$-varieties of languages is proved. |
| 1. Direct Evidence of Spontaneous Abrikosov Vortex State in Ferromagnetic Superconductor EuFe$\_2$(As$\_{1-x}$P$\_x$)$\_2$ with $x=0.21$. Using low-temperature Magnetic Force Microscopy (MFM) we provide direct experimental evidence for spontaneous vortex phase (SVP) formation in EuFe$\_2$(As$\_{0.79}$P$\_{0.21}$)$\_2$ single crystal with the superconducting $T^{\rm 0}\_{\rm SC}=23.6$~K and ferromagnetic $T\_{\rm FM}\sim17.7$~K transition temperatures. Spontaneous vortex-antivortex (V-AV) pairs are imaged in the vicinity of $T\_{\rm FM}$. Also, upon cooling cycle near $T\_{\rm FM}$ we observe the first-order transition from the short period domain structure, which appears in the Meissner state, into the long period domain structure with spontaneous vortices. It is the first experimental observation of this scenario in the ferromagnetic superconductors. Low-temperature phase is characterized by much larger domains in V-AV state and peculiar branched striped structures at the surface, which are typical for uniaxial ferromagnets with perpendicular magnetic anisotropy (PMA). The domain wall parameters at various temperatures are estimated. |
| 1. A rank 18 Waring decomposition of $sM\_{\langle 3\rangle}$ with 432 symmetries. The recent discovery that the exponent of matrix multiplication is determined by the rank of the symmetrized matrix multiplication tensor has invigorated interest in better understanding symmetrized matrix multiplication. I present an explicit rank 18 Waring decomposition of $sM\_{\langle 3\rangle}$ and describe its symmetry group. |
| 1. The PdBI Arcsecond Whirlpool Survey (PAWS). The Role of Spiral Arms in Cloud and Star Formation. The process that leads to the formation of the bright star forming sites observed along prominent spiral arms remains elusive. We present results of a multi-wavelength study of a spiral arm segment in the nearby grand-design spiral galaxy M51 that belongs to a spiral density wave and exhibits nine gas spurs. The combined observations of the(ionized, atomic, molecular, dusty) interstellar medium (ISM) with star formation tracers (HII regions, young <10Myr stellar clusters) suggest (1) no variation in giant molecular cloud (GMC) properties between arm and gas spurs, (2) gas spurs and extinction feathers arising from the same structure with a close spatial relation between gas spurs and ongoing/recent star formation (despite higher gas surface densities in the spiral arm), (3) no trend in star formation age either along the arm or along a spur, (4) evidence for strong star formation feedback in gas spurs: (5) tentative evidence for star formation triggered by stellar feedback for one spur, and (6) GMC associations (GMAs) being no special entities but the result of blending of gas arm/spur cross-sections in lower resolution observations. We conclude that there is no evidence for a coherent star formation onset mechanism that can be solely associated to the presence of the spiral density wave. This suggests that other (more localized) mechanisms are important to delay star formation such that it occurs in spurs. The evidence of star formation proceeding over several million years within individual spurs implies that the mechanism that leads to star formation acts or is sustained over a longer time-scale. |
| 1. Higher structure in the unstable Adams spectral sequence. We describe a variant construction of the unstable Adams spectral the sequence for a space $Y$, associated to any free simplicial resolution of $H^\*(Y;R)$ for $R=\mathbb{F}\_p$ or $\mathbb{Q}$. We use this construction to describe the differentials and filtration in the spectral sequence in terms of appropriate systems of higher cohomology operations. |
| 1. Comparing Covariate Prioritization via Matching to Machine Learning Methods for Causal Inference using Five Empirical Applications. When investigators seek to estimate causal effects, they often assume that selection into treatment is based only on observed covariates. Under this identification strategy, analysts must adjust for observed confounders. While basic regression models have long been the dominant method of statistical adjustment, more robust methods based on matching or weighting have become more common. Of late, even more flexible methods based on machine learning methods have been developed for statistical adjustment. These machine learning methods are designed to be black box methods with little input from the researcher. Recent research used a data competition to evaluate various methods of statistical adjustment and found that black box methods out performed all other methods of statistical adjustment. Matching methods with covariate prioritization are designed for direct input from substantive investigators in direct contrast to black methods. In this article, we use a different research design to compare matching with covariate prioritization to black box methods. We use black box methods to replicate results from five studies where matching with covariate prioritization was used to customize the statistical adjustment in direct response to substantive expertise. We find little difference across the methods. We conclude with advice for investigators. |
| 1. Acoustic Impedance Calculation via Numerical Solution of the Inverse Helmholtz Problem. Assigning homogeneous boundary conditions, such as acoustic impedance, to the thermoviscous wave equations (TWE) derived by transforming the linearized Navier-Stokes equations (LNSE) to the frequency domain yields a so-called Helmholtz solver, whose output is a discrete set of complex eigenfunction and eigenvalue pairs. The proposed method -- the inverse Helmholtz solver (iHS) -- reverses such procedure by returning the value of acoustic impedance at one or more unknown impedance boundaries (IBs) of a given domain via spatial integration of the TWE for a given real-valued frequency with assigned conditions on other boundaries. The iHS procedure is applied to a second-order spatial discretization of the TWEs derived on an unstructured grid with staggered grid arrangement. The momentum equation only is extended to the center of each IB face where pressure and velocity components are co-located and treated as unknowns. One closure condition considered for the iHS is the assignment of the surface gradient of pressure phase over the IBs, corresponding to assigning the shape of the acoustic waveform at the IB. The iHS procedure is carried out independently for each frequency in order to return the complete broadband complex impedance distribution at the IBs in any desired frequency range. The iHS approach is first validated against Rott's theory for both inviscid and viscous, rectangular and circular ducts. The impedance of a geometrically complex toy cavity is then reconstructed and verified against companion full compressible unstructured Navier-Stokes simulations resolving the cavity geometry and one-dimensional impedance test tube calculations based on time-domain impedance boundary conditions (TDIBC). The iHS methodology is also shown to capture thermoacoustic effects, with reconstructed impedance values quantitatively in agreement with thermoacoustic growth rates. |
| 1. Deciphering noise amplification and reduction in open chemical reaction networks. The impact of random fluctuations on the dynamical behavior a complex biological systems is a longstanding issue, whose understanding would shed light on the evolutionary pressure that nature imposes on the intrinsic noise levels and would allow rationally designing synthetic networks with controlled noise. Using the It艒 stochastic differential equation formalism, we performed both analytic and numerical analyses of several model systems containing different molecular species in contact with the environment and interacting with each other through mass-action kinetics. These systems represent for example biomolecular oligomerization processes, complex-breakage reactions, signaling cascades or metabolic networks. For chemical reaction networks with zero deficiency values, which admit a detailed- or complex-balanced steady state, all molecular species are uncorrelated. The number of molecules of each species follow a Poisson distribution and their Fano factors, which measure the intrinsic noise, are equal to one. Systems with deficiency one have an unbalanced non-equilibrium steady state and a non-zero S-flux, defined as the flux flowing between the complexes multiplied by an adequate stoichiometric coefficient. In this case, the noise on each species is reduced if the flux flows from the species of lowest to highest complexity, and is amplified is the flux goes in the opposite direction. These results are generalized to systems of deficiency two, which possess two independent non-vanishing S-fluxes, and we conjecture that a similar relation holds for higher deficiency systems. |
| 1. Many-Body Localization: Stability and Instability. Rare regions with weak disorder (Griffiths regions) have the potential to spoil localization. We describe a non-perturbative construction of local integrals of motion (LIOMs) for a weakly interacting spin chain in one dimension, under a physically reasonable assumption on the statistics of eigenvalues. We discuss ideas about the situation in higher dimensions, where one can no longer ensure that interactions involving the Griffiths regions are much smaller than the typical energy-level spacing for such regions. We argue that ergodicity is restored in dimension d > 1, although equilibration should be extremely slow, similar to the dynamics of glasses. |
| 1. Fault Detection and Isolation Tools (FDITOOLS) User's Guide. The Fault Detection and Isolation Tools (FDITOOLS) is a collection of MATLAB functions for the analysis and solution of fault detection and model detection problems. The implemented functions are based on the computational procedures described in the Chapters 5, 6 and 7 of the book: "A. Varga, Solving Fault Diagnosis Problems - Linear Synthesis Techniques, Springer, 2017". This document is the User's Guide for the version V1.0 of FDITOOLS. First, we present the mathematical background for solving several basic exact and approximate synthesis problems of fault detection filters and model detection filters. Then, we give in-depth information on the command syntax of the main analysis and synthesis functions. Several examples illustrate the use of the main functions of FDITOOLS. |
| 1. Complexity of Deciding Detectability in Discrete Event Systems. Detectability of discrete event systems (DESs) is a question whether the current and subsequent states can be determined based on observations. Shu and Lin designed a polynomial-time algorithm to check strong (periodic) detectability and an exponential-time (polynomial-space) algorithm to check weak (periodic) detectability. Zhang showed that checking weak (periodic) detectability is PSpace-complete. This intractable complexity opens a question whether there are structurally simpler DESs for which the problem is tractable. In this paper, we show that it is not the case by considering DESs represented as deterministic finite automata without non-trivial cycles, which are structurally the simplest deadlock-free DESs. We show that even for such very simple DESs, checking weak (periodic) detectability remains intractable. On the contrary, we show that strong (periodic) detectability of DESs can be efficiently verified on a parallel computer. |
| 1. The Knaster-Tarski theorem versus monotone nonexpansive mappings. Let $X$ be a partially ordered set with the property that each family of order intervals of the form $[a,b],[a,\rightarrow )$ with the finite intersection property has a nonempty intersection. We show that every directed subset of $X$ has a supremum. Then we apply the above result to prove that if $X$ is a topological space with a partial order $\preceq $ for which the order intervals are compact, $\mathcal{F}$ a nonempty commutative family of monotone maps from $X$ into $X$ and there exists $c\in X$ such that $c\preceq Tc$ for every $T\in \mathcal{F}$, then the set of common fixed points of $\mathcal{F}$ is nonempty and has a maximal element. The result, specialized to the case of Banach spaces gives a general fixed point theorem that drops almost all assumptions from the recent results in this area. An application to the theory of integral equations of Urysohn's type is also given. |
| 1. Efficient methods for computing integrals in electronic structure calculations. Efficient methods are proposed, for computing integrals appeaing in electronic structure calculations. The methods consist of two parts: the first part is to represent the integrals as contour integrals and the second one is to evaluate the contour integrals by the Clenshaw-Curtis quadrature. The efficiency of the proposed methods is demonstrated through numerical experiments. |
| 1. Diffraction-Aware Sound Localization for a Non-Line-of-Sight Source. We present a novel sound localization algorithm for a non-line-of-sight (NLOS) sound source in indoor environments. Our approach exploits the diffraction properties of sound waves as they bend around a barrier or an obstacle in the scene. We combine a ray tracing based sound propagation algorithm with a Uniform Theory of Diffraction (UTD) model, which simulate bending effects by placing a virtual sound source on a wedge in the environment. We precompute the wedges of a reconstructed mesh of an indoor scene and use them to generate diffraction acoustic rays to localize the 3D position of the source. Our method identifies the convergence region of those generated acoustic rays as the estimated source position based on a particle filter. We have evaluated our algorithm in multiple scenarios consisting of a static and dynamic NLOS sound source. In our tested cases, our approach can localize a source position with an average accuracy error, 0.7m, measured by the L2 distance between estimated and actual source locations in a 7m\*7m\*3m room. Furthermore, we observe 37% to 130% improvement in accuracy over a state-of-the-art localization method that does not model diffraction effects, especially when a sound source is not visible to the robot. |
| 1. Jacob's ladders, crossbreeding in the set of $味$-factorization formulas and selection of families of $味$-kindred real continuous functions. In this paper we introduce the notion of $\zeta$-crossbreeding in a set of $\zeta$-factorization formulas and also the notion of complete hybrid formula as the final result of that crossbreeding. The last formula is used as a criterion for selection of families of $\zeta$-kindred elements in class of real continuous functions. Dedicated to recalling of Gregory Mendel's pea-crossbreeding. |
| 1. Minimax Estimation of the $L\_1$ Distance. We consider the problem of estimating the $L\_1$ distance between two discrete probability measures $P$ and $Q$ from empirical data in a nonasymptotic and large alphabet setting. When $Q$ is known and one obtains $n$ samples from $P$, we show that for every $Q$, the minimax rate-optimal estimator with $n$ samples achieves performance comparable to that of the maximum likelihood estimator (MLE) with $n\ln n$ samples. When both $P$ and $Q$ are unknown, we construct minimax rate-optimal estimators whose worst case performance is essentially that of the known $Q$ case with $Q$ being uniform, implying that $Q$ being uniform is essentially the most difficult case. The \emph{effective sample size enlargement} phenomenon, identified in Jiao \emph{et al.} (2015), holds both in the known $Q$ case for every $Q$ and the $Q$ unknown case. However, the construction of optimal estimators for $\|P-Q\|\_1$ requires new techniques and insights beyond the approximation-based method of functional estimation in Jiao \emph{et al.} (2015). |
| 1. Density large deviations for multidimensional stochastic hyperbolic conservation laws. We investigate the density large deviation function for a multidimensional conservation law in the vanishing viscosity limit, when the probability concentrates on weak solutions of a hyperbolic conservation law conservation law. When the conductivity and dif-fusivity matrices are proportional, i.e. an Einstein-like relation is satisfied, the problem has been solved in [4]. When this proportionality does not hold, we compute explicitly the large deviation function for a step-like density profile, and we show that the associated optimal current has a non trivial structure. We also derive a lower bound for the large deviation function, valid for a general weak solution, and leave the general large deviation function upper bound as a conjecture.   PROMPT: |

SHORT NL:

You are an AI robot capable of determining the field of a research paper by analyzing its title and abstract. The fields are categorized as follows, along with their corresponding output format: Computer Science: C \ Physics: P \ Mathematics: M \ Statistics: S \ Quantitative Biology: QB \ Quantitative Finance: QF. If a research paper covers multiple fields, the output will be a combination of the respective field codes enclosed in square brackets, for example: [C] + [M].

LONG NL:

Corresponding Categories:

Computer Science: C \ Physics: P \ Mathematics: M \ Statistics: S \ Quantitative Biology: QB \ Quantitative Finance: QF.

You are an AI robot specialized in analyzing the domains covered by research papers. Now, I will provide you with the title and abstract of a paper, and you will determine the relevant fields it covers. By referencing the "Corresponding Categories" mentioned above, you will output the appropriate answers. In case the paper encompasses multiple fields, you should output all relevant fields in the following format: [Field1] + [Field2].

Example:

Input:

Title: Comparative study of Discrete Wavelet Transforms and Wavelet Tensor Train decomposition to feature extraction of FTIR data of medicinal plants.

Abstract: Fourier-transform infra-red (FTIR) spectra of samples from 7 plant species were used to explore the influence of preprocessing and feature extraction on the efficiency of machine learning algorithms. Wavelet Tensor Train (WTT) and Discrete Wavelet Transforms (DWT) were compared as feature extraction techniques for FTIR data of medicinal plants. Various combinations of signal processing steps showed different behavior when applied to classification and clustering tasks. Best results for WTT and DWT found through grid search were similar, significantly improving the quality of clustering as well as classification accuracy for tuned logistic regression in comparison to original spectra. Unlike DWT, WTT has only one parameter to be tuned (rank), making it more versatile and easier to use as a data processing tool in various signal processing applications.

Output: C + S

(END OF EXAMPLE)