CHIST-ERA Projects Seminar 2021
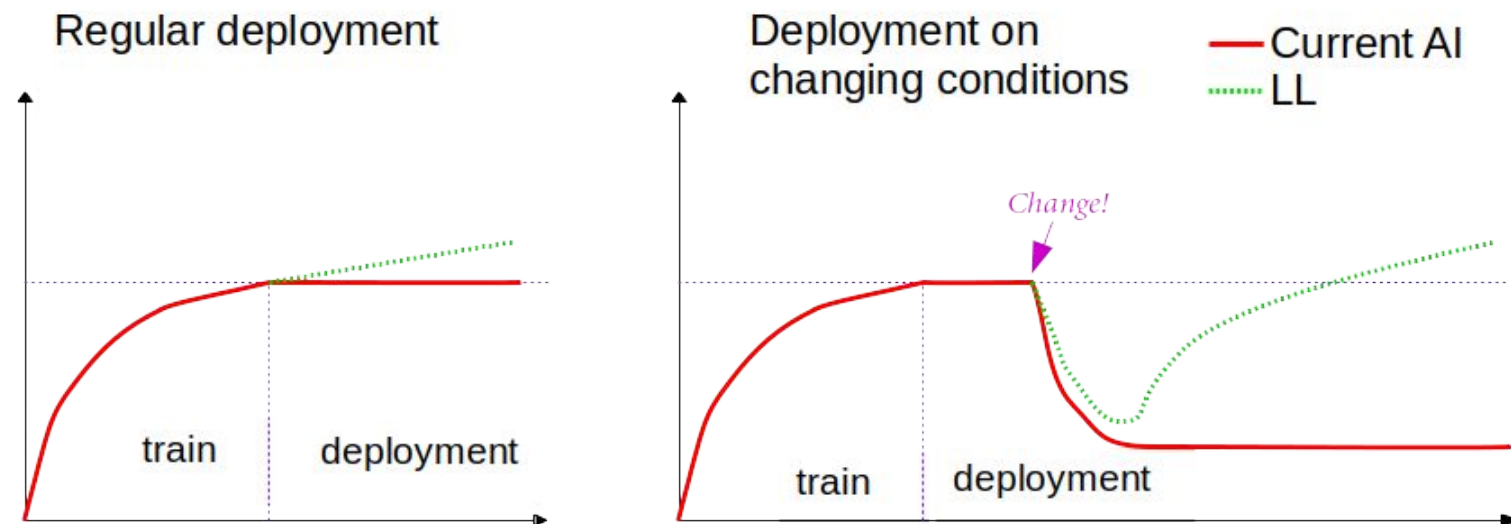## *Lifelong Learning for Intelligent Systems (LLIS)*

Anders Jonsson

April 14, 2021

Source: Agirre, Jonsson, Larcher. Framing Lifelong Learning as Autonomous Deployment: Tune Once Live Forever. IWSDS 2019

- **Lifelong learning**: AI system that evolves throughout its lifetime
- Key challenge: the underlying conditions change over time!
  - **Gradual changes**: conditions evolve slowly but steadily
  - **Abrupt changes**: specific events that cause dramatic change
- AI system should constantly seek to adapt to improve performance

ALLIES

- Evaluation of Human Assisted Lifelong Learning Systems (HALLS)
  - Evaluate the cost and benefit of human interaction across time
  - Derive existing metrics to evaluate HALLS
  - Create protocols, corpora to foster a research community
  - Implement an open platform for reproducible research evaluation
- Proof of Concept on two modalities
  - Machine translation
  - Speaker Diarization
- Main outcomes
  - Open challenges (publicly available corpora, protocols, baselines)
  - Operational platform for reproducible evaluation of HALLS
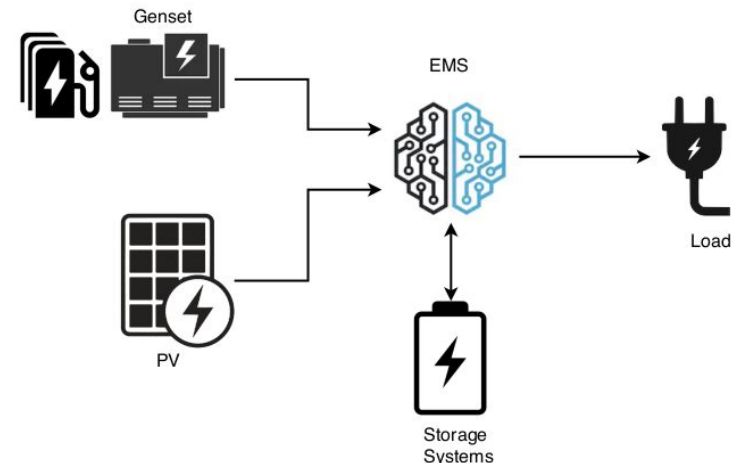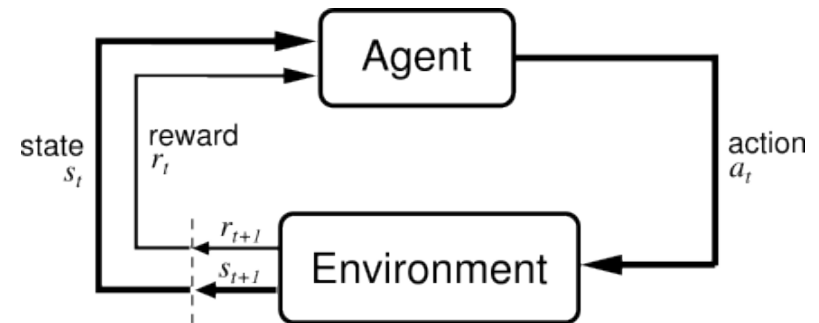 - Follow-up MSCA RISE ESPERANTO project

DELTA

- Reinforcement learning: agent repeatedly interacts with environment
- Aim is to maximize long-term reward
- Address three key issues:
  - Planning
  - Exploration
  - Task decomposition

- Application domain: microgrids
- Gradual changes: seasonal variations
- Abrupt changes: battery failure

LIHLITH

Dialogue systems are changing the way we access information

- Major companies are investing heavily on smart speakers
- But current commercial technology is brittle

LIHLITH applies Lifelong Learning to dialogue systems

- **Key observation: User interaction is natural in dialogues.**
  Seamlessly obtain feedback and information from users
  ⇒ **Obtain additional supervision to improve system "for free"**

Thanks to user feedback, positive results on:

- **Reducing amount of annotated** interactions
- **Lowering cost of deployment** in new domains
- **Improving the quality** on deployment **across time**

Source: dnainfo

Major Achievements and Outputs

ALLIES

- Open challenges (machine translation, speaker diarization)
- Publicly available corpora, baseline systems and protocols
- Follow-up MSCA-RISE ESPERANTO project

DELTA

- Novel algorithms that address three key issues of lifelong learning
- Publicly available simulator based on data from a real microgrid
- Integrated system that implements the algorithms on the simulator

LIHLITH

- Improve results after deployment especially in new domains
- Open evaluation method, four open benchmarks
- 2 paper awards, and 2 Google faculty research awards
- Successful commercial exploitation, 5 follow-up projects/collaborations

Upcoming Challenges and Needs

- Transition from simulation to real-world applications
  - Scalability and responsiveness
  - Access to more data, potentially with more modalities
- Challenges of implementing AI systems
  - Ethics, privacy, discrimination, etc.
  - Trust, explainability, formal verification of actions
- Additional support for technology transfer
  - Industrial contacts
  - Entrepreneur backing for potential start-ups

Roadmap

- Implement lifelong learning systems in actual applications
  - Emphasise performance increase, robustness, flexibility
  - Best selling point is improving over the state-of-the-art
- Build network of academic and commercial collaborators
  - Organise challenges, workshops, tutorials, demonstrations
  - Publish open datasets and simulators
- Technology transfer
  - EIC Transition instrument

- Transnational collaboration is essential!
  - Coordinate projects with partners from different countries
  - Managing multiple funding agencies can be challenging
- Projects seminar
  - Opportunity to interact with other projects on similar topics
- Project management support
  - Most direct interaction related to project extensions

Responsible Research & Innovation

- Gender balance
  - DELTA: one female PI, concerted effort to increase balance
  - LIHLITH: 33% female researchers
- Public engagement
  - Research outcome is best vehicle for interaction
- Ethics and privacy
  - Most results in simulation (no ethical issues)
  - Lifelong learning without human input could enhance privacy

Open Science

- Publication: conferences with open proceedings, open-access journals, or paywall journals which allow for open pre-prints (arXiv)
  - Open datasets and open-source software
  - Open science and technology transfer of academic partners

- Research as OS, TT based on consultancy and on demand
  - Open science and technology transfer in industrial partner
  - OS datasets helped in the face of limited, noisy data
  - OS software/datasets help build more powerful systems (compared to starting from scratch)

- Some obstacles for OS: research evaluation agencies
  - Publication venue: In AI and NLP conferences excel and are open, but agencies tend to value journals more
  - Publishing open datasets and software: substantial overhead but agencies ignore it, or apply one-size-fits-all

Technology Transfer

- Having an industrial partner is key for successful TT
  - Involved personnel with research experience
  - Seamless conversation about results and commercial prospects
  - OS allows quickly raising the technological readiness level (TRL)
- Challenges for TT in CHIST-ERA
  - "Future and emerging technologies" are about scientific advances
  - Academic partners need to focus on research breakthroughs
    => Exploitation opportunities may be missed
  - Follow-up calls from European Innovation Council could help

Questions ?