

# Artificial Intelligence: The "Teenage" Years

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## A Brief History of Industrialization

- Industry 1.0**
  - steam engine
  - physical labor
- Industry 2.0**
  - electricity
  - assembly line
- Industry 3.0**
  - electronics & IT
  - automation
- Industry 4.0**
  - communication
  - autonomy & AI

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## A Brief History of Machine Learning

**ARTIFICIAL INTELLIGENCE**  
 Any technique which enables computers to mimic human behavior

**MACHINE LEARNING**  
 AI techniques that give computers the ability to learn without being explicitly programmed to do so

**DEEP LEARNING**  
 A subset of ML which make the computation of multi-layer neural networks feasible

1950's 1960's 1970's 1980's 1990's 2000's 2010's

CRACLE

→ **Industry 3.0** → **Industry 4.0**

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## Learning is Like Moving to Mars...

[http://www.foundalis.com/res/diss\\_research.html](http://www.foundalis.com/res/diss_research.html), 2012

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## Characteristics of Deep Learning

Input Hidden Output

*Batch, data-heavy supervision with no explanation.*

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## Seeing the Elephant in the Room!

Rosenfeld et al., <https://arxiv.org/abs/1808.03305>, 2018

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### THIS IS YOUR MACHINE LEARNING SYSTEM?

YUP! YOU POUR THE DATA INTO THIS BIG PILE OF LINEAR ALGEBRA, THEN COLLECT THE ANSWERS ON THE OTHER SIDE.

WHAT IF THE ANSWERS ARE WRONG?

JUST STIR THE PILE UNTIL THEY START LOOKING RIGHT.

**alchemy (n.):**  
a seemingly magical process of transformation, creation, or combination.

Munroe, <https://xkcd.com/1838>, 2017

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### AI & the Dunning-Kruger Effect

confidence

competence

"toddler" "teenager" "mature"

Kruger, Dunning, "Unskilled and Unaware of It", *Personality & Social Psychology*, 1999

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### The Present: Machine Learning 2.0

acting

sensing

training

from ML 2.0 / blue-collar workers / assembly-line to ML 4.0 / white-collar workers / communication

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### Do Post-Hoc Explanations Suffice?

How would a machine trained on these images **explain** why it classifies an image as a dog / cat?

**explain dog by**  
black fur: yes  
tongue out: yes  
on grass: yes  
head right: yes

**explain cat by**  
black fur: no  
tongue out: no  
on grass: no  
head right: no

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### Bilateral Explainability in Humans

- Why are you making that move?
- It is the opening phase and I am trying to take control of the center.
- When one of your pieces is being attacked, make sure to protect it.

**Dialectical, one-shot supervision with counterargument.**

**Argument** in support of decision, using syntax and concepts **shared with coach.**

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### The Future: Machine Learning 4.0

Computational Cognition Lab

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### Learning Reality from Appearances

Michael, "Reading Between the Lines", Proc. IJCAI, 2009.

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### Probably Approximately Correct

- Statistical guarantees on the learning quality:
  - improbable to get unrepresentative instances
  - predictions need be only approximately correct

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### Why is Learning Even Possible?

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### Occam's Razor: Keep it Simple!


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### From Labels-Only to Explanations

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### In Lieu of a Conclusion...

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**WENET**  
INTERNET OF US

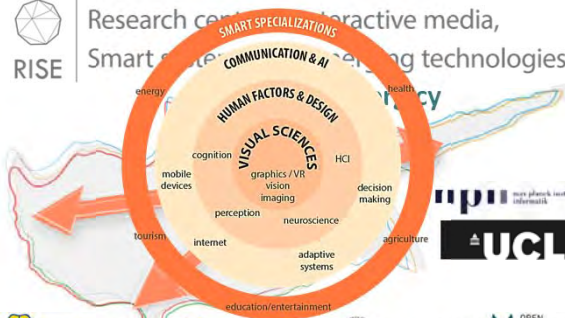
funded by EU's H2020 programme

### machine-mediated diversity-aware human interactions

- Pilot study in 18 university and adult school sites, with 10k participants (+ non-EU).
- Clear ethical guidance for the pilot activities and the technology development.

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## From Research to Innovation



Research centers: interactive media, Smart technologies

RISE

energy health decision making agriculture education/entertainment adaptive systems internet perception neuroscience graphics / VR vision imaging mobile devices cognition HCI

Δήμος Λευκωσίας, Nicosia Municipality Πανεπιστήμιο Κύπρου, University of Cyprus CYPRUS UNIVERSITY OF TECHNOLOGY OPEN UNIVERSITY OF CYPRUS


## Studies in Cognitive Systems

**BLENDING DISTANCE LEARNING METHODOLOGY**  
courses taught online with live tutoring sessions in-class exams in student's country of residence summer tutorial camps in Cyprus (optional)

**Courses Offered**

Theme	Cognitive Psychology	Computer Science
<b>Foundations</b>	CP.F1 Introduction to Cognitive Psychology	CS.F1 Introduction to Artificial Intelligence CS.F2 Computational Intelligent Systems
<b>Perception</b>	CP.P1 Human Perception and Attention	CS.P1 Natural Language Processing
<b>Learning</b>	CP.L1 Learning and Memory in Humans	CS.L1 Computational Learning Theory
<b>Reasoning</b>	CP.R1 Mental Representations and Reasoning CP.R2 Cognitive Modelling	CS.R1 Cognitive Agents CS.R2 Adaptive and Interactive Systems
<b>Systems</b>	CP.S1 Experimental Psychology CP.S2 Cognitive Neuroscience	CS.S1 Cognitive System Design CS.S2 IBM's Watson Machine

**Admission Requirements**  
Geared towards students with a first degree in the STEM fields (Science, Technology, Engineering, Mathematics), Cognitive Science, or Psychology. Basic knowledge assumed in mathematics (discrete mathematics, formal logic, statistics, calculus) and computing (algorithms, basic programming).

For additional information, or expression of interest contact:  
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Open University of Cyprus University of Cyprus

Distance Learning Masters  
Human-Computer Symbiosis  
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Program starts in September 2019