|  |  |  |
| --- | --- | --- |
| ITU logo | INTERNATIONAL TELECOMMUNICATION UNION**TELECOMMUNICATIONSTANDARDIZATION SECTOR**STUDY PERIOD 2017-2020 | **TSAG-TD622** |
| **TSAG** |
| **Original: English** |
| **Question(s):** | N/A | Geneva, 23-27 September 2019 |
| **TD** |
| **Source:** | TSB |
| **Title:** | ITU-T SG and FG work on AI/ML |
| **Purpose:** | Information |
| **Contact:** | Bilel JamoussiITU-T Study Group Department | Tel: +41 22 730 6311E-mail: Bilel.Jamoussi@itu.int |

|  |  |
| --- | --- |
| **Keywords:** | Artificial Intelligence; AI; Machine Learning; ML; Data; |
| **Abstract:** | This TD is to inform TSAG of the work underway in the various ITU-T Study Groups and Focus Groups on Artificial Intelligence and Machine Learning. |

|  |
| --- |
| **AI work in ITU-T, status 23 September 2019** |
| **Group** | **AI Work**  | **Comments** |
| SG2 | SG2 is developing [draft recommendation ITU-T M.somm “Framework of smart operation](https://www.itu.int/itu-t/workprog/wp_item.aspx?isn=14196), management and maintenance” and intelligence is one of the five characteristics of the new framework.  |  |
| SG3 | ITU-T SG3 created new work items in continuation to align technical innovation and policy development. These work items include a Technical Report on the “Future of Regulation for Digital Transformation” and a Technical Paper on “IMT2020-related Policy considering MVNOs”. SG3 has also began working on a proposed new ITU-T Recommendation on “Roaming aspects of IoT and M2M including any related development and tariff principles. |  |
| SG5 | ITU-T SG5 is currently working on the following work item:* [Draft ITU-T L.AI-Env\_effects "AI environmental effect on Networks goods and services"](https://www.itu.int/itu-t/workprog/wp_item.aspx?isn=14879)
* [Draft Recommendation ITU-T L.DCIM "Specifications of data centre infrastructure management (DCIM) system based on Big Data and AI technology"](https://www.itu.int/itu-t/workprog/wp_item.aspx?isn=14873) was consented on 20 September 2019.

A new Focus Group on "Environmental Efficiency for Artificial Intelligence and other Emerging Technologies" was created by SG5 in May 2019 and will hold its first meeting in December 2019 in Vienna, Austria.  |  |
| SG9 | SG9 has reached (2019-06-13) the status of “Consent” for a new draft Recommendation (ITU-T J.1600) *“Premium Cable network platform (PCNP*) *– Framework*”, which features an embedded intelligent analyzer and controller for enabling advanced multimedia services to exploit the cloud based artificial intelligence and network data to optimize the network and TV services. This will enhance cable TV user’s experience and satisfaction. SG9 also plans to establish a new dedicated Question to perform AI related studies *“Usages of intelligence functions for video transmission over integrated broadband networks”*. The current draft ToR for the new Question, which plans to be included in SG9 structure in the next Study Period, is found in [SG9 SharePoint](https://extranet.itu.int/meetings/ITU-T/T17-SG09RGM/17486-190904/DOCs/T17-SG09RGM-17486-190904-DOC-0012.docx)  |  |
| SG11 | One of the presentations given at the [SG11 Workshop](https://www.itu.int/en/ITU-T/Workshops-and-Seminars/201711/Pages/default.aspxhttps%3A/www.itu.int/en/ITU-T/Workshops-and-Seminars/201711/Pages/default.aspx) “Control plane of IMT-2020 and emerging networks. Current issues and the way forward” (November 2017) was about [SDN/NFV Network AI Assurance In Practice](https://www.itu.int/en/ITU-T/Workshops-and-Seminars/201711/Documents/3.S2_Rui.pdf). The [outcomes](https://www.itu.int/en/ITU-T/Workshops-and-Seminars/201711/Documents/Outcomes_Workshop_final.pdf) of this event highlights AI as one of the future research activities of SG11 on control plane.Following this workshop, SG11 developed and finally approved Recommendation ITU-T [Q.5001](https://www.itu.int/itu-t/recommendations/rec.aspx?rec=13701) “Signalling requirements and architecture of intelligent edge computing” (October 2018) which specifies signalling requirements and architecture of intelligent edge computing to provide intelligence to the edge network for efficient data processing within the network.Currently, SG11 is developing new ITU-T Recommendation Q.IEC-PRO “Protocols for microservices based intelligent edge computing” which specifies signalling architecture, protocol interfaces, protocol procedures and message format for microservices based intelligent edge computing. |  |
| SG12 | Machine learning has become a widely used tool in the context of developing speech, audio and video quality models. During the development of Recommendation ITU-T P.1203 and its extensions in SG12, machine learning – for example in form of Random Forest models – was used for selecting relevant features, feature pooling and as component of an audiovisual quality integration module (Recommendation ITU-T P.1203.3).SG12 is currently developing a technical report ([TR-ML](https://www.itu.int/itu-t/workprog/wp_item.aspx?isn=14675)) and a supplement ([Suppl.ML](https://www.itu.int/itu-t/workprog/wp_item.aspx?isn=14956)) on considerations on the use of algorithms based on machine learning and artificial intelligence for QoS and QoE purposes. AI and machine learning play an important role in predicting speech quality. Question 15/12 (Parametric and E-model-based planning, prediction and monitoring of conversational speech quality) is currently considering a voice service quality monitoring and troubleshooting framework for intrusive parametric voice QoE prediction ([P.VSQMTF](https://www.itu.int/itu-t/workprog/wp_item.aspx?isn=14353)).The work of [Question 16/12 (Framework for diagnostic functions)](https://www.itu.int/en/ITU-T/studygroups/2017-2020/12/Pages/q16.aspx) relies on machine learning techniques for network anomaly detection and root cause analysis (e.g., work item [E.FINAD](https://www.itu.int/ITU-T/workprog/wp_item.aspx?isn=14037): Framework for intelligent network analytics and diagnostics). E.FINAD was among the topics discussed in a session on “How do big data and artificial intelligence help in QoE assurance?” at the [ITU Workshop on Telecommunication Service Quality Regulatory Frameworks and Experience-Driven Networking, Geneva, 26 November 2018](https://www.itu.int/en/ITU-T/Workshops-and-Seminars/qos/201811/Pages/Programme.aspx). |  |
| SG13 | Tutorials* On AI, 6 November 2018, 3 presentations;
* WSIS Forum side event, AI talk by FG ML5G chair, 19 March 2018

No further plans for WSs or tutorials.Question 17/13 has AI in its description since November 2016 (*Developing Recommendations for emerging cloud and big data technology overview, requirements aspects such as distributed cloud, and cloud/big data to support artificial intelligence including machine learning*). |  |

| **Work item** | **Question** | **Equiv. Num.** | **Status** | **Timing** | **Approval process** | **Version** | **Liaison relationship** | **Subject / Title** | **Priority** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| [Suppl on Y. Sup.aisr](http://www.itu.int/itu-t/workprog/wp_item.aspx?isn=15184) | Q17/13 |   | Under study | 2020-Q4 | AAP | New | SG16, SG17, SG20, JTC 1/SC 42 | Artificial Intelligence Standard Roadmap  | Medium |
| [Y.MLN-Fr](http://www.itu.int/itu-t/workprog/wp_item.aspx?isn=15014) | Q7/13 |   | Under study | 2021-12 | AAP | New | - | Framework for man-like networking | Medium |
| [Y.qos-ml-arc](http://www.itu.int/itu-t/workprog/wp_item.aspx?isn=15013) | Q6/13 |   | Under study | 2020-03 | AAP | New | - | Architecture of machine learning based QoS assurance for the IMT-2020 network | High |
| [Y.bDDN-MLMec](http://www.itu.int/itu-t/workprog/wp_item.aspx?isn=15183) | Q7/13 |   | Under study | 2021-10 | AAP | New | - | Mechanisms of machine learning for big data driven networking | Medium |
| [Y.MecTA-ML](http://www.itu.int/itu-t/workprog/wp_item.aspx?isn=14619) | Q7/13 |   | Under study | 2020-07 | AAP | New | - | Mechanism of traffic awareness for application-descriptor-agnostic traffic based on machine learning  | Medium |
| [Y.MLaaS-reqts](http://www.itu.int/itu-t/workprog/wp_item.aspx?isn=14484) | Q17/13 |   | Under study | 2020-Q4 | Agreement | New | ITU-T SG16, SG17, SG20, JTC 1 SC 42, ETSI, IEEE | Cloud computing - Functional requirements for machine learning as a service | Medium |
| [Y.3172 (ex Y.IMT2020-ML-Arch)](http://www.itu.int/itu-t/workprog/wp_item.aspx?isn=15020) | Q20/13 |   | Approved 2019-06-22 | 2019-03 | AAP | New | - | Architectural framework for machine learning in future networks including IMT-2020 | High |
| [Y.ML-IMT2020-Data-Handling](http://www.itu.int/itu-t/workprog/wp_item.aspx?isn=15177) | Q20/13 |   | Under study | 2019-Q4 | - | New | ITU-T SG 11 | Framework of data handling to enable machine learning in future networks including IMT 2020 | Medium |
| [Y.Suppl to Y.317X series (ex Y.ML-IMT2020-Use-Cases)](http://www.itu.int/itu-t/workprog/wp_item.aspx?isn=15175) | Q20/13 |   | Under study | 2019-Q4 | - | New | ITU-T SG11 | Machine learning in future networks including IMT-2020: use cases | High |

|  |  |  |
| --- | --- | --- |
| SG15 | None |  |
| SG16 | New Question 5/16 (under review)Artificial intelligence-enabled multimedia applications – ToR: <http://itu.int/en/ITU-T/studygroups/2017-2020/16/Pages/q5.aspx>; Click [here](https://www.itu.int/ITU-T/workprog/wp_search.aspx?isn_sp=3925&isn_sg=3934&isn_qu=7955&isn_status=-1,1,3,7,2&details=0&field=acdefghijo) for work programme updates.. |  |
| Focus Group on AI for healthThe focus group The ITU-T Focus Group on Artificial Intelligence for Health (AI4H) was established by ITU-T Study Group 16 at its meeting in Ljubljana, Slovenia, 9-20 July 2018. In partnership with the World Health Organization (WHO), the Focus Group is working to establish a standardized assessment framework for the evaluation of AI-based methods for health, diagnosis, triage or treatment decisions. The home page is: <https://itu.int/go/fgai4h>.Within the FG-AI4H a range of topics are being worked on: * [Cardiovascular disease risk prediction](https://www.itu.int/en/ITU-T/focusgroups/ai4h/Pages/cardio.aspx)
* [Diagnoses of bacterial infection and anti-microbial resistance (AMR)](https://www.itu.int/en/ITU-T/focusgroups/ai4h/Pages/bacteria.aspx)
* [Dermatology](https://www.itu.int/en/ITU-T/focusgroups/ai4h/Pages/derma.aspx)
* [Falls among the elderly](https://www.itu.int/en/ITU-T/focusgroups/ai4h/Pages/falls.aspx)
* [Histopathology](https://www.itu.int/en/ITU-T/focusgroups/ai4h/Pages/histo.aspx)
* [Malaria detection](https://www.itu.int/en/ITU-T/focusgroups/ai4h/Pages/malaria.aspx)
* [Neuro-cognitive diseases](https://www.itu.int/en/ITU-T/focusgroups/ai4h/Pages/cogni.aspx)
* [Outbreak detection](https://www.itu.int/en/ITU-T/focusgroups/ai4h/Pages/outbreaks.aspx)
* [Ophthalmology](https://www.itu.int/en/ITU-T/focusgroups/ai4h/Pages/ophthalmo.aspx)
* [Psychiatry](https://www.itu.int/en/ITU-T/focusgroups/ai4h/Pages/psy.aspx)
* [Radiotherapy](https://www.itu.int/en/ITU-T/focusgroups/ai4h/Pages/radiotherapy.aspx)
* [Snakebite and snake identification](https://www.itu.int/en/ITU-T/focusgroups/ai4h/Pages/snake.aspx)
* [Symptom assessment](https://www.itu.int/en/ITU-T/focusgroups/ai4h/Pages/symptom.aspx)
* [Tuberculosis](https://www.itu.int/en/ITU-T/focusgroups/ai4h/Pages/TB.aspx)
* [Volumetric chest computed tomography](https://www.itu.int/en/ITU-T/focusgroups/ai4h/Pages/diagnosticct.aspx)

An [article](https://www.sciencedirect.com/science/article/pii/S0140673619307627) on the FG-AI4H was published in the Lancet in July 2019. Workshops on artificial intelligence for health organized / planned by the FG:* Geneva, Switzerland, 25 September 2018 – <https://itu.int/en/ITU-T/Workshops-and-Seminars/20180925>
* New York, USA, 14 November 2018 – <https://itu.int/en/ITU-T/Workshops-and-Seminars/20181114>
* Lausanne, Switzerland, 22 January 2018 – <https://itu.int/en/ITU-T/Workshops-and-Seminars/20190122>
* Shanghai, China, 2 April 2019 – <https://www.itu.int/en/ITU-T/Workshops-and-Seminars/ai4h/20190402>
* Geneva, Switzerland, 29 May 2019 (collocated with AI for Global Good Summit) – <https://www.itu.int/en/ITU-T/Workshops-and-Seminars/ai4h/20190529>
* Zanzibar, Tanzania, 2 September 2019 – [https://www.itu.int/en/ITU-T/Workshops-and-Seminars/ai4h/201909](https://www.itu.int/en/ITU-T/Workshops-and-Seminars/ai4h/201909/Pages/default.aspx)
* New Delhi, India, 11-12 November 2019 – https://www.itu.int/en/ITU-T/Workshops-and-Seminars/ai4h/201911/
 |
|  | AI-related topics in SG16 |
| **Work item** | **Question** | **Status** | **Approval process** | **Subject / Title** |
| [F.743.1 (ex H.IVSReqs)](http://www.itu.int/itu-t/workprog/wp_item.aspx?isn=9275) | Q21/16 | Approved 2015-04-29 | AAP | Requirements for intelligent visual surveillance |
| [F.745 Amd.1](http://www.itu.int/itu-t/workprog/wp_item.aspx?isn=14495) | Q21/16 | 2019 | AAP | Functional requirements for network-based speech-to-speech translation services: Support of automatic sign language generation |
| [F.746.3 (ex H.IQAS)](http://www.itu.int/itu-t/workprog/wp_item.aspx?isn=9942) | Q21/16 | Approved 2015-11-29 | AAP | Intelligent question answering service framework |
| [F.746.5 (ex H.LLS-FW)](http://www.itu.int/itu-t/workprog/wp_item.aspx?isn=13302) | Q21/16 | Approved 2017-12-14 | AAP | Framework for language learning system based on speech/NLP technology |
| [F.746.7 (ex F.IQAS-META)](http://www.itu.int/itu-t/workprog/wp_item.aspx?isn=14066) | Q21/16 | Approved 2018-08-29 | AAP | Metadata for intelligent question answering service |
| [F.AI-MLTF](http://www.itu.int/itu-t/workprog/wp_item.aspx?isn=15262) | Q5/16 | 2020 | AAP | Technical framework for shared machine learning system |
| [F.CUAV](http://www.itu.int/itu-t/workprog/wp_item.aspx?isn=14072) | Q21/16 | 2019 | AAP | Requirements for civilian unmanned aerial vehicle communication services |
| [F.IQAS-INT](http://www.itu.int/itu-t/workprog/wp_item.aspx?isn=15015) | Q21/16 | 2020 | AAP | Interfaces for intelligent question answering system |
| [F.VS-AIMC](http://www.itu.int/itu-t/workprog/wp_item.aspx?isn=14767) | Q27/16 | 2020 | AAP | Use cases and requirements for multimedia communication enabled vehicle systems using artificial intelligence |
| [F.VSBD](http://www.itu.int/itu-t/workprog/wp_item.aspx?isn=14073) | Q21/16 | 2019 | AAP | Requirements for big data application in visual surveillance system |
| [F.WSA](http://www.itu.int/itu-t/workprog/wp_item.aspx?isn=13315) | Q21/16 | 2018 | AAP | Scenario and Requirements for web objects based smart ageing service in virtual home network |
| [H.625](http://www.itu.int/itu-t/workprog/wp_item.aspx?isn=13290) | Q21/16 | Approved 2017-03-01 | AAP | Architecture for network-based speech-to-speech translation services |
| [H.626.5 (ex H.IVS-Arch)](http://www.itu.int/itu-t/workprog/wp_item.aspx?isn=13292) | Q21/16 | Approved 2019-05-14 | AAP | Architecture for intelligent visual surveillance systems |
| [H.CUAV-AIF](http://www.itu.int/itu-t/workprog/wp_item.aspx?isn=14760) | Q21/16 | 2020 | AAP | Framework and requirements for civilian unmanned aerial vehicle flight control using artificial intelligence |
| [H.FRAVSReqs](http://www.itu.int/itu-t/workprog/wp_item.aspx?isn=14434) | Q21/16 | 2019 | AAP | Requirements for Face Recognition Application in Visual Surveillance System |
| [H.ICR](http://www.itu.int/itu-t/workprog/wp_item.aspx?isn=14350) | Q21/16 | 2019 | AAP | Requirements and architecture for in-door conversational robot system |
| [H.IVS-Arch](http://www.itu.int/itu-t/workprog/wp_item.aspx?isn=13292) | Q21/16 | 2017 | AAP | Architecture of intelligent visual surveillance systems |
| [H.IVS-Arch](http://www.itu.int/itu-t/workprog/wp_item.aspx?isn=13292) | Q21/16 | 2017 | AAP | Architecture of intelligent visual surveillance systems |
| [HSTP-DIS-UAV](http://www.itu.int/itu-t/workprog/wp_item.aspx?isn=13303) | Q21/16 | 2018 | Agreement | Use cases and service scenarios of disaster information service using unmanned aerial vehicles |
| SG17 | SG17 is organizing a workshop on AI/ML and security on 21 Jan 2019 prior to next SG17 meeting, see <https://www.itu.int/en/ITU-T/Workshops-and-Seminars/20190121/Pages/default.aspx>. Q2/17 Question text was updated (pending TSAG endorsement, TSAG-[TD511](https://www.itu.int/md/T17-TSAG-190923-TD-GEN-0511/en)) to include study of ‘foundations of artificial intelligence (AI) / machine learning (ML) in supporting the building of confidence and security in the use of ICT’.Q5/17 established a new work item TR.cs-ml “Technical Report: Countering spam based on machine learning” in SG17 Sept 2019 meeting. |
| SG20 | SG20 is currently working on AI and machine learning issues especially in Q3/20, Q4/20 and Q5/20. For example the following work items are being developed: * [Draft ITU-T Y.SSC-AISE-arc "Reference architecture of artificial intelligence service exposure for smart sustainable cities"](https://www.itu.int/ITU-T/workprog/wp_item.aspx?isn=14503)
* [Draft Technical Report – TR.AI4IoT "Unlocking Internet of things with artificial intelligence: Where we are and where we could be"](https://www.itu.int/ITU-T/workprog/wp_item.aspx?isn=14103)

SG20 collaborates closely with oneM2M and address issues including on IoT and machine learning matters. Information on the work carried out in other SDOs and fora, *inter alia,* on AI and machine learning is being shared in the [Joint Coordination Activity on Internet of Things and Smart Cities and Communities (JCA-IoT and SC&C)](https://www.itu.int/en/ITU-T/jca/iot/Pages/default.aspx). The next meeting will take place December 2019, Geneva, Switzerland. |
| FG DPM | None |
| FG DFC | None |
| FG 5GML | <https://www.itu.int/en/ITU-T/focusgroups/ml5g/Pages/default.aspx> The Focus Group will draft technical reports and specifications for machine learning (ML) for future networks including 5G, with focus on network architectures, interfaces, protocols and data formats.Previous meetings: <https://www.itu.int/en/ITU-T/focusgroups/ml5g/Pages/past.aspx> :1st meeting: Geneva, 30 January - 2 February 2018**2nd** meeting: Xi'an, China 24, 26 - 27 April 20183rd meeting: San Jose, USA 8-10 August 2018 , hosted by Intel4th meeting: Tokyo, 27-29 November 20185th meeting: Shenzhen, China, 5, 7-8 March 20196th meeting: Geneva, Switzerland 18-20 June 2019 Upcoming meeting:7th meeting: Berlin, Germany, ​ 6-8 November 201Workshops:* [Workshop on Machine Learning for 5G and beyond](https://www.itu.int/en/ITU-T/Workshops-and-Seminars/20180129/Pages/default.aspx), 29 January 2018
* [Workshop on Impact of AI on ICT Infrastructures, 25 April 2018](https://www.itu.int/en/ITU-T/Workshops-and-Seminars/20180425/Pages/default.aspx)
* [Workshop on Machine Learning in 5G and beyond](https://www.itu.int/en/ITU-T/Workshops-and-Seminars/20180807/Pages/default.aspx), 7 August 2018 (hosted by Intel)
* [Seminar on "Business innovation and value creation utilizing IoT/AI"](https://www.itu.int/en/ITU-T/focusgroups/ml5g/Documents/Seminar_program_26Nov2018.pdf), 26 November 2018
* [Workshop on Towards a New Era - AL in 5G](https://www.itu.int/en/ITU-T/Workshops-and-Seminars/201903/Pages/default.aspx), 6 March 2019
* [Workshop on Machine Learning for 5G and beyond​](https://www.itu.int/en/ITU-T/Workshops-and-Seminars/20190617/Pages/default.aspx), 17 June 2019 ​​​​
* [Workshop "Machine Learning for 5G".](https://www.itu.int/en/ITU-T/Workshops-and-Seminars/201911/Pages/default.aspx) Berlin, Germany, 5 November 2019
 |
| U4SSC  | U4SSC is developing a series of reports on:* "The Impact of Frontier Technologies in Cities (with a special focus on AI and ML in cities)"
* The impact of Sensing technologies and IoT in Cities
* The impact of Artificial Intelligence and Cognitive Computing in Cities
* The impact of Data Processing and Computation in Cities
 |
| FIGI SIT WG | FIGI Security, Infrastructure and Trust WG (SIT WG) is developing a report on the Data Privacy and risks for consumer protection due to emerging technologies such as big data and machine learning. |
| ITU | AI for Good event (-2017, -2018, -2019); upcoming Summit: 4-8 May 2020 |

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_