


Technology, Computation and Artificial Intelligence to Improve the Web Ecosystem

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1. Introduction

Since the appearance of the Internet, many traditional businesses have been transformed, across the areas of shopping, advertising, education, entertainment, and more. It has also been a platform for new markets, such as the cloud, crowdsourcing, and social media platforms. These pre-existing and new environments are being rebuilt yet again during the era of big data, applying novel computational approaches and artificial intelligence. However, this ecosystem is still far from being mature and there are still controversial issues, related to aspects such as finance models, security, and privacy, that are fundamental for the sustainability and user experience of the ecosystem, while the technological developments keep advancing.

This Special Issue (SI) invited researchers to submit their work and advances that help build a more sustainable and user-friendly digital ecosystem. We welcome submissions that apply technology, computational approaches, or artificial intelligence in applications across the wide range of contexts within the Web, such as e-commerce, online advertising, social networks, entertainment, or e-learning, among many others. The topics of interest included, but were not limited to:

- Literature reviews or surveys on the current trends and challenges of the Web ecosystem.
- New technological developments that can represent an advance in the Web ecosystem.
- Empirical research and case studies with detailed analyses that introduce innovation into the Web ecosystem.
- Critical views or positioning papers on the privacy, security and ethics of the Web ecosystem.

There are no doubts regarding how the new developments in terms of technology, computation, and artificial intelligence are dramatically impacting the Web ecosystem. They are broadening the kind of services and products that can be offered while significantly improving their quality. In turn, the population is intrinsically changing the way they socialize, have fun, or earn money [1]. There are multiple examples of these affordances, and the new opportunities that are arising. We will exemplify them with three examples.

First, online advertising, has been, since the beginning, one of the main economical engines of the existing free content and services in the Web ecosystem [2,3]. However, publishers are noticing that they need to take good care of their users and advertisers and are trying to improve the return on their investments through technology. In that sense, some new payment models, such as those based on viewability [4] or in programmatic real-time bidding (RTB) are emerging [5].

At the same time, more data than ever are being generated, and even though these companies try to exploit it, the different nations are starting to prioritize protecting their citizens' privacy rights instead of the companies' interests with new regulations, such as the GDPR [6].



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A second example is regarding how people socialize online and leave open data available for anyone. Social networks (such as Twitter or Facebook) and other content sharing and consumption portals (such as YouTube or Pinterest) are becoming the norm for interacting with others, and creating and consuming content. This is generating digital traces that are frequently open online and can be either scraped or retrieved via APIs. These data hold significant potential for evaluating competences [7] or users, or to be used for professional purposes [8]. However, it also has negative effects, such as using social networks for misinformation and influencing the population [9].

The third and final example is regarding how people learn online. In that sense, we have seen during the last decade how elite universities have started teaching free Massive Open Online Courses (MOOCs) [10], how IT professionals are able to learn how to solve many of their problems in StackOverflow [11], or how people learn by playing online games [12]. While higher education institutions still have an important role within the society, that role might be changing, since content can be accessed online by those with enough interest.

These are three examples of how technology is deeply affecting the Web ecosystem and profoundly changing the world we live in, but many others could be easily raised.

2. Overview of the Special Issue

The SI has gathered seven articles (two review and five research papers) on diverse topics within the scope of this issue. Three main topics are identified in those articles: Web search methods, privacy, and applications related to online advertising, e-health, and e-learning. We will now review the articles of the SI in such thematic groups.

The first group of papers on Web search includes a survey of faceted-based methods and a study of consumers' Web search strategies. The former, Mahdi et al. [13], provides a taxonomy of solutions, dissecting techniques, evaluation measures, graphical models, and faceted models. The authors survey a total of 170 related research papers and discuss current challenges and great-practice recommendations to adopt faceted-based approaches by web-search providers. The latter article is Kwon et al. [14], which explores consumers' web-search strategies users take online before purchasing. The authors used personal clickstream data, which records each purchase-related website that a consumer visits before making a purchase, to create clusters of online search strategies based on the main websites of consumers' searches. Then, the number of brands searched online was analyzed for each search strategy type. With this study, the authors seek to improve the theoretical model of consumer online search behavior and brand consideration.

The second group of papers explores privacy aspects related to the topic of this Special Issue. In particular, Gabrielli et al. [15] investigate users' main expectations, preferences, and concerns regarding the adoption of blockchain-based personal data sharing platforms in health and education domains. In total, 15 participants were involved in a multidimensional evaluation of a prototyped release of the KRAKEN blockchain-based data sharing platform, and were asked to assess it in aforementioned domains. The data collected during the online interviews were analyzed by applying the micro interlocutor technique to provide a descriptive overview of participant responses.

The other article dealing with privacy aspects is Sánchez et al. [6], which proposes a system that automatically assesses privacy policies. The proposed system quantifies the degree of policy compliance with respect to the data protection goals stated by the EU General Data Protection Regulation (GDPR), and provides clear and intuitive privacy scores to the user. With this information, users become aware of the risks associated with the services and their severity, thereby empowering them to take informed decisions when accepting the terms of a service.

Finally, we have the last group papers focusing on applications for online advertising, e-health and e-learning. In online advertising, Romero Leguina et al. [3] tackle the problem of estimating the optimal frequency cap, that is, the number of ad impressions a user should

received that maximizes ad revenue. The authors propose a novel methodology that is validated using simulations and large-scale datasets from real ad campaigns data.

In e-health, López Bernal et al. [16] propose a system that can predict adverse blood pressure events. The proposed system relies on a wearable device measuring patient's biomarkers, such as blood pressure, a mobile application acquiring patient's information, and a Web platform consulting environmental services, processing data, and predicting blood pressure. Among other contributions, the authors develop a proof of concept implementation that can predict blood pressure values both in real-time and future temporal windows within one day.

Finally, in e-learning, Tegoan et al. [17] survey the potential benefits and challenges of using extended reality technology for teaching new languages. The authors provide recommendations to successfully implement such technology and suggest ways to improve motivation, engagement, and enhanced accessibility of learning and teaching resources on both students and teachers.

All these SI articles are accessible open access through the following link https://www.mdpi.com/journal/applsci/special_issues/web_Ecosystem (accessed on 1 December 2022).

3. Conclusions

The SI has gathered diverse papers demonstrating the affordances of technology to improve the Web ecosystem. However, we also need to consider the potential caveats that have been reported during the last years, such as negative uses of open data [18], the constant cyber security breaches [19], algorithmic biases [20], or misinformation [9]. Therefore, future research should also tackle these current negative challenges, instead of solely focusing on new developments. However, this is a mission that will require the cooperation of the large technological companies in order to really advance on these issues together.

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