PROCEEDINGS OF THE 4TH WORKSHOP ON

# MACHINE LEARNING FOR INTERACTIVE SYSTEMS (MLIS-2015)

**Heriberto Cuayáhuitl, Nina Dethlefs, Lutz Frommberger,**

**Martijn van Otterlo, Olivier Pietquin (eds.)**

**July 11, 2015**

**32nd International Conference on Machine Learning (ICML-15)**

**Lille, France**

# 4th Workshop on Machine Learning for Interactive Systems (MLIS-2015)

## Organizers

**Heriberto Cuayáhuitl**
Heriot-Watt University, Edinburgh, UK
hc213@hw.ac.uk

**Nina Dethlefs**
University of Hull, Hull, UK
n.s.dethlefs@gmail.com

**Lutz Frommberger**
Cognitive Systems Research Group, University of Bremen, Germany
lutz@informatik.uni-bremen.de

**Martijn van Otterlo**
Radboud University Nijmegen, The Netherlands
m.vanotterlo@donders.ru.nl

**Olivier Pietquin**
University Lille 1, France
olivier.pietquin@univ-lille1.fr

## Program Committee

Sylvain Calinon, Idiap Research Institute, Switzerland
Xiaoping Chen, University of Science and Technology, China
Sonia Chernova, Worcester Polytechnic Institute, USA
Paul Crook, Microsoft, USA
Heriberto Cuayáhuitl, Heriot-Watt University, UK
Nina Dethlefs, University of Hull, UK
Lutz Frommberger, University of Bremen, Germany
Simon Keizer, Heriot-Watt University, UK
Kazunori Komatani, Osaka University, Japan
George Konidaris, Duke University, USA
Fabrice Lefvre, University of Avignon, France
Eduardo Morales, INAOE, Mexico
Plinio Moreno, Instituto Superior Tcnico, Portugal
Olivier Pietquin, University Lille 1, France
Sinno Jialin Pan, Nanyang Technological University, Singapore
Matthew Purver, Queen Mary University London, UK
Subramanian Ramamoorthy, University of Edinburgh, UK
Alexander Rudnicky, Carnegie Mellon University, USA
Martijn van Otterlo, Radboud University Nijmegen, The Netherlands
Zhuoran Wang, Toshiba Research Europe Ltd., UK
Jason Williams, Microsoft Research, USA

## Sponsors

- Centre de Recherche en Informatique, Signal et Automatique de Lille
  `http://www.cristal.univ-lille.fr/`


- ERC STAC Project n. 269427
  `http://www.irit.fr/STAC/`

## Wokshop Website

`http://mlis-workshop.org/2015`

## Publisher

JMLR Conference and Workshop Proceedings Series
`http://www.jmlr.org/proceedings/`

# List of Accepted Papers

*Imitation Learning Applied to Embodied Conversational Agents*
Bilal Piot, Olivier Pietquin and Matthieu Geist

*Efficient Real-Time Pixelwise Object Class Labeling for Safe Human-Robot Collaboration in Industrial Domain*
Vivek Sharma, Frank Dittrich, Sule Yildirim-Yayilgan and Luc Van Gool

*Human-Guided Learning of Social Action Selection for Robot-Assisted Therapy*
Emmanuel Senft, Paul Baxter and Tony Belpaeme

*Teaching iCub to recognize objects using deep Convolutional Neural Networks*
Giulia Pasquale, Carlo Ciliberto, Francesca Odone, Lorenzo Rosasco and Lorenzo Natale

*Latent Goal Analysis for Dimension Reduction in Reinforcement Learning*
Matthias Rolf and Minoru Asada

*Online Mean Field Approximation for Automated Experimentation*
Shaona Ghosh and Adam Prugel-Bennett

*Iterative Embedding with Robust Correction using Feedback of Error Observed*
Praneeth Vepakomma and Ahmed Elgammal

*Coactive Learning for Interactive Machine Translation*
Artem Sokolov, Shay Cohen and Stefan Riezler

*Visualizing User Model in Exploratory Search Tasks*
Kalle Ilves, Alan Medlar and Dorota Glowacka

# PREFACE

Learning systems or robots that interact with their environment by perceiving, acting or communicating often face a challenge in how to bring these different concepts together. This challenge arises because core concepts are typically studied within their respective communities, such as the computer vision, robotics and natural language processing communities, among others. A commonality across communities is the use of machine learning techniques and algorithms. In this way, machine learning is crucial in the development of truly intelligent systems, not just by providing techniques and algorithms, but also by acting as a unifying factor across communities, encouraging communication, discussion and exchange of ideas.

While intelligent interactive applications draw on machine learning, it is often the case that perception, action and communication activities are not integrated in a systematic and unified way. This represents an unsolved problem that demands to be addressed in a focused manner and from a multidisciplinary perspective. On the other hand, while the machine learning field provides a rich set of computational methods to improve the individual performance of perception, action and communication components in interactive systems and robots, interactive systems provide a rich set of scenarios to challenge machine learning techniques in their application to real-world problems. However, learning systems that encompass multiple of these concepts in a unified and principled way are still rare which is why machine learning is needed to act as a unifying factor. Building a bridge across communities is highly important for practical applications in robotics, human-robot interaction and intelligent interfaces. Equally important, it encourages basic and applied advances in research on adaptive sensorimotor, perception-action and perception-communication loops in general cognition, and also encourages research on novel ways for training systems from interaction with people in their physical environments to form generally intelligent systems.

The goal of this workshop is to bring researchers from multiple disciplines together who are in one way or another affected by the gap between perception, action and communication that typically exists for data-driven interactive systems or robots. We expect to provide a forum for interdisciplinary discussion that allows researchers to look at their work from new perspectives that go beyond their core community and potentially develop new interdisciplinary collaborations driven by machine learning. A multidisciplinary viewpoint is important to develop agents with a holistic perspective of the world. This is also vital for the design of agents that solve large-scale and complex real-world problems in a principled way. Machine learning will stand at the core of the workshop and discussions as a common interest across researchers. The workshop will forge new research directions and collaborations, including paper presentations, joint discussions, and a social event.

This workshop contains papers with a strong relationship to interactive systems and robots in the following topics (in no particular order):

- Reinforcement learning for intelligent interactive machines
- Deep neural architectures for multimodal understanding and generation
- Active and semi-supervised learning for interactive (emotional) systems
- Learning multimodal knowledge bases for interactive machines
- Learning from demonstrations for embodied interactive machines
- Supervised learning for object recognition in interactive machines
- Multi-agent learning for multimodal interactive machines
- Unsupervised learning for interactive systems

The structure of the MLIS'15 workshop will consist of individual oral presentations by authors followed by joint question and discussion sessions concerning their work. In addition, the workshop features four distinguished invited speakers who will present their perspectives on modern architectures and frameworks for interactive robots and other interactive systems. The workshop will close with a general discussion section that aims to summarise ideas raised during the day and come to a common conclusion. We are looking forward to an exciting day of interesting and fruitful discussion.

*H. Cuayáhuitl, N. Dethlefs, L. Frommberger, M. van Otterlo, O. Pietquin (MLIS-2015 organizers)*

# INVITED TALKS

INCREMENTAL INTERACTIVE REINFORCEMENT LEARNING FROM SCRATCH
**Jürgen Schmidhuber**, *IDSIA, Switzerland*

LEARNING RECURRENT ATTENTION MODELS
**Ruslan Salakhutdinov**, *University of Toronto, Canada*

"LESS INPUT": COOPERATIVE LEARNING FOR EMOTIONALLY INTELLIGENT SYSTEMS
**Björn Schuller**, *Imperial College, United Kingdom*

ROBOBRAIN KNOWLEDGE ENGINE: LEARNING FROM WEAK HUMAN SIGNALS
**Ashutosh Saxena**, *Cornell University, United States*