WSIS Forum 2018 OUTCOME DOCUMENT

Template for Submission of Executive Summaries for

Thematic Workshop

Deadline: Thursday 22 March, 2018

Exception: For sessions on Friday 23 March, please send at the latest 2 hours after the session

Please note that the WSIS Forum 2018 Outcome Document will be released on the ***23rd of March***

(the last day of the Forum)

1) **Title of your session**
   Machine Learning for 5G
2) **Name of Organization/s organizing the session**
   International Telecommunication Union (ITU)
3) **Relevance with the WSIS Action Lines – please specify the Action lines C1 to C11**
   C6 - Enabling environment: Machine learning, 5G/IMT-2020 networks, future networks, wireless networks and communication environment.
4) **Key achievements, announcements, launches, agreements, and commitments (these will be reflected in the press release and Outcomes Document of the WSIS Forum 2018)**
   None.
5) **Main outcomes highlighting the following:**
   I. **Debated Issues**

   Prof. Dr. Slawomir STANCZAK, Fraunhofer-Institut für Nachrichtentechnik Heinrich-Hertz-Institut, gave a remote presentation on machine learning for the 5th generation mobile networks (5G).

   The tactile Internet where machines are connected into control loops with humanoid reaction times in the sub-millisecond order is anticipated as a revolutionary leap after the mobile Internet and the Internet of things. The tactile Internet brings many advantages through a paradigm shift from transmitting information for humans to networked control systems; example applications are industrial manufacturing, networked autonomous car driving, collaborative driving, networked virtual reality, augmented virtual reality, or serious gaming. Yet, a number of technical challenges such as performance and efficiency needs to be overcome to make the tactile Internet happen.

   The 5th generation mobile network (5G) is planned to outperform 4G networks with respect to ultra-reliable and low latency mobile communications, for massive machine type communications, and by providing enhanced mobile broadband. 5G networks require more than a 1000-fold increase in throughput as compared to 4G networks. This massive leap can be realized by 5G architectures compared to 4G networks through a higher spectral efficiency and

massive MIMO technology antennas, much smaller cells, and 10 times wider bandwidth in millimeter part of spectrum . Those new requirements demand new approaches addressing reliability, handling system complexity, and performance, and the ability to handle many inherent unknowns.
Machine learning methods are not only widely used in traditional communications for optimization, identification, adaptation and prediction, but are used in many other applications too. Machine learning helps to cope with the massively increased complexity of systems, enhances efficiency and robustness, enables self-organizing networks, and provides robust predictions. An example for machine learning in wireless communications is the prediction of trajectories, or the estimation of load and of capacity maps for cellular hand-off among antennas. Machines are able to learn from past collected data, and using some other context information, are able to adapt their models for forecasting. Simulation of such learning algorithms yielded already very promising predictions of good quality. For example, machine learning can optimize the wireless infrastructure for energy-saving when deactivating unused systems according to the predicted traffic forecast. Still, a number of engineering and technical challenges need to be overcome to make machine learning more robust, versatile, and efficient.

In conclusion, machine learning has great potential for applicability in mobile and wireless communication.

The ITU-T Focus Group on Machine Learning for Future Networks including 5G (ITU-T FG-ML5G), which is open to the public, is addressing standardization gaps in that domain, and works on specifications for machine learning (ML) for future networks, including interfaces, network architectures, protocols, algorithms and data formats. ITU-T FG ML5G next meeting is in Xi'an, China, 24, 26-27 April 2018 with the workshop on 25th.

Quotes

- Please provide two important quotes from the session and the names & organization of the person you are quoting
  - The tactile Internet is anticipated as a revolutionary leap after the mobile Internet and the Internet of things. (Prof. Slawomir, FH-HHI)
  - Machine learning has great potential for applicability in mobile and wireless communication. (Prof. Slawomir, FH-HHI)
  - AI/ML will help to decrease the mismatch between theory and reality.

II. Overall outcomes of the session highlighting

Machine learning has great potential for applicability in mobile and wireless communication. It contributes to removal of uncertainness's.

III. Main linkages with the Sustainable Development Goals

Goal 9: Build resilient infrastructure, promote sustainable industrialization and foster innovation: Self-optimization of future 5G network infrastructure using machine learning techniques.

IV. Emerging Trends related to WSIS Action Lines identified during the meeting

Artificial Intelligence, Machine Learning, Tactile Internet.

V. Suggestions for Thematic Aspects that might be included in the WSIS Forum 2019

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