Philosophy of AI

"Data Science and AI:

Some considerations on the contemporary AI-data science debate"

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Prerequisites for lecture on KR&R

Required background knowledge:

Chapter 1, 2 and 3 of *The Cambridge Handbook of Artificial Intelligence (2014)*

- Franklin, Stan (2014) *History, motivations and core themes*

- Arkoudas, Konstantine & Selmer Bringsjord (2014) *Philosophical foundations*

- Robinson, William S. (2014) *Philosophical Challenges*

Required reading:

- Anderson, C. (2008). "*The end of theory: the data deluge makes the scientific method obsolete*". Wired Magazine 16.07. (link)

- Laan, M.van der (2017) *Targeted Learning: the link from statistics to data science*, STAtOR, 2017, 4

- Usama Fayyad, Gregory Piatetsky-Shapiro, and Padhraic Smyth (1996) *From Data Mining to Knowledge Discovery in Databases* In: AI Magazine Volume 17 Number 3

Required readings for a paper on this theme

The paper on AI and Data Science should be firmly rooted in the philosophical tradition put forward in Chapter 1, 2 and 3 of the handbook; it must address some core themes and controversies (Chapter 1), philosophical foundations (Chapter 2) and challenges (Chapter 3). In addition, it should:

- Integrate in the paper a comment or critical reflection on the position of one of the following authors:

    - Anderson, C. (2008). "*The end of theory: the data deluge makes the scientific method obsolete*". Wired Magazine 16.07.

    - Laan, M. van der (2017) *Targeted Learning: the link from statistics to data science*, STAtOR, 2017, 4

    - Usama Fayyad, Gregory Piatetsky-Shapiro, and Padhraic Smyth (1996) *From Data Mining to Knowledge Discovery in Databases* In: AI Magazine Volume 17 Number 3

- Integrate / use in the paper the position defended in at least one of the "Other papers" associated with the lecture on AI and Data Science (so the suggested readings. provided at Blackboard)

Of course, the student is fully entitled to study and integrate / use other publications as well. However, a strong, profound analysis and substantiated position will receive a better assessment than a systematic review of the literature.

The Dutch AI Manifesto 2018

http://ii.tudelft.nl/bnvki/wp-content/uploads/2018/09/Dutch-AI-Manifesto.pdf
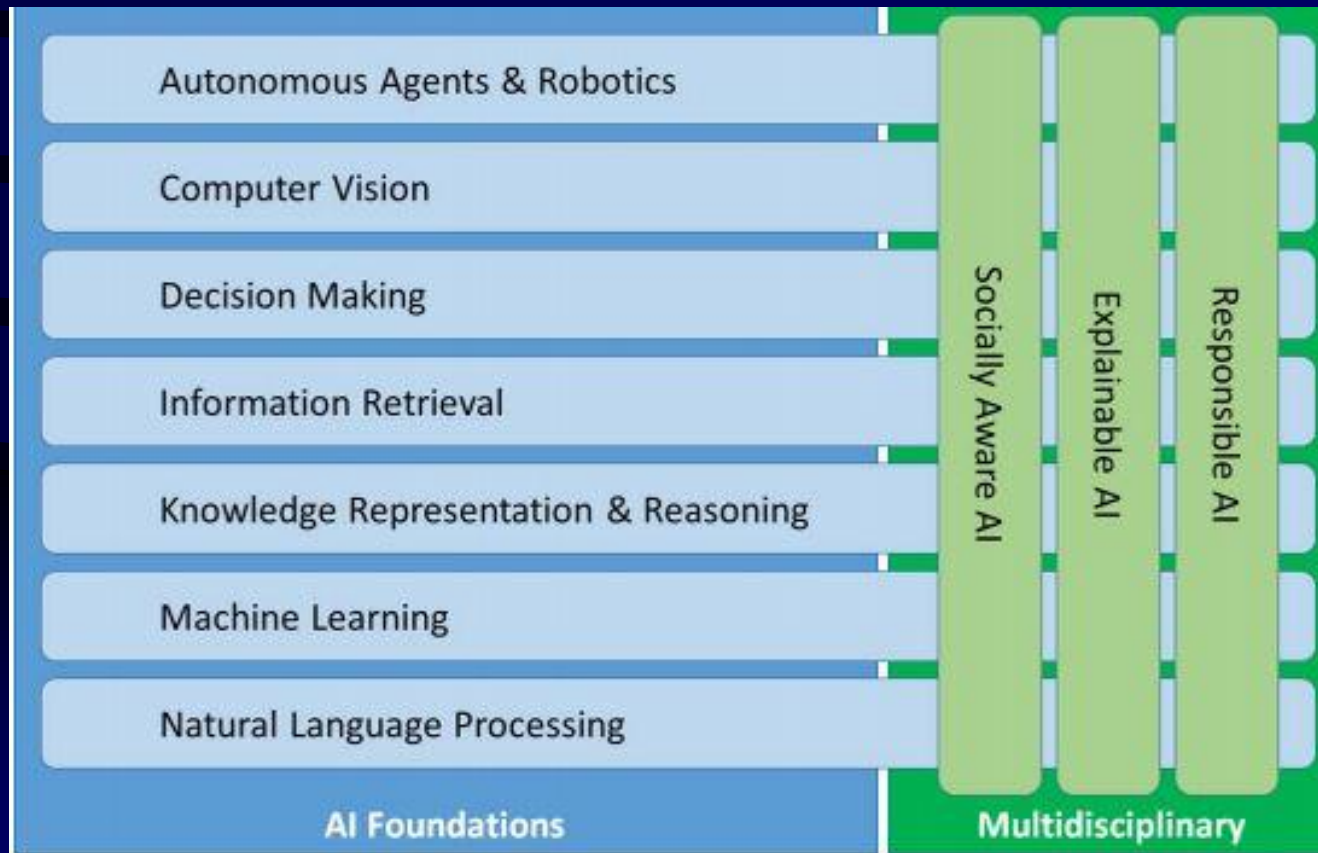
Core themes according to Stan Franklin

- Smart software versus cognitive modelling
- Symbolic AI versus subsymbolic AI
- Reasoning versus perception
- Reasoning versus knowledge
- To represent or not represent
- Embodied versus disembodied AI
- Narrow AI versus human level intelligence

"*Strong*" versus "*Weak* AI"?

All these concepts give shape to the current AI debate !

Key question regarding AI and Data Science

How does data science / big data affect the old ideals, achievements,

prospects and risks of

Artificial Intelligence?

Data science and big data

- the concepts of big data and data science seem closely related, if not inseparable
- self-proclaimed experts, consultants, or apologists of the big data era especially in popular literature
- a panacea for problems of various kinds
- Outlines / visions of a <u>dataficated</u> world in which <u>reality</u> in its full size will gradually be <u>encoded</u> into data, making it accessible and knowable, resulting in better predictions and true knowledge
- <u>Homo mensura</u>: the human quest for selfrealization, progress, and prosperity can only find its eudaimonic completion due to the labors and the supervision of the data scientist

Conceptual analysis of data science

- a notoriously unruly concept with several dimensions and connotations;
- it is therefore <u>functionally vague</u>
- it typically refers to more or too much data than what we are used to, or which can be managed, accessed, analyzed, interpreted, and validated by conventional means, as a basis for useful information or reliable knowledge.
- the wooly adjective "big" in big data implies a dynamic and shifting meaning, depending on possibly highly individual circumstances, advancing technology, available storage capacity, processing power, and other cultural or historical <u>contingencies</u>.
- Some aspects of the <u>genealogy of data science</u>, including the current debate in (*Starmans, 2016*)

Conceptual analysis of data science

- a moving target with several dimensions:
- the <u>volume</u> of data
- the <u>variety</u> of data (various formats, types, and sources),
- the <u>variation</u> in quality and status,
- the <u>continuous generation</u> and production of data, which are seemingly <u>unsolicited</u> and sometimes unintentionally available,
- the <u>velocity</u> with which data are produced and analyzed, and may or must be used
- the often <u>distributed</u> nature, that is, data can be produced and stored nearly everywhere and <u>sources</u> need to be found and <u>integrated</u>

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A definition of data science

- data science is the technical-scientific discipline, specialized in managing the multitude of data: collect, store, access, analyze, visualize, interpret, and protect.

- It is rooted in computer science and statistics

- computer science is traditionally oriented toward data structures, algorithms, computability, scalability and complexity;

- Statistics is focused on analyzing and interpreting the data.

- It gives rise to a tryptich / three pillars of data science

The triptych of data science

We may identify here the following triptych:

- database technology/information retrieval

- computational intelligence/machine learning

- inferential statistics

Databases / information retrieval

- Both are core **disciplines** of computer science since many decades.
- Emerging from this tradition in recent years, notably researchers of Google and Yahoo have been working on techniques to cluster many computers in a data center, making data accessible and allowing for data-intensive calculations:
- for example, BigTable, Google File Systems, a programming paradigms like Map Reduce, and the open source variant Hadoop.
- Advanced search technology

Computational Intelligence

- Based on machine learning, data mining, knowledge discovery in databases).

- It comprises a variety of techniques such as neural networks, <u>deep learning</u>, genetic algorithms, decision trees, association rules, support vector machines, random forest, all kinds of <u>ensemble techniques</u>, and Bayesian learning.

- Put roughly, this pillar fits the tradition of <u>subsymbolic AI</u>.

Inferential Statistics

- Based on theory of probability
- mathematical <u>inferential</u> statistics
- based on <u>estimation theory</u>,
- the <u>dualism</u> of sample and population (the reality behind the data),
- thus allowing to reason with uncertain and incomplete information:
- parameter estimation, hypothesis testing, confidence intervals p values, MLE, and so on.
- Many unsolved philosophical issues !

A new conception of science?

- a more far-reaching interpretation than just a new discipline; it proclaims <u>a new conception of science</u>,

- the essence of knowledge is at stake and the classic questions in epistemology are reconsidered or reformulated.

- What is knowledge, how do you acquire this, how do you justify it, which has methodological consequences?

- What is the status of scientific theories? How do they relate to reality? Are models always wrong? (G. Box)

- Data science has an impact on many classical themes in epistemology: the <u>structure of theories</u>, <u>causality</u>, <u>laws</u> and <u>explanations</u>, completeness and uncertainty of knowledge, the <u>scientific realism debate</u>, the limits of confirmation theory, rationality and progress in science, <u>unification</u> of science, and so on.

The End of Theory

A small selection of Anderson's view on the homo mensura.

"Now Google and like-minded companies are sifting through the most measured age in history, treating this massive corpus as a laboratory of the human condition. They are the children of the Petabyte Age"

Anderson on Methodology

- "At the petabyte scale, information is not a matter of simple three- and four-dimensional taxonomy and order but of dimensionally agnostic statistics.

- It calls for an entirely different approach, one that requires us to lose the tether of data as something that can <u>be visualized in its totality</u>.

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  It forces us to view data mathematically first and <u>establish a context for it later</u>"

Anderson on the humanities

- "Google's <u>founding philosophy</u> is that we don't know why this page is better than that one: If the statistics of incoming links say it is, that's good enough. No <u>semantic</u> or <u>causal</u> analysis is required."

- Out with every <u>theory of human behavior</u>, from linguistics to sociology. Forget taxonomy, ontology, and psychology.

- Who knows <u>why</u> people do what they do? The point is they do it, and we can <u>track and measure</u> it with unprecedented fidelity.

- With enough data, the numbers speak for themselves."

Anderson on Physics

- "Consider physics: Newtonian models were crude approximations of the truth wrong at the atomic level, but still useful).

- A hundred years ago, statistically based quantum mechanics offered a better picture — but quantum mechanics is yet another model, and as such it, too, is flawed,

- no doubt a caricature of a more complex underlying reality"

Anderson on biology

- The models we were taught in school about 'dominant' and 'recessive' genes steering a strictly Mendelian process have turned out to be an even greater simplification of reality than Newton's laws.

- The discovery of gene-protein interactions and other aspects of epigenetics has challenged the view of DNA as destiny and even introduced evidence that <u>environment can influence inheritable traits</u>, something once considered a genetic impossibility.

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  In short, the more we learn about biology, the further we find ourselves from a <u>model that can explain it</u>."

Anderson on methodology

- "Correlation supersedes <u>causation</u>"

- Science can advance even without coherent <u>models</u>, <u>unified</u> <u>theories</u>, or really any <u>mechanistic</u> <u>explanation</u> at all."

Implications for (Philosophy of) AI

- Brute force versus intelligent systems
- Do we need a model of the human mind? Consciousness, mind, personal identity ?
- Strong and Weak AI
- Symbolic versus subsymbolic AI
- Knowledge representation and reasoning
- Frame problem, qualification problem, ramification problem
- Syntax-semantics barrier

Reconsiliating statistics and machine learning

- Statistics and ethics: laborious dialogue through the ages
- "How to lie with statistics?"
- "Lies, damned lies and statistics"
- All sciences, including epistemology have experienced a probabilistic turn
- No undisputed foundations; conflicting schools and paradigms (just like philosophy!)
- textbooks wrongly suggest a united field
- Erosion of concept of model
- Predicament of truth
- Will machine learning even further deteriorate the situation?
- The end of estimation and dualism?

Weapons of Math destruction

- Cathy O' Neill, from data science protagonist to critic / scepticist
- advocate injustice, discrimination, and threathen democracy
- gender, age, race, religion, nationality, sexual inclination, zip code
- Primary versus secondary qualities
- Is science value-free? Creating awareness
- Ethics inside or outside the machine?
- Nothing new under the sun? Classical problem of philosophy of technology?

Data Science and Transhumanism

- NBIC convergence
- Cognitive enhancement
- Anti-aging research
- Pre-natal screaning
- Neural stimulation (DBS)
- Lab-on-a-pill
- Tissue engineering
- Cloning
- Cryronic movement
- …

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Philosophical issues in the AI data science debate

- Just another case in the Philosophy and history of Technology?
- Utopia versus dystopia?
- How does data science <u>accelerate</u> the transhumanism project?
- Ethical machine learning, responsible AI
- "Non discriminant discrimant analysis" (Cathy O' Neill)
- Should the ethics be <u>inside</u> or <u>outside</u> the machine?

- The natural versus the artificial
- <u>Essentialism</u>, living in accordance with nature
- The natural versus the artificial: religious dogma, ecological principle or romantic conception? (Maarten Doorman)
- Friedrich Nietzsche and the Übermensch in "Thus spoke Zarathustra" (1883)
- Helmut Plessner „Die Stufen des Organischen und der Mensch" (1928) Homo faber has always been "artificial" Eccentricity!

Utopia versus dystopia

- Transhumanists versus bioconservatives

- Post humanism? (Habermas, Sloterdijk)

- Post Darwinian? (Fukuyama)

- Eugenetics / social darwinism in disguise? (Francis Galton, Karl Pearson, Ronald A. Fisher)

- The naturalistic fallacy (Hume,Sidgwick, G.E.Moore)

- A plea for meta-ethics technology affects our moral categories

- A contemporary Eutyphro-dilemma

Suggested / recommended publications

Anderson, C. (2008). "*The End of Theory: The Data Deluge Makes the Scientific Method Obsolete*". In: Wired Magazine ,2008,6. (https://www.wired.com/2008/06/pb-theory/)

Bostrom, N. (2016) "*Superintelligence; paths, dangers and strategies*", Oxford University Press, USA.

Brockman, J. (2015) "What to think about machines that think; Todays leading thinkers on the age of Machine Intelligence". HarperCollins New, York.

Brynjolfsson, E., McAfee,A. "*The Second Machine; work progress and progress an prosperity in a time of brilliant technologies*". W.W. Norton & Company, New York.

Halevy, A. P. Norvig, F. Pereira (2009), "*The Unreasonable Effectiveness of Data*", IEEE Intelligent Systems, vol.24, no. 2, pp. 8-12, March/April 2009

Mayer-Schönberger, V., Cukier K. (2013) "*Big Data: A Revolution that will Transform how we Live, Work and Think*". Houghton Mifflin Harcourt, 2013.

O' Neill, C. (2016) *"Weapons of Math destruction; How Big Data Increases Inequality and Threatens Democracy",* Crown Publishing Group New York

Pearl, J. & D. McKenzie (2018) *"The Book of Why; the new science of cause and effect". Basic Books, Hachette Book Group, New York*

Presentation based on the following publications

Starmans, R.J.C.M. (2016). "The Advent of Data Science - some considerations on the unreasonable effectiveness of data". In: Peter Buhlmann, e. a. (Eds.), Handbook of Big Data -Handbooks of Modern Statistical Methods. New York: Chapman & Hall/CRC.

Starmans, R.J.C.M. (2018). "The Predicament of Truth: on Statistics, Causality, Physics and the Philosophy of Science". In: M. van der Laan and S. Rose, Targeted Learning; Causal Inference for Observational and Experimental Data, Springer, New York.

Van der Laan, M.J. & Starmans, R.J.C.M. (2014). "Entering the Era of Data Science: Targeted Learning and the Integration of Statistics and Computational Data Analysis". In: Advances in Statistics, New York: Hindawi Publishing Corporation.

Starmans, R.J.C.M. (2018). A contemporary Eutyphro-dilemma: on Deep Learning and the columns of oracular language (in Dutch). Filosofie, Tweemaandelijks Nederlands-Vlaams Tijdschrift 28 (3) .

Starmans, R.J.C.M. (2018). Passing the caverns of morality: on ethics, statistics and data science. STAtOR, Magazine of the Dutch Society for Statistics and Operations Research18 (1).

Starmans, R.J.C.M. (2015). "With Google toward the automatic Statistician" (in Dutch) In: STAtOR, Magazine of the Dutch Society for Statistics and Operations Research, 12 (2)

Starmans, R.J.C.M. (2015). "The Ant, the Spider and the Bee; Bacons unintended Preamble to the Data Science Debate" (in Dutch) In: Filosofie, Tweemaandelijks Nederlands-Vlaams Tijdschrift, 25 (3)

Starmans, R.J.C.M. (2015). "Contemporary Dystopias; the Fall of Icarus and the Wrath of the Machines" (in Dutch). Filosofie, Tweemaandelijks Nederlands-Vlaams Tijdschrift, 25 (1), Antwerpen