

RDI

Research | Development | Innovation

Annual Report

2022-2023 Academic year





“As we commemorate the 20th anniversary of ESPRIT, we continue to uphold our priority to impactful research aligned with the United Nations Sustainable Development Goals (SDGs). Within our nurturing environment, we foster research, creativity, and innovation, with a special emphasis on translating these results into tangible outputs that significantly contribute to the socio-economic development of our region. Our commitment extends to actively involving students in scientific inquiry, guided by our esteemed faculty, and supported by collaborative efforts with our industrial partners.”

Professor Tahar Ben Lakhdar, ESPRIT CEO and Co-founder

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ESPRIT-Tech

The Research, Development, and Innovation Office

Welcome

Research, Development, and Innovation (RDI) have been among the main pillars of ESPRIT strategy since its inception. In 2010, the university took a monumental step by establishing ESPRIT-Tech, an RDI office dedicated to orchestrating and driving various RDI activities. This research division has actively engaged stakeholders to outline robust research policies, strategies, and priorities.

ESPRIT is uniquely committed to applied research and innovation, prioritizing RDI activities that yield tangible socio-economic impacts while valuing the significance of pure academic research.

This catalog serves as a gateway to help you explore our diverse spectrum of RDI activities, events, initiatives, and achievements.

We eagerly anticipate forging new collaborative RDI partnerships across the local community, private enterprises, and public sectors. These strategic alliances will not only fortify ESPRIT's role but will also lay the groundwork for an even more active and impactful contribution to the socio-economic development of Tunisia. Welcome to a catalog that celebrates innovation, transformation, and the power of collaborations.

Prof. Faouzi Kamoun
Director ESPRIT-Tech
Tel: (216) 99 423 944
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Research Teams

#	Name	Domain	Coordinator	Contact Email address
Information & Communications Technologies (ICT)				
1	ESPRIT-Cloud	Cloud Computing & Security	Manel Madhioub	Manel.madhioub@esprit.tn
2	Wireless Com	Wireless communications	Safa Zhioua Cherif	safa.zhiouacherif@esprit.tn
4	M2M	Ambient & embedded systems	Feten Teber	Feten.teber@esprit.tn
5	WSN-RFID	Wireless sensor networks and RFID	Abderrazak Hachani	Abderrazak.hachani@esprit.tn
6	ESPRIT-Mobile	Mobile applications	Imed Amri	Imed.amri@esprit.tn
7	DASC	Data Science & AI	Sami Sifi	Sami.sifi@esprit.tn
8	Imagin	Computer vision / image processing	Wissal Neji	wissal.neji@esprit.tn
9	I2S	Intelligent Information Systems	Syrine Karoui	Syrine.karoui@esprit.tn
10	SSD	Sustainable social development	Soumaya Argoubi	Soumaya.argoubi@esprit.tn
Electromechanical & Industrial Engineering				
11	ICAR	Robotics	Maher Mkhinni	Maher.mkhinni@esprit.tn
12	EVIS	Electric vehicle innovation systems	Toufik Chaouachi	Taoufik.chaouach@esprit.tn
13	INOBI	Industrial engineering for a better life	Salah Bousbia	Salah.bousbia@esprit.tn
14	ETM	ESPRIT's Tomorrows Materials	Ameni Ellouze	Ameni.ellouze@esprit.tn
15	ISF	Integrated Smart Factory	Yosr Ghozzi	Yosr.ghozzi@esprit.tn
Civil & Building Engineering				
16	REEE	Renewable energy & energy efficiency	Imen Guebebia	Imen.guebebia@esprit.tn
17	SBM	Smart Building management	Asma Karaoui	Asma.karoui@esprit.tn
Applied Mathematics				
18	GRAFICS	Risk management	Mohamed Anis Ben Lasmar	Mohamedanis.benlasmar@esprit.tn
19	MMSN	Mathematical modeling and numerical simulations	Mohamed Hedi Riahi	Mohamedhedi.riahi@esprit.tn
Management & Pedagogical Innovation				
20	MAIN' Team	Management & Innovation	Inés Mhaya	Ines.mhaya@esprit.tn
21	ALEER	Engineering Education Research	Lamjed Bettaieb	Lamjed.bettaieb@esprit.tn

Research Themes

#	Research Team	Research Themes
1	ESPRIT-Cloud	<ul style="list-style-type: none"> ⇒ Infrastructure as a service ⇒ Virtualization technologies ⇒ Cloud security ⇒ Cloud federations ⇒ Platform as a service ⇒ Learning-based Cloud
2	Wireless Com	<ul style="list-style-type: none"> ⇒ Future Wireless Networks ⇒ UAV-based Aerial Networks ⇒ Smart agriculture (UAVs & AI) ⇒ Wireless communication for Public Safety ⇒ E-health
4	M2M	<ul style="list-style-type: none"> ⇒ Healthcare ⇒ Smart homes ⇒ Smart agriculture
5	WSN-RFID	<ul style="list-style-type: none"> ⇒ Design of interconnected objects ⇒ Digital Transformation ⇒ Localization and tracking ⇒ Logistic management ⇒ IoT applications
6	ESPRIT-Mobile	<ul style="list-style-type: none"> ⇒ IoT ⇒ Blockchain ⇒ M-Health ⇒ Augmented Reality / AR ⇒ Virtual Reality / VR & Mixed Reality / MR
7	DASC	<ul style="list-style-type: none"> ⇒ Machine Learning & AI applications ⇒ Social media data analytics ⇒ Education 4.0 ⇒ Risk Cartography
8	ImageIn	<ul style="list-style-type: none"> ⇒ Machine learning for computer vision ⇒ Medical imaging ⇒ Shape recognition ⇒ Image processing
9	I2S	<ul style="list-style-type: none"> ⇒ Intelligent Information Systems (IIS) architectures ⇒ IIS security ⇒ Decision-support systems ⇒ Big data & AI for IIS ⇒ DevOps for IIS
10	SSD	<ul style="list-style-type: none"> ⇒ Behavioral Analysis ⇒ Privacy ⇒ Serious Games ⇒ E-justice: Social development to achieve peace, human rights, and effective governance ⇒ Sustainability in Engineering Education
11	ICAR	<ul style="list-style-type: none"> ⇒ Automation and Robotics ⇒ MEMS and IoT applied for mechatronics
12	EVIS	<ul style="list-style-type: none"> ⇒ Vehicle's mechanical structures

#	Research Team	Research Themes
		<ul style="list-style-type: none"> ⇒ Vehicle's aerodynamics ⇒ Electric power converters ⇒ Battery charging and management systems
13	INOBI	<ul style="list-style-type: none"> ⇒ Innovative pedagogical approaches for industrial engineering education ⇒ Industrial engineering solutions for social innovation and better life
14	ETM	<ul style="list-style-type: none"> ⇒ Valorization of waste in plastic/composite materials ⇒ Valorization of natural fibers resulting from their use as reinforcement in composite materials ⇒ New ecological concretes made with carbonated aggregates
15	ISF	<ul style="list-style-type: none"> ⇒ Immersive environments for manufacturing innovation ⇒ Innovation and technology transfer engineering
16	REEE	<ul style="list-style-type: none"> ⇒ Energy audit ⇒ Energy management and optimization ⇒ Sustainable development & Smart cities
17	SBM	<ul style="list-style-type: none"> ⇒ Methods to improve occupant comfort ⇒ Smart building applications ⇒ Building Information Modelling (BIM)
18	GRAFICS	<ul style="list-style-type: none"> ⇒ Data Mining, Scoring and Big data tools for decision support and actuarial applications ⇒ Efficient algorithms for stochastic control, numerical and statistical processing ⇒ Sensitivity analysis, quantification of uncertainty, and uncertainty modeling ⇒ Rare events analysis for optimal decision making and risk management
19	MMSN	<ul style="list-style-type: none"> ⇒ Applications of mathematical models and simulation techniques: ⇒ Finance: Inverse problem of estimating volatility in the Black and Scholes model ⇒ Environment: Parametric estimation in hydrogeology ⇒ Oil and Gas: Numerical modeling of the impact of rock mechanics in oil reservoirs on flow in porous media ⇒ Biology: modeling electrical activities of the hearts ⇒ Civil engineering: Mixed 3D-1D formulation for the analysis of composite beams
20	MAIN 'Team	<ul style="list-style-type: none"> ⇒ Digital Marketing & Data Marketing ⇒ Innovation management ⇒ Development economics ⇒ Business Finance ⇒ Human resources ⇒ Entrepreneurship
21	ALEER	<ul style="list-style-type: none"> ⇒ Active learning in engineering education ⇒ Collaborative project approaches in Engineering education ⇒ Case studies in Engineering education & lessons-learned ⇒ Learning outcome assessment ⇒ Digital technologies in Engineering education

Major organized RDI events 2022-2023





AI Summer School



The second edition of MASSAI summer school, organized by ESPRIT School of Engineering and ESPRIT School of Business in collaboration with EMSI Morocco, the University of Mundiapolis and the Deep Learning Institute of Nvidia, was held during the period June 12 to June 16, 2023.

The event is targeted for graduate and PhD students, postdocs, academics, members of public or private institutions, and professionals.

The aim of MASSAI was twofold:

- Contribute towards the development of the African potential and stimulate entrepreneurial initiatives in the field of AI.
- Contribute to enriching the AI ecosystem in the region by providing an opportunity to foster collaboration among the different academic actors and industrial players in the AI field.

MASSAI focused on applied AI through a combination of in-depth tutorials, practical labs and instructor-led workshops. MASSAI was delivered in hybrid mode which allowed participants from 11 different countries to benefit from the different scientific and training activities. The flexibility of the delivery modes (face-to-face / blended / hybrid) enabled participants who did not have the financial means to be physically present at the event to

fully benefit from MASSAI remotely. In addition, the Deep Learning Institute of Nvidia's certification workshops were delivered in blended mode thanks to the support of ESPRIT Teaching Assistants who accompanied the international participants via zoom.



Massai 2023



About 70 students were certified in "Accelerated End-to-End Data Science Workflows" workshop / The same number of attendees as above were certified in "Building Real-Time Video AI Applications" workshop.

More information about this event can be found at <https://massai.esprit.tn/>



World Engineering Day for Sustainable Development Conference

On March 4th, 2023, the Sustainable Social Development (SSD) research team led the organization of the World Engineering Day for Sustainable Development Conference. Four Keynote speakers shared their insights on the following topics:

- From eco-responsibility to digital transformation
- Corporate social responsibility
- Quality Education for Sustainable Development
- Embracing technology for sustainable agriculture

More than 150 participants from different institutions took part in this event. A 24-hour Hackathon was also organized [4-5 March 2023]





Clean and Green

ETM RDI team organized the first edition of the **Clean and Green** event.

- **Objective**

The main objective of the event was to increase awareness among participants about the issue of environmental pollution caused by waste. This initiative provided a forum to address and discuss this important issue by bringing together researchers, academics, industrial stakeholders, and members of the civic association. These exchanges enabled the exploration of innovative potential solutions to effectively tackle the environmental challenges posed by waste.

The event took place in two phases:

Phase 1: Hackathon "Clean and Green concept" (November 12-13 2023)

- **Objective**

This hackathon aimed to encourage students to design innovative solutions to address environmental pollution problems, by putting into practice the skills acquired throughout their academic training in the fields of CAO, electrical programming, automation...

- **Participants**

Students from the departments of electromechanics, mechanics, and mechatronics from various engineering schools and institutes throughout Tunisia.



Phase 2: Clean and Green Awareness Day (November 16 2023)

- **Objective**

This day aims to raise awareness of the dangers of waste to the environment and the approaches used to combat this danger through presentations on this topic.

- **Participants**

- **Speakers**



ETM



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ANGED

- o Faculty and Students



- o Closing Award Ceremony





Research Incentive Funds

ESPRIT Research Incentive Funds (RIF) “aka. FARDI- Fonds d’Appui à la Recherche Development Innovation” was as an initiative introduced in 2021 to promote and encourage research productivity and research excellence.

Proposals from ESPRIT research teams are evaluated by a RIF committee composed of 4 members:

- The Director of ESPRIT-Tech (Chair)
- Three members appointed by the Director of ESPRIT-Tech

Proposals were evaluated based on four main criteria: eligibility, relevance, impact, and effectiveness of the implementation. Priority was given to multi-disciplinary applied projects that engage students and that involve the participation of local organizations and industrial partners. The maximum eligible funding is 6,000 Dinars for a 1-year project proposal and 9,000 Dinars for a 2-year proposal.

ESPRIT-Tech received 4 applications during the academic year 2022-2023, among which 2 were accepted for funding:

Project Title	Primary Investigator	Project Duration
Digital Transformation of a Biochemistry Laboratory	Yosra Jmal (PI)	24 months
ECOCYS: Intelligence-Driven Platform for ECONomics of CYber Security	Abderrazek Hachani (PI) Yosra Miaoui (co-PI)	24 months

Research Award

In 2020, we instated the research award to further promote and celebrate research accomplishments by highlighting the work of a faculty member who has particularly distinguished himself by the variety and the quality of his RDI activities and productions. The research award for the 2022-2023 academic year was granted to **Ms. Safa Zhioua CHERIF** (Wireless Com research team).



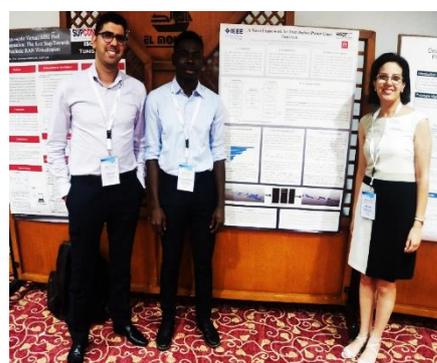
Honoris Values Award

In 2023, ESPRIT Sustainable Social Development (SSD) Research team won the “Honoris values” award for its impactful “Sustainable Minds” event.



Best Student Short Paper & Poster Award

A research team composed of Dr. Safa Cherif head of the WirelessCom RDI team, ESPRIT student Damos Ayobo, and research collaborators from Canada won the "Best Student Short Paper & Poster Award" for their paper titled "A Novel Framework for Distribution Power Lines Detection". The research paper was presented at the IEEE Symposium on Computers and Communications (ISCC), held during the period July 9th -13th, 2023, in Gammarth, Tunisia.



Faculty - Ph.D candidates and graduates

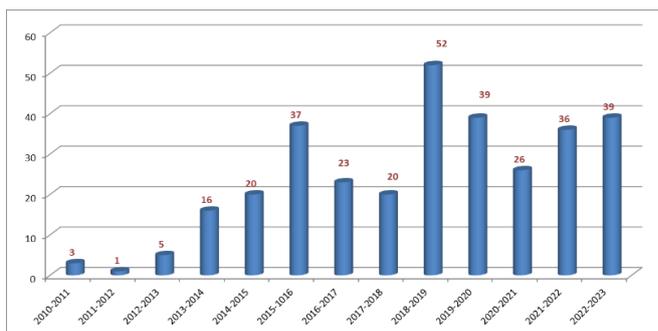
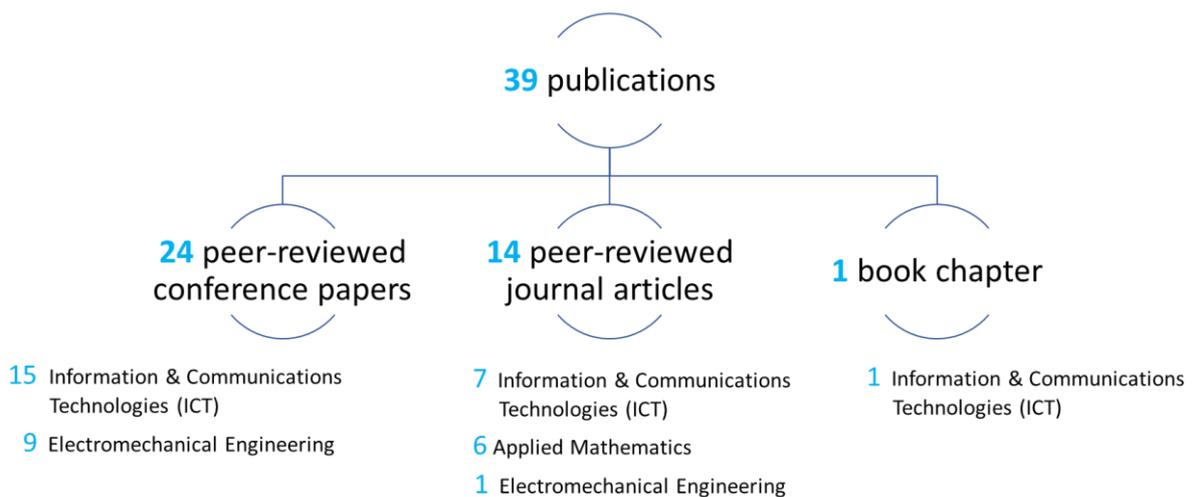
During the 2022-2023 academic year, 6 ESPRIT instructors have successfully completed their PhD degree as illustrated in the table below.

Faculty name	Thesis defense date
Laabidi Houda	24/09/2022
Marwa GANNOUN	21/12/2022
ZORGUI Myriam	23/09/2022
Rihab chaari	28/12/2022
Jamila Sassi	30/06/2022
Amani Lamine	24/05/2023

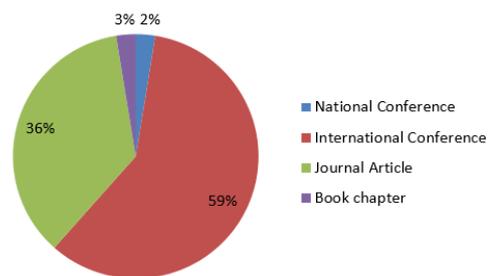
In addition, 7 faculty members are currently pursuing their PhD studies at research laboratories affiliated with public universities:

Faculty name	Thesis title
Safa Lasmar	Planification robuste des soins à domicile
Soumaya Nheri	A Novel Subclass One-Class Classification for Pattern Recognition.
Baazouzi wiem	Study and proposal of a recommendation system based on the response to queries in the context of Knowledge Graphs.
Donia Lassoued	Teaching English for Research Publication Purposes (ERPP) for scientific researchers in Tunisia: Implications and Implementations
Amel Hajji	Modelisation et amelioration de la performance des cellules manufacturières avec des perturbation aléatoires
Jihene Hlel	Digital Transformation in organization
Yosra Hajjaji	Toward Smart Palm Precision Agriculture: A Study on Palm Tree and Red Palm Weevil Detection.

RDI publications highlights 2022-2023 Academic Year (AY)



➤ **Historical evolution of RDI publications**



➤ **Repartition of RDI publications**

According to the **AD Scientific Index** database, ESPRIT is ranked 14th at the National level and the 1st among all private higher education institutions in Tunisia with ~11500 research citations. For more details, visit <https://www.adscientificindex.com/university/ESPRIT/>.

Information & Communications Technologies



ICT RDI Publications (2022-2023 AY)

#		Type ¹	Abstract on Page #
1	DOGHRI, W. , SADDOUD, A., and CHAARI, L. (2023). Optimal Sensor Placement Strategy for Structural Health Monitoring with Application of the Aqueduct El Hnaya of Carthage. In 2023 15th International Conference on Developments in eSystems Engineering (DeSE) (pp. 137-142).	CP	28
2	Damos Ayobo Abongo , Mohamed Gaha, Safa Cherif , Wael Jaafar, Guillaume Houle, Christian Buteau. (2023). A Novel Framework for Distribution Power Lines Detection, in 2023 IEEE Symposium on Computers and Communications (ISCC), Gammarth, Tunisia, 2023 pp. 1-4.	CP	29
3	Iqbal, Farkhund, Faniel Samsom, Faouzi Kamoun , and Áine MacDermott. (2023). When ChatGPT goes rogue: Exploring the potential cybersecurity threats of AI-powered conversational chatbots. Frontiers in Communications and Networks. Volume 4 - 2023 https://doi.org/10.3389/frcmn.2023.1220243 .	JA	39
4	Ayoub Sassi , Wael Jaafar, Safa Cherif , Jihen Ben Abderrazak and Halim Yanikomeroglu. (2023). Video Traffic Analysis for Real-Time Emotion Recognition and Visualization in Online Learning," in IEEE Access, Sept. 2023. doi: 10.1109/ACCESS.2023.3313973.	JA	30
5	Saber Dakhli, Jean Marie Floc'h, Mohammed Aseeri, Ameni Mersani , Hatem Rmili. (2023). Design of Compact and Superdirective Metamaterial-Inspired Two- and Three-Elements Antenna Arrays", July 31, 2023, Journal Of Electromagnetic Engineering And Science, VOL. 23, NO. 4, 362~368, JUL. 2023. DOI: https://doi.org/10.26866/jees.2023.4.r.179	JA	31
6	Ameni Mersani , Jean-Marc Ribero and Lotfi Osman. (2022). Small Button Antenna for Wearable applications, 2022 International Conference on Microelectronics (ICM), Casablanca, Morocco, 2022, pp. 78-81, doi: 10.1109/ICM56065.2022.10005480	CP	32
7	Sarra Abidi , Samir Toumi , Mehrez Essafi, Chirine Ghedira Guegan and Henda Hajjami Ben Ghezala. (2023). Using a Correlation Equation to ensure Stability between Personalization and Security in Composing Web Services, AICCSA 2023	CP	33
8	Soumaya Nheri , Riadh Ksantini, Mohamed Bécha Kaâniche, Adel Bouhoula. (2023). Exploiting scatter matrix on one-class support vector machine based on low variance direction, Intelligent Data Analysis journal. DOI: 10.3233/IDA-227036	JA	34
9	Soumaya Nheri . (2023). Human Face Detection Improvement using Subclass Learning and Low Variance Directions, Conference: 2023 IEEE Symposium on Computers and Communications (ISCC), July 2023 DOI: 10.1109/ISCC58397.2023.10217858	CP	35
10	Wissal Neji , Naouel Boughattas et Faten Ziadi . (2023). Exploring New AI-Based Technologies to Enhance Students' motivation. Issues in Informing Science & Information Technology, vol. 20., p95-110. 16p. https://doi.org/10.28945/5149	JA	36
11	Zaineb Gharsallah , Radhouene Massoudi , Monia Najjar, Bhuvneshwer Suthar . (2022). Slow-Light performance enhancement of delay line based on arced photonic crystal waveguide. 27th Asia Pacific Conference on Communications (APCC), DOI:10.1109/APCC55198.2022.9943744, Korea	CP	37

1* JA: Journal Article – CP: Conference paper - BC : Book Chapter

#		Type ¹	Abstract on Page #
12	Abderrazak Hachani, Nadia Ajaliaa. (2023). Towards New Generation of Civil Engineers in the IoT Era: PBL as a Tool for Integrating IoT in Civil Engineering Curricula, EDUCON 23 May 2023, Kuwait. 10.1109/EDUCON54358.2023.10125234	CP	38
13	Faouzi Kamoun, Walid El Ayeb, Sami Sifi, Farkhund Iqbal, Ibtissem Jabri. (2023). Knowledge, Attitude, and Perception Towards ChatGPT Among University Students and Faculty: A Preliminary Exploration. The 12th European Conference on Education (ECE2024). London, UK. July 13-17, 2023. https://doi.org/10.22492/issn.2188-1162.2023.20	CP	40
14	Madhioub, Manel, Soumaya Mbarek, and Hamdi Gabsi. (2022). Cloud Based Environment for Higher Education Institution in Developing Countries. In 2022 IEEE Frontiers in Education Conference (FIE), pp. 1-8. IEEE, 2022.	CP	41
15	Dhouha Melliti, Myriam Zorgui. (2023). Defis Des Economies Circulaire, Verte et Bleue dans le Contexte du Developpement Durable, 3éme Colloque International de la Faculté des Sciences Juridiques, Economiques et de Gestion de Jendouba. 9-11 Juin 2023. Tunisia.	CP	42
16	Barnawi, Ahmed, Mehrez Boulares, and Rim Somai. (2023). Simple and Powerful PCG Classification Method Based on Selection and Transfer Learning for Precision Medicine Application. <i>Bioengineering</i> 10, no. 3 (2023): 294.	JA	43
17	Cherfi, Anis, and Kaouther Nouira. (2023). Data Discretization for Data Stream Mining. In KES International Symposium on Agent and Multi-Agent Systems: Technologies and Applications, pp. 55-64. Singapore: Springer, 2023.	CP	44
18	Yosra Hajjaji, Ayyub Alzahem, Wadii Boulila, Imed Riadh Farah and Anis Koubaa. (2023). Sustainable Palm Tree Farming: Leveraging IoT and Multi-Modal Data for Early Detection and Mapping of Red Palm Weevil, 27th International Conference on Knowledge-Based and Intelligent Information & Engineering Systems (KES 2023)	CP	
19	W. Jaafar, K. Jean Romeo Beyara, I. Aouini, J. Ben Abderrazak and H. Yanikomeroglu. (2022). On the Deployment of Blockchain in Edge Computing Wireless Networks, 2022 IEEE 11th International Conference on Cloud Networking (CloudNet), Paris, France, 2022, pp. 168-176, doi: 10.1109/CloudNet55617.2022.9978739.	CP	
20	W. Khemiri, W. Jaafar, A. Tarifa and J. B. Abderrazak. (2022). Counterfeit Money Detection: A Hybrid Semi-Supervised GAN-based Approach, 2022 <i>International Interdisciplinary Conference on Mathematics, Engineering and Science (MESIICON)</i> , India, 2022, pp. 1-6, doi: 10.1109/MESIICON55227.2022.10093502.	CP	
21	Youssef TFIFHA, Manel ENNAHEDH, Nehla DEBBABI. (2022). Artificial Intelligence Decision Support System for Groundwater Management under Climate Change: Application to Mornag Plain in Tunisia. Second Mediterranean Geosciences Union. MedGU-22.	CP	
22	Michel Dacorogna, Nehla Debbabi, Marie Kratz. (2023). Building up cyber resilience by better grasping cyber risk via a new algorithm for modelling heavy-tailed data, <i>European Journal of Operational Research</i> , Volume 311, Issue 2, Pages 708-729, ISSN 0377-2217, https://doi.org/10.1016/j.ejor.2023.05.003 .	JA	
23	Kamoun, Faouzi, and Mathew Nicho. (2022) "A New Perspective on the Swiss Cheese Model Applied to Understanding the Anatomy of Healthcare Data Breaches." <i>Research Anthology on Securing Medical Systems and Records</i> , edited by Information Resources Management Association, IGI Global, 2022, pp. 726-749. https://doi.org/10.4018/978-1-6684-6311-6.ch033	BC	

Electromechanical Engineering

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Electromechanical Engineering RDI Publications (2022-2023 AY)

#	RDI publication	Type ²	Abstract on Page #
1	Imen Saidi, Nahla Touati. (2023). Deadbeat Internal Model Control for Temperature of Electric Furnace, IEEE International Conference on Advanced Systems and Emergent Technologies IC_ASET, April 2023, DOI:10.1109/IC_ASET58101.2023.10150571, Tunisia.	CP	48
2	Imen Saidi, Nahla Touati. (2023). Dahlin Deadbeat Internal Model Controller Design for Discrete Systems with Time Delay, International Conference on Control, Decision and Information Technologies CoDIT, July 2023, Rome-Italy	CP	49
3	Mkhhini Maher, Sayahi Intissar, Maaoui Ben Hassine Ikram. (2022). Control of an Autonomous Surface Vehicle with Variable Load by Predictive Control, International Conference on Information Technologies and Smart Industrial Systems IEEE, 15-17 2022 Paris, France	CP	50
4	Mkhhini Maher, Sayahi Intissar, Cherni Thameur. (2022). How to improve pedagogy through the use of tools?, the International Symposium on Pedagogical Innovation in Higher Education CIIP IEEE, 20-22 2022 Sousse, Tunisia	CP	51
5	Mkhhini, Maher, and Ameni Dridi. (2023). Simulating the Dynamic Behavior of Heat Exchange. In 2023 9th International Conference on Control, Decision and Information Technologies (CoDIT), pp. 1273-1278. IEEE, 2023. Rome, Italy	CP	53
6	Sassi, Mehdi Hadj, Asma Karoui, Mounir Ayadi, and Isam Shahrour. (2023). Comfort Analysis in Buildings Based on Machine Learning Methods. In 2023 9th International Conference on Control, Decision and Information Technologies (CoDIT), pp. 1448-1453. IEEE, 2023.	CP	54
7	Mkhhini, Maher, and Ameni Dridi. (2023). Contribution to the Improvement of a Heat Exchanger. In 2023 IEEE International Conference on Advanced Systems and Emergent Technologies (IC_ASET), pp. 1-6. IEEE, 2023.	CP	55
8	BenMansour, Imen. (2023). An effective hybrid ant colony optimization for the knapsack problem using multi-directional search." SN Computer Science 4, no. 2 (2023): 164.	JA	56
9	Yosr Ghozzi. (2023). Un modèle d'apprentissage collaboratif hybride en sciences de l'ingénieur basé sur une chaîne de production cyber-physique. Journées D'études AIPU Section France- Perpignan 2023	CP	
10	I. Sayahi and S. Ismail. (2022). Design and Implementation of an Embedded Vision System for Industrial Inspection," 2022 IEEE 9th International Conference on Sciences of Electronics, Technologies of Information and Telecommunications (SETIT), Hammamet, Tunisia, 2022, pp. 567-572, doi: 10.1109/SETIT54465.2022.9875471.	CP	

2* JA : Journal Article ; CP : Conference Paper

Applied Mathematics RDI Publications (2022-2023 AY)

#	RDI publication	Type ³	Abstract on Page #
1	Marwa Kchaou , Jing-Rebecca Li. (2023). A second order asymptotic model for diffusion MRI in permeable media. ESAIM: Mathematical Modelling and Numerical Analysis, 2023, 57 (4), pp.1953-1980. 10.1051/m2an/2023043ff. fhal-04149697f	JA	56
2	Foued Saadaoui, Monjia Khalfi, Rim Ben Elouefi . (2023). Measuring Islamic Banking Efficiency using Data Envelopment and Regression Analysis. International Journal of Management and Decision Making. Inderscience. DOI:10.1504/IJMDM.2024.10053194	JA	57
3	Bendahou, Imene, Zied Khemiri , and Fethi Mahmoudi. (2023). Spike solutions for a fractional elliptic equation in a compact Riemannian manifold. Pacific Journal of Mathematics 324, no. 1 (2023): 1-47.	JA	58
4	Samir NaitAmor, Rabah Ikhlef, Ahmed Ammar , Hassen Ghalila. (2023). Evidence of CME-Magnetospheric Shock Disturbance of the D-Region Observed in the VLF Signal, Journal of Geophysical Research: Space Physics, August 2023, Volume128, Issue8, https://doi.org/10.1029/2023JA031330	JA	59
5	Riahi, Mohamed Hedi , Hend Ben Ameer, and Nizar Kharrat. (2023). A Posteriori Error Analysis for a Multidimensional Adaptive Parametrization Algorithm. Available at SSRN 4538904. http://dx.doi.org/10.2139/ssrn.4538904	JA	60
6	Rached Jaidane and Abir Amor ben ali . (2023). Non Local Weighted Fourth Order Equation in Dimension 4 with Non-linear Exponential Growth. Taiwanese Journal of Mathematics. 27:3 2023.06[112.06]. DOI: 10.11650/tjm/230202.	JA	

3* JA : Journal Article

Appendix: Paper Abstracts



**Optimal Sensor Placement Strategy for Structural Health Monitoring with Application
of the Aqueduct El Hnaya of Carthage**

DOGHRI, W., SADDOUD, A., & CHAARI, L.

ABSTRACT:

The concept of structural health monitoring (SHM), which ensures maintenance and conservation of the built environment, is progressively growing in importance. SHM offers the building's historical and cultural value in addition to its safety. Nowadays days, Wireless Sensor Networks (WSN) are frequently employed for SHM and offer a strong contender to address a number of problems, including sensor location. A sensor placement approach is therefore needed considering fragility and significance of the historic structures. In this paper, we propose sensors placement methods applied on the historical monument Aqueduct of Carthage of Tunisia. Our method is based on the Finite Element Modeling (FEM) to carry out the mesh model of the structure arches and to identify two types of the arch zones; stressed and unstressed zones. Based on FEM results, we determine the optimal sensor positions to maximize the covered surface, given a limited number of sensor.

DOGHRI, W., SADDOUD, A., & CHAARI, L. (2023). Optimal Sensor Placement Strategy for Structural Health Monitoring with Application of the Aqueduct El Hnaya of Carthage. In 2023 15th International Conference on Developments in eSystems Engineering (DeSE) (pp. 137-142).

A Novel Framework for Distribution Power Lines Detection

**Damos Ayobo Abongo, Mohamed Gaha, Safa Cherif, Wael Jaafar,
Guillaume Houle, Christian Buteau**

ABSTRACT:

Millions of dollars are spent yearly to trim trees along rights-of-way and guarantee reliable distribution line systems. To reduce these costs, power utilities are embracing a new approach based on light detection and ranging (LiDAR) data. They aim to automatically detect the locations of critical branches/trees and assess their risks. In this paper, we propose a novel and robust power lines detection framework with several LiDAR data processing steps, which combines machine learning and geometric approaches. By combining these methods, we efficiently detect distribution lines with an Intersection-over-Union performance superior to those of deep-learning-based benchmarks, and less complex than most of them. The benefit is that by prescribing the use of geometrical/mathematical approaches for the post-processing of deep-learning/machine-learning outputs, we are able to further improve lines detection. Finally, we expect our novel framework to be generalized to detect various LiDAR objects such as poles, cars, buildings and roads.

Damos Ayobo Abongo, Mohamed Gaha, Safa Cherif, Wael Jaafar, Guillaume Houle, Christian Buteau. (2023). A Novel Framework for Distribution Power Lines Detection, in 2023 IEEE Symposium on Computers and Communications (ISCC), Gammarth, Tunisia, 2023 pp. 1-4

When ChatGPT goes rogue: Exploring the potential cybersecurity threats of AI-powered conversational chatbots

Iqbal, Farkhund, Faniel Samsom, Faouzi Kamoun, and Áine MacDermott

ABSTRACT:

ChatGPT has garnered significant interest since its release in November 2022 and it has showcased a strong versatility in terms of potential applications across various industries and domains. Defensive cybersecurity is a particular area where ChatGPT has demonstrated considerable potential thanks to its ability to provide customized cybersecurity awareness training and its capability to assess security vulnerabilities and provide concrete recommendations to remediate them. However, the offensive use of ChatGPT (and AI-powered conversational agents, in general) remains an underexplored research topic. This preliminary study aims to shed light on the potential weaponization of ChatGPT to facilitate and initiate cyberattacks. We briefly review the defensive usage of ChatGPT in cybersecurity, then, through practical examples and use-case scenarios, we illustrate the potential misuse of ChatGPT to launch hacking and cybercrime activities. We discuss the practical implications of our study and provide some recommendations for future research.

Iqbal, Farkhund, Faniel Samsom, **Faouzi Kamoun**, and Áine MacDermott. (2023). When ChatGPT goes rogue: Exploring the potential cybersecurity threats of AI-powered conversational chatbots." *Frontiers in Communications and Networks* . Volume 4 - 2023 | <https://doi.org/10.3389/frcmn.2023.1220243>

Video Traffic Analysis for Real-Time Emotion Recognition and Visualization in Online Learning

Ayoub Sassi, Wael Jaafar, Safa Cherif, Jihen Ben Abderrazak and Halim Yanikomeroğlu

ABSTRACT:

Since the outbreak of the COVID-19 crisis, the transition to remote education presented several challenges to educational institutions. Unlike face-to-face classes where educators can modify and keep track of the lessons and content according to the students' observed emotions and participation, such activities are difficult to complete in online learning environments. To address this issue, we propose here a novel and comprehensive framework that leverages advanced computer vision and analysis techniques to detect students' emotions during online learning and assess their state of mind regarding the taught content. Our framework is composed of three modules. The first module uses a novel lightweight machine learning method, called convolutional neural network-random forest (CNN-RF), to efficiently detect the students' basic emotions, e.g., sad, happy, etc., during the online course. Our approach surpasses existing benchmarks in terms of accuracy (over 71%) on the FER-2013 dataset, while being less complex (i.e., using a smaller number of parameters). The second module consists of mapping the basic emotions to an education-aware state of mind, e.g., interest, boredom, distraction, etc. Unlike the few works that proposed simplistic mapping, we propose here a Plutchik wheel's inspired mapping system, which is more precise and reflects better the relationship between combinations of basic emotions and the resulting education-aware state of mind. Thus, our understanding of the students' cognitive and affective experiences during online learning can be enhanced. The third module is a visualization dashboard that offers clear and intuitive real-time representations of basic emotions and states of mind. This tool provides educators with invaluable insights into students' emotional dynamics, enabling them to identify learning difficulties with high

precision and make informed recommendations for improvements in course content and online teaching methods. In summary, the proposed framework presents a novel and powerful tool that addresses the challenges related to online learning. By accurately detecting the students' emotions, assessing their states of mind, and providing real-time visualization, our approach represents a significant advancement toward the optimization of online education, which is critically needed in rural and remote areas of the globe.

Ayoub Sassi, Wael Jaafar, **Safa Cherif**, **Jihen Ben Abderrazak** and Halim Yanikomeroglu. (2023). Video Traffic Analysis for Real-Time Emotion Recognition and Visualization in Online Learning, in IEEE Access, Sept. 2023. doi: 10.1109/ACCESS.2023.3313973

Design of Compact and Superdirective Metamaterial-Inspired Two- and Three-Elements Antenna Arrays

Saber Dakhli, Jean Marie Floc'h, Mohammed Aseeri, Ameni Mersani, Hatem Rmili

ABSTRACT:

This paper presents the development of a miniature antenna array in a small space in order to achieve superdirectivity for long-range communication. The proposed structures consist of a superdirective metamaterial-inspired array based on a capacitively loaded loop (CLL) driven by an electrically small monopole antenna. This elementary antenna is then used in two- and three-array configurations separated by a fixed interelement distance of 0.1λ to achieve a higher directivity and compact size (with λ the wavelength calculated at the operation frequency 1.850 GHz). The design of the elementary antenna, its simulated radiation performances, as well as those of the parasitic array are also reported. The results of the optimization of two- and three-antenna arrays are discussed. For this study, three corresponding prototypes were fabricated and tested. The measured impedance mismatch and radiation pattern results are presented and shown to be in good agreement with their simulated values. The maximum measured directivity is equal to 5.9 dBi and 4.75 dBi in the case of the two- and three- elements, respectively. The proposed antenna arrays can serve for the realization of point-to-point wireless links and can have a significant impact on compact and high-directive radiofrequency front-ends of a wireless system and for wireless power transfer applications.

Saber Dakhli, Jean Marie Floc'h, Mohammed Aseeri, **Ameni Mersani**, Hatem Rmili. (2023). Design of Compact and Superdirective Metamaterial-Inspired Two- and Three-Elements Antenna Arrays, July 31, 2023, Journal Of Electromagnetic Engineering And Science, VOL. 23, NO. 4, 362~368, JUL. 2023. DOI: <https://doi.org/10.26866/jees.2023.4.r.179>

Small Button Antenna for Wearable applications

Ameni Mersani, Jean-Marc Ribero and Lotfi Osman

ABSTRACT:

This paper focuses on the design, simulation, and manufacture of a miniaturized antenna operating in the 5.8 GHz frequency band for ISM applications. This antenna is fabricated using a dielectric resonator placed above textile materials. This work, therefore, aims to study and design a textile antenna with a dielectric resonator that behaves like a button that will be worn on the body. This is to improve the performance of this antenna. The geometry and dimensions of this antenna have been optimized using CST software. We did several simulations to determine the antenna parameters that most influence its performance. The simulation and measurement results are in good agreement and show that the DRA improves the performance of the antenna and can isolate the human body well. The gain of the antenna is 5.4 dBi and the efficiency is 60%. Consideration is given to the radiation pattern of the proposed flexible DRA antenna.

Ameni Mersani, Jean-Marc Ribero and Lotfi Osman. (2022). Small Button Antenna for Wearable applications, 2022 International Conference on Microelectronics (ICM), Casablanca, Morocco, 2022, pp. 78-81, doi: 10.1109/ICM56065.2022.10005480

**Using a Correlation Equation to ensure Stability between Personalization and Security
in Composing Web Services**

**Sarra Abidi, Samir Toumi, Mehrez Essafi, Chirine Ghedira Guegan
and Henda Hajjami Ben Ghezala**

ABSTRACT:

Because of the increasing complexity, openness and extensibility of services-based Information Systems (IS), Web Services Composition (WSC) became a main challenge that interests many researchers. This interest is growing with the apparition of Cloud applications that are being increasingly available and diversified trying to cover a multitude of services to satisfy the unlimited end-user requirements. In front of applications diversity, it become more difficult for end-user to find the most adequate service that perfectly meet their needs especially when considering personalization in WSC process. This difficulty increases when dealing with security constraints, especially in cloud environment where services are openly accessible and widely exposed to highly potential risks. In such context, WSC must be made in a careful way and personalization should proactively take into account protection measures against all eventual threats. Otherwise, integrating both personalization and security in WSC may result in an instable system. Based on this conviction, finding the correlation between these concepts remains an important issue. Hence, the key challenge of this paper is to study the stability system's through a correlation equation between the precited concepts. To highlight the efficiency of our proposed equation, we will present an E-Learning application that was used during the COVID-19 pandemic.

Sarra Abidi, Samir Toumi, Mehrez Essafi, Chirine Ghedira Guegan and Henda Hajjami Ben Ghezala. (2023). Using a Correlation Equation to ensure Stability between Personalization and Security in Composing Web Services, AICCSA 2023

**Exploiting scatter matrix on one-class support vector machine based
on low variance direction**

Soumaya Nheri, Riadh Ksantini, Mohamed Bécha Kaâniche, Adel Bouhoula

ABSTRACT:

When building a performing one-class classifier, the low variance direction of the training data set might provide important information. The low variance direction of the training data set improves the Covariance-guided One-Class Support Vector Machine (COSVM), resulting in better accuracy. However, this classifier does not use data dispersion in the one class. It explicitly does not make use of target class subclass information. As a solution, we propose Scatter Covariance-guided One-Class Support Vector Machine, a novel variation of the COSVM classifier (SC-OSVM). In the kernel space, our approach makes use of subclass information to jointly decrease dispersion. Our algorithm technique is even based on a convex optimization problem that can be efficiently solved using standard numerical methods. A comparison of artificial and real-world data sets shows that SC-OSVM provides more efficient and robust solutions than normal COSVM and other contemporary one-class classifiers.

Soumaya Nheri, Riadh Ksantini, Mohamed Bécha Kaâniche, Adel Bouhoula. (2023). Exploiting scatter matrix on one-class support vector machine based on low variance direction, Intelligent Data Analysis journal. DOI: 10.3233/IDA-227036

Human Face Detection Improvement using Subclass Learning and Low Variance Directions

Soumaya Nheri

ABSTRACT:

In order to increase the face detection rate in complicated images, a novel approach is presented in this work. The suggested method seeks to improve accuracy by utilizing low-variance directions for data projection and one-class subclass learning. Previous studies have demonstrated that taking into account the data carried by low-variance directions enhances the performance of models in one-class classification. For dispersion data, subclass learning is extremely successful. To evaluate the effectiveness of our subclass method, we conducted a comparison between our proposed approach and other one-class classifiers on multiple face detection datasets. Results reveal that the suggested method performs better than other methods, demonstrating its potential to develop face identification technologies.

Soumaya Nheri. (2023). Human Face Detection Improvement using Subclass Learning and Low Variance Directions, Conference: 2023 IEEE Symposium on Computers and Communications (ISCC), July 2023. DOI: 10.1109/ISCC58397.2023.10217858

Exploring New AI-Based Technologies to Enhance Students' motivation

Wissal Neji, Naouel Boughattas and Faten Ziadi

ABSTRACT:

Aim/Purpose	The aim of this study is to propose a teaching approach based on AI-based chatbot agents and to determine whether the use of this approach increases the students' motivation.
Background	Today, chatbots are an integral part of students' lives where they are used in various contexts. Therefore, we are interested in incorporating these tools into our teaching process in order to profit from their benefits, assist and guide students while working with to prevent issues such as plagiarism and mainly to boost students' motivation.
Methodology	Using the proposed approach, new chatbot based learning activities were designed in three different courses for computer science engineering students. A mixed-method experimental study was conducted to evaluate students' impression and satisfaction. Survey results of the students (N=58) who participated in the experiment (experimental group) were compared to the results of the students from the control group (N=60).
Contribution	Trending AI conversational agents can be engaged in daily teaching activities as a learning assistant and coach to boost students motivation and skills development.
Findings	Our study focuses on the impact of chatbots on student's motivation. The study aimed to analyze the benefits and drawbacks associated with these conversational chatbots. Our findings revealed the significant role that chatbots can play in enhancing student motivation and improving teaching practices.

Wissal Neji, Naouel Boughattas, and Faten Ziadi. (2023). Exploring New AI-Based Technologies to Enhance Students' motivation. *Issues in Informing Science & Information Technology*, vol. 20., p95-110. 16p. <https://doi.org/10.28945/5149>

Slow-Light performance enhancement of delay line based on arced photonic crystal waveguide

Zaineb Gharsallah, Radhouene Massoudi, Monia Najjar, Bhuvneshwer Suthar

ABSTRACT:

In the present paper, we proposed a slow light structure using arced photonic crystal waveguide (PhCW) to design an optical delay line. A delay bandwidth product value is calculated by comparing the arced PhCW with a straight PhCW. It's seen that the arced PhCW offers a very simple method to slow down the light speed with a bandwidth of 294 THz and a delay bandwidth product of 32.34. An average group index equals to 13 is demonstrated which yield to 110 fs delay time for a device footprint of $14 \times 19 \mu\text{m}^2$. The signal shape is notably maintained constant over the proposed delay line. Furthermore, the suggested device is characterized by a small dispersion which leads to a slight group-velocity dispersion.

Zaineb Gharsallah, Radhouene Massoudi, Monia Najjar, Bhuvneshwer Suthar. (2022). Slow-Light performance enhancement of delay line based on arced photonic crystal waveguide. (2022). 27th Asia Pacific Conference on Communications (APCC), DOI:10.1109/APCC55198.2022.9943744, Korea

Towards New Generation of Civil Engineers in the IoT Era: PBL as a Tool for Integrating IoT in Civil Engineering Curricula

Abderrazak Hachani and Nadia Ajaliaa

ABSTRACT:

This paper assesses the merit of exposing civil engineering students to different deployment aspects of IoT (Internet of Things) in civil engineering (CE). This research shows how Project / Problem based Learning (PBL) approaches are used as motivational drivers to acquire new IoT competencies for non-IT students, by designing new adapted IoT curricula for civil engineers. The objective behind integrating such a course is preparing these students for real life projects and shaping their business career by bridging the gap from simple adopter of technology to a major player and engaged one. This work is conducted by empirical study (in the form of a questionnaire) to assess the efficiency of PBL in this experience, by measuring the satisfaction level of students along all the active learning processes and collecting their feedback for future improvements. The questionnaire revealed the importance (major role) of the pedagogical method as well as the pedagogical material; mainly the major role of Low / No coding platforms as IoT experimental empowerment tools. Also, the readiness (after taking this course) of these students to see civil engineering differently in the era of IoT. Among the collected feedback, all students agreed on the importance of the IoT course in their future careers and the necessity to increase the course study hours as well as introducing additional IT courses in previous academic years.

Abderrazak Hachani, Nadia Ajaliaa. (2023). Towards New Generation of Civil Engineers in the IoT Era: PBL as a Tool for Integrating IoT in Civil Engineering Curricula, EDUCON 23 May 2023, Kuwait. 10.1109/EDUCON54358.2023.10125234

Knowledge, Attitude, and Perception Towards ChatGPT Among University Students and Faculty: A Preliminary Exploration

Faouzi Kamoun, Walid El Ayeb, Sami Sifi, Farkhund Iqbal, Ibtissem Jabri

ABSTRACT:

Launched on November 30, 2022, the OpenAI chatbot ChatGPT has taken the world by storm with its ability to generate human-like text in a conversational style. The reactions varied from enthusiasm about its potential to enhance learning to major concerns about its possible threat to learning and academic integrity.

Rooted into the theories of ethical perceptions and behaviors as well as academic misconduct, this exploratory study aims (1) to gauge the general level of knowledge, attitude, and perception (KAP) towards ChatGPT among university students and faculty, (2) to determine if there was a significant relationship among the three KAP indexes and (3) to explore the effect of some demographic characteristics on participants' KAP. To address the above research questions, we use a cross-sectional survey research design based on a validated self-report questionnaire distributed among undergraduate and graduate Business and Engineering students at ESPRIT, Tunisia. We use a bivariate correlation to test for significant relationships between the KAP indexes, independent sample t-tests, and univariate analysis of variance (ANOVA) to determine if there was a significant difference between selected demographic variables and KAP indexes. Statistical analysis of our data is presented, and the implications of our findings for future research and practice are discussed.

To the best of our knowledge, this is the first reported study assessing the levels of knowledge, attitude, and perception towards ChatGPT. The results of our research can guide us towards

developing effective institutional policies and strategies to better respond to the opportunities and threats posed by ChatGPT.

Faouzi Kamoun, Walid El Ayeb, **Sami Sifi**, Farkhund Iqbal, Ibtissem Jabri. (2023). Knowledge, Attitude, and Perception Towards ChatGPT Among University Students and Faculty: A Preliminary Exploration. The 12th European Conference on Education (ECE2024). London, UK. July 13 -, July 17, 2023. <https://doi.org/10.22492/issn.2188-1162.2023.20>

Cloud Based Environment for Higher Education Institution in Developing Countries

Madhioub, Manel, Soumaya Mbarek, and Hamdi Gabsi

ABSTRACT:

Current modern technologies are playing a key role in the development of the higher education sector by providing multiple modes of learning delivery, collaboration and communication. Cloud computing is an emerging paradigm that plays an important role and has major impacts on higher education institutions (HEIs) in developing countries. It enables users to access diverse software applications, share data, collaborate more easily, and keep their data safely in the infrastructure. Despite the intensive use of cloud computing, limited research has been conducted regarding the use of cloud-based environments by HEIs in developing countries. The purpose of this work is, first, to provide a coherent understanding of cloud computing models used in HEIs. We distinguish the various opportunities and challenges emerging from using different cloud computing services. Second, we propose a cloud based-environment where several cloud services and deployment models are orchestrated in order to create a coherent environment containing the necessary tools. This environment puts into practice several expertise fields and deepens the knowledge of both students and instructors. In addition, we demonstrate the effectiveness of our proposed environment through the experience and findings of a Tunisian School of Engineering, where our cloud-based environment is implemented. This school is a private higher education institution founded in 2003, it employs around 500 people and hosts more than 8,000 students. Finally, findings from this study will help academics, instructors, and researchers understand the potential of using cloud computing environments from an engineering school's perspective.

Keywords: COVID-19, Computer aided instruction, Electronic learning, Education, Teamwork, Online services, Problem-solving.

Madhioub, Manel, Soumaya Mbarek, and Hamdi Gabsi. (2022). Cloud Based Environment for Higher Education Institution in Developing Countries. In 2022 IEEE Frontiers in Education Conference (FIE), pp. 1-8. IEEE, 2022.

Defis Des Economies Circulaire, Verte et Bleue dans le Contexte du Developpement Durable

Dhouha Melliti, Myriam Zorgui

ABSTRACT:

En raison du rythme accéléré de la croissance continue de la consommation et de la production de masse, le problème du réchauffement climatique qui ne cesse de s'enraciner et de la perte prononcée de la biodiversité, entre autres facteurs, le 21e siècle a présenté sans précédent une série de défis pour la mise en œuvre des principes de durabilité.

Il est important de souligner qu'au cours des trois dernières décennies, la problématique du développement durable a été discutée à l'échelle mondiale, sur la base des premiers aperçus des questions environnementales et de l'effet de l'activité industrielle non réglementée.

L'Agenda 2030 est une initiative de l'Organisation des Nations Unies (ONU) qui propose un accord global sur le développement durable. L'agenda a été formé par 193 pays en 2015 et est divisé en 17 objectifs de développement durable (ODD) - englobant 169 objectifs qui doivent être atteints d'ici 2030. Le champ d'application est large et diversifié, ce qui nécessite de relier les objectifs entre eux.

Diverses études multidisciplinaires tentent de trouver des solutions à la non-durabilité des modèles économiques actuels, en recherchant en revanche de nouvelles alternatives basées sur le trépied de la durabilité (Lewandowski, 2016 ; Kirchherr et al., 2017 ; Whalen et al., 2018 ; Alonso-Almeida & Rodriguez-Anton, 2019). Dans cette optique, l'économie circulaire (EC) se présente comme un pilier qui vise à rechercher la durabilité dans les sphères : locale, nationale et mondiale. Kirchherr et al. (2017) la conceptualisent comme un système économique qui cherche à réduire, réutiliser, recycler et récupérer les ressources grâce à des modèles

commerciaux durables. Dans cette perspective, l'EC représente une opportunité de changements significatifs pour les entreprises, car elle leur demande de penser au-delà de leurs objectifs environnementaux et d'efficacité énergétique (Leitão, 2015). Les principes de l'EC suggèrent la transition vers un système dans lequel la valeur des produits, des matériaux et des ressources est préservée dans l'économie le plus longtemps possible, avec le moins de production de déchets possible, encourageant ainsi de nouvelles formes d'innovation durable et de développement régional (Kalmykova et al., 2018). Réfléchir aux principaux modèles économiques actuels et à leurs conséquences est un défi qui s'étend du local au global, de la qualité et de la protection des individus à la survie des écosystèmes, en tenant compte des besoins critiques et immédiats des pays en développement (Goyal et al., 2018).

Dhouha Melliti, Myriam Zorgui. (2023). Défis Des Economies Circulaire, Verte et Bleue dans le Contexte du Développement Durable, 3ème Colloque International de la Faculté des Sciences Juridiques, Economiques et de Gestion de Jendouba. 9-11 Juin 2023. Tunisia.

Simple and Powerful PCG Classification Method Based on Selection and Transfer Learning for Precision Medicine Application

Barnawi, Ahmed, Mehrez Boulares, and Rim Somai

ABSTRACT:

The World Health Organization (WHO) highlights that cardiovascular diseases (CVDs) are one of the leading causes of death globally, with an estimated rise to over 23.6 million deaths by 2030. This alarming trend can be attributed to our unhealthy lifestyles and lack of attention towards early CVD diagnosis. Traditional cardiac auscultation, where a highly qualified cardiologist listens to the heart sounds, is a crucial diagnostic method, but not always feasible or affordable. Therefore, developing accessible and user-friendly CVD recognition solutions can encourage individuals to integrate regular heart screenings into their routine. Although many automatic CVD screening methods have been proposed, most of them rely on complex preprocessing steps and heart cycle segmentation processes. In this work, we introduce a simple and efficient approach for recognizing normal and abnormal PCG signals using Physionet data. We employ data selection techniques such as kernel density estimation (KDE) for signal duration extraction, signal-to-noise Ratio (SNR), and GMM clustering to improve the performance of 17 pretrained Keras CNN models. Our results indicate that using KDE to select the appropriate signal duration and fine-tuning the VGG19 model results in excellent classification performance with an overall accuracy of 0.97, sensitivity of 0.946, precision of 0.944, and specificity of 0.946.

Barnawi, Ahmed, Mehrez Boulares, and **Rim Somai**. (2023). Simple and Powerful PCG Classification Method Based on Selection and Transfer Learning for Precision Medicine Application. *Bioengineering* 10, no. 3 (2023): 294

Data Discretization for Data Stream Mining

Cherfi Anis, and Kaouther Nouira

ABSTRACT:

Data discretization has become essential task to cope with streaming data. However, this field still requires particular attention. Indeed, various constraints should be taken into consideration to cope with discretization in data stream scenarios. In this paper, we discuss the discretization process for data stream scenarios. In this setting, we examine the proposed algorithms in the literature, their limitations and the new challenges. Also, we propose a novel discretization method so called Hybrid Online Discretization (HOD). Based on the well-known Minimum Description Length Principle (MDLP) discretization combined with the Online ChiMerge Algorithm, the proposed method guarantees an efficient and effective discretization. Empirical trials show that in most cases the proposed algorithm outperforms its competitors in terms of accuracy level and reduction rate. Finally, we experimentally demonstrate that coupled with HOD, Naive Bayes classifier shows high classification accuracy.

Cherfi Anis, and Kaouther Nouira. (2023). Data Discretization for Data Stream Mining. In KES International Symposium on Agent and Multi-Agent Systems: Technologies and Applications, pp. 55-64. Singapore: Springer Nature Singapore, 2023.

Sustainable Palm Tree Farming: Leveraging IoT and Multi-Modal Data for Early Detection and Mapping of Red Palm Weevil

Yosra Hajjaji, Ayyub Alzahem, Wadii Boulila, Imed Riadh Farah and Anis Koubaa

ABSTRACT:

The Red Palm Weevil (RPW) is a highly destructive insect causing economic losses and impacting palm tree farming worldwide. This paper proposes an innovative approach for sustainable palm tree farming by utilizing advanced technologies for the early detection and management of RPW. Our approach combines computer vision, deep learning (DL), the Internet of Things (IoT), and geospatial data to detect and classify RPW-infested palm trees effectively. The main phases include; (1) DL classification using sound data from IoT devices, (2) palm tree detection using YOLOv8 on UAV images, and (3) RPW mapping using geospatial data. Our custom DL model achieves 100% precision and recall in detecting and localizing infested palm trees. Integrating geospatial data enables the creation of a comprehensive RPW distribution map for efficient monitoring and targeted management strategies. This technology-driven approach benefits agricultural authorities, farmers, and researchers in managing RPW infestations and safeguarding palm tree plantations' productivity.

Yosra Hajjaji, Ayyub Alzahem, Wadii Boulila, Imed Riadh Farah and Anis Koubaa. (2013). Sustainable Palm Tree Farming: Leveraging IoT and Multi-Modal Data for Early Detection and Mapping of Red Palm Weevil, 27th International Conference on Knowledge-Based and Intelligent Information & Engineering Systems (KES 2023)

On the Deployment of Blockchain in Edge Computing Wireless Networks

W. Jaafar, K. Jean Romeo Beyara, I. Aouini, J. Ben Abderrazak and H. Yanikomeroğlu

ABSTRACT:

Blockchain is the core technology at the heart of cryptocurrency such as Bitcoin and Ether. Due to its characteristics, e.g., immutability, decentrality, and consensus, it is now applied in several fields such as communications, e-health, and supply chains. Nevertheless, its integration to communication networks is facing several challenges related to power consumption, unreliable communication channels, and limited computing capacity of devices. In this paper, we focus on blockchain consensus optimization in edge computing wireless networks. Specifically, we propose a novel consensus mechanism adapted to the heterogeneity and dynamicity, e.g., mobility, of edge computing nodes. We call it adaptive blockchain for edge computing (ABEC). Through experiments, we demonstrate the superiority of ABEC over baseline consensus, in terms of block addition/confirmation latency and robustness to the edge nodes' unreliable behaviour. Finally, the impact of several network parameters, e.g., data rate of master ruler/block's owner, and number of transactions per block, is investigated.

W. Jaafar, K. **Jean Romeo Beyara**, **I. Aouini**, **J. Ben Abderrazak** and **H. Yanikomeroğlu**. (2022). On the Deployment of Blockchain in Edge Computing Wireless Networks, 2022 IEEE 11th International Conference on Cloud Networking (CloudNet), Paris, France, 2022, pp. 168-176, doi: 10.1109/CloudNet55617.2022.9978739.

Counterfeit Money Detection: A Hybrid Semi-Supervised GAN-based Approach,

W. Khemiri, W. Jaafar, A. Tarifa and J. B. Abderrazak

ABSTRACT:

Despite recent advances in digital banking around the world, the use of banknotes is still predominant. In this context, the detection of fake money bills is important due to the severe impact of their circulation on the economic system. Automating and making detecting counterfeited bills accessible to anyone is still an under-investigated issue, which is mainly based on the visual inspection of bills. In this paper, we propose a novel semi-supervised generative adversarial network (GAN)-based detection approach that, by visually inspecting a bill, can determine if the latter is authentic or fake. Our method originally combines a parallelized GAN to a semi-supervised GAN. On a dataset of Tunisian bills, our method is able to achieve 100% accuracy, with a Fréchet Inception Distance (FID) below 1, i.e., generating diversified fake images with good quality. These performances are proven superior to those of several benchmark approaches.

W. Khemiri, W. Jaafar, **A. Tarifa and J. B. Abderrazak**. (2022). Counterfeit Money Detection: A Hybrid Semi-Supervised GAN-based Approach," *2022 International Interdisciplinary Conference on Mathematics, Engineering and Science (MESIICON)*, India, 2022, pp. 1-6, doi: 10.1109/MESIICON55227.2022.10093502.

**Artificial Intelligence Decision Support System for Groundwater Management under
Climate Change: Application to Mornag Plain in Tunisia**

Youssef TFIKHA, Manel ENNAHEDH, Nehla DEBBAB

ABSTRACT:

The purpose of this research is to investigate the influence of climate change on GroundWater Level (GWL) in Mornag plain in Tunisia. Indeed, due to the spatiotemporal variability of RainFall (RF) and temperature, aquifers all over the world have seen significant water level volatility in recent decades. Therefore, for a reliable GroundWater (GW) management under climate change context, it is essential to analyze and estimate the GWL variability. In this study, we focus on the plain of Mornag, located in the southeast of Tunisia, since it contributes with 33% in the national agricultural production. From this plain, we have collected historical piezometric and RF data covering the period 2005-2015. Knowing the RF data, our goal is to forecast the GWL one. This issue has already been studied using classical numerical GW modeling such as Modflow and Feflow. Unfortunately, these techniques are data and time consuming. To overcome all these drawbacks, we propose to use an Artificial Intelligence (AI) approach that has shown great performance in literature for recurrent data modeling and forecasting. This approach corresponds to the Long-Short Term Memory (LSTM) Neural Network. Compared with Modflow, LSTM has shown noticeable enhancement in terms of root mean squared error minimization, which confirms its adequacy for GWL forecasting. Using the proposed AI prediction model, the impact of climate change on Mornag GWL has been studied under two Representative Concentration Pathway (RCP) scenarios; RCP 4.5 and RCP 8.5 for three future periods: 2015-2040, 2041-2065 and 2066-2100. As expected, results reveal a future decline of Mornag GWL. The performed study of future Mornag GWL behavior using LSTM could classify this AI approach as a good decision support system that could be used to optimize the management of our limited water resources in order to satisfy the population

needs in terms of drinking water and agricultural production, as well as to prevent upcoming drought.

Youssef TFIFHA, Manel ENNAHEDH, **Nehla DEBBABI**. (2022). Artificial Intelligence Decision Support System for Groundwater Management under Climate Change: Application to Mornag Plain in Tunisia. Second Mediterranean Geosciences Union. MedGU-22

**Building up cyber resilience by better grasping cyber risk via a new algorithm
for modelling heavy-tailed data**

Michel Dacorogna, Nehla Debbabi, Marie Kratz

ABSTRACT:

Cyber security and resilience are major challenges in our modern economies; this is why they are top priorities on the agenda of governments, security and defense forces, management of companies and organizations. Hence, the need of a deep understanding of cyber risks to improve resilience. We propose here an analysis of the database of the cyber complaints filed at the Gendarmerie Nationale. We perform this analysis with a new algorithm developed for non-negative asymmetric heavy-tailed data, which could become a handy tool for applied fields, including operations research. This method gives a good estimation of the full distribution including the tail. Our study confirms the finiteness of the loss expectation, necessary condition for insurability. Finally, we draw the consequences of this model for risk management, compare its results to other standard EVT models, and lay the ground for a classification of attacks based on the fatness of the tail.

Michel Dacorogna, **Nehla Debbabi**, Marie Kratz. (2023). Building up cyber resilience by better grasping cyber risk via a new algorithm for modelling heavy-tailed data, *European Journal of Operational Research*, Volume 311, Issue 2, Pages 708-729, ISSN 0377-2217, <https://doi.org/10.1016/j.ejor.2023.05.003>

A New Perspective on the Swiss Cheese Model Applied to Understanding the Anatomy of Healthcare Data Breaches

Kamoun, Faouzi, and Mathew Nicho

ABSTRACT:

The healthcare industry has been lagging behind other industries in protecting its vital data. Over the past few years, researchers and practitioners have been trying to gain a better understanding of the anatomy of healthcare data breaches. In this chapter, the authors show how Reason's swiss cheese model (SCM) provides a powerful analytic model to explain the human, technical, and organizational factors of healthcare data breaches. They also show how the SCM brings forwards the latent conditions of healthcare data breach incidents that have often been overlooked in previous studies. Based on an extensive literature review and an analysis of reported breaches from credible sources, the authors provide an explanation of the cheese layers and the associated holes. Since the SCM endorses the “defenses in depth” approach, it can assist healthcare organizations and business associates in developing a comprehensive and systematic approach to prevent and mitigate data breach incidents.

Kamoun, Faouzi, and Mathew Nicho. "A New Perspective on the Swiss Cheese Model Applied to Understanding the Anatomy of Healthcare Data Breaches." Research Anthology on Securing Medical Systems and Records, edited by Information Resources Management Association, IGI Global, 2022, pp. 726-749. <https://doi.org/10.4018/978-1-6684-6311-6.ch033>

Deadbeat Internal Model Control for Temperature of Electric Furnace

Imen Saidi and Nahla Touati

ABSTRACT:

In this paper, a deadbeat internal model control structure is proposed. This structure is applied to control the temperature inside the electric furnace. The results of numerical simulations have shown the effectiveness of the proposed structure. The deadbeat internal model control has ensured good performance of the study system as compared to the classic internal model control. In fact, the temperature was stable, accurate and has a short response time with zero transients.

Imen Saidi, Nahla Touati. (2023). Deadbeat Internal Model Control for Temperature of Electric Furnace, IEEE International Conference on Advanced Systems and Emergent Technologies IC_ASET, April 2023, DOI:10.1109/IC_ASET58101.2023.10150571, Tunisia.

Dahlin Deadbeat Internal Model Controller Design for Discrete Systems with Time Delay

Imen Saidi and Nahla Touati

ABSTRACT:

In this paper, the Dahlin Deadbeat Internal Model Control strategy is applied to control discrete systems with time delay. Time delays in systems can lead to instability, poor performance, and even system failure. DDIMC was applied on a neonatal incubator system to control temperature and humidity. Good results were obtained in terms of stability, setpoint tracking and in terms of the rapidity of the system's responses.

Imen Saidi, Nahla Touati. (2023). Dahlin Deadbeat Internal Model Controller Design for Discrete Systems with Time Delay, International Conference on Control, Decision and Information Technologies CoDIT, July 2023, Rome-Italy

Control of an Autonomous Surface Vehicle with Variable Load by Predictive Control

Mkhinini Maher, Sayahi Intissar, Maaoui Ben Hassine Ikram

ABSTRACT:

In the field of marine environment protection, the clean-up of polluted areas is increasingly a difficult task. Indeed, the exhaustive exploitation of this environment, in particular oil exploitation, drilling platforms or waste resulting from the intentional or accidental dumping rubbish in the sea by man, has only increased the rate of pollution of these environments. Consequently, getting rid of this waste and hydrocarbons has become a complicated, costly and time-consuming operation. This is the context of the Sea-neT project, which aims to offer e-capable, flexible and inexpensive solutions for the de-pollution of aquatic areas, particularly for sheltered areas (coasts, ports, rivers, canals, lakes, etc.). As the carrier of this project, the company IADYS has set up the Jellyfishbot, a small remotely operated clean-up robot that collects macro-waste and hydrocarbons. In order to improve the performance of this robot and to automate it in an intelligent and predictive way. This work is carried out in the framework of an ESPRIT end-of-study project in collaboration with the Laboratoire d'Analyse, de Conception et de Commande des Systèmes (LACS) at ENIT and Laboratoire d'Informatique, de Robotique et de Micro-électronique de Montpellier (LIRMM).

Mkhinini Maher, Sayahi Intissar, Maaoui Ben Hassine Ikram. (2022). Control of an Autonomous Surface Vehicle with Variable Load by Predictive Control, International Conference on Information Technologies and Smart Industrial Systems IEEE, 15-17 2022 Paris, France

How to improve pedagogy through the use of tools?

Mkhinini Maher, Sayahi Intissar, Cherni Thameur

ABSTRACT:

Through this work, we will explain how to use survey tools conducted within an engineering educational institution to improve the performance of teaching, reform its education and advance learning. Similarly, we will exploit a survey work done outside the school "extra school" to acquire useful information quantitatively and qualitatively. According to the results and the sampling carried out on a wide industry sector. We will proceed to a reform of the study plan.

Mkhinini Maher, Sayahi Intissar, Cherni Thameur .(2022). How to improve pedagogy through the use of tools?, the International Symposium on Pedagogical Innovation in Higher Education CIIP IEEE, 20-22 2022 Sousse, Tunisia

Simulating the Dynamic Behavior of Heat Exchange

Mkhinini, Maher, and Ameni Dridi

ABSTRACT:

Today , the heat exchange represents an essential element of heating, air-conditioning systems, as well as refrigerating systems. It ensures the heat transfer between two fluids without getting them mixed up. This transfer takes a fundamental place through a wall of high-conducting capacity. There are different kinds of heat exchangers used in different fields. This paper aim to provide heat exchangers, from the way it functions to its efficiency, going through its different types. In this work, two major problems will be discussed, the first one deals with complications caused by corrosion (material problem) while the second one is the problem of energy cost and the impact on the environment. That's why, we will conceive of and develop a model to substitute the heat exchanger following the Greenfloor system (based on transfer functions) which would allow to simulate the dynamic behaviour of the heat exchanger faster than old simulators based on finite elements method The first part of this paper is reserved to the description of the heat exchanger , the second one explains the finite elements model, the model of heat exchanger and the last part will be reserved to the conclusion.

Mkhinini, Maher, and Ameni Dridi. (2023). Simulating the Dynamic Behavior of Heat Exchange. In 2023 9th International Conference on Control, Decision and Information Technologies (CoDIT), pp. 1273-1278. IEEE, 2023. Rome, Italy

Comfort Analysis in Buildings Based on Machine Learning Methods

Mehdi Hadj Sassi, Asma Karoui, Mounir Ayadi, and Isam Shahrour

ABSTRACT:

Comfort conditions in buildings is no more a luxury than a necessity. Architects and designers are focusing their work on providing the best conditions of comfort in am building depending on the activity. The university give students and teachers a space where to share knowledge and experience. Besides, it should offer the best conditions for this process to work properly. That is why a lot of effort is put to bring university occupants a proper space for working and learning. Despite all this effort, an evaluation of the comfort conditions in classroom is necessary, so indoor conditions can be adapted to occupant activity. One way to do that, is to do in-situ measure during teaching hours and compare the results to local standards. Besides the measures, we need occupants review regarding IEQ (Indoor Environment Quality) trough survey. These data give us late feedback regarding the IEQ. Therefor with the different set of data acquired we intend to predict comfort conditions using different machine learning algorithms. A comparison between these algorithms will help us choose the adequate algorithm to estimate perceived comfort.

Sassi, Mehdi Hadj, Asma Karoui, Mounir Ayadi, and Isam Shahrour. (2023). Comfort Analysis in Buildings Based on Machine Learning Methods. In 2023 9th International Conference on Control, Decision and Information Technologies (CoDIT), pp. 1448-1453. IEEE.

Contribution to the Improvement of a Heat Exchanger

Mkhinini, Maher, and Ameni Dridi

ABSTRACT :

Buildings consume a significant portion of the energy used in the world and subsequently an important CO₂ emission. More than half of the energy consumed in buildings goes for heating, ventilation and air conditioning. The heat exchanger is an essential part of heating, air conditioning and refrigeration systems. It allows the transfer of heat between two fluids, without them mixing. This transfer takes place through a wall with high conductive capacities. There are different types of heat exchangers, used in different fields. With our explanations, find out everything you need to know about the heat exchanger, from its operating principle to its efficiency, including the different types that can be found. In this work, we will address two major problems: the first one is the complications caused by corrosion (material problem) and the second one is the energy cost problem. Thus, we will design and develop a Green floorsystem heat exchanger to surrogate model based on transfer functions showing that the dynamic behaviour of the heat exchange is faster than old methods based on the finite element method.

Mkhinini, Maher, and Ameni Dridi. (2023). Contribution to the Improvement of a Heat Exchanger. In 2023 IEEE International Conference on Advanced Systems and Emergent Technologies (IC_ASET), pp. 1-6. IEEE, 2023

**An effective hybrid ant colony optimization for the knapsack problem
using multi-directional search**

Ben Mansour Imen

ABSTRACT:

Finding a good compromise between intensification and diversification mechanisms is very challenging task when solving multi-objective optimization problems (MOPs). In this paper, we propose an Ant Colony Optimization (ACO) algorithm coupled with multi-objective local search procedure, and evolve into a multi-directional framework. The developed MD-HACO algorithm optimizes the overall quality of Pareto set approximation using different configurations of the hybrid approach by means of different directional vectors. During the construction process, Ants optimize different search directions in the objective space trying to approximate small parts of the Pareto front. Afterward, a local search phase is applied to each sub-direction to enhance the search process toward the extreme Pareto-optimal solutions with respect to the weight vector under consideration. A multi-directional set holding the non-dominated solutions according to all directional archives is maintained. MD-HACO is tested on widely used multi-objective multi-dimensional knapsack problem (MOMKP) instances and compared to well-known state-of-the-art algorithms. Experiments highlight that the use of a multi-directional paradigm as well as a hybrid schema can lead to interesting results on the MOMKP and ensure a good balance between convergence and diversity.

BenMansour, Imen. (2023). An effective hybrid ant colony optimization for the knapsack problem using multi-directional search. SN Computer Science 4, no. 2 (2023): 164.

Un modèle d'apprentissage collaboratif hybride en sciences de l'ingénieur basé sur une chaîne de production cyber-physique

Yosr Ghozi

ABSTRACT:

La terminologie des systèmes cyber-physiques (CSP) a été bien accueillie par la communauté industrielle et spécifiquement appropriée dans les milieux éducatifs. Ce concept englobe de nombreux domaines de recherche qui étaient auparavant relativement liés. En fait, nos dernières activités pédagogiques se déroulent autour du développement d'une plateforme cyberphysique expérimentale et pédagogique à l'échelle industrielle en raison d'une étude de marché internationale qui nous a amené à nous placer au cœur de cette technologie. Pour s'aligner sur ces résultats, nous avons mené une étude, selon une approche par compétences, autour du développement dudit modèle CPS, selon un curriculum généré et des activités pédagogiques spécifiques tout en respectant le référentiel de compétences pour une meilleure insertion professionnelle des étudiants. L'objectif praxéologique est de concevoir un dispositif de professionnalisation des étudiants dans un cadre professionnel évolutif en temps de transformation digitale. Nous abordons la pratique réflexive dans le champ professionnel et l'autoévaluation du modèle didactico-pédagogique dans le champ universitaire. Nous démontrons ainsi les concepts de base du paradigme réflexif (réflexion dans l'action, sur l'action, sur le système d'action) et nous procédons à les relier à des réflexions sur l'analyse des pratiques et le travail sur l'habitus en se basant sur les théories de l'action située et de l'inconscient pratique du travail. Nous élaborons également une analyse socio-économique qui élabore une rétrospective conceptuelle dans une analyse de la rhétorique de professionnalisation des étudiants; et nous analysons les contradictions conceptuelles dans le cadre épistémologique associé.

Dans un cadre pratique, la plateforme CSP, conçue modulaire, est à aménager selon les situations de travail générées. La place laissée aux apprentissages expérientiels en vraie grandeur, plus ou moins accompagnés, au regard de l'activité professionnelle future ; les compétences incorporées à l'action (LEPLAT, 1995) et les compétences tacites (NONAKA & TAKEUCHI,1997). L'exercice de la pensée sur les actes qui permet de développer des compétences plus intellectualisées et transférables dans des situations nouvelles (WITTORSKI, 1998) en favorisant la professionnalisantes de l'action professionnelle. Nous abordons ainsi la méthode d'étude de cas que nous définissons comme l'étude spatiale et temporelle d'un phénomène complexe par les conditions, les événements, les acteurs et les implications (WACHEUX, 1996). Une méthode qualitative est lancée. Elle concerne les observations participantes ou directes (situations professionnelles ou formatives), entretiens d'explicitation ou compréhensifs avec les étudiants ou leurs tuteurs, et l'analyse documentaire de traces écrites. Nous procédons à la suite au croisement des discours sur l'activité professionnelle ou formative, des observations de comportements en situations professionnelles ou pédagogiques et des écrits (mémoire professionnel, dossiers thématiques) produits par des apprenants. Cette étape nous permettra de répertorier les types de données et anticiper les évolutions récursives dans le model. D'autre part, le modèle CPS généré a été alimentée par une plateforme de travaux pratiques à distance en collaboration avec l'ISEFC (Institut Supérieur de l'Education de la Formation Continue) et l'INSA de Lyon. Nous avons mis en place avec ces partenaires plusieurs postes de travail pouvant être exploités à distance via la plateforme hybride. Ce projet a été suivi avec la mise en œuvre des normes CDIO, selon leurs standards, pour améliorer la qualification des spécialistes formés.

Yosr Ghozi. (2023). Un modèle d'apprentissage collaboratif hybride en sciences de l'ingénieur basé sur une chaîne de production cyber-physique. Journées D'études AIPU Section France - Perpignan 2023.

Design and Implementation of an Embedded Vision System for Industrial Inspection

Sayahi and S. Ismail

ABSTRACT:

Nowadays, the advantages offered by image processing and deep learning increased their efficiency popularity. Thus, vision systems are widely motivating researchers to develop new protocols and features to optimize existing ones. Of course, technical challenges do not lack since the integration of image acquisition and processing units industrial environment poses considerable problems. In context, we adopted in our work the hybrid approach combining hardware design and software development. This approach makes the system compact, robust and reliable, especially in industrial field to ensure several operations quality inspection and verification. The proposed solution is to design an industrial embedded vision system that matches scalable hardware architectures to adaptable algorithms. this paper, we propose an efficient model to automate quality control in an industrial production line. This work aims to integrate the concept of the multi-tasking image processing in the manufacturing field by offering a whole pack of various inspection operations, from surface to dimensional inspections, based on simple hardware implementations, optical setups, and deep learning algorithms.

Sayahi and S. Ismail. (2022). Design and Implementation of an Embedded Vision System for Industrial Inspection. 2022 IEEE 9th International Conference on Sciences of Electronics, Technologies of Information and Telecommunications (SETIT), Hammamet, Tunisia, 2022, pp. 567-572, doi: 10.1109/SETIT54465.2022.9875471.

A second order asymptotic model for diffusion MRI in permeable media

Marwa Kchaou, Jing-Rebecca Li

ABSTRACT:

Starting from a reference partial differential equation model of the complex transverse water proton magnetization in a voxel due to diffusion-encoding magnetic field gradient pulses, one can use periodic homogenization theory to establish macroscopic models. A previous work introduced an asymptotic model that accounted for permeable interfaces in the imaging medium. In this paper we formulate a higher order asymptotic model to treat higher values of permeability. We explicitly solved this new asymptotic model to obtain a system of ordinary differential equations that can model the diffusion MRI signal and we present numerical results showing the improved accuracy of the new model in the regime of higher permeability.

Marwa Kchaou, Jing-Rebecca Li. (2023). A second order asymptotic model for diffusion MRI in permeable media. *ESAIM: Mathematical Modelling and Numerical Analysis*, 2023, 57 (4), pp.1953-1980. 10.1051/m2an/2023043ff. ffhal-04149697f

Measuring Islamic Banking Efficiency using Data Envelopment and Regression Analysis

Foued Saadaoui, Monjia Khalfi, Rim Ben Elouefi

ABSTRACT:

Banking efficiency is a key indicator for managers and decision makers to ensure economic stability and development. This article proposes a data-mining framework aimed at predicting Islamic banking efficiency (IBE) from a balanced sample of banks operating in developed and emerging economies before and during the subprime mortgage crisis. The variable assessing efficiency in this study is mainly measured using data envelopment analysis (DEA), while regression is performed to estimate the importance of the determinants of each type of efficiency. Experiments show that Islamic Banks in developed countries are more efficient than their counterparts in emerging countries in both crisis and non-crisis periods. As Islamic banks operate under decreasing returns to scale, it is also proven that their main source of efficiency is efficiency of scale. On the other hand, for banks operating within increasing returns to scale, the source of efficiency is rather pure efficiency. The results therefore show that the most efficient banks in both regions are the best capitalized and the largest in terms of size. Accordingly, capitalization and size can be considered as the main determinants of Islamic banking efficiency. In both regions, these findings may have several implications for risk management and corporate social responsibility.

Foued Saadaoui, Monjia Khalfi, **Rim Ben Elouefi**. (2023). Measuring Islamic Banking Efficiency using Data Envelopment and Regression Analysis. International Journal of Management and Decision Making. Inderscience. DOI:10.1504/IJMDM.2024.10053194

Spike solutions for a fractional elliptic equation in a compact Riemannian manifold

Bendahou, Imene, Zied Khemiri, and Fethi Mahmoudi

ABSTRACT:

Given an n -dimensional compact Riemannian manifold (M, g) without boundary, we consider the nonlocal equation

$$\varepsilon^{2s} P_g^s u + u = u^p \quad \text{in } (M, g),$$

where P_g^s stands for the fractional Paneitz operator with principal symbol $(-\Delta_g)^s$, $s \in (0, 1)$, $p \in (1, 2_s^* - 1)$ with $2_s^* := \frac{2n}{n-2s}$, $n > 2s$, represents the critical Sobolev exponent and $\varepsilon > 0$ is a small real parameter. We construct a family of positive solutions u_ε that concentrate, as $\varepsilon \rightarrow 0$ goes to zero, near critical points of the mean curvature H for $0 < s < \frac{1}{2}$ and near critical points of a reduced function involving the scalar curvature of the manifold M for $\frac{1}{2} \leq s < 1$.

Bendahou, Imene, **Zied Khemiri**, and Fethi Mahmoudi. (2023). Spike solutions for a fractional elliptic equation in a compact Riemannian manifold. *Pacific Journal of Mathematics* 324, no. 1 (2023): 1-47.

Evidence of CME-Magnetospheric Shock Disturbance of the D-Region Observed in the VLF Signal

Samir NaitAmor, Rabah Ikhlef, Ahmed Ammar, Hassen

ABSTRACT:

The observation of the *D*-region response to the interplanetary shock (IS) during the storm of 17 March 2015 is carried out using two very low frequency (VLF) transmitter signals (NRK and GQD) recorded at Algiers and Tunis. Data from THEMIS-E and RBSP are used to correlate between the ground and satellite observations. The important finding is the wavy structure of the perturbations observed on the two VLF signals tens of seconds after the space detection of the shock, in concordance with the RBSP electric field measurements. The measured VLF signal amplitude and phase perturbations were: -0.65 dB, 5.81° for NRK and -0.12 dB, -126° for GQD measured at Algiers. For Tunis receiver, the perturbations were: -0.58 dB, 4.7° for NRK and 0.15 dB, -1.19° for GQD. In addition to the observations, simulations of the NRK signal perturbations were done using the long wavelength propagating capability code to determine the electron density modification that lead to the measured perturbations. The simulation results showed that the modified Wait's parameters above the NRK transmitter were: 80.391 km for h' and 0.43 km⁻¹ for β in the case of NRK-Tunis path. Concerning the NRK-Algiers path, the simulation gave 80.316 km for h' and 0.431 km⁻¹ for β . From these parameters values, the modified electron density was not important to explain the observed perturbations. Therefore, the IS effect could be explained by induced heating of the ionosphere due to the penetration of the electric field which leads to the changes of the ionospheric conductivity.

Samir NaitAmor, Rabah Ikhlef, **Ahmed Ammar**, Hassen Ghalila. (2023). Evidence of CME-Magnetospheric Shock Disturbance of the D-Region Observed in the VLF Signal, Journal of Geophysical Research: Space Physics, August 2023, Volume128, Issue8, <https://doi.org/10.1029/2023JA031330>

A Posteriori Error Analysis for a Multidimensional Adaptive Parametrization Algorithm

Riahi, Mohamed Hedi, Hend Ben Ameer, and Nizar Kharrat

ABSTRACT:

We identify storage coefficient and hydraulic transmissivity in groundwater flow governed by a linear parabolic equation. Both parameters are assumed to be piecewise constant functions in space. The unknowns are the coefficient values as well as the geometry of the zones where these coefficients are constant. The goal of this work is to improve an adaptive parameterization approach for solving an inverse problem of parameter estimation. We define a posteriori error estimators depending on parameters to refine the computing mesh during the adaptive parametrization algorithm.

Riahi, Mohamed Hedi, Hend Ben Ameer, and Nizar Kharrat. (2023). A Posteriori Error Analysis for a Multidimensional Adaptive Parametrization Algorithm." Available at SSRN4538904. <http://dx.doi.org/10.2139/ssrn.4538904>

Non Local Weighted Fourth Order Equation in Dimension 4 with Non-linear Exponential Growth

Abir Amor ben ali and Rached Jaidane

ABSTRACT:

In this work, we study the weighted Kirchhoff problem

$$\begin{cases} g(\int_B (w(x)|\Delta u|^2) dx) [\Delta(w(x)\Delta u)] = f(x, u) & \text{in } B, \\ u > 0 & \text{in } B, \\ u = \frac{\partial u}{\partial n} = 0 & \text{on } \partial B, \end{cases}$$

where B is the unit ball of \mathbb{R}^4 , $w(x) = (\log \frac{e}{|x|})^\beta$, the singular logarithm weight in Adam's embedding, g is a continuous positive function on \mathbb{R}^+ . The nonlinearities are critical growth in view of Adam's inequalities. We prove the existence of a positive ground state solution using mountain pass method combined with a concentration compactness result. The associated energy function does not satisfy the condition of compactness. We provide a new condition for growth and we stress its importance to check the min-max compactness level.

Rached Jaidane and **Abir Amor ben ali**. (2013). Non Local Weighted Fourth Order Equation in Dimension 4 with Non-linear Exponential Growth. Taiwanese Journal of Mathematics. 27:3 2023.06[112.06]. DOI: 10.11650/tjm/230202.



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