

CHIST-ERA Projects Seminar
Cross Topics
Topic
Life-long Learning Intelligent
Systems

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Paris, April 12th, 2018



Programme co-funded by the
EUROPEAN UNION



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Introduction: Life-long Learning Intelligent Systems

❖ Machine learning systems rely on human experts to:

- ✓ Select proper data
- ✓ Tune the meta-parameters
- ✓ Choose the training/development/evaluation sets
- ✓ Choose the evaluation protocol

Our aim:

**build autonomous intelligent systems sustaining their performance
across time without machine learning experts**



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Objectives

- ❖ Enable the development of autonomous systems:
« tuned once live forever »
- ❖ Initial training might require expert knowledge
- ❖ Systems may require the help of fields expert (no machine learning experts) $\xrightarrow{\text{SEP}}$ **active / reinforcement learning**
- ❖ System should be able to adapt to unknown environments



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Different aspects of Life-long learning covered

- ✓ classic machine learning (supervised / unsupervised)
- ✓ deep learning
- ✓ reinforcement learning
- ✓ active learning
- ✓ interactive learning



Auto-evolution

Autonomous systems have to:

- ✓ identify « new » information that has to be modeled
- ✓ look for relevant adaptation data
- ✓ balance the importance of « old » and « new » data in the adaptation process
- ✓ collect unsupervised data (technical and legal issues)

Auto-evaluation

- ✓ Enable automatic selection of evaluation data
- ✓ Enable automatic labeling of the data
- ✓ Find a metric that is measurable and related to the objective function
- ✓ Balance the ratio of « old » and « new » data within the auto-evaluation set

Auto-evaluation

- ✓ How to reduce the cost of external supervision?
- ✓ Can the system ask questions on what it thinks is important?
- ✓ Should the user specify what is important?

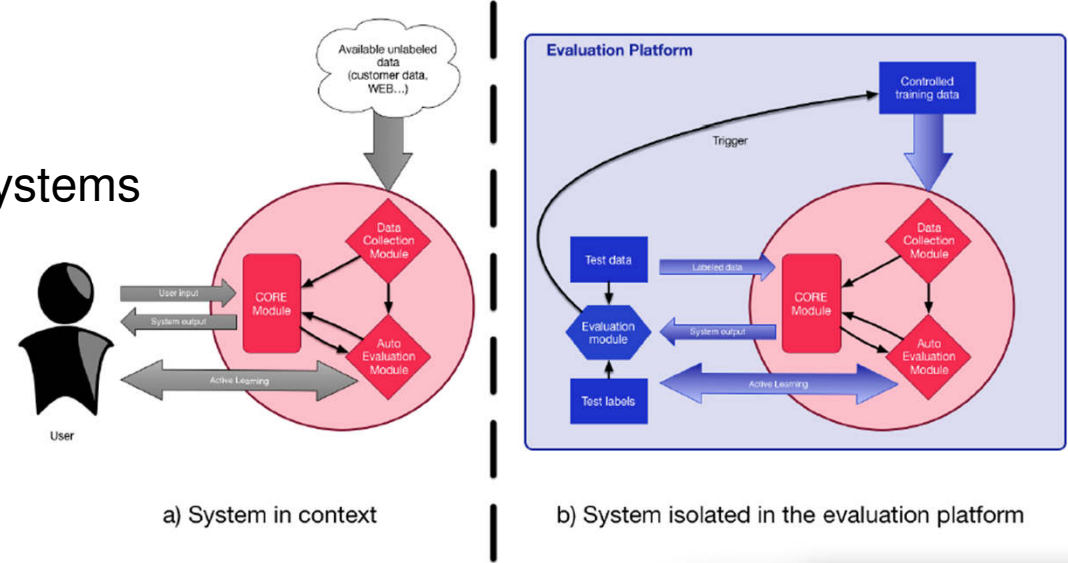
Evaluation of life-long-learning

- ✓ No established protocols yet
- ✓ How to evaluate the task itself
- ✓ How to evaluate the task across time
- ✓ Difficulty of the evaluation depends on the task & on the definition of lifelong learning
- ✓ Generalization of the life-long learning evaluation across tasks

ALLIEs

Autonomous Life-long Learning Intelligent Systems

Supervised evaluation
of
unsupervised life-long learning systems



Proof of concept: protocols and metrics for two modalities

- Speaker diarization: who speaks when in an audio stream
- Machine translation: translate text from one language into another

- Open evaluation campaign
- Workshop on life-long learning systems and their evaluation
- Data for machine translation and speaker diarization



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LIHLITH: Learning to Interact with Humans by Lifelong Interaction with Humans

- ❖ Goal : Lifelong Learning methods to use dialogues to improve systems over time
 - Improve the quality
 - Lower the cost of deployment in new domains
- ❖ Key ideas
 - Systems designed to get feedback from user
 - In particular in LIHLITH, improve dialogue management, question answering, knowledge induction
- ❖ Development of evaluation protocols and benchmarks for reproducibility
- ❖ Open source and industrial valorisation



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DELTA: Dynamically Evolving Long-Term Autonomy

- ❖ Goal : Adapt reinforcement learning to the lifelong setting
 - Relax common stationarity assumptions
 - Develop novel algorithms for planning, exploration and task decomposition
- ❖ Key ideas
 - Reinforcement learning is a powerful technique for adaptive sequential decision making
 - Current algorithms are poor at handling changing environments and tasks
- ❖ Two application domains: active network management
microgrid management

- ✓ evaluation protocols for life-long learning
- ✓ benchmarking
- ✓ scientific reproducible evaluation platform
 - SEP (to supervise unsupervised process)
- ✓ open-source softwares
- ✓ industrial demonstrator



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Questions

Questions ?