2023 6th World Symposium on Communication Engineering (WSCE 2023)

University of Macedonia, Thessaloniki, Greece
September 27-29, 2023
(Hybrid Conference)

University of Macedonia, Greece

Address: 156 Egnatia Street, GR-546 36 Thessaloniki, Greece
https://www.uom.gr/en

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Welcome Address

With great pleasure, we are welcoming you to 2023 6th World Symposium on Communication Engineering (WSCE 2023), be held in University of Macedonia, Thessaloniki, Greece, during September 27-29, 2023. The conference is co-sponsored by OPSS China, and technical co-sponsored by Nagoya Institute of Technology, University of Macedonia, hosted by University of Macedonia.

After several rounds of review procedure, the program committee accepted those abstracts to be presented on conference, and papers to be published in conference proceedings. We wish to express our sincere appreciation to all the individuals who have contributed to the conference in various ways. Special thanks to local committee member: Our Conference Chair Prof. Konstantinos E. Psannis, with whose full support, make this conference to be able to happen in Thessaloniki! Thanks also extended to our committee members for their thorough review of all the submissions, which is vital to the success of the conference, and to the members in the organizing committee and the volunteers who had dedicated their time and efforts in planning, promoting, organizing and helping the conference.

The conference is high lightened by 2 Keynote Speakers and 1 Invite Speaker, they are:
Prof. Panagiotis Sarigiannidis, University of Western Macedonia, Greece
Prof. Sotirios K. Goudos, Aristotle University of Thessaloniki, Greece
Prof. George Kokkonis, International Hellenic University, Greece

As Greece's second-largest city, Thessaloniki is easy to fall in love with – it has beauty, chaos, history and culture, a remarkable cuisine and wonderful, vast sea views. It has become one of Europe's coolest city break destinations (welcoming flights to its international airport throughout the year) with a well-earned reputation for food and nightlife and a colourful arts & culture scene. Galleries and museums, international cinema and arts festivals, traditional tavernas, gourmet restaurants and street food as well as exhibition and conference centres … you'll find it all. And above all, you'll get a Thessaloniki-sized, warm-hearted welcome from the locals.

It will be so amazing and exciting to welcome you in Thessaloniki face to face. Sincerely we hope you will enjoy this city and have a nice experience on this conference!

WSCE 2023 Organizing Committee
27-29 September, 2023

CONFERENCE COMMITTEES

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Tin-Yu Wu, *National Pingtung University of Science and Technology, Taiwan*
Masaru Fukushi, *Yamaguchi University, Japan*

Yu-Chen Fan, *National Taipei University of Technology, Taiwan*
Latifah Munirah Kamarudin, *Universiti Malaysia Perlis, Malaysia*

CONFERENCE VENUE

FOR ONSITE PRESENTERS

❖ Conference Venue

- Conference Room, 1st Floor, Building ΓΔ, Department of Applied Informatics, School of Information Sciences, University of Macedonia, Thessaloniki, Greece

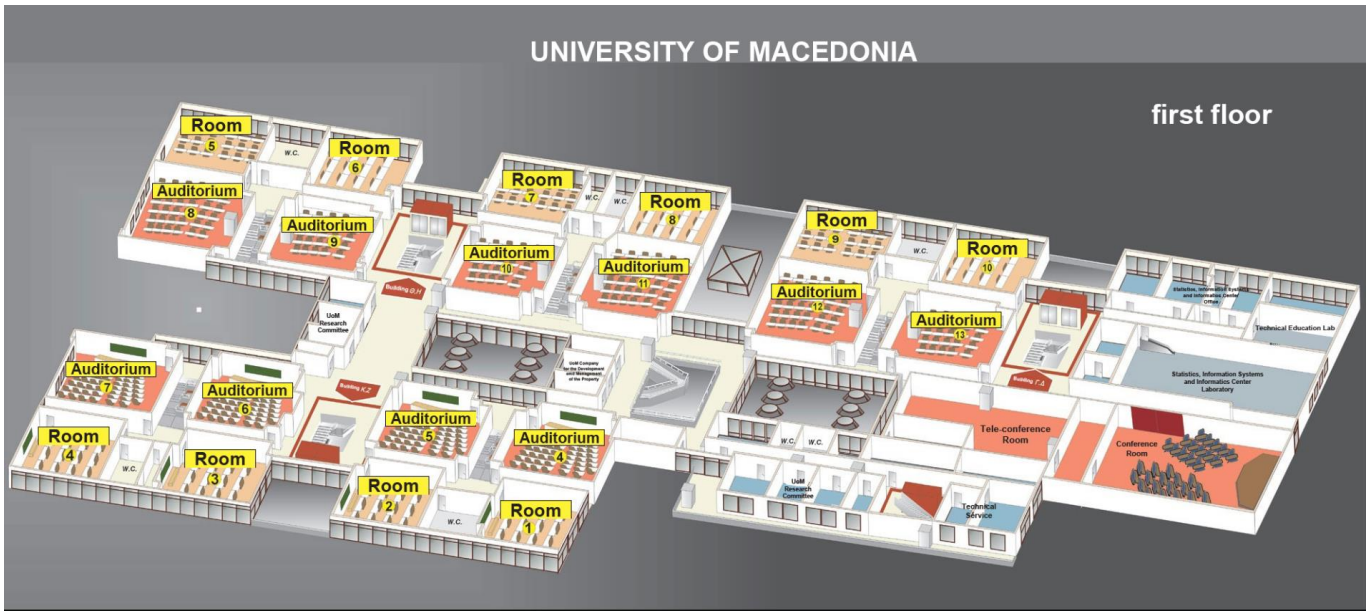
Level	Meeting Room	Sept. 27	Sept. 28	Sept. 29
1F	Conference Room	----	❖	----

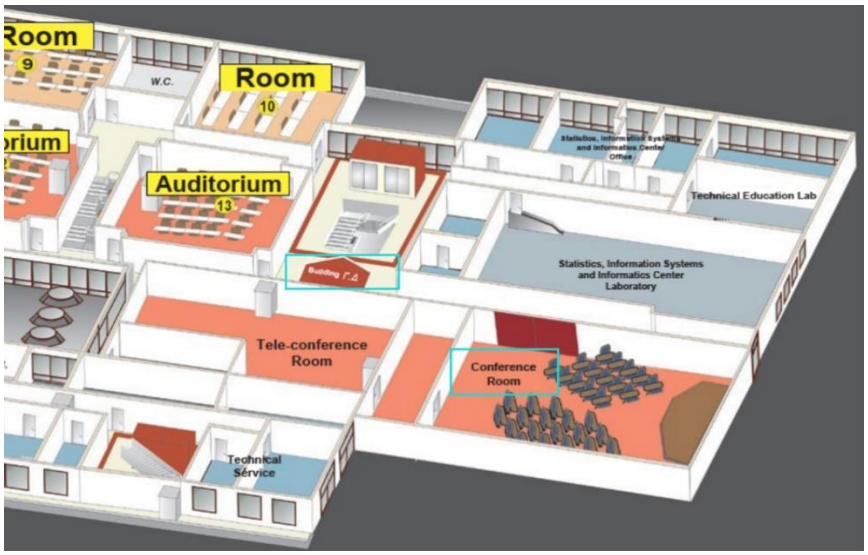
❖onsite meeting room available; ----onsite meeting room unavailable

❖ Sign-in

- Spot: outside of the Tele-conference Room, 1st Floor, Building ΓΔ, Department of Applied Informatics, School of Information Sciences, University of Macedonia, Thessaloniki, Greece
- Time: 14:00-17:00, September 27, 2023

Floor Map

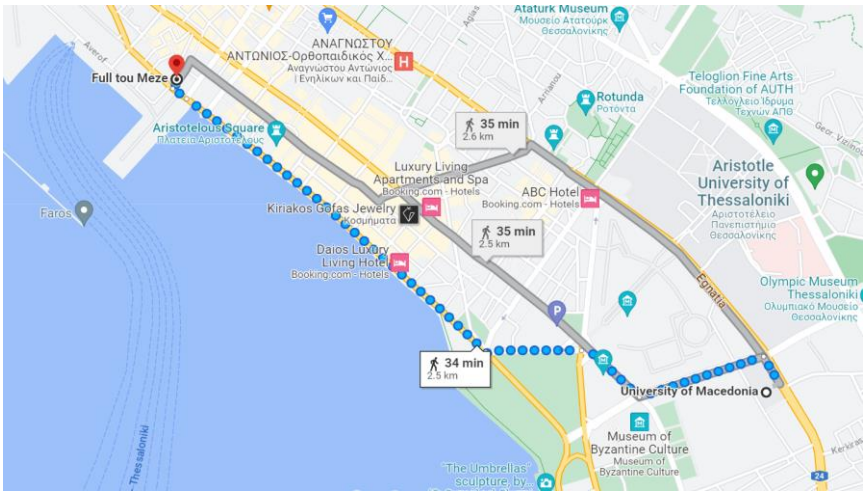




Conference Room: Plenary Session, Session 1, Session 2 on Sept. 28.

No meeting rooms available on Sept. 27 and 29.

Please reserve accommodation by yourself in advance, organizers don't provide accommodation during the conference.



Dinner Venue (Sept. 28 only)**:** Full tou Meze, Katouni 3, Thessaloniki 546 25, Greece

Transportation

- **From Thessaloniki International Airport Macedonia**
  - By Taxi: 20 KM, takes around 25 Mins. (cost around 20 Euros)
  - By Bus: take **01X** or **01N** from airport to Thessaloniki downtown, takes around 70 Mins. (cost around 2 Euros)

Time Zone

- **Greece Time: UTC +3**

Weather

- **September**

Average Low	Average High
15 ℃	27℃

Emergency Call

- **166**

(Information above from internet)

GUIDELINES

FOR ONSITE PRESENTERS

❖ Oral Presentation

- Each oral presentation is with 15 Mins time slot, including 10 Mins presentation and 5 Mins for questions from the audience.
- Your punctual arrival and active involvement in each session will be highly appreciated.
- Get your Presentation PPT slides, or PDF files prepared in advance and backed up.
- Laptop, projector & screen, laser sticks will be provided in the meeting room for presentation use.

❖ Poster Presentation

- Poster size: 0.6m width X 0.8m height
- Poster to be printed and brought to conference site by presenter self.
- At least 1 author to stand by the poster during the Poster session, which is not only to present your work, but also to answer questions from the audience.

❖ More Tips:

- Please take all your belongings when leaving meeting room.
- Conference Organizers do not provide accommodation, please reserve your hotel room in advance.
- Receipt will be emailed to you after the conference.
- Portugal citizens must circulate with an identification document (ID card or passport), so, it's wise that delegates take ID document all the time.

FOR ONLINE ORAL PRESENTERS

❖ Online Platform--Zoom

- Install Zoom tool on your device (https://zoom.us/download), join the meeting by click the Zoom link or insert the meeting ID, with audio and video on.
- For presenters: Rename yourself with “ID+Name”, such as “S1-1 +Name”.
- For Keynote Speaker or Session Chair, please rename as “KN/SC+Name”.
- Laptop with stable internet connection (wired connection preferred).
- Headsets or earphones are recommended to be used during presentation to avoid howling.
- Keep muted when the other presenters speaking until your turn to present, then you could unmute yourself.
- Only oral choice for online presentations.
- Certificate and receipt will be emailed to you after the conference.

❖ Time Zone

- Whole conference scheduled in **Greece Time**: **UTC+3**
- Please make sure your device time is set to correct time zone.

❖ Online Presentation

- Each online oral presentation is with 15 Mins time slot, including 10 Mins presentation and 5 Mins for questions from the audience.

❖ Recording

- Plenary session and online sessions will be recorded, your proper behavior and appearance will be appreciated. Only staff will record the video, presenters will not be allowed to record.

❖ Zoom Meeting ID

Zoom Online Room	Meeting ID	Zoom Link
Room A	822 8073 6008	https://us02web.zoom.us/j/82280736008

❖ Online Zoom Test

Time | Sept. 27	Room A Zoom ID: 822 8073 6008
10:00-12:00	Test

AGENDA OVERVIEW

Day 1 | September 27, 2023

Greece Time	Activity	Venue
10:00-12:00	Online Test	Zoom ID: 822 8073 6008
14:00-17:00	Onsite Sign in & Conference Materials Collection	1F, Building ΓΔ

Day 2 | September 28, 2023

Venue: Conference Room Zoom ID: 822 8073 6008		
Greece Time	**Activity**	
09:00-09:05	**Opening Ceremony**	**Opening Remarks: Prof. Konstantinos E. Psannis** University of Macedonia, Greece
		Host: Prof. George Kokkonis
09:05-09:50	**Plenary Session**	**Keynote Speech 1:** **Prof. Panagiotis Sarigiannidis** University of Western Macedonia, Greece *"Next Generation IoT"*
09:50-10:35		**Keynote Speech 2:** **Prof. Sotirios K. Goudos** Aristotle University of Thessaloniki, Greece *"Emerging Nature-Inspired Algorithms for Wireless Communications: State-of-the-art and Challenges"*
10:35-11:10	**Group Photo & Coffee Break**	
		Host: Prof. Konstantinos E. Psannis
11:10-11:40	**Plenary Session**	**Invite Speech:** **Prof. George Kokkonis** International Hellenic University, Greece *"Haptics Towards 5G Tactile Internet"*
11:40-13:30	**Lunch**	
13:30-15:45	**Oral Session 1:** Modern Computer Science and Intelligent Information Systems	
15:45-16:15	**Coffee Break**	
16:15-18:30	**Oral Session 2:** Next Generation Communication Technology and Future Development	
18:30-20:30	**Dinner**	

Day 3 | September 29, 2023

Greece Time	Activity	Venue
10:00-11:30	**Oral Session 3:** Electronic and Communication Engineering	Zoom ID: 822 8073 6008 *(Online Only)*
----	**Onsite Free City Walk**	

KEYNOTE SPEAKER

Greece Time	09:05-09:50, September 28, 2023	Onsite Room	Meeting Room
Zoom ID	822 8073 6008	Zoom Link	https://us02web.zoom.us/j/82280736008

Panagiotis Sarigiannidis

University of Western Macedonia, Greece

Speech Title: Next Generation IoT

Abstract: The Internet of Things (IoT) comprises a diverse mix of technologies, devices, and platforms that collaborate to optimise data sensing, collection, action, management and analysis. The rise of IoT has woven an intricate web of connections between individuals, services, and gadgets. Nevertheless, emerging IoT systems which utilize smart, integrated features need to process data in real-time at the network's edge, close to the user. Edge computing has become fundamental for the Next Generation IoT (NG-IoT). Coupling this with decentralized AI and machine learning sets the stage for managing and programming vast numbers of new devices that handle colossal data volumes. NG-IoT solutions demand swift analytics and minimal latency, which can be enabled through the deployment of a seamless Software-defined network fabric, advanced streaming analytics for IoT data and distributed federated learning services towards the realization of IoT to edge to core cloud continuum. This presentation will delve into the needs and uses of NG-IoT, bolstered by breakthroughs like 5G communications, edge computing, state-of-the-art distributed federated learning, blockchain, software-defined solutions and network function virtualization. These innovations promise to reshape our digital landscape with faster data speeds, enhanced reliability, cost-efficiency, heightened security and adaptability.

Bio.: Prof. Panagiotis Sarigiannidis *is the Director of the ITHACA lab (https://ithaca.ece.uowm.gr/), co-founder of the 1st spin-off of the University of Western Macedonia: MetaMind Innovations P.C. (https://metamind.gr), and Associate Professor in the Department of Electrical and Computer Engineering in the University of Western Macedonia, Kozani, Greece. He received the B.Sc. and Ph.D. degrees in computer science from the Aristotle University of Thessaloniki, Thessaloniki, Greece, in 2001 and 2007, respectively. He has published over 300 papers in international journals, conferences and book chapters, including IEEE Communications Surveys and Tutorials, IEEE Transactions on Communications, IEEE Internet of Things, IEEE Transactions on Broadcasting, IEEE Systems Journal, IEEE Wireless Communications Magazine, IEEE Open Journal of the Communications Society, IEEE/OSA Journal of Lightwave Technology, IEEE Transactions on Industrial Informatics, IEEE Access, and Computer Networks. He received 6 best paper awards and the IEEE SMC TCHS Research and Innovation Award 2023. He has been involved in several national, European and international projects. He is currently the project coordinator of three H2020 projects, namely a) DS-07-2017, SPEAR: Secure and PrivatE smArt gRid, b) LC-SC3-EC-4-2020, EVIDENT: bEhaVioral Insgihts anD Effective eNergy policy acTions, and c) ICT-56-2020, TERMINET: nexT gEneRation sMart INterconnectEd ioT, one Horizon Europe project, HORIZON-JU-SNS-2022-STREAM-A-01-06, NANCY: An Artificial Intelligent Aided Unified Network for Secure Beyond 5G Long Term Evolution, while he coordinates the Operational Program MARS: sMart fArming with dRoneS (Competitiveness, Entrepreneurship, and Innovation) and the Erasmus+ KA2 ARRANGE-ICT: SmartROOT: Smart faRming innOvatiOn Training. He serves as a technical manger of the DS-04-2020, ELECTRON: rEsilient and seLf-healed EleCTRical pOwer Nanogrid, while he serves as*

a principal investigator in the DS04-2018, SDN-microSENSE: SDN-microgrid reSilient Electrical eNergy SystEm and in three Erasmus+ KA2: a) ARRANGE-ICT: pArtneRship foR AddressiNG mEgatrends in ICT, b) JAUNTY: Joint undergAduate coUrses for smart eNergy managemenT sYstems, and c) STRONG: advanced firST RespONders trainiG (Cooperation for Innovation and the Exchange of Good Practices). His research interests include telecommunication networks, internet of things and network security. He is an IEEE member and participates in the Editorial Boards of various journals.

KEYNOTE SPEAKER

Greece Time	09:50-10:35, September 28, 2023	Onsite Room	Meeting Room
Zoom ID	822 8073 6008	Zoom Link	https://us02web.zoom.us/j/82280736008

Sotirios K. Goudos

Aristotle University of Thessaloniki, Greece

Speech Title: **Emerging Nature-Inspired Algorithms for Wireless Communications: State-of-the-art and Challenges**

Abstract: The lecture will make an introduction to evolutionary algorithms (EAs) basics. The EAs have also been applied to a variety of microwave components, antenna design, radar design, and wireless communications problems. The main algorithms that will be discussed are Biogeography Based Optimization (BBO), Grey Wolf Optimizer (GWO), and Whale Optimization Algorithm (WOA). The use of emerging nature-inspired algorithms in wireless communications will be discussed. In this context, the concept of meta-optimizers will be presented. Moreover, use cases from antenna design and wireless communications will be discussed.

Bio.: Sotirios K. Goudos *is an Associate Professor at the Department of Physics of Aristotle University of Thessaloniki, Greece. He joined the department in 2013 and is currently the director of the ELEDIA@AUTH lab, a member of the ELEDIA Research Center Network. He is also the founding Editor-in-Chief of the Telecom open-access journal published by MDPI. In addition, he serves as an Associate Editor for various journals including IEEE Transactions on Antennas and Propagation, IEEE Access, IEEE Open Journal of the Communication Society, International Journal of Antennas and Propagation (IJAP), Technologies, and Electronics. Prof. Goudos is the author of the book "Emerging Evolutionary Algorithms for Antennas and Wireless Communications", published by the Institution of Engineering & Technology in 2021. He currently holds the position of IEEE Greece Section Vice Chair.*

INVITE SPEAKER

Greece Time	11:10-11:40, September 28, 2023	Onsite Room	Meeting Room
Zoom ID	822 8073 6008	Zoom Link	https://us02web.zoom.us/j/82280736008

George Kokkonis

International Hellenic University, Greece

Speech Title: Haptics Towards 5G Tactile Internet

Abstract: Tactile Internet promises to revolutionize how we interact with and control physical, digital objects and systems in real time, transcending the limitations of distance and delay. Tactile Internet is about transmitting not only data and visuals but also tactile sensations and physical haptic feedback in real time.

Haptic technology promises to unlock new frontiers in human connectivity and control. Haptic marks the beginning of a journey into a tactile Internet where the digital and physical realms converge seamlessly.

Haptics and tactile internet help us minimize the gap between the digital and physical worlds, enabling immersive, ultra-responsive, and highly reliable interactions with remote environments and devices. Haptics stimulates the immersive feeling of “being there” in a tactile internet.

Bio.: George Kokkonis *is assistant Professor at the Dept. of Information and Electronic Engineering of the International University of Greece. He received his PhD from Department of Applied Informatics, University of Macedonia, Greece. He received a five-year Eng. Diploma from the Dept. of Electrical and Computer Engineering, Aristotle University of Thessaloniki and his MSc in Information Systems from the University of Macedonia. He has worked as assistant Professor for three years at the Dept. of Business Administration, University of Western Macedonia, Greece. He also worked as adjunct professor for 12 years at the Dept. of Computer Applications in Management and Economics, Technological Educational Institution (TEI) of West Macedonia, Grevena, Greece. He has been teaching Lessons of Multimedia Systems, Pc Programming and Data Bases and Human Computer Interaction. For 10 years was responsible of the NOC of the branch of the University of Western Macedonia in the city of Grevena, Greece. His research interests include haptic interfaces, multisensory protocols, teleoperations and human–computer interaction.*

Oral Session 1

S1 / Modern Computer Science and Intelligent Information Systems

Greece Time	13:30-15:45, Sept. 28, 2023	Onsite Room	Conference Room
Zoom ID	822 8073 6008	Zoom Link	https://us02web.zoom.us/j/82280736008

Chair: Prof. Takashi Shiba, *Tohoku University, Japan*

Time	ID	Presenter	Affiliation
13:30-13:45	W420	Tzimos Nikolaos	University of Western Macedonia, Greece
13:45-14:00	W816	Takayuki Nakachi	University of the Ryukyus, Japan
14:00-14:15	W5303	Misheel Enkhbaatar	Niigata University, Japan
14:15-14:30	W729	Antonios Giatzis	University of Macedonia, Greece
14:30-14:45	W802	Mahmoud Hammad	Jordan University of Science and Technology, Jodan
14:45-15:00	W803	Panagiotis Sarigiannidis	University of Western Macedonia, Greece
15:00-15:15	W8141	Theofanis Xifilidis	University of Macedonia, Greece
15:15-15:30	W5302	Linfeng Chen	Huzhou Jiuding Electronics Complany Limited, China
15:30-15:45	W8152	Tetsuta Takahashi	Nagoya Institute of Technology, Japan

Details

ID	Title, Author & Abstract
W420	**Haptics-Tactile Internet in Human Computer Interaction** Tzimos Nikolaos, Voutsakelis Georgios, Kokkonis Georgios Human-Computer Interaction (HCI) is a multidisciplinary field that focuses on the design, evaluation, and implementation of interactive computer systems for human use. It encompasses the study of how people interact with computers, the design of user interfaces, and the development of technologies that facilitate effective communication between humans and machines. HCI is a dynamic field that evolves alongside advancements in technology and user expectations. It draws from various disciplines, including computer science, psychology, design, sociology, and anthropology, to create human-centered computing experiences. HCI also addresses the importance of designing inclusive interfaces that can be used by individuals with disabilities. Haptic Human-Computer Interaction (HHCI) refers to the use of touch and force feedback technologies to enable interaction between humans and computers. It focuses on providing users with tactile and kinesthetic sensations that enhance the overall user experience and facilitate communication between users and digital systems. When we lose sight, either because of a visual impairment, or simply by traveling in an environment where the visual sense is impaired, we become aware of the sense of touch. Today, at a technological level, several devices and applications, based on the sense of touch, have been developed, that enable people with visual disabilities to interact with them in order to improve their daily activity. This paper attempts a report on the most usable haptic devices and applications in recent years, as well as how they have affected various areas of users' daily lives.
W816	**A Design Method for Golomb Coding in Layered Scrambled JPEG XS Scheme** Takayuki Nakachi, Hiroyuki Kimiyama, Mitsuru Maruyama

	In this paper, we propose two-layer lossless coding compatible with JPEG XS that can process in the scrambled domain. For encoding scrambled residuals of the enhancement layer, we introduce a design method for Golomb coding. Efficient Golomb coding can be achieved by setting a coding parameter on the basis of a base-layer JPEG XS parameter. Lightweight and efficient encoding can be realized without additional processing for coding parameter optimization. We demonstrated its performance via simulation for 8K ultra-high-definition images.
W5303	**An Anomaly Detection Method for Data Center Devices** Misheel Enkhbaatar, Tatsuya Yamazaki Data center demand is growing significantly due to the widespread use of remote working by businesses and cloudbased services. As a demand grows, the number of infrastructure devices, such as servers and storage, increase. An interruption or the failure of a device is costly for the data centers. To prevent thousands of electric devices from unpredictable failures, the data center must implement a speedy and accurate monitoring method. A visual monitoring method is considered reliable for detecting failures in the electric devices, but the method is very slow to monitor numerous devices due to fully manual work and a pattern of failures is not explicitly defined. Therefore, automation of the visual monitoring method is required for the data centers. This paper discusses an anomaly detection method from the video recording of the devices and development of a monitoring system. In an experimental environment of Niigata University, the proposed method performed 100% (anomaly: 4/4, regular: 225/225) accuracy for detecting anomalies from the video frames.
W729	**A Comparative Analysis of Ethereum Solidity and Sui Move Smart Contract Languages: Advantages and Trade-Offs** Antonios Giatzis, Christos K. Georgiadis, Georgios Digkas This article offers an extensive comparison between Ethereum Solidity and Sui Move, two prominent smart contract languages. As blockchain technology gains momentum, choosing the right smart contract language becomes paramount for building resilient decentralized applications. The study delves into the unique features, strengths, and limitations of both languages, assisting developers in making well-informed decisions. Ethereum Solidity, widely adopted due to its versatility, has been integrated into numerous blockchain projects. Conversely, Move, introduced by the Libra blockchain, prioritizes security and safety through a distinct approach, advantages that the Sui network has incorporated into the Sui Move language. The analysis covers various key elements of each language while at the same time, examines their support for overall security mechanisms, formal verification, and ease of use. By providing an evaluation of Ethereum Solidity and Sui Move, the article aims to empower developers with valuable insights during the process of creating robust and secure decentralized applications.
W802	**Empirical Study of Filtered-based Feature Selection Methods for Arabic Text Classification** Fatima Shannag, Maria Habib, Hossam Faris, Mahmoud Hammad Text classification has many applications in various fields; such as news categorization, sentiment analysis, E-mail spam filtering, and others. However, handling textual data is a challenging task owing to the potentially massive number of features (words). The presence of redundant irrelevant features deteriorates the performance of a learning algorithm and makes the process of text classification more complex. This research conducts a comparison study of several filtering-based feature selection methods in the context of Arabic text classification. Arabic is a highly complex language syntactically and morphologically which leads to more complicated learning tasks. Proposing a robust classification

	model is demanding. Remarkably, integrating filtering approaches results in significant improvements in the performance of classification algorithms.
W803	**Intrusion Detection System Modeling Using Machine Learning: A Comparative Study** Xenofon Akritas, Vasileios P. Rekkas, Sotirios P. Sotiroudis, Panagiotis Sarigiannids, Konstantinos E. Psannis, Sotirios K. Goudos In recent years, the adoption of internet-connected devices has experienced a remarkable surge, fundamentally transforming our everyday routines. Nevertheless, this rapid expansion has also captured the interest of cybercriminals, resulting in a notable rise in both the quantity and complexity of attacks aimed specifically at these devices. In this work, a network intrusion detection system (NIDS) is developed, related to information systems security/cyber security. In this context, various machine learning (ML) methods are utilized, namely knearest neighbors (knn), adaptive boosting (Adaboost), gradient tree boosting (GTB), logistic regression (LR), Decision Tree (DT), Naive Baye as well as Bagging and Voting Classifiers. The performance of the ML models is evaluated based on various metrics, exhibiting great accuracy results in classifying the abnormal behaviors in a cyber network.
W8141	**Fading Channels Performance via Fourier Series Approximation** Theofanis Xifilidis, Kostas E. Psannis In this paper, fading channel distributions are approximated via a Fourier series (FS) and the FS order for curve approximation and energy contained is calculated for which the approximation scales beyond fourth decimal digit. The capacity based on exact fading distributions and FS approximations along with entropy derivations are derived. Finally, the Compressed Sensing (CS) based reconstruction error of transmitted signal is estimated. Applications to 5G systems are also provided. Conclusion summarizes paper analysis and suggests future research directions.
W5302 (Online)	**Structural Analysis and Study of Temperature and Mechanical Reliability of Twinax Pairs with Dual Longitudinal Balanced Shielding** Linfeng Chen, Feng Pan, Vinit Singh This manuscript analyses the structures of twinax pairs with dual longitudinal balanced shielding, and studies the temperature and mechanical reliability of this type of twinax pairs. After introducing the basic structure of the twinax pair with dual longitudinal balanced shielding, single-drain twinax pairs and dual-drain twinax pairs are fabricated, and their signal integrity properties are characterized and discussed. Compared to single-drain twinax pairs, dual-drain twinax pairs are more widely used. Change of signal integrity properties of the dual-drain twinax pairs due to temperature conditioning and mechanical bending are then investigated. Experimental results indicate that the dual-drain twinax pairs with dual longitudinal balanced shielding fabricated in this work exhibit good temperature and mechanical reliability, and can be used for engineering and industrial purposes.
W8152 (Online)	**Effect of Neural Network at Server on Robot Position Control Using Force Information** Tetsuta Takahashi, Shota Ohtani, Yutaka Ishibashi, Pingguo Huang, Konstantinos E. Psannis This paper investigates the effect of employing a neural network at a server for Quality of Service (QoS) control on cooperative work between two remote robot systems with force feedback through experiment. In the work, two robot arms cooperate to grasp and carry an object together. As QoS control, we address the robot position control using force information, which we previously proposed. This involves

	transmitting force information from the robot systems to the server to compute the optimal position adjustment value for the robots using a neural network located at the server based on the force information. The value is then applied to the robot systems. Additionally, the influence of the network delay between the robot systems and the server on the work is investigated. Experimental results demonstrate that using the server is superior to no control (i.e., without QoS control) for network delays of up to approximately 50 milliseconds.

Oral Session 2

S2 / Next Generation Communication Technology and Future Development

Greece Time	16:15-18:30, Sept. 28, 2023	Onsite Room	Conference Room
Zoom ID	822 8073 6008	Zoom Link	https://us02web.zoom.us/j/82280736008

Chair: Prof. Chung Ming Huang, *National Cheng Kung University, Taiwan*

Time	ID	Presenter	Affiliation
16:15-16:30	W002-A	Chung Ming Huang	National Cheng Kung University, Taiwan
16:30-16:45	W5301	Takashi Shiba	Tohoku University, Japan
16:45-17:00	W429	Konstantinos D. Stergiou	University of Macedonia, Greece
17:00-17:15	W706	Panagiotis Sarigiannidis	University of Western Macedonia, Greece
17:15-17:30	W5304	Georgios Minopoulos	University of Macedonia, Greece
17:30-17:45	W8151	Petros Amanatidis	International Hellenic University, Greece
17:45-18:00	W907	Libin Zhang	Guangdong Power Grid Co.,Ltd, China
18:00-18:15	W628	Aliki Christou	University of Macedonia, Greece
18:15-18:30	W702	Anna A. Lioupa	University of Macedonia, Greece

Details

ID	Titles, Authors & Abstracts
W002-A	**The Multi Access Edge Computing (MEC) Life Time aware and Prediction Centric V2V Path Construction Method for VANET Data Offloading** Chung Ming Huang, Jun Jie Lin Data offloading tries to migrate data transmission from cellular network to other networks to reduce cellular network's traffic load. Let two vehicles Va and Vb use 5G cellular network's BSs for their communication, i.e., their communication belongs to the Vehicle-to-Infrastructure (V2I) communication mode normally. When it has a k-hop Vehicle-to-Vehicle (V2V) path P between Va and Vb, it can offload their data transmission traffic to P. The aforementioned scenario is called V2V data offloading. In this work, the Multi-access Edge Computing (MEC) architecture was adopted to control the V2V data offloading, i.e., it belongs to the centralized computing approach. Let each macro BS X of the 5G cellular network be associated with an MEC server Y. Those vehicles that are currently connected with (i) X and (ii) the small cells' BSs that are inside the signal coverage of X send their contexts to MEC server Y periodically. Let each vehicle V periodically (i) broadcast a hello message, which includes its speed/location/direction, ID, etc., to V's neighboring vehicles and (ii) send its context, including speed/location/direction, ID, V's neighboring vehicles' IDs for which V can receive their hello messages, to the MEC server. When the MEC server receives the context reports from two vehicles V_a and V_b that are communicating with each other, the MEC server can derive the corresponding VANET topologies that contain those vehicles administered by the MEC server to calculate and predict the potentially existed k-hop V2V paths between two consecutive calculation context reporting time points for the possibility of V2V data offloading of Va and Vb. This work proposed Life-Time-based Switching and Predicted k-hop V2V Offloading Path (LTSP-V2VOP) method using the MEC architecture to resolve the aforementioned functional scenario of the V2V offloading. Main technical issues of the proposed LTSP-V2VOP method are as follows: (1) How to build a k-hop V2V offloading path that takes the prediction mechanism into consideration? (2) How to keep the V2V offloading

	session as long as possible? (3) How to recover the k-hop V2V offloading path's connection when a link is broken unexpectedly?
W5301	**Power Delay Profile Measurement Applied MUSIC for Local 5G System** Takashi Shiba, Tomoyuki Furuichi, Noriharu Suematsu Power delay profile for Local 5G system at sub-6 band is measured. Modulation method of transmitted signal is not changeable in this case generally. We are not able to use more flexible modulated transmission signals which are suitable for measuring a power delay profile of Local 5G systems. We have already proposed the more flexible measurement method using two antennas for reference signal near transmission point and received signal at observation point. The IFFT function is used in conventional method. The subjects of low time-resolution and high level sidelobe caused by zero-padding are remained in conventional case. We apply MUSIC algorithm with time-oversampling and with increasing data and snapshots for higher time-resolution and low sidelobe characteristics. Measurement results of power delay profile for Local 5G at sub-6 band by using proposed method are shown in this report.
W429 (Online)	**Improving Communication Systems through Federated Learning: An Optimization of Decision-Making** Konstantinos D. Stergiou, Yutaka Ishibashi, Sotirios K. Goudos, Thomas Lagkas, Panagiotis Sarigiannidis, Konstantinos E. Psannis This paper discusses the use of federated learning as a method for optimizing decision-making in communication systems. Federated learning is a machine learning technique that enables the training of models on decentralized data, allowing for the collection and analysis of data from multiple sources while maintaining the privacy and security of the data. This approach is particularly useful in communication systems, as it allows for the optimization of decision-making across a wide range of devices and networks. The paper examines the advantages of federated learning, including the ability to collect a large amount of data from a diverse range of devices, the protection of sensitive data, and the ability to adapt to changing conditions in real-time. The paper also provides specific examples of how federated learning can be used in the optimization of mobile networks and content delivery. The conclusion highlights the growing importance of federated learning in improving communication systems.
W706	**Image Filtering Techniques for Beam Prediction in a Real-world 6G UAV Scenario** Vasileios P. Rekkas, Sotirios P. Sotiroudis, Panagiotis Sarigiannids, Konstantinos E. Psannis, George K. Karagiannidis, Sotirios K. Goudos Millimeter-wave (mm-wave) and terahertz (THz) communication systems can satisfy the high data rate requirements in 5G, 6G, and beyond networks, but still rely on the use of extensive antenna arrays to guarantee sufficient received signal strength. Many antennas incur high beam training overhead; thus, the narrow beams require adjustment to support highly mobile applications. Deep learning (DL) vision-aided solutions can potentially forecast the optimal beams, leveraging raw RGB images captured at the base station. Image filtering techniques have been widely used in computer vision (CV) to modify and enhance the quality of an image, based on specific rules. This work applies different filters to RGB images for accurate mmwave/ THz beam prediction and feature extraction based on pretrained convolutional neural networks (CNNs). The assessment of the developed framework is conducted on an actual dataset captured by an unmanned aerial vehicle (UAV) operating in the millimeter-wave (mm-wave) frequency range. The

	dataset comprises RGB images taken at the base station. Ensemble filtering techniques are also studied, enhancing the beam prediction accuracy of two state-of-the-art (SOTA) DL models.
W5304 (Online)	**Tactile Internet Security System Architecture for Mobile Networks** Georgios Minopoulos, Georgios Kokkonis, Panagiotis Sarigiannidis, Sotirios Goudos, Yutaka Ishibashi, Konstantinos Psannis The deficiencies of the Fifth Generation (5G) mobile networks are stimulating vendors to focus on the specifications of the next generation of wireless systems. The efficient integration of the Tactile Internet with mobile networks, like the emerging Sixth Generation (6G) wireless systems, is anticipated to achieve global ubiquitous accessibility, extremely low latency, high reliability, and elevated security for haptic communication. Based on the characteristics of the new generation of mobile networks, a novel system architecture is proposed along with a security framework for the utilization of Tactile Internet applications.
W8151	**Comparative Evaluation between Accelerated RISC-V and ARM AI Inference Machines** Vasileios Christofas, Petros Amanatidis, Dimitris Karampatzakis, Thomas Lagkas, Sotirios K. Goudos, Konstantinos E. Psannis, Panagiotis Sarigiannidis Embedded AI development has been rapidly improving for the past few years and has had a great impact on edge AI networks. However, as neural networks become deeper and deeper it becomes more difficult to execute complicated tasks without sacrificing a good amount of power and performance. In this paper, we make a comparative evaluation between two AI acceleration devices. The first one features a RISC-V 64-bit processor while the other one is ARM powered. These devices are combined with AI co-processors, or ASICs, with computer vision capabilities. Our benchmark consists of a simple classification task split into multiple versions. The results showed that the RISC-V inference machine had 4 times lower consumption while the ARM machine was up to 15 times faster in our largest network. We discuss the results in great detail while keeping our focus on all aspects equally. Finally, we make recommendations based on their usage and application.
W907 (Online)	**Routing Optimization Mechanism for SRv6 based Power Data Network** Peiming Zhang, Xingnan Li, Yuanjie Liu Under normal circumstances, traffic with different characters caused by different services exists on the Internet at the same time, so the experiences of different services have different sensitivity to network objective indicators. For example, some services are sensitive to latency, while others pay more attention to the bandwidth. The different demands caused different optimal objects. Take the network state as a whole, the route planning of one service is related to others. However, existing algorithms usually optimize only for specific services and do not consider the coexistence of multiple services to provide optimization solutions tailored to each service's characteristics. We focus on how to generate the corresponding reasonable route planning based on the characteristics of different services and meet the respective optimization expectations in the same network. We propose a routing planning algorithm based on multi-agent deep reinforcement learning, which optimizes the experiences of multi-type services parallelly. When the optimization target is set, the algorithm generates the forwarding path according to the network state and the service expectations of each service. The experimental results reveal that routing planning strategies provided by our algorithm can not only meet the expectations of various services but also effectively enhance the overall service experience quality of those services in the same network.

W628	**Revolutionizing Connectivity: The Power of AI, IoT, and Edge Computing for Smart and Autonomous Systems** Aliki Christou, Christos Stergiou, Vasileios Memos, Yutaka Ishibashi, Konstantinos Psannis The growing need for data analysis in the industry and smart city sectors highlight the transformative potential of integrating AI, IoT, and edge computing. Through the utilization of AI algorithms and real-time data derived from IoT devices, these systems enable advanced analytical capabilities at the network edge, thus optimizing efficiency and decision-making processes. Furthermore, the adoption of edge computing mitigates latency and transmission concerns and ensures data security, while the infusion of AI-driven autonomy expands the horizons of applications across sectors such as transportation and manufacturing. However, there are challenges regarding network architecture, data management, and security that need to be addressed in the integrated implementation of AIoT architecture.
W702	**The Integration of 6G and Blockchain into an Efficient AIoT-based Smart Education Model** Anna A. Lioupa, Vasileios A. Memos, Christos L. Stergiou, Yutaka Ishibashi, Konstantinos E. Psannis The technological advances impact the future classrooms and the whole education system. The evolution of 6G promises faster speeds based on terahertz, wireless communication, the leverage of artificial intelligence (AL), virtually reality (VR) and generally a fully connected world. The use of applications of IoT and AIoT improves the education environment, but the intelligent network services undoubtedly gather, store and analyze big data which are vulnerable to attackers. As a solution we may consider the technology of blockchain. The trust and security of next generation intelligent networks are essential part of their design. In this article we suggest a data security system based on blockchain for AL applications in 6G networks. First, we present two AI-enabled applications, indoor positioning and mobile payment within the framework of 6G in the university area. We present the efficiency of blockchain in data security for AI-enabled systems using two case studies of indoor positioning system and mobile payment. The 6G system which is fully supported by AI and the integration of this in technology of blockchain, is ensured the security in future wireless communication.

Oral Session 3

S3 / Electronic and Communication Engineering

Greece Time	10:00-11:30, Sept. 29, 2023		
Zoom ID	822 8073 6008	Zoom Link	https://us02web.zoom.us/j/82280736008

Chair:

Time	ID	Presenter	Affiliation
10:00-10:15	W9010	Hao Wang	Nanjing University, China
10:15-10:30	W982	Myint-Wai PHYU	STMicroelectronics, Singapore
10:30-10:45	W9057	Mengying Li	Nanjing University, China
10:45-11:00	W9281	Guangchao Zhao	Nanyang Technological University, Singapore
11:00-11:15	W9645	Zhiwei Zeng	Chinese Academy of Sciences, China
11:15-11:30	W953	Maria Perepechaenko	Quantropi Inc., Ottawa, Canada

Details

ID	Title, Author & Abstract
W9010 (online)	**A Policy Based Deep Reinforcement Learning for Task Offloading and Resource Allocation in Satellite Terrestrial Integrated Internet of Things** Hao Wang , Zhibo Yan, Qian Tan, Kaiyang Li, Kanglian Zhao , Wenfeng Li, Yuan Fang Onboard computational resources can be deployed on low earth orbit (LEO) satellites to provide multi-access edge computing (MEC) in a satellite terrestrial integrated Internet of Things (STIOT). User equipments (UEs) lacking computational resources on the ground can choose to offload tasks to a terrestrial gateway that can communicate directly with LEO, and the gateway will consider whether to further offload to LEO and allocate computational and communication resources for tasks. But different task offloading and resource allocation strategies will greatly affect the performance of STIOT and the quality of service for UEs. Therefore,choosing an appropriate policy to minimize the total system delay and energy consumption is a critical issue in STIOT. This problem is a mixed integer nonlinear programming problem and we can't find the optimal analytical solution. So we formulated the system as a constrained markov decision process (CMDP) and adopt the deep reinforcement learning algorithm suitable for STIOT as the offloading strategy, and the Lagrange multiplier algorithm as the resource allocation scheme. Simulation results show that the proposed algorithm can increase the performance of the system by up to 25% compared with benchmark algorithm.
W982 (online)	**Dual-edge Triggered Reset Synchronizer for I2C Protocol** Myint-Wai PHYU, Joscel Ann Agabao IGNACIO, Richard OEY In this paper, dual-edge triggered reset synchronizer for Inter Integrated Circuit (I2C) protocol is proposed. The proposed reset synchronizer design aims for the asynchronous reset to have asynchronous assertion and synchronous deassertion for I2C slave protocol, in which system reset and software reset is synchronized to a targeted clock. This is to avoid the metastability issue when the reset is released with respect to the target clock. Taking the role of I2C START condition, which signifies the beginning of a transmission, the proposed methodology uses START condition as a clock to synchronize the external reset or software reset before transmission begins. Both edges of the START signal will be

	used for synchronization. Since START timing must be respected according to I2C protocol, it is safe to be used as a clock without impacting any setup/hold (reset/recovery) timing issue.
W9057 (online)	**Topology Planning of Space Deterministic Networks** Mengying Li, Qian Tan, Ze Li, Kanglian Zhao, Wenfeng Li and Yuan Fang Deterministic networks are network technologies proposed by industry in recent years to solve the problems of delay and packet loss in traditional networks. In this paper, we introduce the concept of deterministic networks in space networks, and address the problem of large variation of propagation delay in intercontinental communication scenarios in space networks. First, we establish a network model to observe the variation of delay in low-earth-orbit constellations, and then we realize the optimization of delay jitter between city pairs through network topology planning to build a deterministic network in space. Simulation results show that the end-to-end delay jitter variance value of the network topology planning scheme proposed in this paper is reduced by about 50% in the continuous time period compared with the traditional grid scheme.
W9281 (online)	**Implementation of High-speed Multi-trit Adders for Balanced and Unbalanced Ternary Logic** Guangchao Zhao, Zhiwei Zeng, Xingli Wang, Philippe Coquet, Mingqiang Huang and Beng Kang Tay Ternary logic with larger data density has great potential in high-performance data processing. Even though ternary half/full adders are intensively investigated in recent years, the high-speed multi-trit ternary adders, which are urgently needed for high-efficient ternary computing, remain unexplored. In this study, we present ternary carry lookahead adders (CLAs) to eliminate the tedious delay caused by the cascade-connected carry signals. Different implementation methods are used for unbalanced and balanced ternary logic. A delay analysis model of ternary CLAs is established. Compared with reported ternary carry ripple adders (CRAs), our 5-trit unbalanced and balanced ternary CLAs can achieve a 61.45% and 75.18% reduction in delay, respectively.
W9645 (online)	**Low Power-Delay-Product Ternary Adder with Optimized Ternary Cycling Gates** Zhiwei Zeng, Guangchao Zhao, Xingli Wang, Beng Kang Tay and Mingqiang Huang Ternary logic system has attracted more and more attention because of its higher information density as compared with the binary system. In the prevalent multi-threshold-based ternary logic synthesis method, carbon nanotube field effect transistors (CNTFETs) are intensively utilized to realize various ternary logic circuits due to the convenient control of threshold voltages. However, a general ternary logic gate requires three kinds of threshold voltage, whose specific values needs to be determined to optimize the delay and power performance. In this paper, an unbalanced ternary full adder based on ternary cycling gates is presented. Beneficial from the ternary arithmetical algorithm, the circuit complexity of the ternary adder has been largely simplified with only 93 transistors involved, which is much less than previous works. Besides, the optimal threshold voltage combination method has been investigated to optimize the circuit power-delay-product (PDP), and the lowest PDP of 12.55 aJ is achieved.
W953 (online)	**FIPS Compliant Quantum Secure Communication using Quantum Permutation Pad** Alex He, Dafu Lou, Eric She, Shangjie Guo, Hareesh Watson, Sibyl Weng, Maria Perepechaenko and Randy Kuang

	Quantum computing has entered fast development track since Shor's algorithm was proposed in 1994. Multi-cloud services of quantum computing farms are currently available. One of which, IBM quantum computing, presented a road map showing their Kookaburra system with over 4158 qubits will be available in 2025. For the standardization of Post-Quantum Cryptography or PQC, the National Institute of Standards and Technology or NIST recently announced the first candidates for standardization with one algorithm for key encapsulation mechanism (KEM), Kyber, and three algorithms for digital signatures. NIST has also issued a new call for quantum-safe digital signature algorithms due June 1, 2023. This timeline shows that FIPS-certified quantum-safe TLS protocol would take a predictably long time. However, 'steal now, crack later' tactic requires protecting data against future quantum threat actors today. NIST recommended the use of a hybrid mode of TLS 1.3 with its extensions to support PQC. The hybrid mode works for certain cases but FIPS certification for the hybridized cryptomodule might still be required. This paper proposes to take a nested mode to enable TLS 1.3 protocol with quantum-safe data, which can be made available today and is FIPS compliant. We discussed the performance impacts of the handshaking phase of the nested TLS 1.3 with PQC and the symmetric encryption phase. The major impact on performance using the nested mode is in the data symmetric encryption with AES. To overcome this performance reduction, we suggest using quantum encryption with a quantum permutation pad for the data encryption with a minor performance reduction of less than 10%.

Must-see Attractions in Thessaloniki

Archaeological Museum


Macedonia's prehistory, Hellenistic and Roman periods are charted in this wonderful museum, home to many of the region's major archaeological discoveries. Highlights include goldwork from various hoards and graves, and the Derveni Krater (330–320 BC), a huge, ornate Hellenistic bronze-and-tin vase marked by intricate relief carvings of Dionysos, along with mythical figures, animals and ivy vines. The Derveni Papyrus, Greece's oldest surviving papyrus piece (320–250 BC), is recognized by UNESCO as Europe's oldest 'book'.

Church of Agios Dimitrios


This enormous 7th-century basilica honors Thessaloniki's patron saint. A Roman soldier, Dimitrios was killed around AD 306 at this former Roman bath site by order of Emperor Galerius, infamous persecutor of Christians. The martyrdom site is now a crypt; Dimitrios' remains occupy a silver reliquary inside. The Ottomans made Agios Dimitrios a mosque, and plastered over frescoes that were again revealed after the 1913 Greek reconquest. While the city's fire of 1917 was very damaging, five 8th-century mosaics survive.

Museum of Byzantine Culture


This fascinating museum has plenty of treasures to please Byzantine buffs, plus simple explanations to introduce this long-lived empire and its culture to total beginners. More than 3000 Byzantine objects, including mosaics, intriguing tomb paintings, icons, jewellery and glassware, are showcased with characterful asides about daily life. You'll be confidently discerning early-Christian from late-Byzantine icons in no time. Temporary exhibitions might focus on anything from satirical maps to the work of Cretan writer and mystic Nikos Kazantzakis.

Church of Osios David


This serene little 5th-century church, once the katholikon (major church) of the Monastery of Saviour Christ of Latomos, is one of the most significant early-Christian sites in Thessaloniki. It contains rare 12th-century frescoes and an even-more extraordinary 5th-century mosaic of Christ and the prophets Ezekiel and Habakkuk. Utterly glorious, it was covered up by the Turks during the church's time as a mosque, and only rediscovered in 1920.

White Tower


Thessaloniki's iconic landmark, the 34m-high White Tower has a harrowing history as a prison and place of execution. Built by the Ottomans in the 15th century, it was here in 1826 that Sultan Mahmud II massacred the garrison of rebellious janissaries (forcibly Islamicised elite troops). One story goes that the structure was known as the Tower of Blood until a prisoner painted the tower white in exchange for his liberty in 1883, when it was renamed Lefkos Pyrgos (White Tower).

New Waterfront


Thessaloniki's New Waterfront is evidence that architecture can improve urban life through intelligent redesign of the space in which it is lived. Recipient of numerous awards for its architects Prodromos Nikiforidis and Bernard Cuomo, this 3.5km walkway extends from the White Tower to the Thessaloniki Concert Hall. Completed in 2013, it has been embraced by Thessalonikans with absolute delight as the perfect place to promenade, rollerblade, bike, play, eat ice cream or just enjoy peripatetic conversation.

Arch of Galerius


South of the Rotunda on Egnatia, the Arch of Galerius (AD 303) celebrates the eponymous emperor's victory over the Persians in martial scenes carved into the marble panels that face its masonry core. Known locally as Kamara, this landmark is also the city's main meeting spot. The Arch originally had four main and four supporting pillars, with eight gates and arches, and a dome – only two of the central arches and one supporting arch can be seen today.

Monastery of Vlatadon


Believed to have been founded around 1351 on the place where Paul preached in Thessaloniki, this secluded monastery blends fascinating history with some of the best views of the city. Listed by UNESCO, it is thought to have been significant for Hesychasm, a controversial movement whose foremost 14th-century proponent, St Gregory Palamas, is depicted in a fresco here. You can explore the grounds, the ancient church, a museum of icons, and an aviary filled with peacocks.

MEMO