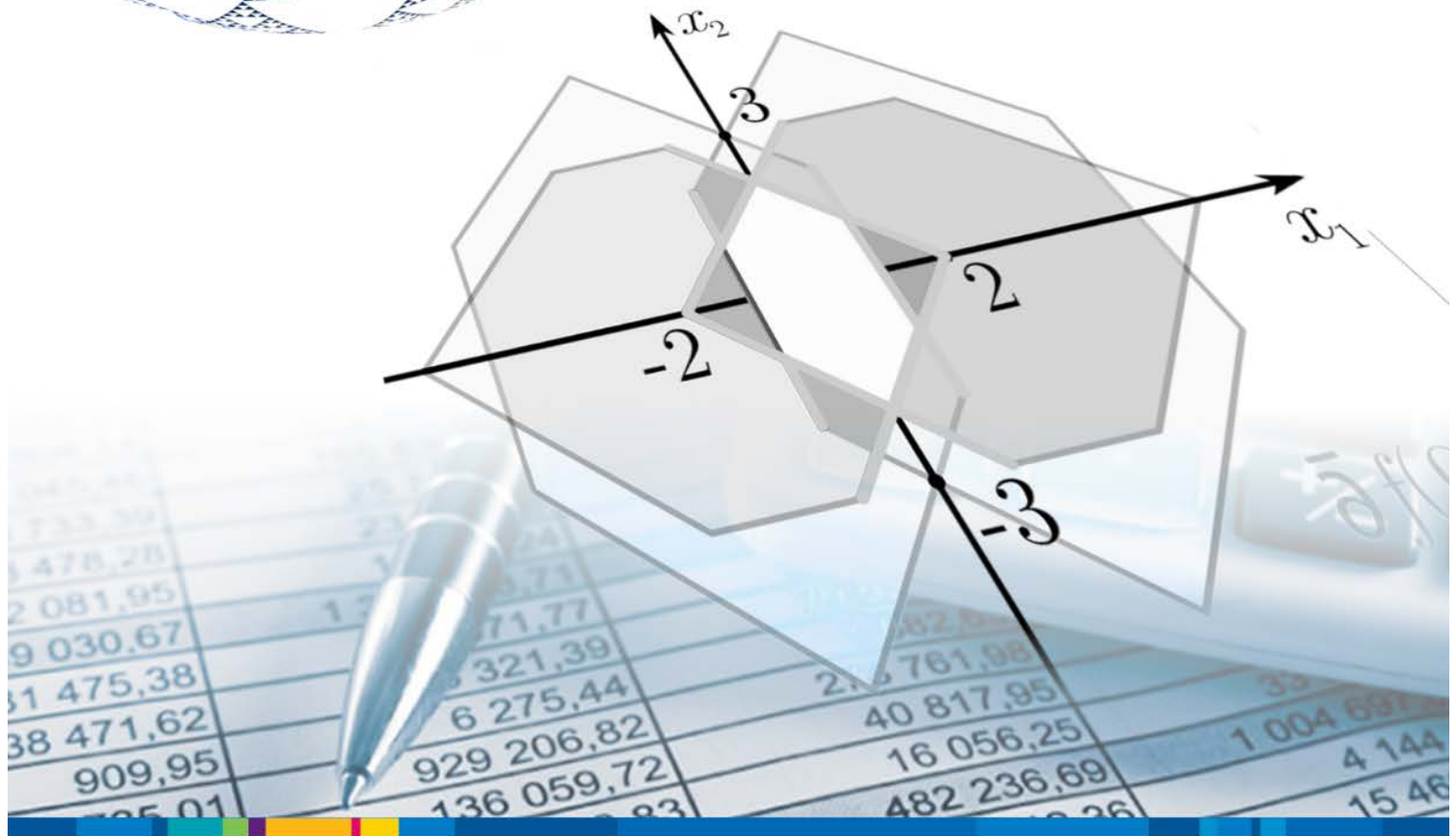




# CIAO Newsletter

Centre for Informatics and  
Applied Optimization

Edition #42: October-December 2019



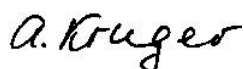
## Director's section

Welcome to our final Newsletter of 2019. It covers the period October to December.

There were many events and achievements during this period. In my (very subjective) opinion, our WoMBaT 2019 was a highlight. It was the fourth meeting in the series of annual events. The series has obviously gained momentum with increasing numbers of Australian and renowned international researchers in optimisation and variational analysis willing to participate and present. In their feedback, many participants praise WoMBaT for high quality of talks, open problem sessions, and its unique friendly atmosphere, especially beneficial for ECRs and research students. I am happy to see that our WoMBaT is already an adult and can exist on its own.

The discussions concerning the structure of management of research at the university are still continuing. CIAO research seems to loosely fit into the newly determined university Research Priority Area called "*Virtual, Digital and Computational Environments*". By the time I am writing these notes, an application has been submitted for a new "*Centre for Information Technology and Mathematical Science (ITMS)*" comprising the current CIAO and MCCAIR (Centre for Multimedia Computing, Communications, and Artificial Intelligence Research). The decision on university Research Centres is expected mid-2020. Around that time, a new call is expected for Research Groups.

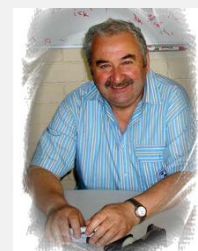
All available previous issues starting from 2003 as well as the series of the *School of Information Technology & Mathematical Sciences* Research Newsletters dating from 1998 can be accessed from the CIAO web site: <http://federation.edu.au/ciao>. Some *GSITMS Graduates of Distinction* newsletters from 2007 – 2010 have been added. They represent an interesting piece of our common history. If someone by chance has the missing issues, please contribute.



Prof Alex Kruger  
6 February 2020

### In this issue:

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Prof Alex Rubinov  
CIAO Founding  
Director



Prof Alex Kruger  
CIAO Research  
Director



A/Prof David Yost  
Editor of CIAO  
Newsletter

## Grants, awards and recognition

### Henry Sutton PhD scholarships

Two of the Henry Sutton PhD scholarships have been awarded to students who will be supervised by CIAO researchers David Yost and Savin Chand. *Jie Wang* from China will work on *f-vectors and decomposability of polytopes*, while *Soubhik Biswas* from India will work on *Subseasonal-to-seasonal prediction of bushfire conditions in Australia*. This will be a welcome boost to CIAO's research.

### More PhD Scholarships for climate extreme research

CIAO researcher, Dr Savin Chand has also been successful in acquiring Scholarships for two more students in climate extreme research.

*Alea Yeasmin* from Werribee has been awarded a Research Training Program (RTP) Stipend Destination Australia Co-Funded Scholarship, to work on the topic *Impact of climate change on tropical cyclones predictability: role of ocean-atmosphere teleconnection process*.

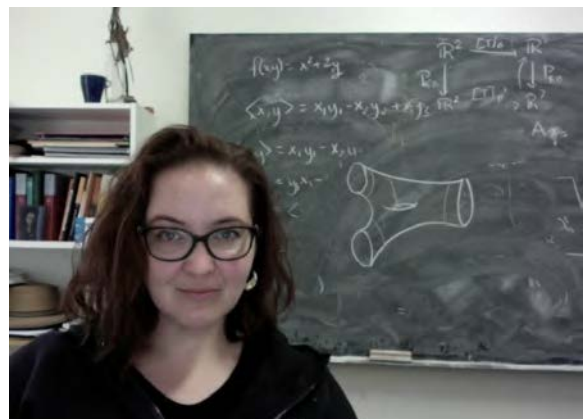
*Alick Harihiru* from the Solomon Islands will commence his PhD at Federation University in July 2020. His Australian Awards Scholarship is a long term awards administered by the Department of Foreign Affairs and Trade, in a scheme whose aim is to contribute to the development needs of Australia's partner countries in line with bilateral and regional agreements. Alick's PhD project will examine *how tropical cyclone characteristics and associated risks will change in the Pacific Island countries* as a result of global warming.

## Events

With the exams over and summer approaching, CIAO members might be expected to relax. Instead, they ramped up their research and engagement activities.

### Alexander Rubinov Memorial Oration

Each year usually in November, CIAO recognises its founding Director Prof Alex Rubinov who established CIAO in 2000 as one of the first University Research Centres. On 14 November 2019 the Guest Orator was Dr Marcy Robertson, University of Melbourne who spoke, on "*MC Escher – Visualising the Infinite*".



### China Australia Workshop on Optimisation

The Ninth China-Australia Workshop on Optimization:

Theory, Methods and Applications (CAWO2019) took place in Shanghai, China 16 – 18 November 2019. This is a biennial event organised by the China-Australia Collaboration in Applied Optimization (CACAO), which involves four universities: Federation University Australia, Curtin University, Shanghai University and Chongqing Normal University. This time the workshop was combined with the Joint Annual Symposium of Operations Research Society of Shanghai, Chongqing and Hunan.

CAWO2019 brought together about 40 researchers, research students and practitioners in optimization to exchange ideas and approaches, present research findings and state-of-the-art

solutions, share experience and future research development on theory, methods and applications of optimization. The previous CAWOs were held in Shanghai (2003, 2007, 2011), Ballarat (2004, 2009, 2013), Chongqing (2015) and Perth (2017).

CIAO Research Director Prof Alex Kruger served as a CAWO2019 co-chair. He gave a plenary talk “*About Semiregularity of Mappings*”. CIAO honorary research fellows Prof Zhiyou Wu and Prof Fusheng Bai also presented at the workshop.

The Tenth China-Australia Workshop on Optimization is going to take place at Mt Helen in 2021.

2019年沪渝湘运筹学会联合年会暨中澳优化理论、方法与应用研讨会

Joint Annual Symposium of Operations Research Society of Shanghai, Chongqing and Hunan 2019

The Ninth China-Australia Workshop on Optimization: Theory, Methods and Applications (CAWO2019)

2019年11月16~17日



## China-Australia Collaboration

As part of the China-Australia Collaboration in Applied Optimization (CACAO), 16-28 November 2019 CIAO Research Director Prof Alex Kruger visited Shanghai University, Zhejiang University, Zhejiang Sci-Tech University and Chongqing Normal University to discuss collaboration and joint research in optimisation. While in Shanghai, he gave a plenary talk at the Ninth China-Australia Workshop on Optimization: Theory, Methods and Applications and met with representatives of Curtin University and several Chinese universities. Then he visited Hangzhou and gave invited lectures at Zhejiang University and Zhejiang Sci-Tech University. In Chongqing, Alex gave a series of invited lectures for graduate and postgraduate students at Chongqing Normal University, while CIAO honorary researcher Dr Zari Dzalilov gave a seminar. Several staff and students of Chongqing Normal University are going to visit Ballarat in January.



Prof Alex Kruger, Dr Zari Dzalilov and Prof Fusheng Bai

## Federation University researcher gives seminar at UNSW

CIAO researcher **A/Prof David Yost** received an invitation to the University of New South Wales, where he presented a seminar “*Nearly simple polytopes*” on 21<sup>st</sup> November 2019.

## AI in IoT Colloquium

Key academics, researchers and industry professionals in the IoT space contributed to this event, held all day on Friday 6 December at Data 61’s offices in Docklands (Melbourne). It was supported by Federation University, IEEE Computational Intelligence Society and IEEE Victoria Section, and organised by Sattar Seifollahi. Participants from CIAO included Sona Taheri, Adil Bagirov, Andrew Stranieri and Iqbal Gondal.

Each day the **Internet of Things (IoT)** technologies from devices and sensors produce vast amounts of data. The growth in the use of IoT technologies is increasing significantly from common home and personal appliances, to commercial applications in industry, including safety-critical systems, building & transport management, healthcare, driverless vehicles, smart agriculture and energy systems.

IoT generated data can assist business decision making by ensuring best use of resources, in production and business management and safety. It is anticipated that by 2025 the number of IoT devices will grow globally to over 100 billion, and generate revenue close to USD 11 trillion.

There is a strong relationship between **Artificial Intelligence (AI)** and IoT. IoT is about integrating and connecting machines, producing non-stop and real-time data and making use of the data from those machines. AI is about simulating human-like thinking and logic, and is an effective solution framework to manage the large amount of data from IoT system.

The Colloquium had a focus on AI based solutions for IoT in industry and energy sustainability and provided opportunities to promote collaboration and mutual exchange of knowledge between academics and industry professionals.



## Australian Mathematical Society Conference

The 63rd Annual meeting of the Australian Mathematical Society was held at Monash University from 3<sup>rd</sup> to 6<sup>th</sup> December 2019. Hoa Bui, Cuong Nguyen and Alex Kruger all gave talks in the Optimisation section. Sid Morris and David Yost also participated in the meeting.

## WoMBaT 2019

The fourth *Workshop on Metric Bounds and Transversality (WoMBaT 2019)* took place at Swinburne University of Technology in Melbourne 8-10 December 2019.

The program included lectures by international experts:

- Prof Fusheng Bai, Chongqing Normal University (China)
- Prof Ewa Bednarczuk, Polish Academy of Sciences
- Prof Jean-Pierre Crouzeix, University Clermont-Auvergne (France)
- Dr Reinier Diaz Millan, Federal Institute of Espirito Santo (Brazil)
- Prof Asen Dontchev, The University of Michigan (USA)
- Prof Alexander Ioffe, Technion (Israel)
- Dr Scott Lindstrom, Hong Kong Polytechnic University
- Prof Marco López, University of Alicante (Spain), CIAO Adjunct Professor
- A/Prof Héctor Ramírez, University of Chile
- Dr Nir Sharon, Tel Aviv University (Israel)
- Prof Hong-Kun Xu, Hangzhou Dianzi University (China)

There were also many invited talks by researchers from Australia, including four CIAO researchers, five CIAO honorary members and two PhD students.

The topics of the workshop included error bounds, metric (sub-)regularity, Aubin property and calmness, transversality of collections of sets, subdifferential characterisations and applications of these properties to estimating the convergence of fundamental optimisation algorithms.

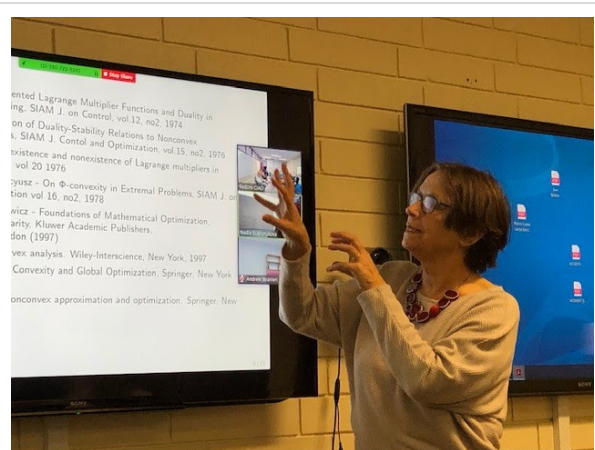


## CIAO seminars

Date	Name	Affiliation	Topic	
11 Oct	Prof Alan L Harvey	IEEE Victoria Chair	Benefits of IEEE membership. Power Supplies for IoT	
11 Oct	Dr Tim Trudgian	UNSW Canberra	Primes with Riemann and computers	
17 Oct	Dr Nadia Sukhorukova	Swinburne University of Technology	Rational approximation in Chebyshev (infinity) norm	
25 Nov	Dr Paul Pang	Unitec Institute of Technology, New Zealand.	Big-data powered Cyber resilience for Networked Medical Devices	
12 Dec	Prof Ewa Bednarczuk	Polish Academy of Sciences, Systems Research Institute	On Lagrange duality for some classes of nonconvex optimization problems	
12 Dec	Prof Marco A. López	University of Alicante, Spain	Subdifferentials and stability analysis of feasible set and Pareto front mappings in linear multiobjective optimization	
19 Dec	Prof Ponnuthurai Nagaratnam Suganthan	Nanyang Technological University, Singapore	Differential evolution with ensemble and topologies for numerical optimization	



Tim Trudgian's Seminar, 11 October 2019



Ewa Bednarczuk's Seminar, 12 December 2019

## CIAO visitors

Dates	Name	Institution
1-7 Dec	Prof Albert Ferrer	Polytechnic University of Catalonia, Spain
2-18 Dec	Dr Napsu Karmitsa	University of Turku, Finland
5-12 Dec	Prof Ewa Bednarczuk	Polish Academy of Sciences, Systems Research Institute, Poland
7-13 Dec	Prof Asen Dontchev	University of Michigan, USA
8-15 Dec	Prof Marco Lopez Cerda	University of Alicante, Spain

## HDR news

### PhD graduations

Congratulations to three CIAO PhD students and one Masters student, who received their degrees at ceremonies in December.

Graduate: **Dr Sam Bell**. Thesis Title: *Tropical Cyclone Tracks in CMIP5 models: Statistical Assessment and Future Projections*

Graduate: **Dr Adam Bignold**. Thesis Title: *Rule-Based Interactive Assisted Reinforcement Learning*

Graduate: **Dr Grant Meredith**. Thesis Title: *A probe into the use and perceptions of e-learning tools by teachers working within the University of Ballarat's SMB campus*

Graduate: **Mr Benjamin Buurman**. (Master of Computing). Thesis Title: *Intelligent Sewer Blockage Detection System using Internet of Things*

### Vale Andrew Percy

We are saddened by the passing of our colleague, Dr Andrew Percy who succumbed to a long illness on 18 December.



Andrew completed his PhD in algebraic topology at the University of New England in 2004, under the supervision of Imre Bokor. Soon after, he moved to the Gippsland campus of Monash University, where he supervised two PhD students, Jillian Dickinson and Ahsan Jaleel, both completing in 2016. In 2014, Andrew remained in place as the Gippsland campus was detached from Monash and folded into Federation University.

During his many years in Gippsland, Andrew played a significant role in course development. He acquired a reputation amongst undergraduate students as passionate, inspiring, and talented at explaining complicated maths. His commitment and enthusiasm will be sorely missed.

After his cancer diagnosis, he returned to northern NSW to be close to family members.

## A blast from the past: CIAO in history

### 20 years ago (Research Newsletter #11, December 1999)

The book "*Convex Analysis on the Plane*" by V.D. Matveenko, R.T. Pashaev and A.M. Rubinov was translated into English in Baku (Azerbaijan). This book was published in Russian in 1994. It is a small textbook for students of high schools and universities with explanation of main ideas of convex analysis and its applications to optimization and economics. There are many pictures and examples in this book.

### 15 years ago (CIAO Newsletter #7, December 2004)

Professor Karl Hofmann accepted an offer of appointment from the University of Ballarat Council as Visiting Professor in ITMS, for the period 1 October 2004 until 31 January 2005. Karl and his wife, Isolde, arrived Monday 17 September 2004, and will stay for a period of three months. Both Karl and Isolde participated in the ITMS Retreat held in Geelong on 31 October and 1 November 2004.

While here, Karl and Sid Morris will concentrate on the completion of their co-authored book, "*Lie Theory and Structure of Pro-Lie groups and Locally Compact Groups*", of which approximately 420 pages have been typed. Karl is a scholar of international stature, having published nearly 200 papers, 20 books and monographs, has been the Editor of three journals, and supervised the research of over 30 students. During Karl's visit to ITMS two years ago, he made very significant contributions to our research and teaching, including suggesting the ITMS Learning Centre.

Karl is also well-known for his artistic contributions. He provided the calligraphy and artwork for the 2004 Outstanding Service to ITMS Certificates.

### 10 years ago (CIAO Newsletter #26, Summer 2009)

**Borwein presents Rubinov Lecture.** CIAO was delighted and privileged to welcome Professor Jon Borwein as guest speaker at this year's Alexander Rubinov Memorial Lecture. The 2009 Lecture - the second in the series - was held on 9 November 2009 at Ballarat's Brewery Lecture Theatre. This annual event is held to honour the late Professor Alexander Rubinov, the Founding Director of CIAO. More than 70 people attended the event, including his two sons Mika and Eldar, academics from other universities, local secondary school teachers and numerous UB personnel. Guest speaker Professor Borwein's topic for the evening was "*The Computer as Crucible: The End of Theory?*"

**Staff Member Profile.** Dr David Yost is currently a Senior Lecturer in Mathematics and Deputy Head of the Graduate School of Information Technology & Mathematical Sciences. He was recently promoted to Level D, and will officially become an Associate Professor on 1 January 2010. One month later he will step down as Deputy Head of School, after three very full years in the role. Dr Yost joined UB in July 2003, after more than twenty years of significant international experience.

## Publications: October-December 2019 (SCOPUS)

1. Ahmad U., Song H., Bilal A., Alazab M., Jolfaei A. *Securing smart vehicles from relay attacks using machine learning.* (2019), Journal of Supercomputing, 10.1007/s11227-019-03049-4.
2. Bell S.S., Chand S.S., Camargo S.J., Tory K.J., Turville C., Ye H. *Western north pacific tropical cyclone tracks in cmip5 models: Statistical assessment using a model-independent detection and tracking scheme.* (2019), Journal of Climate, vol. 32, pp. 7191-7208, 10.1175/JCLI-D-18-0785.1.
3. Bell S.S., Chand S.S., Tory K.J., Turville C., Ye H. *Eastern North Pacific tropical cyclone activity in historical and future CMIP5 experiments: assessment with a model-independent tracking scheme.* (2019), Climate Dynamics, vol. 53, pp. 4841-4855, 10.1007/s00382-019-04830-0.
4. Black P., Gondal I., Vamplew P., Lakhotia A. *Evolved similarity techniques in Malware Analysis.* (2019), Proceedings - 2019 18th IEEE International Conference on Trust, Security and Privacy in Computing and Communications/13th IEEE International Conference on Big Data Science and Engineering, TrustCom/BigDataSE 2019, pp. 404-410, 10.1109/TrustCom/BigDataSE.2019.00061.
5. Cruz F., Dazeley R., Vamplew P. *Memory-Based Explainable Reinforcement Learning.* (2019), Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics), vol. 11919, pp. 66-77, 10.1007/978-3-030-35288-2\_6.
6. Dontchev A.L., Gfrerer H., Kruger A.Y., Outrata J.V. *The Radius of Metric Subregularity.* (2019), Set-Valued and Variational Analysis, 10.1007/s11228-019-00523-2.
7. Ghane Ezabadi S., Jolfaei A., Kulik L., Kotagiri R. *Differentially private streaming to untrusted edge servers in intelligent transportation system.* (2019), Proceedings - 2019 18th IEEE International Conference on Trust, Security and Privacy in Computing and Communications/13th IEEE International Conference on Big Data Science and Engineering, TrustCom/BigDataSE 2019, pp. 781-786, 10.1109/TrustCom/BigDataSE.2019.00113.
8. Gondal I., Kamruzzaman J., Zhang L. *One-shot malware outbreak detection using spatio-temporal isomorphic dynamic features.* (2019), Proceedings - 2019 18th IEEE International Conference on Trust, Security and Privacy in Computing and Communications/13th IEEE International Conference on Big Data Science and Engineering, TrustCom/BigDataSE 2019, pp. 751-756, 10.1109/TrustCom/BigDataSE.2019.00108.
9. Jolfaei A., Kant K., Shafei H. *Secure data streaming to untrusted road side units in intelligent transportation system.* (2019), Proceedings - 2019 18th IEEE International Conference on Trust, Security and Privacy in Computing and Communications/13th IEEE International Conference on Big Data Science and Engineering, TrustCom/BigDataSE 2019, pp. 793-798, 10.1109/TrustCom/BigDataSE.2019.00115.
10. Kaur M., Kaur G., Sharma P.K., Jolfaei A., Singh D. *Binary cuckoo search metaheuristic-based supercomputing framework for human behavior analysis in smart home.* (2019), Journal of Supercomputing, 10.1007/s11227-019-02998-0.
11. Keatley D.A., Arntfield M., Gill P., Clare J., Oatley G., Bouhana N., Clarke D.D. *Behaviour tracking: using geospatial and behaviour sequence analysis to map crime.* (2019), Security Journal, 10.1057/s41284-019-00216-3.
12. Khoda M., Imam T., Kamruzzaman J., Gondal I., Rahman A. *Selective adversarial learning for mobile malware.* (2019), Proceedings - 2019 18th IEEE International Conference on Trust, Security and Privacy in Computing and Communications/13th IEEE International Conference on Big Data Science and Engineering, TrustCom/BigDataSE 2019, pp. 272-279, 10.1109/TrustCom/BigDataSE.2019.00044.
13. Khraisat A., Gondal I., Vamplew P., Kamruzzaman J., Alazab A. *A novel ensemble of hybrid intrusion detection system for detecting internet of things attacks.* (2019), Electronics (Switzerland), vol. 8, 10.3390/electronics8111210.
14. Kruger A.Y., Lopez M.A., Yang X., Zhu J. *Hölder Error Bounds and Hölder Calmness with Applications to Convex Semi-infinite Optimization.* (2019), Set-Valued and Variational Analysis, vol. 27, pp. 995-1023, 10.1007/s11228-019-0504-0.

15. Kurniawan B., Vamplew P., Papisimeon M., Dazeley R., Foale C. *An Empirical Study of Reward Structures for Actor-Critic Reinforcement Learning in Air Combat Manoeuvring Simulation.* (2019), Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics), vol. 11919, pp. 54-65, 10.1007/978-3-030-35288-2\_5.
16. Leiderman A.G., Morris S.A., Tkachenko M.G. *The separable quotient problem for topological groups.* (2019), Israel Journal of Mathematics, vol. 234, pp. 331-369, 10.1007/s11856-019-1931-1.
17. Rafferty J., Ranson C., Oatley G., Mostafa M., Mathema P., Crick T., Moore I.S. *On average, a professional rugby union player is more likely than not to sustain a concussion after 25 matches.* (2019), British journal of sports medicine, vol. 53, pp. 969-973, 10.1136/bjsports-2017-098417.
18. Sayad Haghghi M., Farivar F., Jolfaei A., Tadayon M.H. *Intelligent robust control for cyber-physical systems of rotary gantry type under denial of service attack.* (2019), Journal of Supercomputing, 10.1007/s11227-019-03075-2.
19. Sukhorukova N., Ugon J., Yost D. *Chebyshev Multivariate Polynomial Approximation and Point Reduction Procedure.* (2019), Constructive Approximation, 10.1007/s00365-019-09488-9.
20. Taheri S., Bagirov A.M., Gondal I., Brown S. *Cyberattack triage using incremental clustering for intrusion detection systems.* (2019), International Journal of Information Security, 10.1007/s10207-019-00478-3.
21. Uddin M.A., Stranieri A., Gondal I., Balasurbramanian V. *A lightweight blockchain based framework for underwater iot.* (2019), Electronics (Switzerland), vol. 8, 10.3390/electronics8121552.
22. Ukoha C., Stranieri A. *Criteria to measure social media value in health care settings: Narrative literature review.* (2019), Journal of Medical Internet Research, vol. 21, 10.2196/14684.
23. Van Ngai H., Tron N.H., Van Vu N., Thera M. *Directional Metric Pseudo Subregularity of Set-valued Mappings: a General Model.* (2019), Set-Valued and Variational Analysis, 10.1007/s11228-019-00522-3.
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25. Vinayakumar V., Alazab M., Jolfaei A., Kp S., Poornachandran P. *Ransomware triage using deep learning: Twitter as a case study.* (2019), Proceedings - 2019 Cybersecurity and Cyberforensics Conference, CCC 2019, pp. 67-73, 10.1109/CCC.2019.000-7.