ISSEP 2019 – LARNACA, CYPRUS

UNDERSTANDING ARTIFICIAL INTELLIGENCE
A PROJECT FOR THE DEVELOPMENT OF COMPREHENSIVE TEACHING MATERIAL

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The Science Year 2019 on Artificial Intelligence

- Funded by German Federal Ministry of Education and Research
- One Topic each year
- Several activities each year – one: Youth campaign for teachers and students
- Youth campaign: "Bringing knowledge to all students"

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About the Youth Campaign

**Goal of the Campaign:** Providing a basic understanding of *Artificial Intelligence* and *Machine Learning* for secondary school students (approx. 12 – 18 years)

**Target Group:** Teachers of different topics, informatics but also philosophy, ethics or social studies

**Core element:** Simulation Game: "*MAN, MACHINE!*" presented on WiPSCE 2019 in detail

2.019 classroom sets ordered, more will be produced
The Story behind the Concept – The ProDaBi Project

Jan. 2018 – Dez. 2022
Development of a curriculum and teaching material for the data science, machine learning and artificial intelligence in secondary schools

Large focus on implementing AI systems
Currently: Project courses in grade 12
Together with didactics of statistics
Design-based research

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Challenges for the Science Year material

- For cs teachers
  - Implementing several concepts of AI and ML
  - Moduls with focus on mathematical and theoretical knowledge
  - Currently only for higher secondary students

- For cs AND non-STEM teachers
  - Focus on social and societal questions
  - Moduls contain also teacher information
  - For students of all school types from 12 to 18 years – great heterogenity!

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How to master these challenges?

Methodical approach

- Teachers must gain PCK
- Connecting knowledge on AI and how to teach AI
- Hints on possible problems of the students
- Design-based design of the material

Decisions

- Using as many elements as possible from ProDaBi
- Independent modules based on the game
- Modules are always starting from students' activities
How to develop with very tight schedule …

- From official start to finalizing less than 4 months
- Development of activities also in seminars with master students
- Invitation of around 20 classes from grade 6 to 12 to evaluate
- Experience from testing could be directly included into the development process

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Mini course unit

Teacher's Booklet for the Game
- Background of the game: How to play? What’s important?
- Recommended combinations of modules
- References to other modules

Simulation Game

Module 1
- Stand-alone possible

Module 2
- Core element

Module 3

Module 4

Module 5

Module 6
- Future workshop

What does intelligence mean?

General introduction and motivation
- Pedagogical and didactic notes
- Scientific texts
- Worksheets and tasks

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Hinweise zu Arbeitsblatt 4: Chatbot Mitsuku auf den Zahn gefühlt

Hier können die Jugendlichen nochmals genauer untersuchen, wie „menschlich“ der schon aus Arbeitsblatt 2 bekannte Chatbot agieren kann, indem sie ausgewählte (englische) Fragen und Antworten der Vorteile des Weltbewerbs zum Loebner-Preis 2010 analysieren.


Die für das Arbeitsblatt verwendeten vollständigen Transkripte aus dem Votum des Loebner-Preises 2010 sind als pdf online verfügbar:


Möchten Sie mit Ihren Lerngruppen weiterarbeiten, was ein gut transferierbarer Teil darstellt, so können Sie sich die Vorschläge für die Fragen in den Markenpostern von [Name] heraus, die auf ihrer Homepage (alle Artikel) finden. Sie können anhand der Vorschläge in die interaktiven Sitzungen der Schüler/eine weiterarbeiten.

Materials

- Simulation Game "Man, Machine!"
- Booklet for Teachers
- Learning diary for students
- Supporting (online) material
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Simulation Game "Man, Machine!"
Simulation Game „Man, Machine!“

Matchbox Computer "Hexapawn" by M. Gardner (1962)

"Sweet Learning Computer" (CS4Fn)

"Learning Analog Computer for Hexapawn" (LAC-H), Research Project "ProDaBi"
Simulation Game "Man, Machine!"

- **Supervised learning**
- **Reinforcement learning**

- Learning = deleting bad moves
- Learning = modifying and training a model
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Worksheets and tasks

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Teachers' booklet - Module 1

- Getting started
  - **Worksheet 1:** Artificial Intelligence in my life
  - **Worksheet 2:** Artificial Intelligence: What does this have to do with me?
  - **Worksheet 3:** Artificial Intelligence: What does this mean?
Teachers' booklet - Module 2

- How does machine learning work?
  - What exactly means AI and ML?
  - How to play "Man, Machine!"
    - Worksheet 1: Findings from the game "Man, Machine!"
    - Worksheet 2: "Man, machine!" more closely examined
- For advanced students
  - Methods of machine learning
  - How do artificial neural networks work?
  - Last, but not least: What does "deep learning" actually mean?
Teachers' booklet - Module 3

• Man and Machine – who is more intelligent?
  - Worksheet 1: Intelligence - what is it?
  - Worksheet 2:
    - Does the chatbot show Intelligence?
    - How human can a machine be? And is "intelligence" a suitable indicator to evaluate a machine?
  - Worksheet 3: Man or Machine? The Turing test helps to decide
    - How human can a machine be? - The Turing Test
  - Worksheet 4: Testing the Chatbot Mitsuku
Teachers' booklet - Module 4

- Historical development of AI
  - Worksheet 1: Milestones of AI
    - Activity: Create your own stop motion film on ONE moment in AI history
  - Worksheet 2: Tweets to contemporary witnesses
  - Excursus: Transformation of computer science through AI and big data
Teachers' booklet - Module 5

- Which AI do we want in our lives?
  - **Worksheet 1:** What does "autonomous driving" mean?
  - **Role play:** Trolley problem
    - Utilitarianism vs. deontology (ethics of duties) according to Kant – two basic viewpoints of normative ethics
  - In-depth discussion: Modification of role play
  - **Final survey** on "how much autonomy do we want to give to the machines?"
Teachers' booklet - Module 6

• Future Workshop: In which "AI world" do we want to live?
  • Several phases:
    o Phase of criticism
    o Imaginative phase
    o Realisation phase
  • Different scenarios and possible activities described
    o Debates
    o Building scenes
    o Creative methods
  • Necessary time: 4h to 1week
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Students' learning diary

Quizzes
Tasks for further discussion
Review of lessons

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First Experience

• Suitable for all secondary school students
  • Students easily learn how the machine learns
  • Game can be used as introduction into in-depth discussions about Machine Learning and Artificial Intelligence
  • Activities are suitable also for younger students as they can be adapted to them
  • Many opportunities to dive deeper into the concepts by introducing programming artificial neural networks or decision trees (e.g. ProDaBi)

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What is important on this Concept

- Experiencing is better than just seeing or hearing
- AI becomes comprehensible
- Encourages further thinking and discussion
- Understanding the technology
- Encouraging reflection on and about AI in everyday life
Further activities

Teacher sets has been sent by our partners

Evaluation:
Pre-post-test
Currently being completed

General question:
How does the professional self-concept of the teachers change through this material?

... We go on improving the material
... Materials will be further used for ProDaBi

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And now? Discuss or play ...

AI becomes comprehensible