**COURSE PROGRAM FOR EACO/ITU WORKSHOP IN ZANZIBAR, DECEMBER 2018**

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| Time | **December 10** | **December 11** | **December 12** | **December 13** |
| 08.30-09.00 | **Opening Session** |  |  |  |
| 09.00-10.30 | **Session 1**  Introduction to IoT (SK) | **Session 4**  Introduction to AI (FA) | **Session 7**  Security in IoT (SK) | **Session 11**  Business models in IoT and AI (SK/FA) |
| **10.30-11.00** | **Morning Health Break** | **Morning Health Break** | **Morning Health Break** | **Morning Health Break** |
| 11.00-12.30 | **Session 2**  - Examples of IoT applications (SK)  - Intro to IoT Regulation (SK) | **Session 5**  - Applications of AI (FA)  - What is Machine Learning (FA) | **Session 8**  Overview of LPWAN technologies (SK) | **Session 12**  [Working group exercise]  Discussion and way forward. |
| **12.30-14.00** | **Lunch Break** | **Lunch Break** | **Lunch Break** | **Lunch Break** |
| 14.00-15.30 | **Session 3**  [Working group exercise]  - develop understanding of IoT through working group exercise | **Session 6**  [Working group exercise]  - What are the ethical implications of AI?  - Understanding through case studies. | **Session 9**  Open Issues in AI applications (FA) | **Session 13**  Radio Regulations (Cont’d): Capture, Validation and Submission of Earth Stations |
| **15.30-15.45** | **Aft’noon Health Break** | **Aft’noon Health Break** | **Aft’noon Health Break** | **Afternoon Health Break** |
| 15.45-16.30 | [Working group exercise]  Presentation of exercise results | [Working group exercise]  Presentation of exercise results | **Session 10**  Machine Learning in Action (FA) | **Closing ceremony** |

SK: Srdjan Krco

FA: Franck Albinet

**EXPANDED SESSIONS CONTENT**

**Preliminary note:**

The course material is developed in order to present a broad overview of the domains covered, state-of-the-art techniques, implementations, challenges and opportunities. Special focus will be given to special needs and expectations of participants through various working group sessions. Course content is not meant to be delivered in a top-down approach but instead will be delivered in order to make interaction as frequent and fluid as possible through the exposition of thought-provoking themes.

**Session 1 and Session 2: Introduction to IoT**

* IoT concepts and architecture
* Overview of IoT applications and their benefits
* Edge computing: sensors, gateways
* IoT platforms: cloud, features, benefits
* IoT challenges and societal aspects
* IoT regulatory framework: GDPR, data ownership, radio spectrum

**Session 3: Building an IoT solution exercise**

* Describe an IoT scenario and its requirements
* Identify the main technological components
* Design solution architecture
* Analyse costs and benefits

**Session 4 : Introduction to AI**

* What is AI? Difference with Data Science, Machine learning, Deep learning, …
* Relation to decision making in the context of the datafication of the world
* Prediction as a core component, elementary brick
* Affects all sectors of Society & economy
* Organize knowledge & meaning (chain value from data to decision making)
* AI is by essence multi-faceted, is multidisciplinary, has evolving boundary
* Is not anymore only a research field
* Great variety of approaches and not really new. The several AI winters
* Its visionary nature leads to far-fetched fantasy, hype, …
* Need to manage/balance expectations
* Has achieved significant successes: what are key enablers? Key role played by IoT
* Should be considered from ethical, societal, technical, business, … perspectives
* A quick overview of Public policies on AI
* Outline of forthcoming sessions

**Session 5: Applications of AI & What is Machine Learning?**

* AI applications can be categorized by technology type, activity sectors but many are trans-sectoral
* Examples of Speech recognition, Image recognition, Object detection, NLP applications
* Examples of applications in Health, Agriculture, Environment, Industry, Finance, …
* Examples of trans-sectoral applications: Energy, …
* Different type of data for different applications
* When applications are beyond human-level performance
* Different classes of Machine Learning techniques: Supervised, Unsupervised, Semi-supervised and Reinforcement learning
* Machine Learning practitioner vs. Statistician mindset
* From simplistic linear models (2 parameters) to Deep Neural Networks (hundreds of millions of parameters)
* Exemplify (gamification) what is a model through online educational tools <http://playground.tensorflow.org>, small grid world, …

**Session 6**

* Quick overview of AI ethics
* AI-led progress drives public debates: Need to rally society at large
* Not necessary related to Human existence threat and Artificial General Intelligence or singularity but rather to already existing algorithms
* AI should comply with value and social norms of our societies
* Issues of lack of transparency (black-box)
* Algorithms sometimes reflect Human bias (or even discrimination mindset), for instance confirmation bias
* Need for explainable-AI (DARPA initiative, ...)
* Sensitive areas: Courts, Defence (autonomous weapons), Insurance, …
* Should not exacerbate inequalities
* Some recommendations from drafted public policies, …
* Introduction to the case studies and working group sessions

**Session 7: Security in IoT**

* Overview of security challenges in IoT
* Securing edge devices
* Securing data transmission
* How to protect from IoT security threats and the role of government

**Session 8: Overview of LPWAN technologies**

* LPWAN landscape: who’s who
* LoRa WAN overview
* NB-IoT overview
* Discussion about real deployments challenges

**Session 9: Open issues in AI**

* Balancing expectations, hype of AI with reality and state-of-the-art
* A constant catch-up game with extremely active research (disruption taking place almost daily)
* Technological transfer challenges to industry
* Required computing, human, data resources
* Labelled vs. Unlabelled data (a challenge and opportunity)
* Technical challenges and trends (Reinforcement Learning, Generative Adversarial Networks, …): decision making in long horizons environments, …
* Rewards and sparsity in Reinforcement learning. The side effects of designed objectives, definition of successes, …
* Summary of Ethics of AI and approaches (open discussion)

**Session 10: Machine Learning in action**

* Air quality prediction
* Movement detection
* Reinforcement Learning

**Session 11: Business models in IoT**

* IoT ecosystem roles
* Business models and value flow
* Selling IoT solution principles
* Decomposing workflows and defining requirements
* Predictions as elementary brick
* ROI analysis based on:
  + Prediction goals and accuracy
  + Data required
  + Computing resources
  + Human resources
  + Architecture
* Several examples
* To be further discussed with (SK)

**Session 12**

**Session 13**