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| **TSAG** | |
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| **Purpose:** | | | Information | | |
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| **Keywords:** | Kaleidoscope; academic papers; machine learning; 5G; artificial intelligence; communication technologies; standardization; |
| **Abstract:** | This document provides an overview of the ITU Kaleidoscope academic conference 2018 (K-2018) that was held in Santa Fe, Argentina, from 26-28 November 2018. The Annex to this document presents a keynote speech, invited papers and accepted papers selected for presentation and publication, and identifies links to related activities in ITU-T and other ITU sectors. This document also announces the next Kaleidoscope edition and mentions official recognition of the success of the Kaleidoscope conferences (PP relevant Resolutions). |

**Action required**

TSAG, ITU-T study groups and focus groups are invited to review the papers relevant to their scope of work, and to take into consideration this input from the research community. Tailored TDs are also being submitted to the ITU-T study groups and focus groups. In addition, this report will be transmitted to RAG and TDAG.

# Highlights of the conference

The ITU Kaleidoscope conference 2018 (K-2018) was kindly hosted by the Secretary of Modernization of Argentina, the Government of the Province of Santa Fe and the Universidad Tecnológica Nacional, Santa Fe, Argentina.

Nearly 250 delegates from 18 countries participated at the conference and over 75 participants joined remotely. Photos (on the ITU Flickr) and the webcast will be available shortly at the event´s webpage.

The event was technically co-sponsored by the Institute of Electrical and Electronics Engineers (IEEE) and the IEEE Communication Society (IEEE ComSoc), and generously supported by the Santa Fe Lottery and NEC.

An 11-month, substantial preparatory process was required for this Kaleidoscope edition which involved the efforts and collaboration of dedicated Steering Committee members: Héctor Mario Carril (ITU-T Study Group 20 Vice-Chairman, Argentina), Christoph Dosch (ITU-R Study Group 6 Vice-Chairman; IRT GmbH, Germany), Kai Jakobs (RWTH Aachen University, Germany); Mitsuji Matsumoto (Professor Emeritus Waseda University, Japan) and Mostafa Hashem Sherif (Consultant, USA), who also chaired the Technical Programme Committee (TPC) of 83 members (all internationally recognized ICT experts from academia, research institutes and the private sector), ensuring transparency through the double-blind peer-review process; partnering organizations which supported the promotion of the conference: Waseda University, the Institute of Image Electronics Engineers of Japan, the Institute of Electronics, Information and Communication Engineers of Japan, the Chair of Communication and Distributed Systems at RWTH Aachen University, the European Academy for Standardization, and the University of the Basque Country; our local partners, Comisión Técnica Regional de Telecomunicaciones, Comisión Interamericana de Telecomunicaciones, Centro Internacional de Investigación Científica en Telecomunicaciones, Tecnologías de la Información y las Comunicaciones, Corporación Universitaria para el Desarrollo de Internet, Centro de Capacitación en Alta Tecnología para Latino América y el Caribe, Universidad Austral, Universidad de Buenos Aires, Universidad de Cuenca, Universidad de Las Américas, Universidad Distrital Francisco José de Caldas, Universidad ICESI, Universidad Nacional de la Plata, Universidad Nacional de Río Cuarto, Universidad Nacional de San Luis, and Universidad Nacional del Sur; and media partners, Convergencia Latina and the Journal of Big Data and Cognitive Computing.

The Host provided excellent logistics and organized several outstanding social events throughout the whole conference (cocktail reception, dance spectacles, sightseeing boat trips, visits to the local brewery and a fascinating and educational visit to a local Data Centre).

The Award Committee, that selected the winners of the awards for the **three best papers**, was composed of five conference attendees: Joan Garcia-Haro (Technical University of Cartagena, Spain), Eva Ibarrola (University of the Basque Country, Spain), Mostafa Hashem Sherif, Duncan Sparrell (Consultant, USA) and Tomás Bracalenti (Universidad Tecnológica Nacional, Santa Fe Regional Faculty, Argentina). The winning papers are as follows:

FIRST best paper: "[Consideration on Automation of 5G Network Slicing with Machine Learning​](https://www.itu.int/en/ITU-T/academia/kaleidoscope/2018/Documents/Presentations/S3.2_Consideration_on_Automation_of_5G_Network_Slicing_VedKafle.pdf)" by Ved P. Kafle, Yusuke Fukushima, Pedro Martinez-Julia and Takaya Miyazawa (National Institute of Information and Communications Technology, Japan)

SECOND best paper: "[A Gendered Perspective on Artificial Intell​igence](https://www.itu.int/en/ITU-T/academia/kaleidoscope/2018/Documents/Presentations/S6.1_A%20Gendered%20Perspective%20on%20AI_Parsheera.pdf)" by Smriti Parsheera (National Institute of Public Finance and Policy, New Delhi, India)

THIRD best paper: "[Ethical Framework for Machine Learning](https://www.itu.int/en/ITU-T/academia/kaleidoscope/2018/Documents/Presentations/S6.2_Ethical%20Framework%20for%20machine_Malhotra.pdf)" by Charru Malhotra (Indian Institute of Public Administration, India); Vinod Kotwal (Department of Telecommunications, India); Surabhi Dalal (India Centre for Migration, India)

Alongside the winners of cash prizes, eight entrants received **Young Author Recognition Certificates**, and a **special mention** was made of eleven graduate students and their Professor from Universidad Distrital Francisco José de Caldas, Bolívar, Colombia – an ITU Academia member – for their outstanding contribution to Kaleidoscope conferences as well as university projects that have achieved strong social impact.

Kaleidoscope 2018 also featured three **Tutorials**, the eight edition of the **Jules Verne’s corner (JVc)** entitled “[*The Future of Work and the Future of Privacy in the Era of Artificial Intelligence*](https://www.itu.int/en/ITU-T/academia/kaleidoscope/2018/Pages/jules-verne-corner.aspx)”, and a side event – ​[Local Universities Exhibit](https://www.itu.int/en/ITU-T/academia/kaleidoscope/2018/Pages/local-universities-exhibit.aspx) (26-28 November).

Programme, presentations, abstracts and biographies are available [online](https://www.itu.int/en/ITU-T/academia/kaleidoscope/2018/Pages/programme.aspx), as well as the [Final Report](https://www.itu.int/en/ITU-T/academia/kaleidoscope/2018/Pages/default.aspx).

**Daily Highlights** are available at the ITU News Portal:

* [Japan’s NICT claims 1st prize at Kaleidoscope 2018 for research on automated 5G network slicing](http://news.itu.int/1st-prize-at-kaleidoscope-2018/)  
  Published Thu, 29 Nov 2018
* [Kaleidoscope 2018: Highlights from Day 2](http://news.itu.int/kaleidoscope-highlights-day-2/)  
  Published Wed, 28 Nov 2018
* [Kaleidoscope 2018: Highlights from Day 1](http://news.itu.int/kaleidoscope-highlights-day-1/)  
  Published Tue, 27 Nov 2018

Full papers are reproduced in the [Conference Proceedings](https://www.itu.int/pub/T-PROC-KALEI-2018). All papers will be also available shortly on the IEEE *Xplore* digital library. The best papers will be evaluated for potential publication in IEEE Communications Standards Magazine and other international journals. Please contact [kaleidoscope@itu.int](mailto:kaleidoscope@itu.int) for any queries.

# Next edition

The **eleventh edition** of the ITU Kaleidoscope academic conferences will be hosted by the ITU Academia member, Georgia Institute of Technology, USA, in November 2019. The theme and all relevant information will be made available soon [here](https://www.itu.int/en/ITU-T/academia/kaleidoscope/Pages/default.aspx).

# Official recognition of Kaleidoscope

The success of the ITU Kaleidoscope academic conferences has been acknowledged by PP-18 delegates in the following resolutions:

* RESOLUTION 169 (REV. DUBAI, 2018) - Admission of academia to participate in the work of the Union: “that the Kaleidoscope event, held annually since 2008, is an ITU initiative to strengthen cooperation with academia that **has been highly successful**, and has addressed many topics, including innovations for digital inclusion, new emerging technologies and building sustainable communities”; “instructs the Director of the Telecommunication Standardization Bureau to continue to **organize the Kaleidoscope event annually** on a rotational basis, to the greatest extent possible”; “to **encourage the participation of academia in** various open events and activities organized or co-organized by ITU, such as ITU Telecom World, **ITU Kaleidoscope**, World Summit on the Information Society forums and other workshops and forums”.
* RESOLUTION 198 (REV. DUBAI, 2018) - *Empowerment of youth through telecommunication/information and communication technology: “*recognizing the annual "Kaleidoscope" academic essay competition organized by the ITU Telecommunication Standardization Sector (ITU‑T), targeting young ICT scientists, researchers and engineers;
* RESOLUTION COM5/1 (DUBAI, 2018) - ITU Journal: ICT Discoveries: “that the Kaleidoscope event, held annually since 2008, **has increased dialogue between Academia and ICT standardization experts**, identifying, through original, peer-reviewed papers, areas in need of international standards to assist the development of the information society”.

# ANNEX

The **Annex** to this document presents a keynote speech, two invited papers, and 15 accepted papers that have been selected by the Steering and Technical Programme Committees of Kaleidoscope 2018, and identifies links to related activities in ITU-T and other ITU sectors.

Upon request, the ITU Kaleidoscope Secretariat can establish contact between Study Groups/Focus Groups and authors, e.g. to arrange for a remote presentation of the findings of the paper during a Study Group/Focus Group meeting.

The Annex is structured as follows: **Table 1** gives an overview of all papers and keynote speech. **Table 2** maps the papers and keynote speech to ongoing ITU activities, if applicable. Table 2 also includes links to the respective presentations.

# ANNEX Evaluation of Kaleidoscope 2018 papers with respect to relevance in ITU activities

## Table 1: Titles of ITU Kaleidoscope 2018 keynote and papers

| # | Title |
| --- | --- |
| K1 | Impact of Machine Learning in 5G Planning and Deployment |
| S1.1 | A Machine Learning Management Model for QoE Enhancement in Next Generation Wireless Ecosystems |
| S1.2 | Unsupervised Learning for Detection of Leakage from the HFC Network |
| S1.3 | Double Sarsa Based Machine Learning to Improve Quality of Video Streaming over HTTP Through Wireless Networks |
| S2.1 | Self-Healing and Resilience in Future 5G Cognitive Autonomous Networks |
| S2.2 | AI as a Microservice (AIMS) over 5G Networks |
| S2.3 | Multifractal Modeling of the Radio Electric Spectrum Applied in Cognitive Radio Networks |
| S2.4 | Towards Cognitive Autonomous Network in 5G |
| S3.1 | Machine Learning Opportunities in Cloud Computing Data Center Management for 5G Services |
| S3.2 | Consideration on Automation of 5G Network Slicing with Machine Learning |
| S4.1 | A Deep Reinforcement Learning Approach for Data Migration in Multi-access Edge Computing |
| S4.2 | Predicting Activities in Business Process with LSTM Recurrent Neural Networks |
| S5.1 | Smart Usage of Multiple RAT in IoT-oriented 5G Networks: A Reinforcement Learning Approach |
| S5.2 | Message Collision Identification Approach Using Machine Learning |
| S5.3 | Optical Flow Based Learning Approach for Abnormal Crowd Activity Detection with Motion Descriptor Map |
| S6.1 | A Gendered Perspective on Artificial Intelligence |
| S6.2 | Ethical Framework for Machine Learning |
| S6.3 | Undeclared Constructions: A Government's Support Deep Learning Solution for Automatic Change Detection |

## Table 2: Mapping of ITU Kaleidoscope 2018 keynote and papers and ITU activities

| # | Title and presentation | Author & affiliation | Keywords | Standards relevance | Related ITU-T study groups / activities | Other ITU sectors | Comments |
| --- | --- | --- | --- | --- | --- | --- | --- |
| K1 | Impact of Machine Learning in the 5G Planning and Deployment  [[Presentation](https://www.itu.int/en/ITU-T/academia/kaleidoscope/2018/Documents/Presentations/Machine%20Learning%205G_Hugo%20Miguel.pdf)] | **Hugo Miguel** (Modernization Government Secretariat, Argentina) |  |  | ITU-T Focus Group on Machine Learning for Future Networks including 5G (FG-ML5G) |  | Keynote speech |
| S1.1 | A Machine Learning Management Model for QoE Enhancement in Next Generation Wireless Ecosystems  [[Presentation](https://www.itu.int/en/ITU-T/academia/kaleidoscope/2018/Documents/Presentations/S1.1_ML_QoE_Ibarrola.pdf)] | Eva Ibarrola (University of the Basque Country (UPV/EHU), Spain); Mark Davis (Dublin Institute of Technology (DIT), Ireland); Camille Voisin and Ciara Close (OptiWi-fi, Ireland); Leire Cristobo (University of the Basque Country (UPV/EHU), Spain) | Big data; machine learning; QoBiz; QoE; QoS; Wi-Fi | Proposal for new standards on QoS and ML for NGW ecosystems.  ITU-T Rec. G.1000 "Communications Quality of Service: A framework and definitions" - SG12  ITU-T Rec. E.804 "Quality of service aspects for popular services in mobile networks" - SG12  ITU-T Rec. E.802 "Framework and methodologies for the determination and application of QoS parameters" - SG12  [IEEE 802.11] | ITU-T SG12 - Performance, QoS and QoE  ITU-T SG13 - Future networks (& cloud)  ITU-T FG-ML5G |  | **Invited paper**  Founding Academia member (University of the Basque Country) |
| S1.2 | Unsupervised Learning for Detection of Leakage from the HFC Network  [[Presentation](https://www.itu.int/en/ITU-T/academia/kaleidoscope/2018/Documents/Presentations/S1.2_Unsupervised%20learning%20for%20Detection_Gibellini.pdf)] | Emilia Gibellini and Claudio E. Righetti (Telecom Argentina, Argentina) | Machine learning; unsupervised learning; pattern clustering; spectral analysis; content distribution networks; signal processing algorithms | Proposal for a standardization of the measurement process. | ITU-T SG9 - Broadband cable and TV  ITU-T SG15 - Transport, access and home | ITU-R  - FM radio signals  - Digital TV  - 3G downlink signals |  |
| S1.3 | Double Sarsa Based Machine Learning to Improve Quality of Video Streaming over HTTP Through Wireless Networks  [[Presentation](https://www.itu.int/en/ITU-T/academia/kaleidoscope/2018/Documents/Presentations/S1.3_Double%20Sarsa%20Video%20Streaming_Kumar.pdf)] | Dhananjay Kumar and Narmathaa Logganathan (Anna University, India); Ved P. Kafle (National Institute of Information and Communications Technology, Japan) | Video streaming; QoE; machine learning; Sarsa; video quality measurements | ITU-T Rec. P.1203.1 "Standardization of future audio-visual streaming services over wireless IP network" - SG12  ITU-T Rec. J.247 "Objective perceptual multimedia video quality measurement in the presence of a full reference" - SG12  ITU-T Rec. H.264 "Advanced video coding for generic audiovisual services" – SG16  ITU-T Rec. G.107 “The E-model: a computational model for use in transmission planning” " - SG12  ISO/IEC JTC1/SC29/WG11 and ITU-T SG16 Q.6 JVT-AB031, “New Video Quality Metrics in the H.264 Reference Software” | ITU-T SG12  ITU-T SG13  ITU-T SG16 - Multimedia | ITU-R SG6 “Broadcasting service” |  |
| S2.1 | Self-Healing and Resilience in Future 5G Cognitive Autonomous Networks  [[Presentation](https://www.itu.int/en/ITU-T/academia/kaleidoscope/2018/Documents/Presentations/S2.1_Self-healing_and_resilience_in_future_5G_Ali-Tolppa.pdf)] | Janne Ali-Tolppa​ (Nokia Bell Labs, Germany); Szilárd Kocsis, Benedek Schultz and Levente Bodrog (Nokia Bell Labs, Hungary); Márton Kajó (Technical University of Munich, Germany) | SON; cognitive network management; self-healing; anomaly detection machine learning |  | ITU-T SG12  ITU-T SG13  ITU-T FG-ML5G | ITU-R - Radio Access Networks (RANs)  - LTE |  |
| S2.2 | AI as a Microservice (AIMS) over 5G Networks  [[Presentation](https://www.itu.int/en/ITU-T/academia/kaleidoscope/2018/Documents/Presentations/S2.2_AI%20as%20a%20Microservice_UM.pdf)] | Gyu Myoung Lee (Liverpool John Moores University, United Kingdom); Tai-Won Um (Chosun University, Rep. of Korea); Jun Kyun Choi (Korea Advanced Institute of Science & Technology, Rep. of Korea) | AIMS; microservice; AI; 5G |  | ITU-T SG13  ITU-T SG20 - IoT, smart cities & communities  ITU-T Focus Group on Data Processing and Management to support IoT and Smart Cities & Communities (FG-DPM)  ITU-T FG-ML5G |  | Academia member (KAIST) |
| S2.3 | Multifractal Modeling of the Radio Electric Spectrum Applied in Cognitive Radio Networks  [[Presentation](https://www.itu.int/en/ITU-T/academia/kaleidoscope/2018/Documents/Presentations/S2.3_Multifractal_Modeling_of_the_Radio_Tuberquia%20David%26Hernandez.pdf)] | Luis Tuberquia David and Cesar Hernández (Universidad Distrital Francisco José de Caldas, Colombia) | Multifractal; cognitive radio; radio electric spectrum; Bogota; Hurst parameter |  |  | ITU-R SG1 | Academia member |
| S2.4 | Towards Cognitive Autonomous Network in 5G  [[Presentation](https://www.itu.int/en/ITU-T/academia/kaleidoscope/2018/Documents/Presentations/S2.4_Towards%20Cognitive%20Autonomous%20Networks_Mwanje.pdf)] | Stephen S. Mwanje and Christian Mannweiler (Nokia Bell Labs, Germany) | Cognitive autonomous network; network management automation; 5G | ITU-T Rec. M.3400 "TMN Management functions" – SG2 | ITU-T SG13  ITU-T SG11 Protocols and test specifications  ITU-T SG2 - Operational aspects  ITU-T FG-ML5G | ITU-R |  |
| S3.1 | Machine Learning Opportunities in Cloud Computing Data Center Management for 5G Services  [[Presentation](https://www.itu.int/en/ITU-T/academia/kaleidoscope/2018/Documents/Presentations/S3.1_Machine%20Learning%20Opportunities%20in%20Cloud%20Computing%20Datacenter_Baran.pdf)] | Fabio López-Pires (Itaipu Technological Park, Paraguay); Benjamín Barán (National University of the East, Paraguay) | 5G service operations; cloud data centers; machine learning; virtual machine placement |  | ITU-T SG13  ITU-T FG-ML5G |  | **Invited paper** |
| S3.2 | Consideration on Automation of 5G Network Slicing with Machine Learning  [[Presentation](https://www.itu.int/en/ITU-T/academia/kaleidoscope/2018/Documents/Presentations/S3.2_Consideration_on_Automation_of_5G_Network_Slicing_VedKafle.pdf)] | Ved P. Kafle, Yusuke Fukushima, Pedro Martinez-Julia and Takaya Miyazawa (National Institute of Information and Communications Technology, Japan) | Machine learning; artificial intelligence; 5G network; slicing, standardization | ITU-T Rec. Y.3102 "Framework of IMT-2020 network" – SG13  ITU-R Rec. M.2083-0 "IMT Vision - Framework and overall objectives of the future development of IMT for 2020 and beyond" – ITU-R SG5 | ITU-T FG-ML5G  ITU-T SG13 | ITU-R SG5 – Terrestrial Services | **FIRST** best paper award |
| S4.1 | A Deep Reinforcement Learning Approach for Data Migration in Multi-access Edge Computing  [[Presentation](https://www.itu.int/en/ITU-T/academia/kaleidoscope/2018/Documents/Presentations/S4.1_A%20Deep%20Reinforcement%20Learning_Bruneo.pdf)] | Fabrizio De Vita, Dario Bruneo and Antonio Puliafito (University of Messina, Italy); Giovanni Nardini, Antonio Virdis and Giovanni Stea (University of Pisa, Italy) | Multi-access edge computing; 5G; LTE; deep reinforcement learning; data migration; SimuLTE | Multi-access Edge Computing (MEC) - ETSI | ITU-T SG13  ITU-T FG-ML5G | ITU-R  LTE |  |
| S4.2 | Predicting Activities in Business Processes with LSTM Recurrent Neural Networks  [[Presentation](https://www.itu.int/en/ITU-T/academia/kaleidoscope/2018/Documents/Presentations/S4.2_Predicting%20Activities%20in%20Business_Roa.pdf)] | Edgar Tello-Leal (Autonomous University of Tamaulipas, Mexico); Jorge Roa​ (Universidad Tecnológica Nacional, Facultad Regional Santa Fe, Argentina); Mariano Rubiolo (Universidad Tecnológica Nacional, Facultad Regional Santa Fe & FICH/UNL-CONICET, Argentina); Ulises Ramírez-Alcocer (Autonomous University of Tamaulipas, Mexico) | LSTM;, event log; process mining; business process |  | ITU-T SG13  ITU-T SG20  ITU-T SG11  ITU-T FG-ML5G |  | Academia member (Universidad Tecnológica Nacional) |
| S5.1 | Smart Usage of Multiple RAT in IoT-oriented 5G Networks: A Reinforcement Learning Approach  [[Presentation](https://www.itu.int/en/ITU-T/academia/kaleidoscope/2018/Documents/Presentations/S5.1_Smart%20Usage%20of%20Multiple%20RAT_Sandoval.pdf)] | Ruben Martínez Sandoval​, Sebastian Canovas-Carrasco, Antonio-Javier Garcia-Sanchez and Joan Garcia-Haro (Technical University of Cartagena, Spain) | 5G; IoT; reinforcement learning; Multi-RAT; LPWAN; machine learning |  | ITU-T SG5 - Environment and circular economy  ITU-T SG20  ITU-T FG-ML5G | ITU-R (RATs) |  |
| S5.2 | Message Collision Identification Approach Using Machine Learning  [[Presentation](https://www.itu.int/en/ITU-T/academia/kaleidoscope/2018/Documents/Presentations/S5.2_Message%20Collision%20Identification_Marengo%26Prina.pdf)] | Juan Pablo Martín, Bruno Marengo, Juan Pablo Prina and Martín Gabriel Riolfo (Universidad Tecnológica Nacional, Facultad Regional San Nicolás, Argentina) | Automatic dependent surveillance-broadcast; support vector machine; k-Nearest neighbours | Automatic Dependent surveillance-Broadcast (ADS-B)  ITU-R WP5B, “Reception of automatic dependent surveillance broadcast via satellite and compatibility studies with incumbent systems in the frequency band 1 087.7-1 092.3 MHz,” ITU-R Report M.2413-0 – ITU-R SG5 |  | ITU-R  World Radiocommunication Conference (WRC)​​ | Academia member |
| S5.3 | Optical Flow Based Learning Approach for Abnormal Crowd Activity Detection with Motion Descriptor Map  [[Presentation](https://www.itu.int/en/ITU-T/academia/kaleidoscope/2018/Documents/Presentations/S5.3_Optical%20Flow%20Based%20Learning_Kumar.pdf)] | Dhananjay Kumar and Govinda Raj Sampath Sarala (Anna University, India) | Optical flow; Euclidean distance; K-means; angle of deviation | Standard datasets, UMN and UCSD  ITU-T Rec. F.743.1 "Requirements for intelligent visual surveillance" – SG 16  ITU-T Rec. X.1157 "Technical capabilities of fraud detection and response for services with high assurance level requirements" – SG 17 | ITU-T SG16  ITU-T SG17 -Security |  |  |
| S6.1 | A Gendered Perspective on Artificial Intelligence  [[Presentation](https://www.itu.int/en/ITU-T/academia/kaleidoscope/2018/Documents/Presentations/S6.1_A%20Gendered%20Perspective%20on%20AI_Parsheera.pdf)] | Smriti Parsheera (National Institute of Public Finance and Policy, New Delhi, India) | Artificial intelligence; gender; ethics; fairness | Proposal for ethical standards | ITU Task Force on Gender Issues  AI for Good Global Summit |  | **SECOND** best paper award |
| S6.2 | Ethical Framework for Machine Learning  [[Presentation](https://www.itu.int/en/ITU-T/academia/kaleidoscope/2018/Documents/Presentations/S6.2_Ethical%20Framework%20for%20machine_Malhotra.pdf)] | Charru Malhotra (Indian Institute of Public Administration, India); Vinod Kotwal (Department of Telecommunications, India); Surabhi Dalal (India Centre for Migration, India) | Ethics; artificial intelligence/machine learning; design approach, spiritual quotient, emotional quotient | Proposal for ethical intelligence algorithms in ML | AI for Good Global Summit |  | **THIRD** best paper award |
| S6.3 | Undeclared Constructions: A Government's Support Deep Learning Solution for Automatic Change Detection  [[Presentation](https://www.itu.int/en/ITU-T/academia/kaleidoscope/2018/Documents/Presentations/S6.3_Undeclared%20construction%20A%20government_Lezaun%26Olivieri.pdf)] | Pamela Ferrari Lezaun and Gustavo Olivieri (Universidad Tecnológica Nacional, Facultad Regional Santa Fe, Argentina) | Building detection; undeclared constructions; illegal construction; machine learning; computer vision |  | ITU-T FG-ML5G |  | Academia member |

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