

ANNUAL REPORT 2019

WELCOME

IIT 2019



Dr Vangelis Karkaletsis
 Director of the Institute of Informatics
 and Telecommunications, NCSR Demokritos

What a year!

Our Institute is growing fast building on its expertise, skills and infrastructure.

IIT is becoming a hub for Artificial Intelligence (AI), with its many EU and national R&D projects, the recently established international Center of Excellence on Document Intelligence, the House of Classical Greek Ideas, the Time Machine initiative, the AI & Telecommunications project ARIADNE, the joint projects with other NCSR labs exploiting AI in nanotechnology, material science, biosciences, nuclear fusion. Also through our two Joint MSc programmes on Data Science and AI; through the ahead Digital Innovation Hub on AI, Big Data and IoT, the provision of AI services, the submission of patents.

IIT is also a focal point on 5G with its fully functional end-to-end 5G network, its many large EU research projects on 5G, involving among others, UAV test cases (5G Drones), security issues in 5G beyond networks, (INSPIRE 5G Plus), provision of 5G pilot services at the Aegaleo municipality (5G Essence).

The Institute also maintains and extends its strong position in security through various projects including research on security and privacy, tools for assisting Law Enforcement Agencies (FLYSEC, Trespass), as well as with the appointment of Dr D. Kyriazanos, as the national representative in H2020 Secure Societies programme.

IIT is also researching and innovating in the area of wireless wearable systems, implementing the first fully textile embroidered antenna prototypes, as well as in the management and optimization of computer networks (ATLAS).

Research and education programmes on the use of ICT in special education are also growing with new MSc programmes and trainings hosted at NCSR Demokritos.

We enter 2020 with high expectations! I am certain that IIT will continue to grow at a faster pace, extending its research, education, and innovation initiatives. And also building its new infrastructures. The construction of the new IIT building and the renovation of our old building, through the funding programme of the European Investment Bank, is about to start, bringing in the near future more opportunities for growing and excelling in the international research and innovation field.

“ We are working towards making IIT, an international research and innovation hub on AI, 5G and IoT technologies. ”



Year at a Glance



NEW PROJECTS




EXTREME EARTH
From Copernicus Big Data to Extreme Earth Analytics, H2020
January 1, 2019 - December 31, 2021
NCSR budget: 426,250€ | SKEL
<http://earthanalytics.eu/>




Fair for Fusion - open access for fusion data in Europe, H2020
September 1, 2019 - August 31, 2021
NCSR budget: 280,000€ | SKEL
<http://www.fair4fusion.eu/>

INFORE
Interactive Extreme-Scale Analytics and Forecasting, H2020
January 1, 2019 - December 31, 2021
NCSR budget: 646,875€ | SKEL
<http://www.infore-project.eu/>




is-enes
INFRASTRUCTURE FOR THE EUROPEAN NETWORK FOR EARTH SYSTEM MODELLING
Infrastructure for the European Network for Earth System modelling - Phase 3, H2020
January 1, 2019 - December 31, 2021
NCSR budget: 107,500€ | SKEL
<https://is.enes.org/>



5G! DRONES
Unmanned Aerial Vehicle Vertical Applications' Trials Leveraging Advanced 5G Facilities, H2020
June 1, 2019 - May 31, 2022
NCSR budget: 638,750€ | MNL
<https://5gdrones.eu/>



AI4EU
A European AI On Demand Platform and Ecosystem, H2020
January 1, 2019 - December 31, 2021
NCSR budget: 105,625€ | SKEL
<https://www.ai4eu.eu/>



D4FLY
DETECTING DOCUMENT FRAUD AND IDENTITY ON THE FLY
Detecting Document fraud and iDentity on the fly, H2020
September 1, 2019 - August 31, 2022
NCSR budget: 673,450€ | ISL
<https://d4fly.eu/>




INSPIRE-5Gplus
INtelligent Security and Pervasive tRust for 5G and Beyond, H2020
November 1, 2019 - October 31, 2022
NCSR budget: 356,250€ | MNL
<https://www.inspire-5gplus.eu/>


DICE
Document Intelligence Center of Excellence
August 1, 2019 - July 31, 2024
NCSR budget: 1.000.000€ | SKEL
<https://www.iit.demokritos.gr/projects/dice/>

CLOUDLEDGE TOC
CLOUD Learning on the EDGE of Tourism and Culture
National project
February 1, 2019 - March 31, 2020

EN.I.R.I.S.S.T.
Intelligent Research Infrastructure for Shipping, Supply chain, Transport and Logistics
National project
April 1, 2019 - March 31, 2022
NCSR budget: 98,625€ | SKEL



ARIADNE
Artificial Intelligence Aided D-band Network for 5G long term Evolution, H2020
November 1, 2019 - October 31, 2022
NCSR budget: 723,125€ | WiCom SKEL
<https://www.ict-ariadne.eu/>



ROBOTICS 4 Deaf
Robotics through sign language: Ensuring access and engagement of students with disabilities to the digital world of Coding and Robotics, Erasmus+
October 1, 2019 - November 30, 2021
NCSR budget: 34.706€ | NML
<https://robotics4deaf.eu/>

HOUSE OF CLASSICAL GREEK IDEAS
An innovative exhibition on Greek ideas and ancient Greek philosophy, National project
September 1, 2019 - February 28, 2022
NCSR budget: 1,401,431€ | SKEL
<https://www.iit.demokritos.gr/house-of-classical-greek-ideas/>

PROJECTS APPROVED TO KICK-OFF IN 2020

NANONOSE

Volatile Organic Compound (VOC) Sensor Development for Food Safety
National project, January 2020 / NCSR "D" budget: 199,800€ | SKEL

DEBATELAB

From linked data to linked arguments
National project, January 2020 / NCSR "D" budget: 51,065€ | SKEL

P4-LUCAT

Personalized Medicine for Lung Cancer Treatment: Using Big Data-driven approaches for decision support
National project, April 2020 / NCSR "D" budget: 199,750€ | SKEL

NAVMAT

Knowledge based System for naval materials failures
National project, February 2020 / NCSR "D" budget: 200,000€ | SKEL

DELHILA

Deployable high gain antenna structure for small spacecraft science missions
ESA Science Core Technology Programme, March 2020 / NCSR "D" budget: 150,000 € | WiCom

SAFETY4RAILS

Data-based analysis for safety and security protection for detection, prevention, mitigation and response in trans-modal metro and railway networks
H2020, September 2020 / NCSR "D" budget: 447,950 € | ISL

RESPOND-A

Next-generation equipment tools and mission-critical strategies for First Responders
H2020, May 2020 / NCSR "D" budget: 387,500 € | MNL

PALANDIR

Practical Autonomous Cyberhealth for resilient SMEs & Microenterprises
H2020, May 2020 / NCSR "D" budget: 251.250 € | MNL

FINANCIALS



EU research grants

3.916.395,87 €

National research grants

416.442,40 €

Regular public budget

829.528,16 €

Other funding

340.347,40 €

INTERNATIONAL COLLABORATIONS

Brand new Center of Excellence in Artificial Intelligence created at NCSR Demokritos in cooperation with EY Global



Dr Hans Jessen
EY Global Innovation Leader – Intelligent Automation

“ It is a great pleasure to further contribute to the immense, future possibilities of Artificial Intelligence research in Greece, the birthplace of mathematical and scientific thinking. Our partnership with NCSR Demokritos will help inspire a fresh start for research opportunities in Artificial Intelligence in Greece. ”

In August 2019, NCSR Demokritos and EY announced an important and innovative cooperation in the field of Artificial Intelligence on a global level. EY, the leading professional services organisation, has selected Greece and specifically NCSR Demokritos to create a new Center of Excellence in Document Intelligence (DICE). DICE will bring together AI researchers, scientists and practitioners with business experts from a wide variety of industry sectors, aiming to leverage emerging technologies, to accelerate innovation and establish a reference point for document intelligence in Greece and abroad.



Dr George Nounesis
Director of Research and former President of the NCSR Demokritos Board of Directors

“ EY’s decision to invest in NCSR Demokritos confirms the high quality of the Center’s research results and the outstanding work of its researchers. The fact that, in the near future, NCSR Demokritos will co-manage intellectual property with EY, signifies a new area of global innovation for us. I am particularly moved by this success. This cooperation, which is the result of great effort and hard work, opens the road to other global companies to join the ecosystem of Aghia Paraskevi and contributes to the return of young scientists to our country. ”



Dr Vangelis Karkaletsis
IIT Director spoke about the pioneering collaboration and the AI activities NCSR Demokritos is involved in, emphasizing the value of such an investment for Greece.

“ The AI Center of Excellence at NCSR Demokritos will serve as a reference point for Artificial Intelligence on a global level, conducting primary research in intelligent document analysis, information mining and other related fields. ”

Collaboration launch event between NCSR Demokritos and EY Global at SNFCC

On Thursday 31 October 2019 the collaboration between NCSR Demokritos and EY Global was launched during a celebratory evening held at the Stavros Niarchos Foundation Cultural Center. The collaboration included the launch of the Center of Excellence in Artificial Intelligence (DICE) which will be set up on campus at NCSR Demokritos.

In their opening speeches Hans Jessen, EY’s Global Innovation Leader – Intelligent Automation, Vangelis Karkaletsis, Director at the Institute of Informatics and Telecommunications, NCSR Demokritos and George Paliouras, Director of the newly created Center of Excellence in Artificial Intelligence warmly welcomed guests. Minister of State and Digital Governance Kyriakos Pierrakakis, Deputy Minister for Research and Technology at the Ministry of Development & Investments Christos Dimas and Deputy Minister for Higher Education at the Ministry of Education and Religious Affairs Vassilis Digalakis participated in the panel discussion that followed talking about the role of Artificial Intelligence for the future of Greece.

This innovative collaboration in the domain of Artificial Intelligence is of great importance for the country itself as it will contribute towards Greece’s national AI policy and the efforts to revert the brain drain by attracting more than 40 talented scientists in the first three years.



Dr George Paliouras
Director of the newly created Center of Excellence in Artificial Intelligence warmly welcomed guests.

“ The research team, that is being created, comprises of young talented scientists and experienced researchers. The aim is to build one of the largest and most productive research teams in the field of Artificial Intelligence in Europe. A reference point for AI internationally. ”

INTERNATIONAL PROJECTS

Successful demonstration of 5G services pilot in Aegaleo City with 5G-ESSENCE project



Dr Anastasios Kourtis
Media Networks Laboratory (MNL)

In October, MNL of Dr Anastasios Kourtis conducted a pilot operation of a 5G network in Aegaleo city. The provision of 5G services was successfully demonstrated at the "Stavros Mavrothalassitis" Municipal Stadium of Aegaleo during a friendly football match between the teams of "A.C. THEMISTOKLIS" and "AMATEURS AEGALEO" as part of the European 5G-ESSENCE research project. During the football match, 5G Edge network acceleration technology was demonstrated, which achieves low latency and improved user Quality of Experience. The game was broadcasted via a 360 camera, with broadcasting / eMBMS technology, developed in the context of 5G-ESSENCE, offering to local spectators an enriched event experience.

The exciting point-of-view perspectives, the reduced production costs and the increased key 5G-ESSENCE functionalities are of main interest to mobile operators, stadium/venue owners, broadcasters, sponsors, as well as for the visitors themselves.



NATIONAL PROJECTS | CULTURE & TECHNOLOGY

House of Classical Greek Ideas



Prof Theodore Scaltsas
Professor Emeritus of Philosophy
University of Edinburgh

In September 2019 a new and very ambitious project was initiated, a collaboration of the Institute of Informatics & Telecommunications of NCSR Demokritos with the Ministry of Culture and Sports.

The aim of the project is to create the House of Classical Greek Ideas, a model exhibition on Greek ideas and ancient Greek philosophy -the greatest cultural achievement of ancient Greeks and a worldwide cultural legacy.

The development of the interactive exhibits will employ an innovative method of exhibiting ideas, with the aim to display abstract ideas and values in an attractive and accessible way for non-academic visitors, developed by Theodore Scaltsas, Professor Emeritus of Philosophy, University of Edinburgh.

The exhibition will be housed in the building of the Athens Conservatoire, which is adjacent to the emblematic archaeological site of "Aristotle's Lyceum".

“From the beginning, the innovation of our exhibition has been: Ancient Hellenic ideas and values will be presented to a visitor by leading the visitor in a journey deep into their own souls, to find Hellenic antiquity in themselves. Exhibiting ideas and values will usher in a new type of museological exhibit internationally.”

The project will utilize cutting-edge technologies such as interactive digital walls, augmented reality applications and applications that use Artificial Intelligence as part of the interaction with the visitor. The exhibition will target different types of visitors such as tourists and school students.



Dr Georgios Petasis
SKEL

“As part of the project we plan to create an ontology and a semantic index concerning philosophical ideas, as well as digital agents that will be able to engage in dialogue with the visitors of the exhibition.”



Dr Lida Arnellou
SKEL

“The exhibition will be divided in two areas: the motivation space that will ignite the visitor's curiosity regarding philosophical ideas and the exploration space that will host digital interactive exhibits inviting the visitor to dive deeper in ideas and values.”

The project has a duration of 30 months and is funded by the Operational Programme Competitiveness, Entrepreneurship and Innovation 2014-2020 (EPAnEK) with a total budget of 2.223.321,77 euros.

Project duration: 01/09/2019 - 28/02/2022

EDUCATION



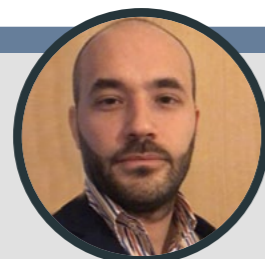
Dr Dimitris Kyriazanos
Education Manager

The Institute's educational strategy is fully aligned with one of the key missions of NCSR Demokritos: the unification of higher education with research and the building and nourishment of capabilities, ideas and knowledge in Greek society through education. In this direction, the Institute implements a wide set of activities spanning across different levels of education, transferring innovation and excel-

lence in ICT and relevant disruptive technologies into educational assets for post doc and PhD students, MSc and BSc students as well as interns whilst covering also secondary education. Our researchers were particularly happy this year to receive great interest and host our brilliant students through internships, BSc and MSc theses in a series of high-impact and innovative topics.

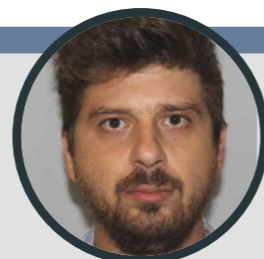
PhDs and Scholarships

IIT devotes significant effort in supervising PhD students. In 2019 the excellent collaboration of the Institute with accredited Greek and foreign Universities in Europe, Canada and the US continued through many Joint PhD programmes and scholarships, including the highly successful Stavros Niarchos Foundation Industrial Research Fellowship programme. The scholarships provide a fruitful framework, creating prospects that boost the researchers' careers.



Alexandros Papangelis
Senior Research Scientist, Uber

“The Joint PhD programme presented a unique opportunity to collaborate and meet people from Europe through NCSR Demokritos and US through the University of Texas, which boosted my career.”



Konstantinos Tsiakas
Post doctoral Researcher, Industrial Design

“The Joint PhD programme gave me the opportunity to collaborate with top researchers from the University of Texas at Arlington, NCSR Demokritos, University of Southern California and Yale University and helped me establish my career goals as a current post doc at Eindhoven University of Technology.”



Michalis Papakostas

Post doctoral Research Fellow, AI Lab, Computer Science & Engineering, University of Michigan

In 2019 two PhD students from foreign Universities have completed their Theses, Michalis Papakostas (University of Texas at Arlington) and Nikos Sarafianos (University of Houston). Three more were selected for the new cycle of Joint PhDs: Fasoulis Romanos (Rice University, Texas), Lygerakis Fotis (University of Texas at Arlington) and Sevastopoulos Christos (University of Texas at Arlington).

“My participation in the Joint PhD programme was packed with knowledge, new skills and professional experiences, crucial to starting my career as a researcher abroad. The programme has helped me to create a professional network in Europe and the US, forced me to expose myself to new, competitive environments and thus played a key role in my personal and professional development. In my opinion it is a great opportunity that has helped many young scientists in the last decade, while enhancing the level of scientific research in Greece.”

Master's Programmes

The Institute participates in four cross-Institutional MSc programmes with Greek universities. The new MSc programme in Artificial Intelligence started successfully in 2019 along with the rest of our well-established and appealing programmes in Data Science and cross-cutting ICT & Special Education and ICT & Health.

MSc in Artificial Intelligence [Collaboration with University of Piraeus](#)

MSc in Data Science [Collaboration with University of the Peloponnese](#)

MSc in ICTs & Special Education – Psychopedagogy of Integration
[Collaboration with Democritus University of Thrace](#)

MSc in Clinical Practice and Applications Technology in Health

[Collaboration with Democritus University of Thrace](#)



Summer Schools

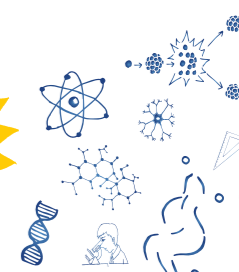


The **1st Athens Natural Language Processing** Summer School took place from 18 to 25 September 2019 in the campus of NCSR Demokritos. The Summer School is organised jointly by IIT's SKEL, Athena Research Center, the Athens University of Economics and Business and Heriot-Watt University. AthNLP cooperates closely with the organisers of LxMLS.



European School of Antennas

WiCom Lab organised the **European School of Antennas 2019 (ESoA2019)** for “Advanced Materials for Antennas and Microwave Devices”. The five day-long Postgraduate School took place from 10 to 14 June 2019 at the School of Mechanical, Electrical and Manufacturing Engineering at the University of Loughborough, UK and was organised in collaboration with the University of Loughborough. The School is a European geographically-distributed postgraduate course, supported by the European Association of Antennas and Propagation (EurAAP), aiming to enhance European training and research in antennas and related applications.



ΓΙΑ ΠΡΟΠΤΥΧΙΑΚΟΥΣ ΦΟΙΤΗΤΕΣ & ΠΤΥΧΙΟΥΧΟΥΣ ΘΕΤΙΚΗΣ & ΤΕΧΝΟΛΟΓΙΚΗΣ ΚΑΤΕΥΘΥΝΣΗΣ

The **54th Summer School** of NCSR Demokritos took place from 1 to 11 July 2019 on campus. The Summer School is a historic activity of the Center which offers free courses to undergraduate students and graduates of the positive sciences (STEM) with technological direction. IIT was actively involved with contribution to round tables, researcher speeches and workshops on specific themes.

School Visits

NCSR Demokritos welcomes every year a plethora of schools and students in its premises in the framework of its science education programme. Dedicated museum educators develop and implement educational programme for students between 8-18 years old. IIT participates with two programmes and a parallel activity. This year about 130 schools and more than 5000 students had the opportunity to learn more about computer science through this interaction.



Robots at play

The robotics educational programme “Robots at Play” for elementary school students is developed from SKEL (Roboskel group) and NCSR Demokritos' museum educators. Students are dealing with questions such as: What are robots? Where do they come from? What can they do?, trying to learn more about the past, present and future of robotics.



Databases

Bases for a better life

IIT developed this programme for high school students to help them understand the multifaceted importance of database systems, as collection and storage of huge amounts of information is crucial to our evolution.



Mind Pong Game

Brain-Computer Interfacing

Through the Mind Pong Game students receive basic information about how the human brain functions through games and smart illusions. Students use a brain-computer interfacing device to move virtual objects with their thoughts, as well as to compete in a ping pong game on the computer by moving their rackets using their mind.

SCIENCE COMMUNICATION

The Institute invests substantial efforts in communicating the produced scientific knowledge to the public and inform citizens on how research impacts society.

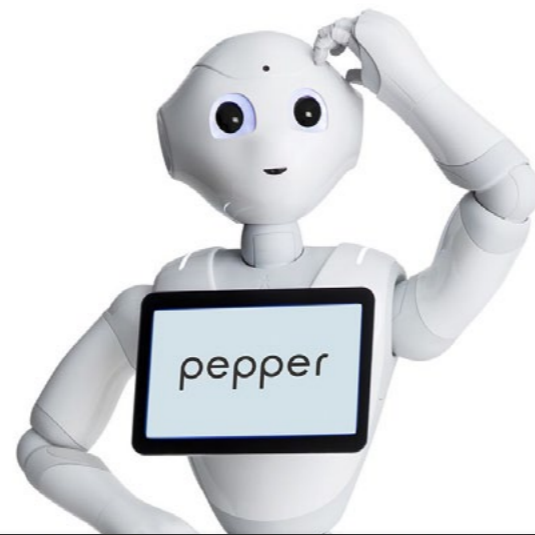
EVENTS

In November 2019, the European AI community gathered in Athens at the **AI4EU Ecosystem Development Forum**. As a partner of the AI4EU project, SKEL successfully organised the two-day long Forum with important speakers and more than two hundred delegates.



ROBOT PEPPER

IIT developed a new dialogue system for Pepper the robot, with the use of AI as part of a research collaboration between IIT and the Athens International Airport “Eleftherios Venizelos”. Pepper can now interact with people and answer thousands of questions, a feature demonstrated in various outreach events, school visits and media interviews.



IIT participated in the **84th Thessaloniki International Fair** from 7 - 15 September, where Pepper answered thousands of questions posed by visitors.



Pepper continued its public appearances and interviews in the Media. One of them during a **live broadcast on national Greek TV (ERT)** in September.

OTHER INITIATIVES



The Integrated Systems Lab presented **iGuide: From the Palace to Ariadne's Journey**, at Avgoulea Schools in Peristeri, Attica in March.



SKEL co-organised the event **Science & Technology in the Public Sphere** in March at InnovAthens with the participation of Mr K. Fotakis, Alt. Minister of Research & Innovation and Dr V. Karkaletsis, Director of IIT in the panel discussion.



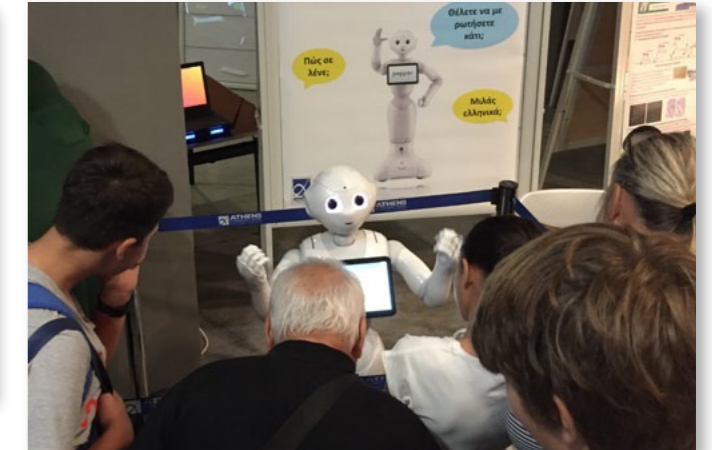
IIT participated in the **Athens Re-Science Festival 2019** in April.



In the frame of promoting transferrable knowledge and educating its young researchers, IIT regularly organises **scientific talks from experts** who strive to communicate their research results to the community.



In September IIT participated in the **Researcher's Night 2019**, with Pepper the robot engaging in dialogue with the public.



INNOVATION



ahedd was awarded Silver BDVA i-Space

During the European Big Data Value Forum 2019, held in October in Helsinki, the ahedd Digital Innovation Hub was certified as a Silver BDVA i-Space for 2019. ahedd is the first Greek DIH to receive such an award and hence to be an integral part of the BDVA ecosystem.

BDVA i-Spaces serve as European hubs for Big Data research and innovation activities. The Big Data Value Association (BDVA) grants a label for European Data Innovation Spaces to help drive forward Big Data adoption and AI based innovation across all domains within European industry. The label is granted in three grades: Bronze, Silver and Gold. These grades are aligned with the maturity and potential impact of the candidates in five main domains: Excellence of Infrastructure, Quality of Services, Projects and sectors, Impact to Eco System and Business model.

[More information here](#)

ahedd. Attica Digital Innovation Hub for the Economy of Data and Devices



Dr Xenia Ziouvelou
Innovation Officer

The **ahedd Digital Innovation Hub** kicked off within 2019 and is an open digital innovation ecosystem of research organisations and SMEs that aims to close the gap of digital transformation and digital innovation in Greece. IIT is one of ahedd's founding members with high specialisation and significant expertise in core technologies such as Artificial Intelligence, Big Data Management and IoT. ahedd aspires to provide commercial-ready solutions via the provision of an array of specialised testbeds and experimentation platforms that are available for free or fee-based in different fields with strategic impact to the Greek economy: Maritime, Culture, Agriculture, News and Media and Health.

ahedd is now part of the leading Europe-wide federation of DIHs that acts as an open digital innovation ecosystem that is cross-thematic (Artificial Intelligence, Big Data Management, Internet of Things) and aims in closing the gap of digital transformation and digital innovation in Greece.



1st prize at the 9th Innovation & Technology Competition of NBG Business Seeds

Linked Business, a start-up of the **Lefkippos Technology Park**, was awarded the first place at the 9th Competition of Innovation & Technology of NBG Business Seeds amongst 331 proposals. The company was founded by Dr Michalis Vafopoulos and researchers of the Software and Knowledge Engineering Laboratory (SKEL). The competition was aimed at highlighting and rewarding innovative ideas based on new technologies and promoting innovation in Greece so as to support innovative entrepreneurship.



Dr Michalis Vafopoulos
Linked Business

We are proud to have succeeded in materializing a decade-long effort from lab to market so as to provide effective market analysis services in B2B sales lead generation as well as in KYC, due diligence and internal auditing.

<https://www.iit.demokritos.gr/newsevents/1st-prize-nbg-business-seeds/>

SCIENTIFIC BOARDS

IIT ADVISORY BOARD

In April 2019, IIT celebrated the creation of a new Advisory Board for the Institute. The Board consists of five distinguished scientists who will provide expert advice on issues related to the IIT's strategic goals, scientific and technological priorities. The five members of the board are:



Prof Timos Sellis
Swinburne's Data Science Research Institute



Prof Christos Faloutsos
Carnegie Mellon University



Prof George V. Eleftheriades
University of Toronto



Dr Dimitrios Pezaros
University of Glasgow



Dr Michalis Matthaïou
Queen's University Belfast

[More information on the CVs of the Advisory Board members are available here.](#)

The Scientific Council of IIT

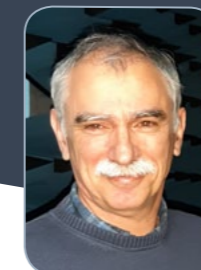
The Scientific Council of IIT consists of Directors of Research and key personnel who meet regularly so as to discuss current issues of the Institute that require strategic decisions.



Stavros Perantonis
Chair of the Council



Evangelia Alexopoulou



Antonis Alexandridis



Athanasios Drigas



Kimon Kontovasilis



George Paliouras



IIT Director Member of ESETEK

In November 2019, IIT Director Vangelis Karkaletsis was appointed member of the newly established National Research Technology & Innovation Council (ESETEK). The Council is Greece's top advisory body on the development of a national strategy for research, technology and innovation with accredited academics and researchers from Greece and abroad as well as people with proven experience and ability in innovation.

<https://www.iit.demokritos.gr/newsevents/iit-director-member-esetek/>



LAB

NeL focuses on issues relevant to the design, operation, management and optimization of communications and computer networks, with an emphasis on performance and efficiency aspects. Through the continued exploration of relevant research directions, the lab produced significant research results in 2019.



Dr Kimon Kontovasilis

Telecommunication
Networks Laboratory (NeL)

2019 marked the successful completion of the ATLAS project, a sub-project into the 2nd Open Call of the RAWFIE Horizon 2020/FIRE+ project targeting research experimentation in the domain of unmanned networked devices. ATLAS explored opportunistic networks of mobile nodes attached to unmanned vehicles (UxVs) for providing delay-tolerant network connectivity to remote areas without conventional network infrastructure. To this end, ATLAS enhanced the RAWFIE facilities, equipping the UxV devices with up to date opportunistic networking capabilities implemented on attached Raspberry Pi devices. The ATLAS solution employed MAD, a "lightweight" routing protocol for the versatile and efficient opportunistic forwarding of information packets between mobile network nodes. MAD is a product of NeL's prior research activities.

mable Radio Access Networks (RANs) and on RAN slicing architectures, NeL addressed the important use case of mobile access indoors, through small-cells managed by a neutral-host and shared by multiple operators. The proposed solution enables the efficient and adaptive spectrum sharing among competing operators, appropriately controlling spectrum demand through dynamic pricing driven by a deep reinforcement learning process. Apart from the significance of the results per se, this work exemplifies applications of networking technologies in conjunction with Artificial Intelligence/Machine Learning. Such cross-fertilization between the two domains is an important technological trend and aligns with the broader future objectives of IIT. The results from NeL span additional areas, such as mobility/handover management and schemes for offloading mobile network traffic.

“Cross-fertilization between networking technologies and AI/Machine Learning is an important technological trend and aligns with the broader future objectives of IIT.”



Alongside the project's "core" activities, NeL also published broader results, useful for modeling the time patterns associated with a large class of stochastic events that underlie the operation of mobile ad hoc networks (MANETs). The models bring a deeper understanding of how the network conditions and mobility patterns affect key operational decisions and the gained insight can be exploited towards improved processes or protocols. Application of these results improved further the efficiency of the MAD protocol. In another direction, NeL contributed towards the next generation of mobile and wireless networks. By leveraging prior know-how (including the experience from the past FLEX FP7 project) and results on SDN-driven flexible and program-

As always, in 2019 NeL was an active contributor of services to the scientific community. Lab members were invited to the Technical Program Committees (TPC) of more than 10 leading international conferences on networking (IEEE Globecom, IEEE ICC, IEEE VTC-Spring and ACM MSWiM, among others) and another member was a TPC co-Chair of EAI CrownCom 2019. Customarily, NeL's research activities serve also as a vehicle for graduate education. In 2019, one PhD student fulfilled the requirements for the degree (conferred by the National Technical University of Athens). Additionally, a member of NeL was invited to the examination committee of another external PhD student (with the University of Athens).

<https://www.iit.demokritos.gr/labs/nel/>



LAB

CIL's main task is to undertake research and development activities in the area of intelligent and adaptive learning systems. CIL was founded in 2002 as a continuation of the former "Artificial Neural Networks Laboratory" which has been conducting research in selected strategic sectors of computational intelligence (neural networks and intelligent image processing) for more than a decade.



Dr Stavros Perantonis

Computational
Intelligence Laboratory (CIL)

After four years of hard work, the H2020 project READ (Recognition and Enrichment of Archival Documents) came to an end. READ has been a highly successful project involving 13 partners in leading-edge research for automated recognition, transcription, indexing and enrichment of handwritten archival documents. The main outcome of the project, the Transkribus platform where documents can be uploaded, transcribed and shared, is now up and running. Users can also use their own transcriptions of historical documents to train the platform to read more texts in the same handwriting.

READ

In 2019 we actively participated at the Time Machine, a new initiative for international collaboration to build a map of European history that spans thousands of years, having our team member Dr Vassilis Gatos acting as a Time Machine Ambassador for Greece.

The Time Machine is by far the most ambitious and far-reaching project ever undertaken, intending to develop and use Artificial Intelligence to create and interpret Big Data of the Past.

CIL continued the support to the Australian company Purebills providing innovative tools for automatic analysis of invoices and receipts. New perspectives on this collaboration were launched during 2019, when Purebills established a new company branch and joined the Lefkippos Technological Park in Demokritos in order to have closer collaboration and support from our lab.

The lab has two ongoing projects that aim to provide robust methodologies for automatic recognition of several aspects of human behavior, VISOR and ENORASI.



VISOR project aims to provide a novel virtual coaching approach combining methodologies for recognition of activities of daily living and emotions, focusing on elder population and using non-invasive sensors, such as cameras and microphones, located at the users' home environment or off-the-shelf wearables. The vision of ENORASI is to provide a novel wearable system that offers accessibility and guidance to open environments of high cultural and tourist value, while it provides a unique user experience, including users with limited sight or total blindness. The system is equipped with sensors enabling localization in an area of interest and also recognition of objects of cultural/tourist interest, obstacles or even dangerous situations around. Also, it provides directions for navigation and guided touring and automatically creates personalized summaries which consider user's emotions while navigating.



Dr Homer Papadopoulos

is leading the eHealth Unit which integrates technologies to implement eHealth services.

<https://www.iit.demokritos.gr/labs/cil/>



Dr Anastasios Kourtis
Media Networks Laboratory (MNL)

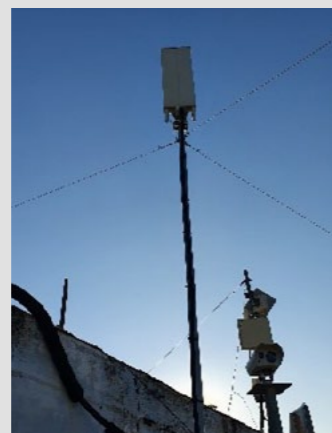
MNL specialises in networks and multimedia technologies. The lab has been active for more than a decade in a number of national and European research projects capitalizing on strong research achievements which are reflected in numerous scientific publications and collaboration with Greek and international partners, both industrial and academic.

MNL owns and operates advanced and flexible 5G experimental infrastructures. It is a fully functional end-to-end 5G network, featuring 5G New Radio, 5G Core, Edge Computing, Network Functions Virtualisation, Software Defined Networking, Network Slicing and Integrated Management and Orchestration. It is also fully compatible with commercial 5G smartphones and terminals.

During 2019, MNL continued its research activities in 5G, through its successful participation in 7 EU funded projects, namely 5G-ESSENCE, 5G-TANGO, IORL, MATILDA, 5G-MEDIA SHIELD and 5GENESIS. While two projects (5G-ESSENCE & SHIELD) ended in 2019, two new H2020 projects kicked off, both of them related to 5G: 5G!DRONES and INSPIRE-5GPlus with a duration of 36 months.

Project 5G!DRONES aims to test several UAV use-cases covering eMBB, URLLC, and mMTC 5G services, and to validate 5G KPIs. The project will show that 5G is able to guarantee UAV vertical KPIs, and will also demonstrate that 5G can support challenging use-cases that put pressure on network resources, such as low-latency and high bandwidth requirements, simultaneously. 5G!DRONES will build on top of the 5G platform, developed in Athens, in the frame of 5GENESIS project.

The goal of INSPIRE-5Gplus is to advance security of 5G beyond networks by exploiting the features of new technologies and trends such as Trusted Execution Environments, Remote Attestation/Path Proof/RCA, AI/ML and Blockchains, in order to achieve intelligent and trusted multi-tenancy across multi-tenants infrastructure, and confront vulnerabilities and compromises for the infrastructure owners and tenants. In the past year MNL had the honour to contribute to two 5G-related standardization bodies: MEF and IMT-2020.



For 2020 MNL plans to retain a leading position in 5G and has secured two new H2020 projects: RESPOND-A and PALANDIR.

RESPOND-A aims at developing holistic and easy-to-use solutions for First Responders by bringing together the complementary strengths of its Investigators in 5G wireless communications, Augmented and Virtual Reality, autonomous robot and unmanned aerial vehicle coordination, intelligent wearable sensors and smart monitoring, geovisual analytics and immersive geospatial data analysis, passive and active localisation and tracking, and interactive multi-view 360° video streaming.

PALANDIR focuses on a systematic approach for ensuring digital security mainly for SMEs by providing multi-layered, infrastructure-wide threat monitoring, cyber-resiliency and knowledge sharing in a heterogeneous ecosystem, in the form of Security-as-a-service (SECaaS), by applying and exploiting Network Functions Virtualization (NFV) and Software-Defined Networking (SDN) technologies.

MNL's future plans include the enhancement of its 5G platform with more 5G features.

At scientific research level, during 2019 the MNL has published 9 scientific papers in journals, 9 in conferences and 2 in book chapters.



“For 2020 MNL plans to retain a leading position in 5G as it has secured two new H2020 projects in this direction.”



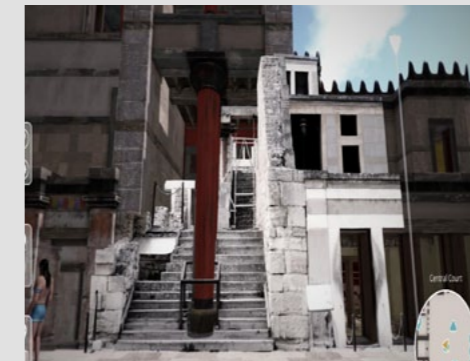
Dr Harilaos Koumaras
Media Networks Laboratory, 5G!DRONES



Dr Stelios Thomopoulos
Integrated Systems Laboratory (ISL)

2019 was a very productive R&D year for ISL being the Coordinator in the successful ongoing EU H2020 “Secure societies” projects TRESSPASS, CIVILNEXT and MARINE-EO while also winning a new grant in simulation and 3D face biometrics with D4FLY project. Other highlights of the year are briefly presented below.

Presenting extensive relevant ISL research since 2013 on combining Cultural Heritage and Digital Design, the scientific paper “Digital approaches for public outreach in cultural heritage: The case study of iGuide Knossos and Ariadne’s Journey” was published in November 2019 in Elsevier “Digital Applications in Archaeology and Cultural Heritage” Journal from authors Giorgos Farazis, Christina Thomopoulos, Christos Bourantas, Sofia Mitsigkola and Stelios C. Thomopoulos.



“In 2019 ISL maintained its momentum in European Research on Security as well as Research combining Cultural Heritage and Digital Design.”



In another ISL research highlight for 2019, ISL completed the development of a highly disruptive and innovative gamified intervention programme for assisting children to manage and overcome the ADHD symptoms. Supported by the H2020 EU research framework, the FocusLocus project was successfully coordinated by ISL and completed in January 2019, receiving a very positive appraisal during the Final Project Review.

ISL research on AI and Ethics in Automated Decision Making inspired the cover of a most prestigious international scientific journal in security and privacy. Featured in the March/April 2019 issue of IEEE Security and Privacy was the selected article entitled “Automated Decision Making in Airport Checkpoints: Bias Detection Toward Smarter Security and Fairness” by authors Dimitris M. Kyriazanos, Konstantinos Giorgos Thanos and Stelios C.A. Thomopoulos, which included work supported by FLYSEC EU project.



Finally, an important highlight in the context of ISL's leading presence in European research on Security, ISL researcher Dr Dimitris Kyriazanos was appointed by GSRT as national representative in H2020 Programme Committee for Secure Societies. It is an honorary and important position working on the strategic planning for European research, whilst ensuring links and alignment with national activities.



Dr Dimitris Kyriazanos
National representative in H2020 Secure Societies Programme Committee



LAB



Dr Antonis Alexandridis

Wireless Communications Laboratory (WiCom)

“WiCom Laboratory implemented in 2019 the first fully textile embroidered antenna prototypes, as part of the lab’s key focus on wireless wearable systems.”

WiCom Laboratory specialises in electromagnetic radiation aspects, propagation of electromagnetic waves (theoretical aspects and measurements) and radio access of various communication systems.

WiCom 2019 activities

The research activity of WiCom Laboratory during 2019 focused mainly on issues relating to wireless wearable systems. Specifically, the lab dealt with the design and development of textile antennas and transmission lines (mainly within the SYNTESIS project) but also with issues relating to the interaction of wearable antennas with the user’s body (under the SERENE/SNF project). Moreover, we continued to work on MIMO systems, advanced transmit/receive techniques and 5G technologies. Specifically, new directions of research refer to investigation of systems operating at mm-waves focusing on propagation modeling, system-level analysis and design of mmWave MIMO transceivers. The latter is supported by an SNF postdoc fellowship.

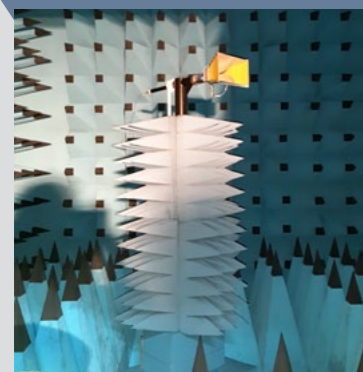
A milestone of the WiCom for 2019 is the funding of the ARIADNE proposal in the framework of Horizon 2020, after joining forces with SKEL of IIT. ARIADNE plans to bring together a novel high frequency advanced radio architecture and Artificial Intelligence (AI) processing and management approach into a system beyond 5G operating in D-frequency band (mmWaves). The project started in November 2019.

The exploitation of the embroidery machine, recently supplied by the laboratory, started and the first fully textile embroidered antenna prototypes were implemented. Antenna characterization measurements in the anechoic chamber showed satisfactory results and raised issues for optimization of this technique.

aimed at optimising antenna functionalities. Postgraduate students from 9 countries and 15 different institutions attended the course. Also included in the lab’s educational/training activities are the guided tours at the Institute’s Antenna measurements facilities (Anechoic chamber) to groups of students, as well as lectures by members of the lab on events such as Demokritos Summer School 2019 and Advanced Training Course Spintronics Radar Detectors (STMD2019).



In the area of specialized scientific services provision, the WiCom laboratory was in partnership with ANTRUM Ltd. UK, for research and development of a VHF antenna for M2M satellite communications under a programme facilitated by ESA. The first phase of this project has been successfully completed in 2019. Finally, the proposal (DELHILA) was approved for funding by ESA. The WiCom participates in collaboration with the Greek company Adamant Composites Ltd. The project will start at the beginning of 2020 and aims at the development of a deployable high gain antenna structure for small spacecraft science missions.



The Anechoic Chamber at NCSR Demokritos



In the context of the lab’s educational activities, WiCom successfully co-organised the European School of Antennas 2019 (ESoA 2019) for Advanced Materials for Antennas and Microwave Devices with Loughborough University, UK. Key point of the synergy between Materials Science and Antenna Technology

NML & Mind

LAB



Dr Athanasios Drigas

Net Media Lab & Mind-Brain R&D

EU PROJECTS

NML & Mind currently participates in 5 Erasmus+ projects, namely: Seniors Go Digital, CLICHA, MeLDE, CODESKILLS4ROBOTICS & ROBOTICS4DEAF. Our lab coordinates CODESKILLS4ROBOTICS, a project introducing pupils aged 9-12 to the world of Coding & Robotics and successfully submitted the Interim Report in December 2019.

In October, we organised the 3rd Transnational Project meeting for MeLDE (21 & 22/10), during which we presented the e-learning platform to host the Digital and Media Literacy e-courses to our partners. ROBOTICS4DEAF is a new project, which kicked-off in December 2019 in Lodz, Poland.

Our future plans include the final blended training activities and the International Conference for the Seniors Go Digital Project and the participation in 3 more Erasmus+ project proposals for the 2020 call.



CLIMATE CHANGE

In the frame of the “CLICHA - Climate Change in Agriculture” project, NML & Mind organised a 2-day Training Activity, on 8 - 9.10.2019, on campus at NCSR Demokritos. Ten Tunisian academics from five Tunisian Universities participated in the activity and were trained on the implementation of new technologies in education.

The main objective of the CLICHA project is the modernization of Tunisian HEIs in order to create qualified scientists who will contribute to the development of environmentally friendly and sustainable agriculture.

In addition, delegation of our lab attended the Business Forum “Agriculture and Livestock Production under the Challenges of Climate Change” which took place in Torino on 12/6/2019 for the same project.



EDUCATION

The postgraduate programme “Specialization in ICTs & Special Education-Psychopedagogy of Integration” held the Graduation Ceremony for the 70 graduates of the 1st academic cycle (2016-2018) on 1/2/2019. The 2nd year of the programme (2017-2019) was completed in May 2019 and the graduation ceremony will take place in early 2020. A new group of 100 students (70 in Athens and 30 in Komotini) were chosen after interviews in May for the new Academic season. Each year, 2 cycles of the programme run concurrently.

As part of our Annual Seminars on “Special Education & ICTs”, which have been running since 2013, five seminars, of 32 hours duration each, took place in the first semester of 2019 concluding the 2018-2019 annual Seminar, entitled “Special Education & ICT: The Spectrum of Autism”. On 29/9/2019, a free seminar entitled “ICT & ADHD” was organised attracting more than 200 participants.

Finally, our lab organised a Workshop on Edison Robots to Primary School students, during the Researcher’s Night 2019 Pre-event, which took place on 25/9/2019. 22 students from the 6th Primary School of Agia Paraskevi and 22 students from the 11th Primary School of Amaraoussion attended the educational workshop, which introduces pupils to the world of Coding & Robotics.



DISTINCTIONS

A policy report of the European Commission “Artificial Intelligence. A European Perspective”, included in its chapter “Educational Perspective”, NML & Mind Lab’s study-article “Drigas, A. and Ioannidou, R. E. 2013. ‘Special Education and ICTs’. International Journal of Emerging Technologies in Learning (IJET) 8 (2): 41–47”, about ICTs and Artificial Intelligence in Special Education.

The European Commission selected, in 2019, as a Good Practice Example, the Net Media Lab’s Erasmus+ project “Code@Youth: An Innovative Programme in the Digital Era” for introducing young people (13-17 yrs) to the world of Coding and Robotics.





LAB



Dr Vangelis Karkaletsis

Software & Knowledge Engineering Laboratory (SKEL)

The Software & Knowledge Engineering Laboratory (SKEL) is one of the largest research labs at NCSR Demokritos with more than 60 researchers, which are organised in 6 research groups (BioHIT, CER, CAKT, RoboSKEL, PerSoNA and DEG). The lab focuses on content analysis and intelligent human-computer interaction, exploiting and advancing Artificial Intelligence methods and tools. Its research activities span from Artificial Intelligence and Big Data to IoT and Robotics.

“ For SKEL, the year 2019 has been demanding and at the same time very rewarding for the team as a whole. We look forward to continuing with the same stamina and creativity for the years to come. ”



AthNLP 2019 Summer School

Scientific achievements

The growing interest of the scientific community and the wider public in Artificial Intelligence and Big Data, led to the lab holding a competitive advantage in 2019. Nine new research projects kicked off, six of them funded by the H2020 programme (ARIADNE, AI4EU, INFORE, IS-ENES3, Extreme Earth, Fair4Fusion), two National (House of Greek Classical Ideas and EN.I.R.I.S.S.T.) and one is an international privately-funded project (DICE).

organised jointly with the Athens University of Economics and Business, Research Center “Athena” and Heriot-Watt University.

Innovation

In October 2019, SKEL initiated the Innovation Services Initiative with the aim to exploit the lab’s long-standing expertise in AI technologies and applications by providing high-end solutions to industrial problems. In the first quarter of its operation, meetings with 14 business stakeholders have been realized (from industries as diverse as Maritime, Legal, Banking, Telecom), discussing AI-enabled services provision tailored to their business needs. Two of the projects discussed have led to a contractual agreement in the beginning of 2020 and more are expected to follow. This initiative is supported by SciFY, as a technology transfer partner, and ahead.

Education

SKEL is an important lead of the Institute’s educational initiatives creating and offering educational programmes to students of all ages ranging from elementary school to Joint PhDs and scholarships. Additionally the lab organised the first Athens Natural Language Processing Summer School (AthNLP) which gathered more than 100 University students. The summer school was



The AI Ecosystem Development Forum took place in Athens in the frame of the AI4EU project in November 2019.



2020 brings a change of leadership for SKEL. Vangelis Karkaletsis is handing the baton over to George Paliouras.

<https://www.iit.demokritos.gr/labs/skel/>

FUTURE PLANS

New IIT Buildings



In 2019 NCSR Demokritos became the first Research Center in Greece to receive funding from the European Investment Bank (EIB). With a total budget of € 48.3 Million, the project involves the construction of four new buildings and the renovation of seven existing buildings helping toward creating a smart, autonomous and green campus ready to meet the challenges of the exponential changes in Research and Technology. Construction work will start with the new smart building of the Institute of Informatics & Telecommunications, the first of the buildings to be built with a total area covering 3,573m² and a budget rising to 6.8 M€. This building will serve the growing needs of the Institute concerning research, innovation, education, networking, exhibitions and the dissemination of research results. It will also provide the necessary lab spaces to develop, test and exhibit applications, hosting approximately 150 people. The existing building infrastructure of IIT, which now stands at 1,100 m², will also undergo a considerable renovation as part of the EIB funding, with a budget of 2.2 M€.

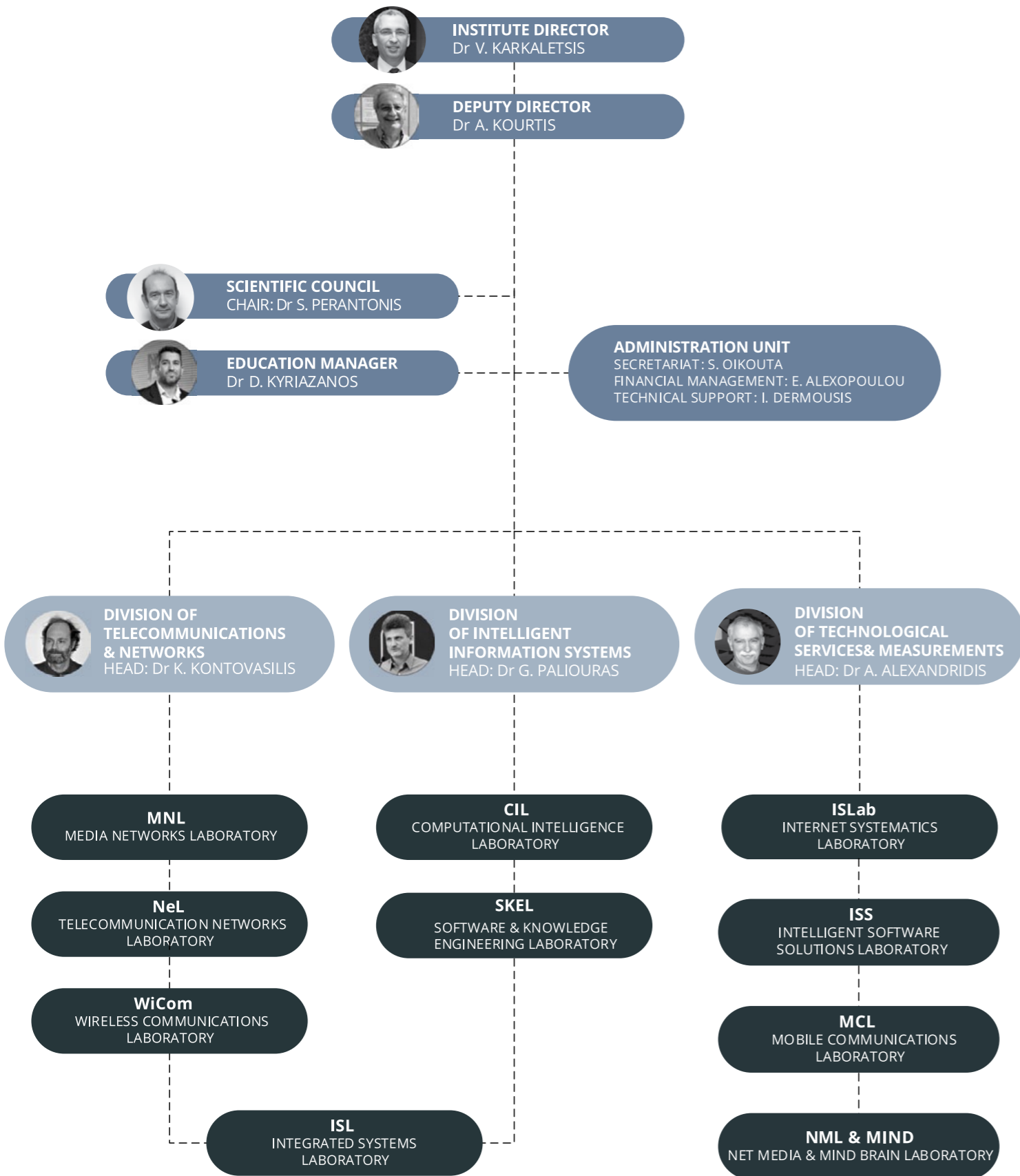


Existing IIT Building



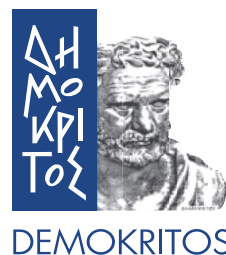
<https://www.iit.demokritos.gr/newsevents/new-iit-buildings/>

ORGANISATIONAL CHART



For more information, click on the respective bubbles.





Creative: Yota Sotiropoulou



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