

## The potential of Artificial Intelligence in academic research at a Digital University

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**Abstract:** Steady growing research material in a variety of databases, repositories and clouds make academic content more than ever hard to discover. Finding adequate material for the own research however is essential for every researcher. Based on recent developments in the field of Artificial Intelligence and the identified digital capabilities of future universities a change in the basic work of academic research is predicted. This study defines the idea of how Artificial Intelligence could simplify academic research at a Digital University. Today's studies in the field of AI spectacle the true potential and its commanding impact on academic research.

**Keywords:** Artificial Intelligence, Academic Research, Digital Strategy, Digital Capabilities, Digital University

### 1 Introduction

Research material in general is available from many different sources, including databases and repositories. Although living in a highly-digitalized world, the growing amount of digitally available academic content is still stored decentralized in an unstructured way and therefore more, hard to find. Studies estimate that more than half of all scientific papers are only read by their authors, editors and peer reviewers [Rm16] and as much as 90% have never even been cited [Rd16]. The described characteristics of academic data perfectly match the IBM definition of big data [Zp13]. It is now state of the art to use Artificial Intelligence (AI) for the evaluation of big data [Od13]. If you imagine an entirely digital university providing simple access to academic material, there won't be any way to avoid AI. This hypothesis leads to our research question: How can AI simplify academic research?

This discussion paper is based on a literary review with focus on Artificial Intelligence (Sec. 4) and Academic Research. Focusing on Academic Research the multiple offers of online university courses such as Coursera [CO17] or Stanford Online [SU17] are not in scope of this paper because they focus on providing a new way to present processed

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academic information rather than helping academics to find resources. We presume that a digital university is essentially in favor of potential support of AI in academic research. Therefore, in Section 2 it is explained what digital capabilities are needed to transform a university into a digital university. Section 4 outlines the potential starting points for AI in academic research. The results will be finally summarized in conclusions (Sec. 5).

## 2 Herman Hollerith Center Böblingen as Digital University

The Herman Hollerith teaching and research center (abbr. HHZ) is integrated into the structure of Reutlingen University, the Reutlingen Research Institute and the computing faculty. Entrepreneurial questions are focused on strategic research topics and explored in a closed dialogue between research and practice [HH17]. Universities are competing globally for students, academic staff and funding, and only those that manage to remain relevant and leverage new digital capabilities will benefit in the digital age [PC17]. Digital technology as driving force in digitization is used to transform the customer experience, operational processes and business models [Wg14]. Therefore, it is essential for the HHZ to develop own digital capabilities by identifying the activities that would most benefit from rapid digitization.

As a result of our research we identified five top capabilities the HHZ should focus on next:

1. Boosting the customer (student) experience by using new technologies,
2. Establishing students as influencers and brand ambassadors by establishing a successful alumni-network,
3. Building a solid IT governance to enhance collaboration, innovation in learning & research environments and education,
4. Re-designing exams in an environment of blended learning and
5. Simplifying academic research through Artificial Intelligence.

Latter will be discussed more detailed.

## 3 Artificial Intelligence

There is not the one standard definition for Artificial Intelligence. A simple catchy definition is provided by Chuck Williams [Wc83]: ‘Artificial Intelligence is a multi-disciplinary field whose goal is to automate activities that presently require human intelligence’. Rather more comprehensive Stuart J. Russell and Peter Norvig [RN95] believe Artificial Intelligence could be clustered into four categories: Systems that think like humans, systems that act like humans, systems that think rationally and systems that act rationally.

Behaving like humans is primarily relevant for AI when interacting with people. This kind of expert systems need to know the rules of conversation in order to substantiate their decisions or interact with humans. The underlying principles therefore might also be based on human conversational behaviors. Historically AI in the category of thinking like humans is often similarly designed to the thinking patterns of the human brain. Whereas nowadays AI is also used to evaluate human decisions for example in traffic situation. The categories of thinking or acting rationally are mainly based on making logical decision. Accordingly, problems must be simplified and described in a logical notation. In a complex environment, the solution provided by AI might not be perfect but at least reasonable. In addition, AI provides the solution before the human mind has even taken the decision into consideration [RN95].

AI also can be distinguished in strong AI and weak AI. While strong AI is defined as general intelligence in the sense of the creation of human-like intelligence of machines, whereas weak AI aims to provide intelligent algorithms somewhere stored inside the software [HT17]. Machine-learning, deep-learning, natural language processing and neural networks are often summarized under the term of AI.

Correctly it should be differentiated between Artificial Intelligence and Computational Intelligence (CI) as a sub-area of AI. CI includes concepts, paradigms, algorithms and implementation of developing systems that enable intelligent behavior in complex environments to be automated [KR11]. Neural networks and machine learning are falling under CI, while the others are related to AI.

To enable systems to think or act like humans or simply rationally the system generally must be supplied with a good knowledge about the areas of application. The AI can either learn about the relevant topics by itself, when it is implemented as neural network, or it can be trained on sample data. Once enabled, AI can solve problems based on special search algorithms, combining existing knowledge and reasoning with a novel perspective and making decisions where knowledge is uncertain.

One state of the art example is IBMs Watson. Back in 2011 a machine using Watson AI won against a human player in Jeopardy<sup>®</sup>. The same technology is now able to perform visual recognition [GI17]. IBM however, is not the only company in the field of Artificial Intelligence: In 2016 Google attracted attention with its AI AlphaGo, which defeated Go star Lee Sedol. Special interest created some unorthodox movements by AI, which are not common standard in the game [TG17]. AI as a not common standard is able to support represented and inferred knowledge about a specific topic. Amassing knowledge about every user relevant topic is the goal of Facebook. Therefore, they are utilizing the user data to train their own AI to analyze, cluster and rate the content of every single post [SO17]. As already mentioned another relevant field of usage of AI is communication. Latest trends in communication based on AI are chatbots, systems for voice recognition in cars or products for home automation – those meanwhile are even provided as software-as-a-service [AW17].

## 4 Unleashing the power of AI

The basis of each academic research is to collect all relevant information on the current situation and the level of the research. Could these two aspects be the starting point for the development of new use cases for existing AI systems? Moreover, can experienced AI systems be used to simplify academic research?

AI could support researchers in various situations such as helping with qualitative surveys with experts. Creating, executing and evaluating those surveys takes researchers a lot of time, because the questions of course need to be based on facts, the spoken word must be transcribed and finally the insights must be analyzed. By using AI speech recognition and language skills time can be saved when creating and evaluating questionnaires. With an advanced understanding of human communication, it would also be possible for AI to carry out interviews on its own. Chatbots and virtual assistant technology can be used to build that kind of academic support.

The effort spent searching through literature to ascertain the current state of the research is incredibly high. Finding information about current developments, which are often press released from specific institutions, seem in some cases even impossible. It also includes a certain degree of uncertainty because one can never be sure of finding all important and relevant information. Many academic search engines helping researchers already exist, among them Google Scholar, Microsoft Academic Search, PubMed and JSTOR. Yet these only search through papers using clearly categorized information such as the publication date and keywords. If AI could be taught to find meaning in the thousands of books and research papers published each year, it could automatically highlight important new trends or discoveries, and draw conclusions from them. A tool named Semantic Scholar developed by the Allen Institute for Artificial Intelligence seems to be an interesting step towards high quality academic search results [Kw15]. Advanced search algorithms, which combine search in a specific themed field with auto-detection of related themed fields, clustering results e.g. based on self-created tags and/or relevance of authors, will be a beneficial usage of AI in academic research.

AI could be a kind of scientific assistant offering researchers new perspectives for their topics, assisting them in the everyday research work and could thus enable real scientific progress.

## 5 Conclusion

Artificial intelligence can support academics like professors and researchers with contextual information, connections between topics and further assistant tasks during their research. If we think of a digital university, where all structured and unstructured data is stored in a digital way and is thus available for Artificial Intelligence transferring existing AI algorithms and concepts have a lot of potential in academic research.

Furthermore, the exponential growth of digitally available data worldwide and advances in cloud computing combined with the use of AI can help to unleash the real potential of new scientific knowledge and accelerate scientific progress.

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