Systematic Review

The Use of Artificial Intelligence in eParticipation: Mapping Current Research

Zisis Vasilakopoulos, Theocaris Tavantzis, Rafail Promikyridis and Efthimios Tambouris

Abstract: Electronic Participation (eParticipation) enables citizens to engage in political and decision-making processes using information and communication technologies. As in many other fields, Artificial Intelligence (AI) has recently started to dictate some of the realities of eParticipation. As a result, an increasing number of studies are investigating the use of AI in eParticipation. The aim of this paper is to map current research on the use of AI in eParticipation. Following PRISMA methodology, the authors identified 235 relevant papers in Web of Science and Scopus and selected 46 studies for review. For analysis purposes, an analysis framework was constructed that combined eParticipation elements (namely actors, activities, effects, contextual factors, and evaluation) with AI elements (namely areas, algorithms, and algorithm evaluation). The results suggest that certain eParticipation actors and activities, as well as AI areas and algorithms, have attracted significant attention from researchers. However, many more remain largely unexplored. The findings can be of value to both academics looking for unexplored research fields and practitioners looking for empirical evidence on what works and what does not.

Keywords: eParticipation; Artificial Intelligence (AI)

1. Introduction

Citizens’ participation refers to citizens’ ability to influence and direct political decision-making and administrative tasks [1]. Citizens’ participation results in an increase in transparency, acceptability, and trust in governmental decisions and policies [2]. As a result, increasing citizens’ participation in political processes constitutes a priority for democratic governments worldwide. Citizen participation can be facilitated by employing Information and Communication Technologies (ICT) and tools. The use of ICT in public participation is usually referred to as electronic Participation (or eParticipation) [2]. eParticipation “describes efforts to broaden and deepen political participation by enabling citizens to connect with one another and with their elected representatives using Information and Communication Technologies” [3]. During the last two decades, eParticipation has attracted considerable attention from both research and practitioner communities [4].

eParticipation can be divided into several activities, including online political discourse (or eDeliberation), eConsultation, ePetitioning, eCampaigning, etc. For example, eCampaigning research investigates the use of ICT in political campaigns. An example is Obama’s campaign in 2008, which relied on the extensive use of the Internet and social media to approach voters [5]. Another important activity is eDeliberation, which investigates the use of ICT in discussing and deciding on political matters. A sub-activity of eDeliberation is eRulemaking, which refers to the use of ICT to enable citizens to access proposed rulemaking and submit comments. Historically, different ICT technologies and tools have been used in the field of eParticipation, including the Internet and social media.

Lately, there has been an increased interest in the use of Artificial Intelligence (AI) in eParticipation. AI refers to “systems which display intelligent behavior by analyzing their
environment, and act with some degree of autonomy, to achieve specific goals” [6]. Also, according to [7], “artificial intelligence is the activity devoted to making machines intelligent, and intelligence is that property that enables an entity to function appropriately and proactively in its environment”. In the case of eDeliberation, AI can not only support large-scale deliberations but also enable the introduction of new features that were not previously possible, e.g., support the integrity of deliberations, enable video as an input, support gamification by providing incentives, etc. [8]. Work has been done in applying AI and Large Language Models (LLMs) to deliberation-specific tasks such as consensus building [9], summarization/moderation on deliberation platforms [10], argument extraction [11,12], fact-checking [13], and misinformation detection [14].

In the literature, the potential benefits of using AI in deliberations include operational and analytical improvements (e.g., increased efficiency, enhanced data analysis, efficient resource allocation, real-time feedback, cost savings, adaptability to changing contexts, deliberative quality checks), decision-making enhancements (e.g., improved decision support, reduced human biases, transparent decision-making, integrity in decision processes), user-centric benefits (e.g., personalization, citizen empowerment, enhanced accessibility, improved inclusivity, enhanced public engagement), and data security.

As another example, chatbots are increasingly employed in Government-to-Citizen (G2C) applications, to enhance openness and stakeholders’ consultation [15]. Besides the traditional communication channels, AI enables governments to obtain citizens’ feedback via new channels. For example, due to the enormous content generated by citizens on social media, they constitute a prominent source of information [16]. However, the adoption of AI is accompanied by relevant concerns. For example, a concern is related to participants’ privacy, despite guidelines and regulations, e.g., GDPR [17]. As a result, during the last few years, a significant amount of scientific literature has been accumulated, aiming to investigate the use of AI in the field of eParticipation. Although there are several literature reviews of eParticipation, according to our knowledge, no literature review currently exists specifically on the use of AI in eParticipation. Therefore, accumulating and analyzing this literature is timely and important as this will allow a first mapping of this emerging field.

The aim of this paper is to map the current research on the use of AI in eParticipation. For this purpose, we conducted a systematic literature review and then analyzed and synthesized the results.

The rest of this paper is structured as follows. Section 2 presents an analysis framework and background work on relevant areas. Section 3 lists the research questions and methodology that was followed. Section 4 presents the results of our research. Finally, Section 5 discusses the findings and concludes with implications, research limitations, and future work.

2. Analysis Framework

In this section, we present the analysis framework for the study. The aim of the framework is to determine the main concepts of this emerging research field along with their relationships. We start by presenting the literature reviews in this area. From these, we will select the ones that propose conceptual models for eParticipation. Such a model will form the heart of our work. Finally, we extend the selected conceptual model to also include important and relevant AI concepts.

A number of literature reviews have been conducted to map the current state of the art of eParticipation. These reviews aim to map research work into models [4,18] or capture the entirety of research production in a 10-year timeframe [19]. Some studies examine the evolution of various eParticipation’s concepts [20–26]. One study focuses on the technologies, tools, and areas of eParticipation [27], while another focuses on the primary research sources, i.e., which journals, authors, and articles have the greatest impact on the field [28]. There are also studies such as [29] that focus on the importance of ICT in democratic processes and the development of eParticipation.
The existing literature reviews present (a) the current problems of eParticipation [30–32], (b) the adoption models of eParticipation [33], (c) the use of social media in eParticipation [34], and (d) the participation of citizens in eGovernment service delivery [35]. Finally, there are attempts to map the field by proposing a general model to describe the area [36,37] or a model of the theoretical contributions to the field [38].

A comprehensive examination of 131 papers by [36] results in a synthesized conceptual model categorizing the principal components of the eParticipation domain. At the center of that model lie eParticipation activities, denoted as “social activities or behavioral patterns (e.g., voting, attending political meetings/debates, collecting signatures) facilitated by technology, typically internet-based”. These activities are orchestrated or initiated by various subjects (actors) and engender consequences to which subjects may respond. The context in which these activities occur is analyzed in the literature and the factors that determine it (contextual factors) are considered important for the outcomes of the activities. These outcomes serve to validate the necessity and significance of the activities. Furthermore, these outcomes are subjected to evaluation, appraising their significance. The conceptual model proposed in [36] was augmented in [4] by introducing a subcategory for actors (Researchers and scholars) and an evaluation subcategory (Transparency and openness).

In conclusion, as articulated by [4,36], the eParticipation field is characterized by diverse concepts. Specifically, the conceptual framework for eParticipation can be delineated by elucidating its (a) actors, (b) activities, (c) contextual factors, (d) effects, (e) evaluation processes, and (f) the interrelations among them.

Figure 1 presents the five main concepts and the prominent values per concept from [4,36]. Most of these values are self-explanatory except for effects and evaluation. Specifically, the values for “eParticipation effects” include:

- Deliberative is about the quality of participation expressed. A democratic perspective is considered a point of reference where discussions are conducted in a thorough, logical, and fair manner.
- Democratic concerns general effects on democracy in any direction, positive or negative.
- Civic Engagement concerns the basic idea of eParticipation, where the concept of classic participation is extended. More or new participants, new forms of participation, or more contributions are usually desirable.
- Furthermore, the values for “eParticipation Evaluation” include:
  - Openness and Transparency in governance, eParticipation platforms, policy formulation, and decision-making processes.
  - Quantity of the participation, which measures the civic engagement effect.
  - Tone and Style denote the quality of citizens’ participation.
  - Demographics that value the demographics of participants in eParticipation activities.

In this model, underlying technologies are considered a Contextual factor. Therefore, we set “Underlying technologies” to AI and proceeded to identify concepts related to it. A study of the AI literature suggests that important concepts include AI areas and sub-areas such as Machine Learning, Deep Learning, Supervised Learning, Unsupervised Learning, Robotics, chatbots, argument mining, robotics process automation, etc. Furthermore, AI algorithms, methods, and techniques such as naive Bayes, decision trees, convolution neural networks, random forests, etc., hold a prominent position in the AI literature. These are evaluated by various relevant evaluation methods, which are also deemed important.

Based on the above, we present in Figure 2 the analysis framework used in our study. This is based on the conceptual model proposed by [4], albeit enhanced with concepts from the AI literature. This model will constitute the basis for the analysis of the scientific literature on the use of AI in eParticipation.
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Based on the above, we present in Figure 2 the analysis framework used in our study. This is based on the conceptual model proposed by [4], albeit enhanced with concepts from the AI literature. This model will constitute the basis for the analysis of the scientific literature on the use of AI in eParticipation.

Figure 2. Analysis Framework.

3. Research Questions and Methodology

Based on the study objectives and the analysis presented in the previous section, we set the following three research questions:

**RQ1** Which are the prominent eParticipation Actors and Activities?

**RQ2** What is the focus of research concerning eParticipation Contextual Factors, Effects, and Evaluation Methods?

**RQ3** Which are the prominent AI Areas, Algorithms, Methods, Techniques, and Evaluation Methods?

The research approach we followed includes three main steps, as follows:

**Step 1. Study selection.** The selection process of the study includes four phases following the PRISMA statement [40]. Further details about each step are presented below.

**PRISMA Phase: “Identification”**. The search for the relevant scientific literature was carried out in the scientific databases of Scopus and Web of Science. In the authors’ knowledge, these databases are considered reliable, inclusive, and suitable for the task at hand. The keyword used consisted of two parts, one part for the eParticipation field and
one for the AI field. For eParticipation, the keyword included the main activities described in [4]. For AI, the most common areas and techniques were used (as presented in Section 2). The final phrase we used as the keyword was ‘TITLE-ABS-KEY(“eParticipation” OR “e-participation” OR “electronic participation” OR (“eGovernment” AND “participation”) OR (“e-government” AND “participation”) OR (“eGovernance” AND “participation”) OR (“e-governance” AND “participation”) OR “eConsult*” OR “e-consult*” OR “eDeliberat*” OR “e-deliberat*” OR “online deliberat*” OR “ePetition*” OR “e-petition*”) AND (“Artificial Intelligence” OR “AI” OR “machine learning” OR “ML” OR “deep learning” OR “generative adversarial network*” OR “GAN” OR “GANs” OR “reinforcement learning” OR “RL” OR “Natural language process*” OR “NLP”)). The search took place in June 2023 and resulted in 196 results in Scopus and 39 results in Web of Science, producing a total of 235 studies.

**PRISMA Phase: “Screening”**. Two authors independently screened the studies derived from the previous step. Screening included reading the title and abstract of each paper. In cases where there were doubts regarding retaining an article, a discussion between the authors produced the proposed solution. At the outset, 30 studies were excluded as duplicates. After reading the titles and abstracts, 120 studies were also excluded because (a) they were irrelevant to our goal, (b) they were not fully available, or (c) they were not in English. In total, 85 articles proceeded to the eligibility phase.

**PRISMA Phase: “Eligibility”**. We studied the articles retrieved from the previous step and filtered them based on the following inclusion and exclusion criteria.

**Inclusion criteria:**
- Studies should be published in journals or conferences.
- Studies should directly refer to the implementation of AI in the eParticipation field.
- Studies could include an empirical analysis and a case study or refer to AI applications in a theoretical manner.

**Exclusion criteria:**
- Studies do not specifically focus on the use of AI in eParticipation; instead, they concern the use of AI in public sector procedures.
- Studies make a brief reference to the area of AI but do not delve into the applications, impacts, and challenges of AI use in eParticipation.

In total, 40 articles were excluded in this phase.

**PRISMA Phase: “Included”**. The papers were studied further, and one more highly relevant study was found in their citations and added to the selected studies. Therefore, the final number of the studies was 46 (Figure 3).

Figure 3. PRISMA flow diagram for the study selection (adapted by [40]).
The final list of papers considered is presented in the References section [41–86].

**Step 2. Present the profiles of the studies.** In this step, the profiles of the 46 papers are presented in terms of publication year and authors. More specifically, the number of papers per year, participating authors, and corresponding countries are documented and visualized in appropriate figures. The results of this step are presented in Section 4.1.

**Step 3. Mapping the domain.** In this step, the 46 papers are mapped in the analysis framework presented in Figure 2. The concepts of the framework used as a guide for analyzing the papers and reporting insights. The results of this step are presented in Section 4.2.

4. Results

**4.1. Article Profiles**

Figure 4 presents the number of papers per year. This figure shows that most research is conducted from 2019 onwards, which is consistent with the development and spread of AI.

![Figure 4. Number of research papers per year.](image)

Figure 5 presents the number of papers per author (for authors with more than two papers). In total, 121 authors contributed to this research area, coming from 24 different countries (Figure 6). A few research papers were written by multinational teams.

![Figure 5. Number of research papers per author.](image)
4.2. Mapping the Domain

In this section, we outline the results from mapping the scientific literature in each of the concepts presented in our analysis framework illustrated in Figure 2.

4.2.1. eParticipation Actors

The vast majority of studies on the application of AI in eParticipation concern Citizens and Government Institutions. Reference is made to politicians as potentially interested in the adoption of a proposed application or technology [72,75], as directly interested in the results of research [52] or within the context of parliamentary debates about ePetitions [44]. Voluntary Organizations are mentioned in one study, while Researchers are not mentioned in any study. Table 1 presents the analysis results.

<table>
<thead>
<tr>
<th>Actors</th>
<th>Paper ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>Citizens</td>
<td>[41–70,72–84,86]</td>
</tr>
<tr>
<td>Government institutions</td>
<td>[41,43–57,59–68,72,74–78,80–82,84–86]</td>
</tr>
<tr>
<td>Politicians</td>
<td>[44,52,72,75]</td>
</tr>
<tr>
<td>Voluntary Organizations</td>
<td>[50]</td>
</tr>
</tbody>
</table>

4.2.2. eParticipation Activities

eParticipation initiatives revolve around various activities, with online political discourse maintaining a prominent position. The relevant research focuses on analyzing citizens’ online discussions to discern their opinions [67,74]; on introducing new platforms, technologies, or techniques for facilitating discussions [71,78]; or both [51]. Theoretical investigations into the role of algorithms in online discussions [41], as well as design practices of online discussion platforms [79], constitute other research objectives.

The second category of eParticipation activities pertains to citizens’ requests, commonly known as ePetitions. Studies in this domain frequently involve analyzing existing requests to extract citizen opinions [56,59] or derive other insightful conclusions [52]. Efforts are also made to develop methods facilitating citizens in drafting requests [61,86]. Additionally, petitions serve as subjects for parliamentary debates and further analysis [44].

The third category of eParticipation activities concerns online citizen assistance in policy formulation, aka online decision-making. Similar to previous categories, analyses
are conducted on platforms where citizen proposals are published [73]. In addition, new technologies or platforms are proposed to streamline policy formulation processes [50,60,75]. Challenges encountered in implementing online debate initiatives for policy shaping are also reported [81].

Finally, the collection of citizens’ opinions, termed eConsultation, constitutes another category of eParticipation activities that is present in the studies. Most studies in this cluster focus on data analysis from eConsultation platforms [43,46,47]. Additionally, exploration into game design principles to enhance eConsultation initiatives [55] and optimize AI utilization in governance through eConsultation platform data [45] is noted.

eVoting, eCampaigning, and eActivism are eParticipation activities where the application of AI has not yet been investigated, therefore constituting interesting areas for further research (see Table 2). Interestingly, some articles do not mention any specific activity [70,85].

Table 2. eParticipation Activities.

<table>
<thead>
<tr>
<th>Activities</th>
<th>Paper ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>Online political discourse</td>
<td>[41,42,46,49,51,53,54,62,66–68,70–72,74,76,78–80,83,84]</td>
</tr>
<tr>
<td>ePetitioning</td>
<td>[44,52,56–59,61,69,77,82,86]</td>
</tr>
<tr>
<td>Online decision-making</td>
<td>[50,60,63,65,73,75,81]</td>
</tr>
<tr>
<td>eConsultation</td>
<td>[43,45,47,48,55,64]</td>
</tr>
</tbody>
</table>

4.2.3. eParticipation Contextual Factors

When it comes to contextual factors (see Table 3), the first result is that, in the existing literature, governmental organizational changes are often addressed superficially, hence lacking depth [49,81]. Theoretical inquiries advocate for governance model redesign through the incorporation of novel infrastructures, processes, or technologies [45,50]. Only one study delves extensively into the practical implications, exploring novel organizational paradigms and processes within government [51].

Table 3. eParticipation Contextual Factors.

<table>
<thead>
<tr>
<th>Contextual Factors</th>
<th>Paper ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underlying technologies</td>
<td>[41–86]</td>
</tr>
<tr>
<td>Governmental organization</td>
<td>[45,49–51,81]</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>[54,60,74]</td>
</tr>
<tr>
<td>Accessibility</td>
<td>[49,60,74,79,86]</td>
</tr>
<tr>
<td>Information availability</td>
<td>[41,50,60,61,79,81,86]</td>
</tr>
<tr>
<td>Policy and legal issues</td>
<td>[41,49,50,55,74,80,81,85]</td>
</tr>
</tbody>
</table>

The essential infrastructure required for online participation activities, termed Infrastructure, is a crucial consideration, particularly in cases where internet access is limited [60]. Accessibility to necessary resources and eParticipation initiatives is a significant factor in the public sector. Despite this, articles only briefly touch upon accessibility issues [74] or inequalities [79], if at all. Specific factors influencing accessibility mentioned in the literature include age [49], gender, religion [60], and digital literacy [86]. The availability of information (Information availability) is frequently cited as a critical factor that may hinder participation in eParticipation activities. Certain research endeavors aim to mitigate the adverse effects of this factor by developing new platforms that provide users with the necessary information [60,61].

Furthermore, diverse techniques and technologies are employed including asynchronous discussion [79], information provision via AI [41], utilization of NLP [81], and
facilitation of ePetition drafting [86]. Additionally, legal considerations (policy and legal issues) significantly influence eParticipation. Most prominently, the European Union’s General Data Protection Regulation (GDPR) garners frequent mention in the literature [45,74]. Furthermore, pre-GDPR, the necessity of data protection and adherence to relevant regulations was mentioned [49]. In addition, reference is made to European Union policies concerning the principle of explainable AI [50]. In two papers, legal factors are briefly discussed [46,53]. Lastly, a study addressing challenges in the implementation of an eParticipation initiative highlights the ambiguous legal framework, which partially obstructs activity implementation, compounded by official bodies’ inability to furnish clear guidance [81].

4.2.4. eParticipation Effects

Studies related to the “Deliberative” effect: Eleven articles explore various techniques and technologies to enhance participation quality, ranging from chatbots for organizing arguments [77] to applications facilitating ePetition drafting [61] and virtual reality approaches [71]. Additionally, analyses of online consultation platform designs concerning discussion quality principles are included in the literature [41,79], while there is a study proposing an innovative platform based on game design principles [55]. Challenges encountered in online consultation initiatives aimed at fostering qualitative discussions for policy formulation are also documented [81].

Studies related to the “Democratic” effect: This category is relatively infrequently mentioned, with sporadic references to democracy. Some view public debates as fundamental to democratic societies [81] while technological advancements are sometimes presented as tools to aid democracy [50,54]. Conversely, concerns are raised about the democratic nature of online consultations due to inadequate technological understanding [79] or the perceived imposition of technologies on citizens [41]. It is also argued that increased citizen participation does not inherently equate to enhanced democracy [44].

Studies related to the “Civic Engagement” effect: The objective of boosting civic engagement is highlighted in most articles discussing eParticipation outcomes, with various AI technologies developed to facilitate or support eParticipation activities. These technologies range from chatbots [77] to text analysis techniques [49,58,63,72,80] and ePetition assistance systems [86]. Moreover, proposals for eParticipation platforms addressing both governments and citizens are put forth [51,60,74,78]. Recommendations for government adoption of social media platforms based on citizen message analyses are also made [68,83]. Two studies delve into the scalability of online consultations and the democratic considerations in their design [41,79]. Finally, other studies include proposals for new policy-making cycles [50] and descriptions of challenges in integrated online consultation initiatives for policymaking [81]. Table 4 summarizes the research articles per eParticipation effect.

<table>
<thead>
<tr>
<th>Effects</th>
<th>Paper ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deliberative</td>
<td>[42,48,55,61,64,65,69,71,79,81,86]</td>
</tr>
<tr>
<td>Democratic</td>
<td>[41,44,50,54,65,81,85]</td>
</tr>
<tr>
<td>Civic Engagement</td>
<td>[41,44,47,49–51,53–55,58,60,63,65,66,68–70,74,76,78–83,85,86]</td>
</tr>
</tbody>
</table>

4.2.5. eParticipation Evaluation

In general, only a few articles evaluate the results of eParticipation activities (see Table 5). In some studies, these evaluations are about “Openness and Transparency” that the implementation of a new technology [77] or a new platform [60] offers while others document problems that are caused by the lack of Openness and Transparency in existing platforms [79].
Table 5. eParticipation Evaluation.

<table>
<thead>
<tr>
<th>Evaluation</th>
<th>Paper ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity</td>
<td>[41,44,60,62,65,66,69,74,81,86]</td>
</tr>
<tr>
<td>Tone and style</td>
<td>[41,53,54,61,63,65,69–71]</td>
</tr>
<tr>
<td>Demographics</td>
<td>[41,49,60,74,79]</td>
</tr>
<tr>
<td>Transparency and openness</td>
<td>[41,60,65,76]</td>
</tr>
</tbody>
</table>

As for “quantity”, the literature almost never mentions a particularly high increase in participation. Divergent outcomes follow the implementation of digital platforms for policymaking. For instance, in [60], a notable uptake in participation after the launch of an online policy-making platform is reported. Conversely, in [77], authors observed only a marginal increase following the integration of a chatbot aimed at facilitating discussions on a similar platform. Furthermore, the dynamics of citizen participation are explored in the context of various aspects of eParticipation tools. Studies by [44] and [69] delve into the relationship between citizen engagement and the attributes of ePetitions. Similarly, ref. [80] examines citizen participation in correlation with the characteristics of government-published tweets. Interestingly, the transition to asynchronous communication within online policymaking platforms as opposed to synchronous methods does not necessarily yield increased citizen participation, as evidenced in [81].

Various methodologies are also employed to assess the “tone and style” within eParticipation studies. Firstly, user questionnaires and post-implementation interviews of participation support tools or new ePetition applications serve as evaluative measures [61,77]. Theoretical frameworks have been proposed to assess participant behavior in virtual reality environments based on qualitative dialogue principles [71]. Additionally, the content and interaction patterns within ePetitions can serve as indicators of social tension [69]. However, technological interventions in online consultation design may not necessarily enhance discussion quality and could potentially even detract from it [41,79]. Challenges in assessing participation quality may arise from data limitations [81].

Finally, participants’ demographics are infrequently recorded in eConsultation studies [79]. One study aims to diversify discussion participants by including underrepresented social groups such as women and religious minorities [60]. In other instances, demographic data are mentioned but not extensively analyzed, merely being considered as influencing factors in urban development policy effectiveness [74] or as a parameter in proposed policy formulation support platforms [49].

4.2.6. AI Areas

Most studies explicitly mention a specific AI area with the exception of only two (see Table 6). Machine Learning and Natural Language Processing (NLP) are mentioned in 43 and 37 studies, respectively. Notably, all articles published in the last three years refer to at least one Machine Learning or NLP sub-area. An AI area mentioned in only one study is Robotics. This paper was published in 2023, suggesting that there might be more studies in this area in the future.

Table 6. AI areas.

<table>
<thead>
<tr>
<th>AI Area</th>
<th>Paper ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural Language Process</td>
<td>[41,42,44,45,47–51,53,55–60,63–70,72,74–84,86]</td>
</tr>
<tr>
<td>Robotics</td>
<td>[50]</td>
</tr>
</tbody>
</table>

Different AI sub-areas are identified in 44 studies. Deep learning, a technique used to train AI models [60], has been applied in 18 studies. In addition, classification is used
in 28 studies. The extensive use of classification is due to the fact that the main source of communication between citizens and governments is social media or other similar platforms. Consequently, AI methods are employed to analyze people’s emotions and thoughts expressed via posts and text in general. Apart from classification, other techniques related to text processing are frequently used, such as sentiment analysis, topic modeling, and text mining.

Classification constitutes a supervised learning technique. Most articles refer to text classification. Therefore, supervised learning is the machine learning sub-area with the highest frequency, appearing in 31 studies. Unsupervised learning is also preferred, as it is closely linked with topic modeling. Finally, chatbots seem to have hopeful prospects, since four out of the five studies about chatbots in eParticipation activities were published in the last 3 years.

4.2.7. AI Algorithms/Methods/Techniques

Different AI algorithms are mentioned in studies, although details are missing in many cases (see Table 7). More specifically, technical details are discussed in 30 out of 46 articles. Most AI algorithms used in the literature are in the context of classification and topic modeling. Machine learning algorithms such as Support Vector Machine and Naive Bayes are frequently discussed. Furthermore, Convolutional Neural Networks are the most discussed Neural Networks. Finally, Latent Dirichlet Allocation is the most discussed Algorithm applied for topic modeling.

<table>
<thead>
<tr>
<th>AI Algorithms/Methods/Techniques</th>
<th>Paper ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>Support Vector Machine</td>
<td>[43,47,52,62,63,66,67,73,74,77,86]</td>
</tr>
<tr>
<td>Naive Bayes</td>
<td>[44,47,48,62,66,67,78,80]</td>
</tr>
<tr>
<td>Neural Networks</td>
<td>[46–48,54,60,71,77,82]</td>
</tr>
<tr>
<td>Convolutional Neural Networks</td>
<td>[47,48,60,71,77,82,86]</td>
</tr>
<tr>
<td>Decision Tree</td>
<td>[47,48,52,62,63,65,77]</td>
</tr>
<tr>
<td>Random Forest</td>
<td>[43,52,66,70,77,80,86]</td>
</tr>
<tr>
<td>Latent Dirichlet Allocation</td>
<td>[56–59,69,78]</td>
</tr>
<tr>
<td>k-Nearest Neighbors</td>
<td>[43,52,62,63,66,80]</td>
</tr>
<tr>
<td>Word2vec</td>
<td>[47,48,77,82]</td>
</tr>
<tr>
<td>AdaBoost</td>
<td>[43,66,80]</td>
</tr>
<tr>
<td>Gradient Boosting</td>
<td>[43,52]</td>
</tr>
<tr>
<td>Breadth First Search</td>
<td>[75]</td>
</tr>
<tr>
<td>Cubist Algorithm</td>
<td>[52]</td>
</tr>
<tr>
<td>Explicit Semantic Analysis</td>
<td>[72]</td>
</tr>
<tr>
<td>Gaussian Process</td>
<td>[63]</td>
</tr>
<tr>
<td>Layer-Wise Relevance Propagation</td>
<td>[86]</td>
</tr>
<tr>
<td>Multivariate adaptive regression splines</td>
<td>[52]</td>
</tr>
<tr>
<td>Quadratic Discriminant Analysis</td>
<td>[63]</td>
</tr>
<tr>
<td>Robust Growing Neural Gas algorithm</td>
<td>[84]</td>
</tr>
<tr>
<td>Attention Networks</td>
<td>[60]</td>
</tr>
<tr>
<td>Self-Organization Maps</td>
<td>[52]</td>
</tr>
<tr>
<td>Graph Neural Networks</td>
<td>[77]</td>
</tr>
</tbody>
</table>
4.2.8. AI Evaluation

Researchers proceeded to evaluate the AI models in only about half of the studies. The metrics used in the studies include Accuracy, Precision, F-measure, Statistical Significance, and R-squared. The most widely used are those related to classification, namely accuracy, precision, recall, and F-measure (see Table 8).

Table 8. AI Evaluation metrics.

<table>
<thead>
<tr>
<th>Evaluation</th>
<th>Paper ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>F-measure</td>
<td>[44,45,47,48,57,58,60,64,66,73,77,80,82,86]</td>
</tr>
<tr>
<td>Precision</td>
<td>[43,45,57,60,62,66,67,73,76–78,80,82,86]</td>
</tr>
<tr>
<td>Accuracy</td>
<td>[43,44,46,62,63,69,70,73,76–78,80,82]</td>
</tr>
<tr>
<td>Recall</td>
<td>[45,52,57,60,62,66,73,77,78,80,82,86]</td>
</tr>
</tbody>
</table>

5. Discussion, Implications, and Conclusions

5.1. Summary of the Research

The aim of this paper was to map existing research on the use of AI in eParticipation. For this reason, we conducted a systematic literature review and analyzed the results derived from the selected literature.

The main concluding remarks drawn from this study are as follows. The first relates to the analysis framework employed. In order to map this emerging research domain, we developed an analysis framework by integrating an established conceptual model of eParticipation with certain interesting AI elements. The resulting analysis framework worked well in our study but can be further developed.

The second concluding remark concerns this new field of study. Our analysis suggests certain areas have attracted significant attention from researchers while other areas remain largely unexplored. For example, research focused on the analysis of political discussions using machine learning and NLP techniques. This is not surprising considering the capabilities of AI. However, it seems that there is still room for research when it comes to more innovative uses of AI to deeply revolutionize eParticipation. This is also true for research on the application of AI for certain “eParticipation Actors” (namely Politicians, Voluntary Organizations, and Researchers), in certain “eParticipation Activities” (namely eVoting, eCampaigning, and eActivism), and in eParticipation evaluation and eParticipation effects.

5.2. Theoretical and Practical Implications

The analysis of the studies provides some interesting insights into the application of AI in eParticipation. The first set of results concerns the use of AI in these studies. Specifically, classification and supervised learning AI methods and algorithms were applied in most research papers. In terms of applications, chatbots seem to be increasingly used in eParticipation research while the application of Robotics in one study is notable.

A second set of results concerns eParticipation. Here, it is suggested that the primary source of citizens’ feedback on governments’ policies comes from social media. In addition, the anticipated outcomes of eParticipation activities usually lack clarity on how the proposed approach or technology will bring them to fruition. Moreover, the evaluation of eParticipation activity results is seldom addressed in the literature. This observation is not confined solely to highly technical articles but encompasses a significant portion of the literature. Conversely, there are only general claims about enhancing the efficiency and effectiveness of public administration or governance without providing details. Furthermore, more than half of the articles do not explicitly mention any eParticipation effect.

The analysis further revealed some important outcomes regarding policymaking. Several articles highlight the need to use citizens’ opinions to create policies. For example, ref. [67] used available techniques for performing opinion mining in the analysis of citizens’ feelings about public policies. In addition, ref. [49] documents the early developments
of a decision support system that uses political discussions on social media to provide useful information regarding citizens’ opinions to policymakers. Furthermore, ref. [57] analyzes ePetitions using named entity recognition and topic modeling with latent Dirichlet allocation. The results revealed that the techniques proposed can be utilized for gauging public sentiment. Kumar and Sharma in [62] present and test a framework for analyzing people’s tweets regarding a major agricultural policy. Filatova and Volkovskii in [54] propose the use of neural networks for the analysis of online discussions and to match people who are for or against a particular policy. In [60], it is proposed that the use of a decision support system by citizens could help policymakers to identify solutions to citizens’ problems. Finally, ref. [55] argues that gamification can improve the currently low-quality online deliberations and focuses on how policymakers can put citizens’ input to use before generating and enacting public policies.

As a result, this study can be useful to academics and practitioners. Academics can use the results of the analysis in order to better understand which areas have already been investigated and what the current results are. Similarly, they may easily identify areas where further research is needed. Practitioners can use the analysis results to better understand which AI methods have already been tested and with what results and conditions. Policymakers can better understand the relationships between AI-enhanced participation and the current legal framework, particularly in the European Union, where GDPR is in force while the new AI Act is also in effect.

5.3. Limitations of the Research

As with any other study, this research has certain limitations: (a) The search for studies was performed in only two scientific databases (Scopus and Web of Science). (b) The study is based only on articles written in English. (c) The eligibility criteria set out in Section 3 inevitably limit the scope of the study. (d) The study only contains articles published in journals and conferences (e.g., no books or grey literature are included).

5.4. Future Studies and Recommendations

Our analysis revealed some interesting research gaps that trigger future research. A first direction for future work is the articulation of a comprehensive analysis framework specifically for this new field, i.e., the application of AI in eParticipation. This analysis framework could include theoretical considerations (such as research methods used in the research) and a comprehensive view of AI, including benefits, barriers, and risks, as well as legal and ethical aspects. All these remain open for further research.

Another direction for future work involves studying all those areas where research is currently limited. As an example, this includes evaluation methods to assess the qualitative impact of AI applications in eParticipation. By devising robust evaluation frameworks, researchers can effectively gauge the efficacy and implications of AI-driven interventions in eParticipation initiatives. In addition, the innovative use of AI to revolutionize the field of eParticipation is an interesting direction for future research.

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