AI in Flux – International Conference on Artificial Intelligence and Cybernetics

Deutsches Museum München/Munich (online), 29 Nov – 1 Dec 2021

NB: all times are CET

Montag, 29 November 2021 (auf Deutsch / in German)

13:00-13:15 Eröffnung

Ulf Hashagen / Helmuth Trischler (Deutsches Museum)

13:15-13:45 Ingenieur-Geist und Geistes-Ingenieure: Künstliche Intelligenz und Kognitionswissenschaft

Helen Piel, Rudolf Seising (IGGI-Team, Deutsches Museum)

Wir werden eine Einführung in die Tagungsthemen (sowohl des deutschsprachigen ersten Tages als auch der englischsprachigen letzten Tage) geben. Dabei werden wir kurz das Projekt „IGGI: Ingenieur-Geist und Geistes-Ingenieure. Eine Geschichte der Künstlichen Intelligenz in der Bundesrepublik Deutschland“ vorstellen und zuletzt die Beziehungen zwischen den Forschungsbereichen KI und Kognitionswissenschaft skizzieren.

13:45-14:30 Andere Intelligenzen? Gemeinsame und getrennte Geschichten von Tierintelligenz und Künstlicher Intelligenz

Susanne Schregel (Fellow des Historischen Kollegs München)

Die Unterscheidungen und Abgrenzungen, die in der Auseinandersetzung um Intelligenz getroffen wurden, und die Lebewesen und Dinge, auf die diese sich richteten, veränderten sich im Laufe der Zeit immer wieder. Avancierte die Maschine in der zweiten Hälfte des 20. Jahrhunderts zum paradigmatischen Beispiel, an dem sich die Möglichkeit nicht-menschlicher Intelligenzen kristallisierte, so war es im späten 19. Jahrhundert das Tier. In diesem Zeitraum stießen Kontroversen um die Evolution und die Abstammung des Menschen in Großbritannien, den USA und Deutschland breite öffentliche Debatten um das kognitive Fähigkeitsspektrum von Tieren an, die sowohl in wissenschaftlichen wie in breitenwirksamen Medien geführt wurden.

Der Vortrag bezieht diese Debatten um die Tierintelligenz im späten 19. Jahrhundert auf die Kontroversen um die „maschinelle“ beziehungsweise „künstliche Intelligenz“ in der zweiten Hälfte des 20. Jahrhunderts. Dadurch wird deutlich, wie sich die Wahrnehmung „künstlicher Intelligenz“ in eine längere Geschichte der „anderen“ Intelligenzen einreihte. Fluchtpunkt sowohl der Tierintelligenzfrage wie der Kontroversen um die „künstliche Intelligenz“ bildeten Grenzverhandlungen zwischen Menschen und anderen Entitäten, die im Rückgriff auf variable Kriterien des Kognitiven geführt wurden, und die sich auch im Streit um die Methoden der Feststellung von Intelligenz manifestierten.

14:30-15:15 Künstliche Intelligenz im Trans- und Posthumanismus. Eine philosophische Reflexion

Janina Loh (Stiftung Liebenau)

Im ersten Teil dieses Vortrages werde ich in der gebotenen Knappheit die drei Strömungen des Transhumanismus, technologischen und kritischen Posthumanismus vorstellen, ihre jeweiligen Ziele und Vorgehensweisen, um diese zu erreichen, skizzieren. Im zweiten Teil bespreche ich die Rolle der künstlichen Intelligenz (KI) in den genannten drei Strömungen und unterziehe sie darüber einer philosophischen Reflexion und Kritik. Ich beschließe den Vortrag mit einem Plädoyer für mehr Sensibilität und ein gesteigertes Bewusstsein für die ethischen Fragen, die sich in der Entwicklung von Technik einstellen.

15:15-15:30 Pause

15:30-16:15 Verteidigung des Menschen. Was menschliche und künstliche Intelligenz unterscheidet

Thomas Fuchs (Universität Heidelberg)

Mit den Fortschritten der künstlichen Intelligenz, der Digitalisierung der Lebenswelt und der Reduzierung des Geistes auf neuronale Prozesse erscheint der Mensch immer mehr als ein Produkt aus Daten und Algorithmen: Wir begreifen uns selbst nach dem Bild unserer Maschinen, während wir umgekehrt unsere Maschinen zu neuen Subjekten erheben. Gegen diese Selbstverdinglichung des Menschen wendet sich ein Humanismus der Verkörperung: Unsere Leiblichkeit, Lebendigkeit und unser Selbstverhältnis unterscheiden uns grundlegend von allen Erzeugnissen künstlicher Intelligenz.

16:15-17:00 Animierte Intelligenz, oder: Was ist schon ‚künstlich' an künstlicher Intelligenz?

Clemens Apprich (Universität für Angewandte Kunst Wien, Centre for Digital Cultures der Leuphana Universität Lüneburg)

Die Ausrichtung künstlicher Intelligenz an der Geschichte der Gehirnforschung, wie sie nicht zuletzt in aktuellen Debatten erfolgt, ist zutiefst problematisch. Der in der Neurowissenschaft historisch verankerte Konnektionismus, also die Annahme, dass sich Intelligenz auf ihre hirnphysiologische Verdrahtung reduzieren ließe, erfreut sich mit der Wiederentdeckung künstlich neuronaler Netzwerke großer Beliebtheit. Mein Vortrag folgt den Spuren einer solch biologistischen Bestimmung von Intelligenz und stellt ihr kreative, das heißt tatsächlich ‚künstliche' Vorstellungen gegenüber. Aufbauend auf einer psychoanalytisch inspirierten Medienkritik von KI, möchte ich die Materialitäten, Prozesse und Techniken in den Blick nehmen, die benötigt werden, um intelligentes Verhalten hervorzubringen. Nicht die Simulation, sondern die Animation von Intelligenz rückt dabei in den Mittelpunkt.

17:00-17:30 Pause

17:30-18:15 KI-Entwicklung im deutsch-deutschen Vergleich – zwischen Kaltem Krieg und deutscher Innovationskultur

Rebekka Roschy (Technische Universität Dresden)

KI begann sich in Deutschland zu der Zeit zu etablieren, als mit der Bundesrepublik und der DDR zwei Staaten mit unterschiedlicher politischer, wirtschaftlicher und weltanschaulicher Ausrichtung existierten. Dieser historische Sonderfall erlaubt eine besondere deutsch-deutsche Vergleichsperspektive auf die Entwicklung von KI.

So lässt sich einerseits die systembedingte Differenz des Einflusses auf Forschung und Technologieentwicklung nachvollziehen, andererseits zeigen sich durchaus parallele Entwicklungspfade. Hier sind Konzepte der (nationalen) Pfadabhängigkeit und der „Innovationskultur" geeignet, Gründe für Persistenz und Kontinuitäten, aber auch für Brüche zu verdeutlichen.

Der Beitrag umreißt die Meilensteine der KI-Entwicklung in der Bundesrepublik und der DDR. Für beide Staaten spielte ihre Position innerhalb der Ost-West-Konfrontation eine wichtige Rolle. Die Bundesrepublik war ab den 1960er Jahren bemüht, die „technologische Lücke" gegenüber den USA zu verringern. Die DDR hingegen konnte kaum von ihrer Zugehörigkeit zum Ostblock profitieren, so dass auch hier die Entwicklung des Westens, insbesondere die der „Referenzgesellschaft" Bundesrepublik, ein wichtiger Bezugspunkt blieb.

Welche Auswirkungen die internationale Konstellation, politische und wirtschaftliche Faktoren auf die Entwicklung von KI in beiden Teilen Deutschlands hatten, aber auch die Frage einer spezifisch deutschen KI-Ausprägung, soll anhand eines verflechtungsgeschichtlichen Ansatzes betrachtet werden.

18:15-18:30 Pause

18:30-20:00 Rückblicke auf KI und Kognitionswissenschaft in der Bundesrepublik (Podiumsdiskussion)

Podium: Sybille Krämer, Jörg Siekmann und Werner H. Tack

Moderation: Manuela Lenzen

Tuesday, 30 November 2021 (in English / auf Englisch)

10:00-10:30 Welcome

Ulf Hashagen / Helmuth Trischler (Deutsches Museum)

Florian Müller, Dinah Pfau, Helen Piel, Rudolf Seising, Jakob Tschandl (IGGI Project, Deutsches Museum)

10:30-11:00 A Network for Learning Machines – Karl Steinbuch's "Kybernetik" and the Modelling of Human and Mechanic Intelligence in Early German AI

Christian Vater (Karlsruhe Institute of Technology)

Before 'Artificial Intelligence', there was 'Cybernetics'. This was the approach that stuck most in post-war Germany, West and East, and it was picked up by communications engineer Karl Steinbuch at the Technical University of Karlsruhe (today KIT). He understood it as a universal approach, modelling information-processing systems – human, animal and machinery alike, calling his concept "Informatik". This article highlights three aspects of his work: (a) His definition and use of models in theory, (b) his practical development of models in two and three dimensions, drawn and built, (c) his network of research, both in print and to persons, in a transnational and trans-disciplinary research style. He connected the western and eastern hemisphere of a world during the Cold War, crossing ideological borders and academic boundaries of the "Two Cultures". Later in life, he became a 'public scientist', advocating a 'reasonable' Control of Public Affairs based on a Scientific Model of Society. In this he failed.

11:00-11:30 Sensa(c)tion: Modelling Intelligence in Sensor-Actor-Systems

Christiane Heibach (University of Regensburg)

In his canonical study on Cybernetics of 1948 Norbert Wiener states the equivalence between automates and biological systems which both dispose of "sense organs, effectors and the equivalent of a nervous system" (2nd ed. 1961, p. 43). Following this analogy, British cyberneticists start several experiments during the 1960s, which aim to simulate the human nervous system – partly relating it to artificial senses, partly skipping the 'detour' via sensory perception. All of these systems perform a very basic intelligence applying the rather simple stimulus-response model, while current (much more complex) sensor-actor-systems develop towards specific non-human technological epistemologies and thus seem to veer away from the cybernetic's isomorphism between technical and biological systems.

The proposed contribution starts from the assumption that sensor-actor-systems refer to different notions of intelligence, depending on their complexity. While discussing this issue from the 1960s to the present it will be of particular interest, which lines of tradition can be drawn between European cyberneticists and the developers of the successive perceiving systems.

11:30-12:00 From Theoretical Physics to Cybernetics, AI (and beyond). The strange case of the Italian path to Information Sciences and Technology

Settimo Termini (DMI Università degli Studi di Palermo. Accademia Nazionale di Scienze, Lettere e Arti di Palermo)

The paths followed by AI for establishing itself as a crucial and driving force at the frontier of innovation in different places and periods have been various and different, as the "dynamical" name of the Conference strongly suggest. It is also to observe that for fully grasping its impact it is important to take into account all the general condition under which new scientific activities began developing.

The case of Italy adds something very specific and, in a sense, unusual: the predominant (and, perhaps, overwhelming) presence, in the first years, of physicists. Specifically, of theoretical physicists.

This fact can be looked at from an historical point of view trying to answer such questions as: why this happened only in a country or whether this specific event had some visible impact on the type of research done.

There is, however, also another aspect which goes beyond the historical interest. Conclusions which can be drawn from this historical case, can be useful for studying and forecasting development and role of present AI in present Society?

The talk, focusing on the previous items, will briefly present some comments on these arguments.

12:00-12:30 Break

12:30-13:00 Next Frontiers of Machine Vision & Learning and the Digital Humanities

Björn Ommer (Heidelberg University)

Recently, deep learning research has seen enormous progress that has tremendously propelled artificial intelligence and its applications. However, in light of the grand challenges of this field the technology still shows significant limitations. The ultimate goal of artificial intelligence and computer vision in particular are models that help to understand our (visual) world. Explainable AI extends this further, seeking models that are also interpretable by a human user. The talk will discuss some of the recent breakthroughs in machine vision and learning, highlight future challenges, and propose ways to improve the accessibility of content. Which methodological advances are needed to fully leverage the potential of intelligent data analysis and what is the next frontier? The talk will then showcase novel applications in the digital humanities and, time permitting, in the life sciences.

13:00-13:30 Literature and artificial intelligence

Hans-Christian von Herrmann (Technical University Berlin)

Based on a story by E. A. Poe, Claude E. Shannon constructed his mind-reading (?) machine in 1953, which the Parisian psychoanalyst Jacques Lacan was to focus on the following year in his seminar on language and cybernetics. As early as 1949, Alan Turing had spoken to the *London Times* in a telephone interview that computers would soon be able to prove themselves in all areas of human activity, even when writing sonnets. In 2019, the English author Ian McEwan in his novel *Machines Like Me*, which contains a history of artificial intelligence and also leads the reader back to the beginning of the 1980s, once again made a virtuously clear statement that links literary fiction and AI. The presentation turns to these very different intersections of literary history and artificial intelligence in order to explore how they reveal a profound change in the modern relationship between culture and technology.

13:30-15:30 Lunch

15:30-16:00 Late socialist AI? Transformations of state and computer research in the GDR

Martin Schmitt (Technical University of Darmstadt)

Analyzing the history of AI in Europe, some researchers tend to forget that the continent was divided until 1990. But computer technology played an important role in socialist states, so did AI. As new literature showed the potential of comparative approaches, this article aims to investigate the developments of early AI research in the GDR. Did GDR AI research differ from Western approaches? How was it integrated into the broader plans for computer development of a state reaching its financial limits? Answers to these questions might contribute to an analysis of a possible co-construction between AI and societal, cultural and political developments. Through an analysis of main projects and the transnational cooperation within Eastern European states, this article contributes to the overall theme of the special-issue on transformations of AI research. Based on interviews with main protagonists, media sources like newspapers and a re-evaluation of literature, the article will provide new insights into the formation and transformation of AI research in the GDR in the 1980s and 1990s.

16:00-16:30 Between System Theories and AI: The European Origin of the New Three Theories in the People's Republic of China (the 1980s-)

Bo An (Yale University/Max Planck Institute for the History of Science)

The paper examines the impact of European systems theory had on cybernetics and, by consequence, AI research in the People's Republic of China since the 1980s. As one of the core disciplines that formed the Chinese tradition of AI research, cybernetics as developed by Qian Xuesen, a prominent Chinese scientist and technocrat, witnessed a revival in the 1980s during the reform era, with the introduction of three theories by three European scientists: Austrian system theorist Ludwig von Bertalanffy's Theory of Dissipative Structure, French mathematician Rene Thom's Catastrophe Theory, and Germany physicist Hermann Haken's synergetics. Following the old triad--systems theory, information theory, and control theory, they became known and popularized in China as the New Three Theories, deemed crucial to develop alternative Chinese AI systems and visions. The paper explains the unlikely rendezvous by contextualizing it in the exchange between Europe and China in a recent past that has become barely recognizable in standard AI histories.

16:30-17:00 The Mind in a Technological System: Artificial Intelligence in Late Socialism

Ekaterina Babintseva (Harvey Mudd College)

In the 1960s, Soviet scientists and government contended that the country's prosperity depended on the computerization of production and its efficient management. Responding to this verdict, Soviet psychologists proposed that to advance computerization, the Soviets needed to master logic-based methods of problem-solving. This paper examines psychologist Lev Landa's Algo-Heuristic Theory (AHT), which described human problem-solving with a set of logical prescriptions. At first, the AHT assisted Soviet teachers in training students to solve technoscientific tasks. In the US, where Landa emigrated in 1974, the AHT found its application in management training and the development of expert systems, a dominant approach to AI in the 1970s. I argue for Soviet and American converging visions of the role of computers and rule-based methods of thinking in their economies. While the mid-century American public associated pattern-based thinking with totalitarianism, American managers and computer scientists praised the AHT for its ability to optimize human, and later, computational thinking. Additionally, AHT's applications across pedagogical, managerial, and AI contexts are emblematic of the parallel developments in 20th-century computerization and the standardization of human thinking. While the AHT did not lead to thinking machines, its logic-based methods of problem-solving succeeded in making some humans think like machines.

17:00-17:30 Break

17:30-18:00 Online Performance: Sophie Schmidt (http://sophieschmidt.info/)

18:00-19:00 KEYNOTE

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18:00-19:00 KEYNOTE

The Computer Model of the Mind and Computational Intractability

Thomas Sturm (ICREA & Universitat Autónoma de Barcelona) &

Javier Poveda (Universitat Autónoma de Barcelona)

The most successful 20th-century metaphor of the mind was provided by the computer, made popular especially through receptions of Turing's and Simon and Newell's works in cognitive science. We will outline major steps of its rise and the expectations that came along with its growing popularity in cognitive science, especially the view that it provides a *realistic* model of cognitive processes – in Johnson-Laird's (1983) words, the "computer is the last metaphor; it need never be supplanted". While such optimism was spreading, one of the most serious limitation became slowly discovered too: the problem of computational intractability. In his 1936 paper "On computable numbers, with an application to the *Entscheidungsproblem*", Turing showed the impossibility of finding any solution to the halting problem. Turing's paper served as inspiration to philosopher Hao Wang. He formalized the concept of tractable/intractable problems using a game of dominoes. Wang found an analogy of his distinction with a Turing machine. Moreover, Wang's work influenced his former doctoral student Stephen Cook. Cook's 1971 paper "The complexity of theorem proving procedures" distinguished problems that could be solved in a reasonable amount of time from those that cannot. We will also look at how the discovery of computational intractability was related to the Cold War.

Wednesday, 1 December 2021 (in English / auf Englisch)

10:00-10:30 The mechanisation of thought processes – the view from 1958

Matthew Cobb (University of Manchester)

In 1958, the UK National Physical Laboratory held a meeting with 200 delegates, including many leading thinkers from around the world in the embryonic fields of AI, machine learning, pattern recognition, mechanised translation and literature searching. The proceedings of the meeting – including transcripts of discussions – were published in a 1000-page two-volume collection. These documents provide a snapshot of the attitudes of both academia and industry regarding the future. In particular, there was palpable excitement over recently-developed techniques for pattern recognition (Perceptron and Pandemonium). This article will explore the significance of this meeting in the development of AI and its application in science and industry, and the forgotten hopes and fears of researchers at the very beginning of this field.

10:30-11:00 Models, Mechanisms and Organisms in Turing and Ashby

Hajo Greif (Warsaw University of Technology)

This paper will outline the differences in approaches to and resources of "producing models of the action of the brain" (Turing 1946) in Alan M. Turing and W. Ross Ashby, who were in conversation on these topics as members of the "Ratio Club". Ashby (1960) explicitly committed himself to building analogue machine models of the adaptive behaviours of brains and other systems, their functions and their relationships to their environments, all understood in explicitly Darwinian terms. However, he restricted his focus to the origins of adaptive behaviour by learning, leaving aside "genic" adaptation, and therefore the organic basis of that behaviour. Conversely, Turing developed a notion of idealised theoretical machines, known as "logical computing machines", which originally served metamathematical purposes but informed the concrete design of the digital computer. He used his theoretical machines for inquiries into a varied set of phenomena, from proto-connectionist models of the brain via simulation of conversational behaviour to pattern development in organisms. Notably, in the latter (1952) he relied on the non-Darwinian account of morphogenesis in Sir D'Arcy Thompson's On Growth and Form (1942). We will broadly outline the state of biological theorising on which Turing and Ashby relied at the time of their writing, and ask how their specific biological commitments may have influenced their choice of modelling approach.

Work on this paper is supported by National Science Centre (NCN) grant "Turing, Ashby, and 'the Action of the Brain'", no. 2020/37/B/HS1/01809, Hajo Greif (PI).

11:00-11:30 A handful of beginnings: AI in West Germany

Florian Müller, Dinah Pfau, Jakob Tschandl (IGGI Project Team, Deutsches Museum)

Research into Artificial Intelligence (AI) has been done for over 60 years, often with the difficulty of how to define its contents and borders. AI was and is an umbrella term for an interdisciplinary field using methods and theories of both the sciences and humanities. Looking at five AI research areas, we explore these issues for West Germany, where the internationally emerging fields of Automated Deduction, Natural Language Processing, and Image Processing took off in the 1950s. But it needed the initiative of several young researchers active in these fields during the 1970s to establish an AI community. This community then experienced a shift in focus, partly due to international political and economic influences, towards research into Expert Systems, which dominated AI during the 1980s. While this field was emphasising technological applicability, a parallel strand of research, Cognitive Science, focused on understanding natural intelligent systems. Though seemingly disparate, we will show how all of these beginnings and transformations characterise West German AI.

11:30-12:00 Break

12:00-12:30 "Autonomous technical systems" – a new paradigm in technological science?

Benjamin Rathgeber (Karlsruhe Institute of Technology, Munich School of Philosophy)

Autonomous technical systems (ATS) are now present in all areas of our modern society. They already play a central role not only in the areas of mobility, the military and production, but also in the financial sector, care and research, and will become even more important in the coming years. However, a lot of different technological developments can be related to ATS and it is not always clear what exactly is meant by "autonomy". If the claim is to develop technical systems that are supposed to evolve independently of the developer and to behave completely autonomously of the developer's purposes, then a new paradigm shift in technological development would have to occur. This means however, that the specific purposes ATS serve are no longer clear and that a disparity exists between the understanding of technology and the autonomy of the objects it produces. The presentation will explore this inherent problem of ATS from a methodological point of view. By reconstruction recent technological developments, a solution will be proposed how we can meaningfully talk about ATS and autonomy.

12:30-13:00 Algorithms, Knowledge, and Data: On the Evolution of AI Systems Design

Eyke Hüllermeier (Chair of Artificial Intelligence and Machine Learning Institute of Informatics, LMU Munich)

During the past decades, the design of intelligent systems and development of applications in artificial intelligence (AI) has been subject to a steady evolution. Most notably, there has been a significant shift from the classical knowledge-based paradigm to a strongly data-driven approach. This shift has been fostered by the recent emergence of data science as a scientific discipline and the success of machine learning (ML) as one of its core methodologies.

Elaborating on the evolution of algorithm and intelligent systems design in general, this talk will therefore specifically focus on recent developments in machine learning. Proceeding from the standard algorithmic approach as commonly adopted in computer science, three paradigms will be motivated and explained briefly.

13:00-13:30 Blurred vision. Computer Vision between Computer and Vision

Birgit Schneider (University of Potsdam)

How much human vision is in computer vision and how much of it is analogy? What kind of concept of human vision does it take to think computer vision? What does computer vision "see"? These questions are the focus of this paper, which tries to approach the 'seeing' of computer vision with the heuristic method of visual disorder by looking at European approaches in the field. After the perceptron model had already been used at the end of the 1950s to introduce the functioning of an artificial neural network, including the inductive idea of a learning rule as a seeing machine, this branch of research came to a standstill. The book that sparked renewed interest in neural networks for the emerging field of computer vision was a 1982 cognitive science book on human vision. It was entitled “Vision – A Computational Investigation into the Human Representation and Processing of Visual Information” and was written by British neuroscientist and psychologist David Marr. The chapter will contextualize this work and its impact and analyze the analogies of seeing in humans and machines in the early times of computer vision.

Wrap-up