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

*Anthony Larcher*

Paris, April 12th, 2018
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
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) ➔ active / reinforcement learning

- System should be able to adapt to unknown environments
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)
Key Challenges

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
Key Challenges

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?
**Key Challenges**

**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
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
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
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 (to supervise unsupervised process)
✓ open-source softwares
✓ industrial demonstrator
Questions ?