

A Driving License for Intelligent Systems

Martin Kandhofer

Institute of Software Technology
Graz University of Technology
Inffeldgasse 16b/II,
8010 Graz, Austria
kandhofer@ist.tugraz.at

Gerald Steinbauer

Institute of Software Technology
Graz University of Technology
Inffeldgasse 16b/II,
8010 Graz, Austria
steinbauer@ist.tugraz.at

Abstract

Artificial Intelligence (AI) is becoming increasingly important. Thus, sound knowledge about the principles of AI will be a crucial factor for future careers of young people as well as for the development of novel, innovative products. Addressing this challenge, we present an ambitious 3-year project focusing on developing and implementing a professional, internationally accepted, standardized training and certification system for AI which will also be recognized by the industry and educational institutions. The approach is based on already implemented and evaluated pilot projects in the area of AI education. The project's main goal is to train and certify teachers and mentors as well as students and young people in basic and advanced AI topics, fostering AI literacy among this target audience.

Introduction and Motivation

Artificial Intelligence (AI) plays an increasingly important role in our daily life. In the near future jobs will largely be related to AI as it is the basis for upcoming disruptive technologies. Sound knowledge about the principles of AI and its application (e.g. in robotics) will be a crucial factor for careers in various occupational fields. In this context it is important to familiarize people with those topics early in order to develop AI literacy. Therefore, in 2017 we launched a 3-year project (*EDLRIS - European Driving License for Intelligent Systems*¹) funded by the European Union. The main goal of this project is to develop a professional, international, standardized training and certification system in the area of AI for trainers (e.g. teachers, educators, mentors, . . .) and trainees (young people aged between 13 and 18; e.g. secondary school students, undergraduate students, . . .). It is important that the level and quality of the training is sufficiently advanced so that it will be recognized and accepted by educational institutions and the industry. The project is based on several pilot projects conducted and evaluated in previous years focusing on familiarizing different age groups with fundamental topics of AI (Kandhofer et al. 2016; Burgsteiner, Kandhofer, and Steinbauer 2016). The idea of an "AI driving license" is inspired

by the well-established *International Computer Driving Licence (ICDL)*² which tests and certifies people's skills necessary to use common computer applications (e.g. word processing, spreadsheet, . . .) (Csapo 2002). Further approaches can be found in current literature. For instance, the *Roberta Initiative* (raising girl's interest in technical topics) conducted teacher training courses (including certification) only in robotics applying a train-the-trainer concept. (Bredenfeld and Leimbach 2010). Several approaches focused on teaching AI concepts exclusively to undergraduate or graduate students at certain universities or colleges (e.g. (Torrey et al. 2016; Barik et al. 2013)) or on teaching the basics of AI only to teacher trainees (e.g. (Dilger 2005)). Other approaches only dealt with selected topics of AI at school level (e.g. (Heinze, Haase, and Higgins 2010)) or with very specific tools used to illustrate certain AI concepts (e.g. (Featherston et al. 2014)). To sum up, a project as presented in this paper, aiming at training and certifying teachers/mentors as well as students/young people in fundamental topics of AI on a broad, international scale is quite unique.

Methodology

The challenges and main goals of the presented project can be summarized as follows: **a)** addressing state of the art technological content in AI; **b)** developing AI training curricula on different levels (beginner, advanced); **c)** developing adequate, sound technological and pedagogical teaching material (on-line and handout material); **d)** developing a certification system that allows companies and educational institutions to recognize skills and competencies acquired through the training; **e)** conducting training courses for trainers/trainees; **f)** testing and certifying acquired technological (AI) skills; **g)** gaining high acceptance and a broad, international deployment of the training and certification system;

In order to address those challenges and to establish a sustainable and extendable programme we follow a three stage approach:

1. Project base and preparation: Development of a training and certification system for trainers and trainees (beginner, advanced) as well as adequate on-line and handout teaching materials. The curricula/teaching materials are developed applying well-grounded didactic concepts based

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¹www.interreg-athu.eu/edlris

²https://icdl.org/

on the principles of constructionism (Papert 1993) and comprise ready-to-use material, scripts, tutorials, tools (software, hardware) as well as examples/exercises and tasks (including sample solutions). The certification will be done on-line. Providing on-line material and on-line certification will ensure the access to the training also in rural areas. The project consortium is composed of two technical universities which have a strong research background in AI and robotics (ensuring sound technological preparation), one university of teacher education ensuring the sound didactical preparation as well as two computer societies with long-term experience in conducting computer certifications across Europe. In order to facilitate acceptance, an advisory board comprising members from industry, educational institutions and public bodies is involved from start-up to the completion of the project.

2. Educating the trainers: The training comprises several class attendance and on-line teaching units as well as practical projects (for beginners and advanced trainers). It will be conducted by researchers and educators following the concept of "train-the-trainer". By completing this training, teachers/mentors (=trainers) acquire a certificate and will then be able to train young people/students (=trainees) on a professional level.

3. Educating the trainees: Once the trainers are certified they will start educating trainees in accordance with the AI curricula developed within project. This training also combines class attendance, on-line teaching units and practical projects for beginners and advanced trainees. Finally, trainees will also have the opportunity to acquire a certificate proofing their AI skills gained.

The trainings for trainers and trainees deal with major AI topics (as described in (Russell and Norvig 2009)), having a close connection with current AI research. The following list provides an overview of topics covered (complexity and extent of contents vary depending on beginner/advanced training) (Burgsteiner, Kandlhofer, and Steinbauer 2016):

Introduction to AI: definition/discussion ("what is AI?", Turing Test, ...), history, fields of applications;

Basics of AI and computer science: graphs and data structures (stack, queue, trees, ...), control statements and paradigms, data representation, sorting algorithms;

Intelligent agents: demonstrating the modelling process of making and executing decisions; topics: definition and structure of an agent, different classes of agents, ...;

Automata: illustrating the decision making process; basis for describing systems and behaviors;

Problem solving by search: essential concept in AI with numerous areas of application (e.g. CSP, SAT solving or planning); major topics covered: definition of a problem in the context of AI, informed-, uninformed search, search algorithms (e.g. breadth-first-, depth-first- and A*-search);

Planning: modeling problems, making decisions, establishing/evaluating plans; logic (logical operators, logical reasoning); topics: state-space planning, forward/backward chaining, propositional/predicate logic;

Machine learning: different approaches to learning agents (e.g. logic-based learning, knowledge based systems, reinforcement learning), decision trees and neural networks;

Summary and Outlook

In this paper we presented a 3-year project (launched in 2017) focusing on developing and implementing an extensive, professional, standardized training and certification system for Artificial Intelligence (AI). Based on already implemented and evaluated pilot projects (Kandlhofer et al. 2016; Burgsteiner, Kandlhofer, and Steinbauer 2016) and following the concept of the well-known ICDL (Csapo 2002) the goal is to establish an internationally accepted and recognized *Driving License for Intelligent Systems* (training and certifying teachers/mentors as well as students in basic and advanced AI topics). The upcoming steps in 2018 and 2019 are the implementation of teacher trainings (train-the-trainer) and certifications based on the AI training curricula developed in the first phase of the project. By the 2019/2020 winter term those certified trainers will implement student trainings (e.g. in schools) in different European countries based on the developed AI training curricula and teaching materials. By applying this systematic, long-term approach we envision a broad distribution of the training and certification system, fostering the development of AI literacy on a broad scale, preparing young people for new jobs as well as stimulating innovation and entrepreneurship.

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