

AI for the Media Industry: Application Potential and Automation Levels

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Abstract. Tools based on artificial intelligence (AI) are increasingly used in the media industry, addressing a potentially wide range of application areas. Based on a survey involving media professionals and technology providers, we present a taxonomy of application areas of AI in the media industry, including an assessment of the maturity of AI technology for the respective application. As many of these applications require human oversight, either due to insufficient maturity of technology or the need for editorial control, we also propose a classification of automation levels for AI in the media domain, with examples for different stages of the media value chain. Both of these aspects are strongly linked to the role of human users and their interaction with AI technologies. The results suggest that human-AI collaboration in media applications is still an unsolved research question.

Keywords: Artificial intelligence, media, collaborative AI, automation levels

1 Introduction

This paper reports selected results from a study on the potential of artificial intelligence (AI) in the media industry. The study aimed at assessing the state of the use of AI in the media industry and the technology offer for this domain in Austria, and to identify the key challenges for a wider adoption of AI by the media industry. The methodology of the study consisted of a literature survey and web research, of a survey among media consumers ($n = 500$), interviews with technology providers ($n = 19$), media professionals ($n = 7$) and researchers ($n = 9$), and two half-day workshops bringing together participants from these three groups (mostly focusing on defining the challenges). In addition, a panel of three experts (IT, journalism, law) provided inputs to the work. A comprehensive report of the study has been published (in German) [8].

In this paper, we focus on two results which we consider of interest to a broader audience. One is a taxonomy of application areas of AI in the media industry, including an assessment of the maturity of AI technology for the respective application. The other is a classification of automation levels for AI in the media domain (similar to those for automated driving), with examples for different stages of the media value chain. Both of these aspects are strongly linked to the role of human users and their interaction with

AI technologies. This has various reasons, from AI technologies having limited maturity allowing only for semi-automatic approaches, over tasks requiring creative inputs by humans, to decisions where journalistic ethos or the reputation of a medium is at stake.

The rest of the paper is organized as follows. The remainder of this Section provides definitions and discusses related work. In Section 2 we present a taxonomy of application areas for AI in the media industry, and in Section 3 we propose automation levels for this domain. Section 4 provides conclusions.

1.1 Definitions

Both key terms of this work – media and AI – are used in various ways, and it seems worthwhile to define how we use them in this work.

Media: We consider media as social institutions and complex organizations, possibly with commercial interests. They provide communication channels or use third party channels to provide content and information they create to address needs of a large set of recipients. This definition includes a wide range of actors, but focuses on the creation of content, excluding actors that only operate platforms.

AI: We understand AI as a set of approaches and methods that, given data and an objective, are able to build a model, that allows the system to generate predictions or decisions for a particular set of tasks. This definition is similar to that used in the ISO/IEC 22989 standard under development [7], and focuses on narrow AI, which is sufficient for currently available technologies. It encompasses a wide range of approaches, including symbolic and sub-symbolic ones.

1.2 Related work

The interest of using AI in the media industry is increasing. In a recent survey of the Reuters Institute for the Study of Journalism [11], almost 70% of media managers consider AI an important technology for their organizations. For this reasons, a number of reports and surveys have assessed the use of AI in the media industry, and have identified potential application areas. Goldhammer et al. [3] make a distinction into assistive technologies, generative technologies and distributive technologies. Chan-Olmsted [2] proposes the following eight application areas: audience content recommendations/discovery, audience engagement, augmented audience experience, message optimization, content management, content creation, audience insights, and operational automation. Nel and Milburn-Curtis [10] detail this list to 15 application areas, although some of those may be considered specializations of others. Other reports try to collect concrete evidence of the use AI in particular organizations, which provides valuable data for assessing maturity and acceptance in a particular application. One is a study commissioned by the European Parliament [13], focusing on the audiovisual sector. The probably most comprehensive work in this area is done by the Journalism AI initiative and collected in their report [1]. Like for other technology areas, technology landscapes have been published. One example, which focuses on some particular application areas is the work by Hauck et al. [4]. Another, providing a comprehensive overview on synthetic media has been published by Samsung NEXT³.

³ <https://www.syntheticmedialandscape.com/>

2 Assessing application areas

AI applications in the media industry are diverse, and include rather generic technologies that find use across all industry domains, like data analytics or customer care, text and multimedia analysis technologies similar to those used in other domains (e.g., transportation, public safety) as well as very specific ones like virtual studios or automated news hosts.

We propose a taxonomy of application areas, that extends and details the one proposed in [10]. As the top level structure, we use three main stages of the media value chain: *sourcing* deals with collecting, organizing and assessing information, *production* is concerned with the actual creation of content and *distribution* involves publishing, monitoring impact and interaction with consumers. The next level structures these stages into tasks or applications for certain types of content, with one additional level where needed. The granularity of the taxonomy was chosen based on the heterogeneity of the task and the amount of existing AI solutions (i.e., coarser groups were formed, where the available technology is still sparse). Tables 1-3 present the resulting taxonomy with a brief description of each application area. In addition, we provide an assessment of the maturity of AI technology for each application area. The scale of this assessment goes beyond that of technology readiness level (TRL) [6], as we also assess specifically the experimental or productive use in the media industry. However, we use a coarser scale (merging stages prior to the point when a media company could at least experimentally try the technology), classifying the assessment into research (R), prototypes (Pt), products/services (Pr) and experimental (Ue) or productive use (Up). As the current status is not reflected by a single point but rather a range on this scale, this assessment is visualized as a gradient in Tables 1-3.

The taxonomy reflects the vast range of potential AI uses in the media domain. It also shows a relatively high level of technical maturity in many applications, with products and services being available, and experimental use being reported by media organizations. However, only a small share of applications have moved into productive use beyond a few early adopters. This is mostly due the lack of robustness, but also due to the lack of trained models on data relevant for the particular media organization (e.g., non-English language models). Closing this gap is not feasible on short term, and human-in-the-loop approaches are required to enable the gradual introduction of AI technologies in these application areas.

3 Automation levels in the media domain

In the different application areas, AI may take a rather supporting role, being applied to very specific tasks, or have a higher degree of autonomy and contributes to decisions or takes them alone. The acceptable degree of automation depends very much on the application area, where media creators are usually more concerned about AI technology creating content or making decisions interfacing with customers.

The automation levels for autonomous driving [14] are well known. To the best of our knowledge, no such classification exists for the media domain. We thus propose a similar framework for the media domain. Table 4 summarizes the proposed

Table 1. Applications of AI in content sourcing and assessment of maturity.

Application	Description	Assessment				
		R	Pt	Pr	Ue	Up
Text analysis						
Terms and entities	named entities, keywords					
Classification	including topic detection and clustering					
Sentiment	analysis of emotion of content, user reaction or attitude towards a topic					
Summarization	summarizing single or multiple articles					
Multimedia analysis						
Preprocessing	temporal segmentation, proxy extraction					
Spoken language	speech-to-text, language identification, speaker identification					
Classification	by topic, genre, age, etc.					
Sentiment	analysis of emotion of content or user reaction					
Text in image, video, documents	text detection and OCR, layout segmentation					
Faces	face detection and recognition, age/gender estimation					
Similarity	fingerprinting, copy detection, instance search					
Summarization	summarizing videos or collections					
Technical quality	visual/audio quality and defect analysis					
Topics & knowledge						
Semantics & knowledge	semantic enrichment, knowledge representation, linking, reasoning					
Topic monitoring	monitoring sources, discovering topics, assessing relevance					
Verification	verifying content, assessing trustworthiness of sources					
License analysis	representing and querying contracts and licenses					

Table 2. Applications of AI in media production and assessment of maturity.

Application	Description	Assessment R Pt Pr Ue Up
Text generation	generating text from structured or unstructured input data	
Multimedia generation/improvement		
Text-to-speech	generated speech from text (multilinguality, accessibility)	
Text-to-image/video	generating talking heads, illustrating spoken text	
Music	background music generation (rights free, appropriate length)	
Improvement	super-resolution, colorization, artifact concealment	
Editing & storytelling	rough cuts, automated editing	
VFX & visualization		
VFX & virtual studios	visual effects, camera control, keying	
Data visualization	interactive data exploration	
Inclusion and accessibility		
Subtitling	generating closed captions from spoken text	
Sign language	generating and visualizing sign language	
Image description	generate acoustic image description for visually impaired consumers	
Translation	translation to other language, including simplified language	
Business decision support	predict popularity and user acceptance of content	
Content enrichment	consumer guidance, product placement	

Table 3. Applications of AI in media distribution and assessment of maturity.

Application	Description	Assessment R Pt Pr Ue Up				
Recommendation & targeting	including all forms of personalization and customization (e.g., version for particular target devices, content length)					
Content placing & linking	placing content, displaying linked content, adjusting paywall settings					
Encoding & streaming	learned media coding and rate control					
Moderation	identifying inappropriate comments					
Media monitoring						
Ads, brands, sponsorship	monitoring impact of ad-related content					
IPR enforcement	monitoring to detect rights violations					
Gender & diversity	monitoring own or others' programme for equal representation of different groups					
Reach analysis	for traditional and social media					
Conversational interfaces	chatbots for customer care and interaction with content					

categorization into six levels, and provides examples of the role of AI for applications in sourcing, production and distribution.

AI-enhanced tools describes the case where AI technologies perform a very specific task, replacing a traditional algorithm in a specific component. This happens very often for low-level tasks and thus mostly “under the hood”. In many cases users will be unaware of the particular components included and their functionalities, thus the questions of acceptance and explainability are often neglected in this setting.

AI-based assistance covers cases, where AI-based tools generate information, that is used in later process stages under human control. AI-based methods do not take any decisions in this scenario. Most of today’s information extraction and content analysis tools fall into this category, as they produce information that is either reviewed by humans, or used in a process fully under human control (e.g., content search). Users are aware of the information produced by AI, and their quality, so that questions of reliability and explainability of results become relevant. As the AI-based tools mostly feed data into other process steps, there is typically no interaction between humans and AI (beyond validation of results).

Conditional automation describes a scenario where AI-based tools take over steps in a process, but the process still foresees control by a human user. This probably is the one of the automation levels, where human-AI interaction is most frequent, and thus designing this interaction is most important. As the human user needs to interact with the AI components, explainability is important to understand their behavior and provide appropriate feedback for further training.

High automation reduces the role of the human user to supervision, and interfering with the process only when necessary. This will often be the case for content or decisions that are directly addressing media consumers. While interaction between human and AI will be less frequent, explainability is very important in this scenario, as the human supervisor needs to develop an intuition in which cases they trust the AI-based components, and in which cases checking is particularly important.

Full automation covers scenarios where an AI-based system performs tasks autonomously. If the quality of AI-based tools permits, it is likely that information gathering, content versioning and targeting/personalization will use this approach. Apart from some low-profile content types most media organizations are not likely to use this automation level for content creation in the foreseeable future.

For some applications in the media industry, the higher automation levels may be entirely out of scope, or limited to specific cases. One reason is the technical feasibility, as journalism’s task is to report about “the world”, i.e., news may involve all possible domains and topics. Thus, the requirements for a fully automatic solution may come close to that of artificial general intelligence (AGI). Another important reason is the wish to keep human oversight over information and processes, that may have a strong impact on democracy and society, rather than leaving automated content generation and recommendation algorithms negotiate public opinion. For modifications that concern merely technical aspects, e.g., adapting content to requirements of specific consumption devices, full automation is likely to be acceptable.

Table 4. Automation levels for AI in the media domain, and examples for sourcing, production and distribution applications.

Level	Description	Sourcing	Production	Distribution
0 No automation	humans control non-AI-based tools	topics monitored by humans, content analyzed and verified by humans	content created by humans, tools based on non-AI technologies	content selection and playout by humans
1 AI-enhanced tools	humans operate tools using AI for specific tasks in their workflows	content quality analysis, content similarity/near duplicates, model fitting for statistical data	content modification and enhancement tools use AI for low level tasks (e.g., color correction, spell checking, inpainting)	media monitoring tools
2 AI-based assistance	AI-based tools generate information that is used in subsequent steps, with human verification/correction, no decision	ASR, content tagging, classification, object/logo/face detection, trustworthiness scoring, knowledge modeling	content completion, summarization, subtitling support	suggestion of content and ads
3 Conditional automation	processes including AI-based decisions, with human intervention required at some points	selection of relevant topics and sets of source content	text/media generation from highly structured information, preparation of accessibility content	automated choice of encoder settings, bitrate selection, content recommendation, automated compliance checking
4 High automation	fully AI-based processes under human supervision (in particular for consumer facing decisions)	automatic filtering and selection of sources, automatic content verification	automatic generation of content (with review), fully automatic generation of versions	automated user targeting and content adaptation to user (with human checks), chatbot with handoff
5 Full automation	fully AI-based processes directly interfacing consumer, without human supervision	automated relevance assessment, and analysis, assessment of content	automated content creation/adaption tools for all modalities, automatic accessibility	automated user targeting and content adaptation to user, chatbot without handoff

4 Conclusion

We have proposed a taxonomy of application areas for AI in the media industry. Those span the entire media value chain, and range from AI technologies applied across industries to very specific solutions for media use cases. Technologies have progressed beyond research prototypes in many of these areas, and at least experimental use has commenced for some of them. It is evident, that the successful application of AI in many of these use cases will require embedding them into collaborative human-AI workflows. Also one of the specific challenges identified in the study addresses a smart assistant for journalists, supporting information collection and organization as well as content creation. The interaction between human and machine, including continuous training based on the implicit feedback by the human in the loop, is of key importance here.

Different application areas require different levels of human oversight. To this end, we have proposed automation levels for the media domain, inspired from those for automated driving. While in low automation levels AI is rather an isolated background component, in particular the mid- to high- automation levels require tight human interaction. This topic still requires further research, as currently most of the work on human AI collaboration focuses on robotics, maintenance and logistics. Existing works in the creative industries deal with other applications than media. A recent survey on collaborative AI in the creative industries [5] identified 34 publications covering applications like graphic design, urban planning, fashion and computer games, but no journalism related ones. Three archetypes of tasks in knowledge work are defined in [12], in which there is either a “human in the loop of AI” or “AI in the loop of human intelligence”. As an example, the creation of a journalistic text is used. The results of a co-design workshop for a collaborative AI-based verification tool shows, that explainability and transparency are central components for collaborative use of an AI-based system [9].

Providing AI as an assistive technology in journalistic workflows, that provides support, but does not require much additional effort from users under stressful situations in order to learn, is still an open research challenge. However, given the importance of collaborative human-AI workflows in the media industry, we consider solving this challenge as a key for the successful and wider adoption of AI technologies in the media industry.

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