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Machine Learning in Artificial Intelligence

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Abstract: *AI has received increased attention from the information systems (IS) research community in recent years. There is, however, a growing concern that research on AI could experience a lack of cumulative building of knowledge, which has overshadowed IS research previously. This study addresses this concern, by conducting a systematic literature review of AI research in IS between 2005 and 2020. The search strategy resulted in 1877 studies, of which 98 were identified as primary studies and a synthesise of key themes that are pertinent to this study is presented. In doing so, this study makes important contributions, namely (i) an identification of the current reported business value and contributions of AI, (ii) research and practical implications on the use of AI and (iii) opportunities for future AI research in the form of a research agenda.*

Keywords: Artificial intelligence, AI Machine learning, Systematic literature review, Research agenda

I. INTRODUCTION

AI has been claimed to offer transformational potential across sectors and industries, ranging from supply chain management. Studies have reported that AI provides opportunities to reinvent business models, change the future of work performance improvements, and even enhance human capabilities.

The aim of this research is to understand the various characteristics of AI studied within the context of IS. A systematic literature review is important as it can be used to provide a valuable baseline to aid in further research. The aims of this systematic review are to:

1. Identify the reported business value and contributions of AI
2. Examine the practical implications on the use of AI
3. Identify the opportunities for future AI research in IS.

The structure of the paper is as follows. First, an introduction to related work on AI in the IS field is presented. Then the methodology of the systematic literature review is explained, and limitations of the study are acknowledged. The paper ends with a conclusion and directions for future research.

Intelligence usually means “the ability to solve hard problems”. “AI is concerned with methods of achieving goals in situations in which the information available has a certain complex character. The methods that have to be used are related to the problem presented by the situation and are similar whether

II. METHODOLOGY

This section outlines the systematic review process adopted for this study. A Systematic Literature Review is defined as “means of identifying, evaluating and interpreting all available research relevant to a particular research question, or topic area, or phenomenon of interest”. This systematic approach was chosen for its ability to offer reviews of high quality and transparent and replicable review. Additionally, it is useful for studies with a clearly formulated research question and summarising large quantities of research studies. Thus, the SLR was chosen for the following reasons: (i) the study will generate large amounts of literature; (ii) this study aims to answer a specific research question; (iii) we intend to systematically extract relevant AI references from the studies transparently; and (iv) therigour and replicability it offers leads to an unbiased scientific study. The foundation of our guide was taken from the guideline developed by Okoli (2015).

III. LITERATURE REVIEW

Okoli (2015) propose a systematic review process that consists of 8 steps, namely planning (2 steps), selection (2 steps), extraction (2 steps) and execution (2 steps) that are completed across 4 phases (see Fig. 1.). Each of these four phases and eight steps are discussed in detail in the remainder of the section.

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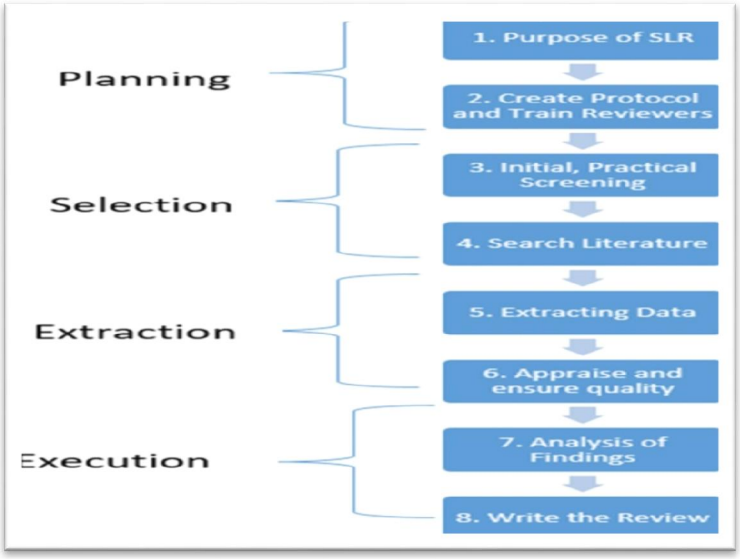

Figure 1: A systematic guide to literature review development (Okoli, 2015).

Figure 2 shows the study selection process. After the initial step of identifying a search string was complete, pilot steps were carried out on the databases used. This entailed refining the search string for each database. However, the terms used to search the databases were used the same throughout. The lead author analysed the 1877 studies retrieved in the initial search.

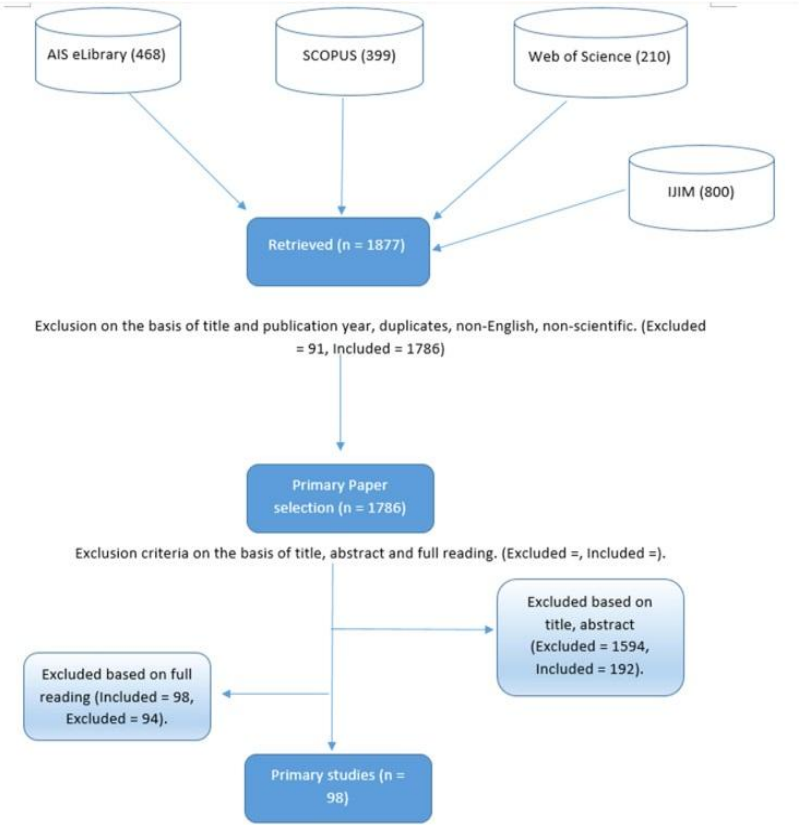

Figure 2: Study selection process.

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A second reviewer was invited to analyse these studies as well, to pre-emptively combat potential bias. The two reviewers had to agree for a study to stay a primary study. Based on the removal of duplicates, non-scientific and non-English studies, 91 were removed, leaving 1786. These 1786 studies were then analysed based on title. The title gave a clear indication on whether they were outside the focus of the study, and thus excluded. If a title did not clearly reveal application domain of the study it was included for review in the subsequent steps, where title, keywords and abstract were examined. Based on title, abstract and keyword, the 1786 studies were further narrowed down to 187. There were still cases where the abstract was unclear, so these studies carried onto the next stage, where the contents of the full study were examined. An in-depth examination of the 187 remaining studies was undertook by the reviewers, which resulted in a further 90 studies being excluded. This resulted in a total of 98 primary studies used as the basis of this SLR.

3.1 How is AI being defined in the field of IS?

The aim of this research question is to identify and analyse the different definitions of AI used in the field of IS. It was noted in Section 2.1 the difficulties the field of AI had with definitions, and this research questions aims to look at how IS has handled those difficulties. However, despite AI and Machine Learning being a large part of the primary studies, many did not provide a definition, or used definitions that were not cited (see Fig. 3).

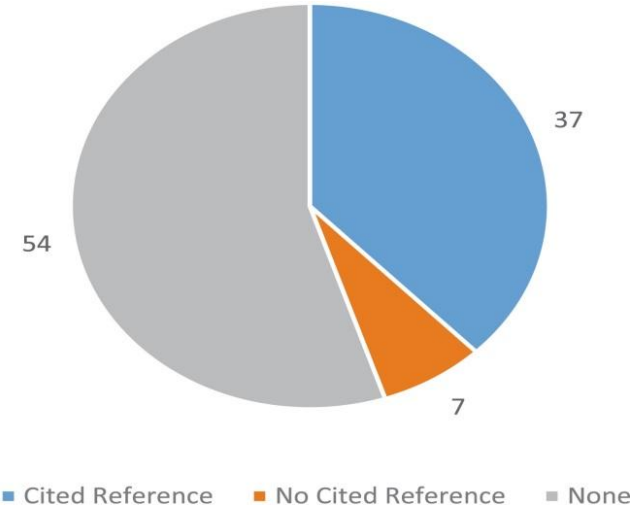

Figure 3: AI definition cited.

Of the 98 primary studies, 54 of them gave no clear definition of the AI relevant to the study. And of the 44 studies that did give a definition, 7 of them cited no reference for the definition given. The definitions of AI used in the primary studies varied in both term of definition and source cited. Disregarding the seven studies that defined AI without citing a source, Russel &Norvig's book Artificial Intelligence: A Modern Approach was the most frequently cited source for defining AI, though the actual edition of the book varied, with each studies using the latest edition at the time

3.2 What number of IS academic studies on AI has been published between 2005 and 2020?

The aim of this research question is to identify the number of academic studies involving Artificial Intelligence and Machine Learning in the field of Information Systems, specifically those between the years 2005 and 2020 (see Fig. 4.). Fig. 4.reveals that studies on AI remained relatively low for most of this period, with a total of 11 studies between the years 2005 and 2015. 2019 and 2020 show an immense surge in AI related studies in IS, signifying a much greater interest in the field. Due to the inclusion and exclusion criteria of this study, there were no studies on AI in Information Systems in the years 2007, 2008, 2010, and 2012.

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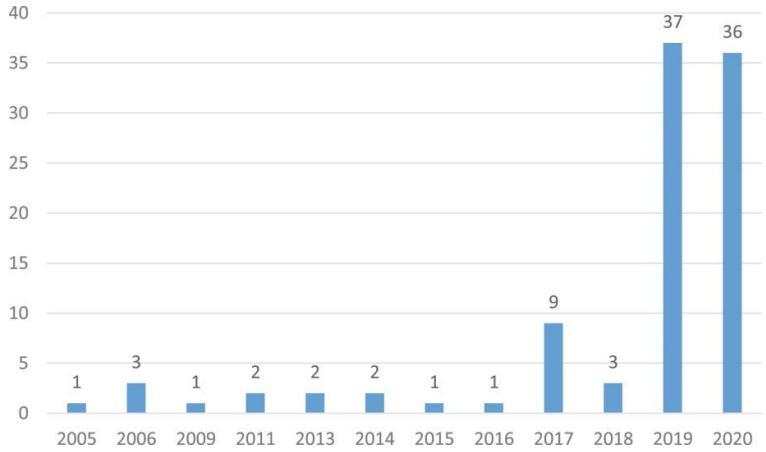

Figure 4: Number of studies by year.

What types of AI technologies are used by IS researchers?

The aim of this research question is to categorise studies on AI based on the type of AI used in the primary study. It is possible to combine a variety of these types together into a single AI system. For example, IBM's Watson combines NLP, ML and machine vision techniques (Jarrahi, 2018, Jarrahi, 2018). However, for the purpose of this SLR, the study will be categorised solely based on the primary AI type of the study (see Fig. 5.).

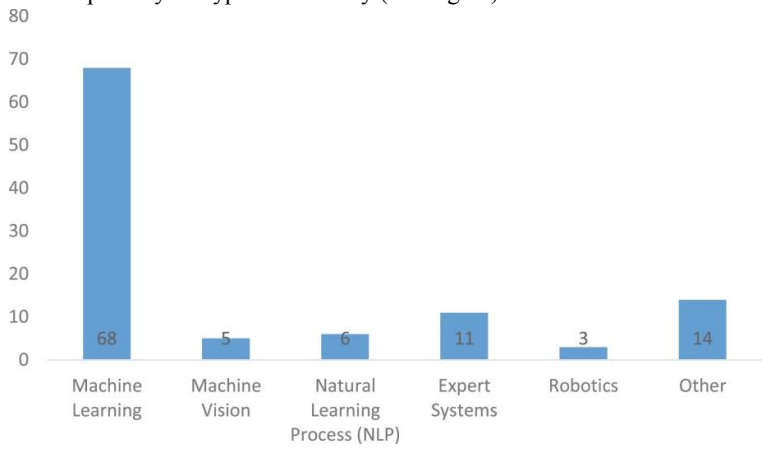

Figure 5: Types of AI.

Fig. 5 shows that ML is the most popular form of AI used in the primary studies, with 69 studies categorised under it. There was less range between the other types, expert systems having 11, machine vision with five and NLP at 6. Robotics was the least common with 3 studies having it as the primary focus.

IV. Result and Discussion

This section summarises the findings of the SLR and highlights some areas that research to date has focused and the key findings from these studies. It is then followed by a discussion on the theoretical contributions and implications for practice. The overall goal is to uncover themes that are relevant for research and practice and identify areas which warrant further research. This section will discuss relevant insights we found from the literature, starting with the lack of cohesion around the definition of AI, the resurgence of AI interest and research in recent years, the specific contribution types of AI literature, and the disproportionate focus on machine learning and process automation.

In this study we conducted a SLR that provides a comprehensive overview on AI in IS related studies. By using a systematic literature review, we identified, classified, and analysed 1877 studies on AI and ML in IS that were published between 2005 and 2020. Of these, 98 were identified as primary studies, after a rigorous filtering process. To understand the fundamentals of AI in IS we examined and studied the articles based on studies by year, publication channel, research

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methods used, and their contribution to IS contributions research. Prior to commencing this task however, we had to consider the problem that the definitions of artificial intelligence were largely varied and ambiguous.

Our findings show that while there was a lack of studies in the first decade of the relevant time, there has been a resurgence in recent years. Over half of the primary studies were published in 2019 and 2020.As previously shown in Fig. 4, there was a resurgence in interest in AI in 2017, before it seemed to really expand in 2019 and 2020.

V. CONCLUSION

This systematic literature review study provides a structured understanding of the state-of-the-art of AI research in IS. This was achieved by identifying 98 primary studies out of 1877 related AI articles over a fifteen-year period (2005 – 2020) and analysed them with respect to (i) definitions of AI, (ii) frequency of publication by year, and (iii) type of AI.

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I hereby declare that all the information provided in the respected paper is authenticated, authorized and hence reliable. I would like to thanks all the viewers and readers of this paper for their precious time.

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