



Dipartimento di Informatica
Università di Pisa

Combining IoT and Intelligent Robotics Challenges and Opportunities

IOT WEEK 2017

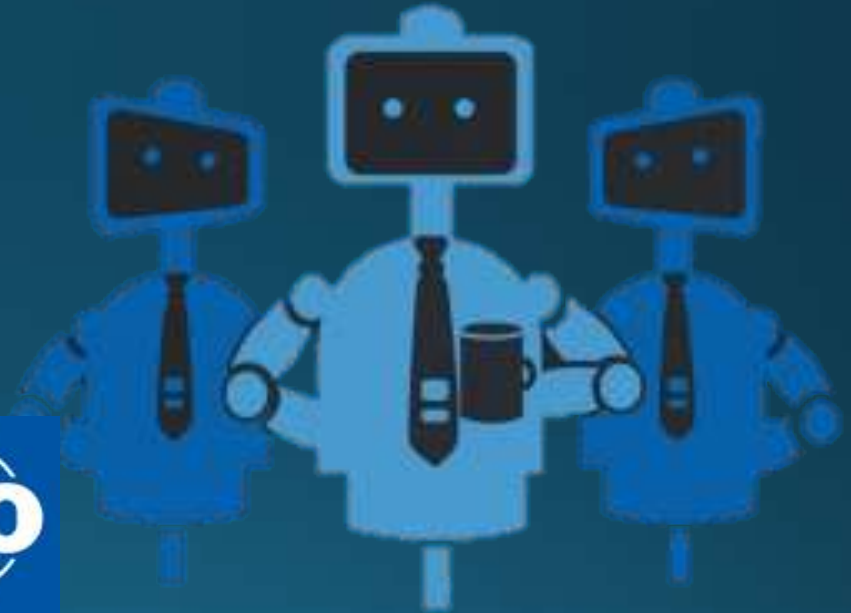


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Machine Learning and Distributed Intelligence

Question 1 – Added Value

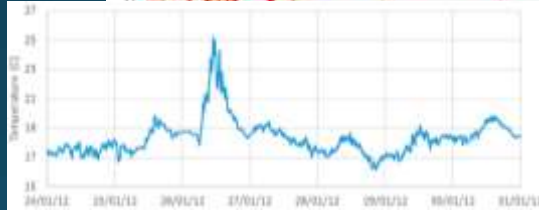
What is the added value of integrating IoT and Robotics?



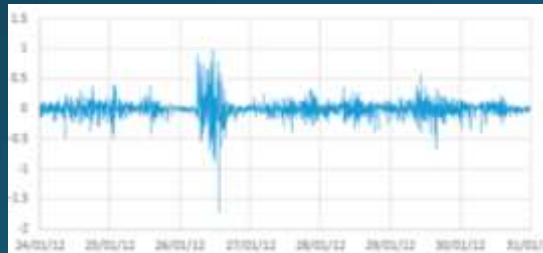
“The nice thing about standards is that you have so many to choose from” (A.T.)

Question 2 - Enablers

What AI and cognition enabler have you used in your experience?



...



Neural models that can handle sequences



Redundancy

Noise

Complexity

Sequences of heterogenous (sensor) data

Question 3 - Platforms

What platforms you consider mature for your needs?



Cloud-based

Edge Analytics



Standard ML models



Services at development time

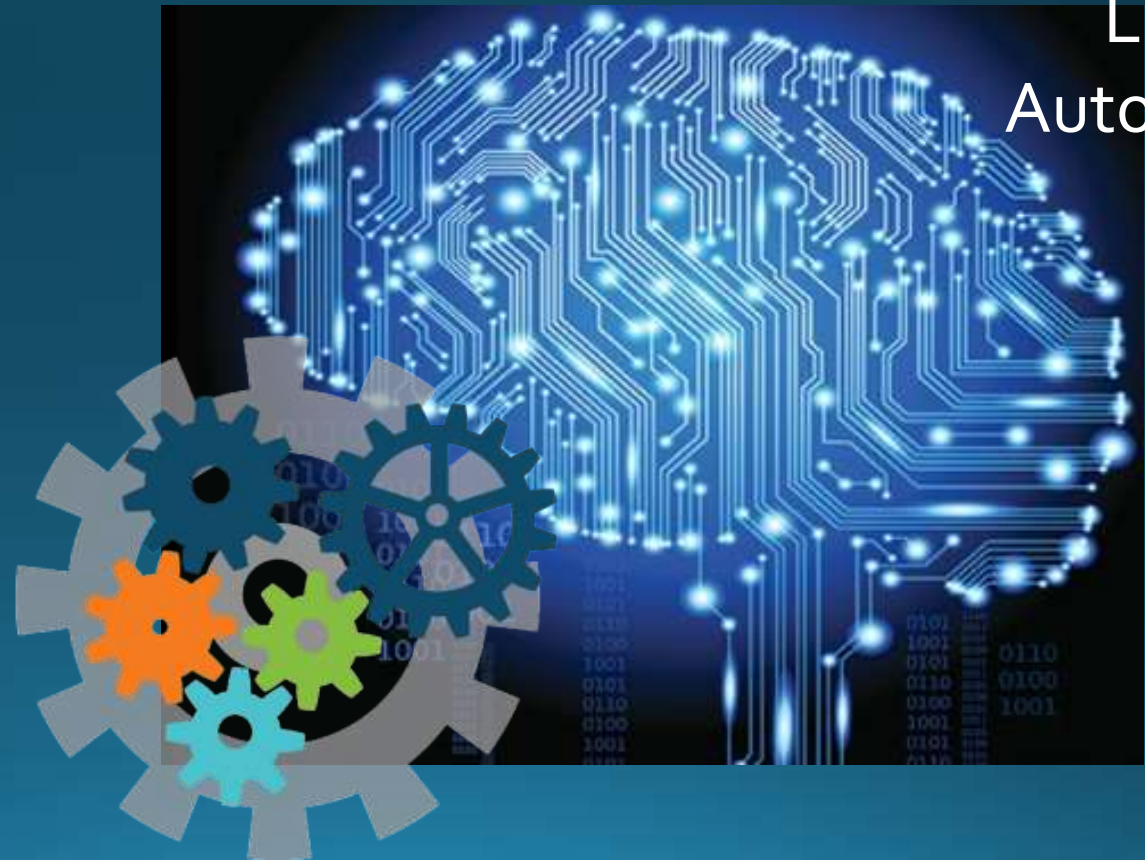
Increasing integration of data analytics and machine learning services

Question 4 - Obstacles

What are the obstacles to build integrated IoT-Robotics-AI systems today?



Language and understanding



Learning
Automation

Question 5 – Lessons Learned

Can you share ONE single lesson learnt in your experience about integrating IoT, Robotics and AI?



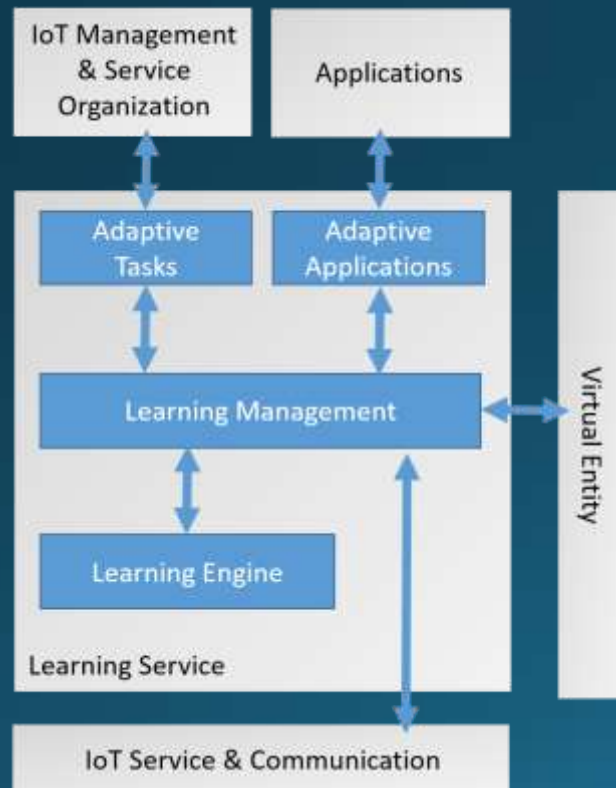
A scalable approach requires the ability to share and exchange learned knowledge

User, environment and platform specific



On the Need of Machine Learning as an IoT Service (ML4IoT)

Enable IoT applications and platform components to autonomously learn from their settings and their past experience

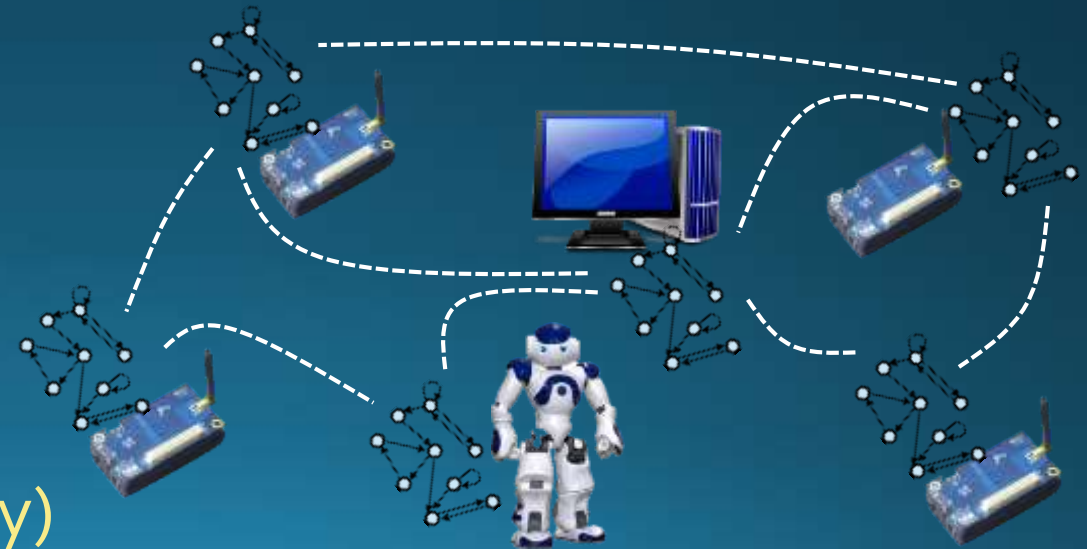
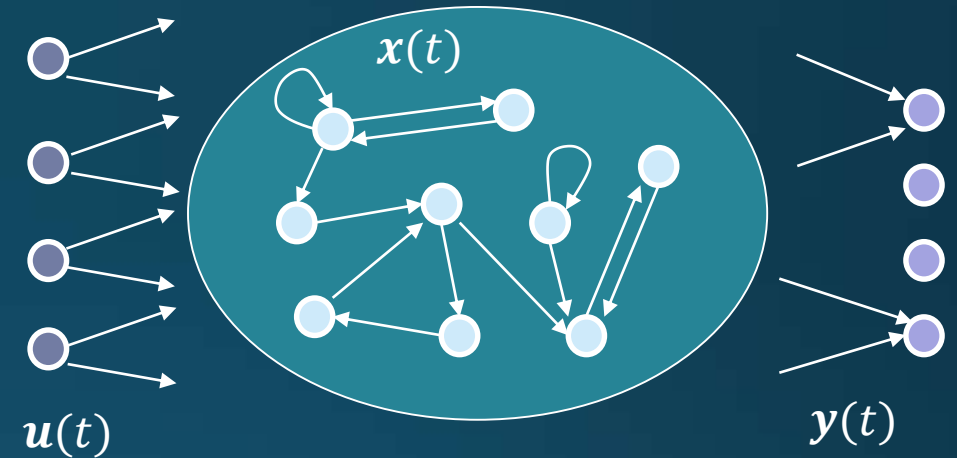


- Distribution
- Locality and hierarchical compositionality
- Computational heterogeneity
- Coping with time-series
- General purpose
- Standardized

D. Bacciu; S. Chessa; C. Gallicchio; A. Micheli, On the Need of Machine Learning as a Service for the Internet of Things, To Appear in the Proc. of IML 2017, ACM, Liverpool 17-18 Oct 2017

Distributed Embedded ML

- **Reservoir Computing (RC)** as a learning paradigm for IoT
 - Noisy time-series
 - Computational efficiency (**8Kb memory**)
 - Scalable from tiny devices to **deep** models
- A **distributed learning system** of embedded RC models
 - Management and OTA deployment
 - Feature selection
- **Applications:** Event classification, indoor localization, balance assessment, calorimetric estimation, adaptive planning...



Reservoir Computing Python library (ReCoPy)