

Challenges and Approaches for Web Archive Creation and Usage

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The Web has been established as a worldwide information and communication medium. New technologies constantly extend the usage and enable also unexperienced users to publish content or to contribute to discussions. Therefore the Web is seen as good documentation of today's society and Web archiving and preservation has become a cultural necessity in preserving knowledge. This is especially the case for non-traditional digital publications, e.g., social media, collaborative space, or digital lab books. The challenge with new forms of publications is that there can be a lack of alignment between what institutions see as worth preserving, what the owners see as of current value, and the incentive to preserve together with the rapidness at which decisions have to be made. For ephemeral publications such as the Web, this misalignment often results in irreparable loss.

In addition to the "common" challenges of digital preservation, such as media decay, technological obsolescence, authenticity and integrity issues, Web preservation has to deal with the sheer size and ever-increasing growth and change rate of Web data. Ntoulas et al. [Ntoulas et al., 2004] showed that the Web is growing by more than 8% per week and that after one year, 40% of the pages are still accessible, while 60% of the pages are new or changed. Hence, the selection of content sources becomes a crucial and challenging task for archival organizations.

A pivotal factor for enabling next-generation Web archives is crawling. Crawlers are complex programs that nevertheless implement a simple process: follow links and retrieve Web pages. In the ARCOMEM approach, however, crawling is much more complex, as it is enriched with functionality dealing with novel requirements. Instead of following a "collect-all" strategy, an increased interest can be observed from archival organizations and research trying to build community memories that reflect the diversity of information in which people are interested. Community memories largely revolve around events and the entities related to them, such as persons, organizations and locations. These may be unique events, such as the first landing on the moon or a natural disaster, or regularly occurring events, such as elections or TV serials. Thus, entities and events are natural candidates for focusing new types of content acquisition processes in preservation, as well as for archive enrichment.

Current Web crawler technology is mainly inspired or based on crawlers for search engines. Therefore, they have limited or no notion of topics, entities, events or the Social Web context. The ARCOMEM system represents a new kind of Web crawler that addresses the special needs of Web archiving organizations. This new crawler generation analyzes and mines the rich social tapestry of the Social Web to find clues for deciding what should be preserved (based on its reflection in the Social Web), to contextualize content within digital archives based on their Social Web context and to determine how to best preserve this context. Contextualization based on the Social Web is complemented by exploring topic-centered, event-centered and entity-centered processes for content appraisal and acquisition, as well as for rich preservation.

The result of the ARCOMEM project [Risse et al., 2014] was a first step in the development of a new crawler technology that make use Social Media and content semantics. With iCrawl project we go beyond enable the collection of fresh and relevant Web and Social Web content for a topic of interest through seamless integration of Web and Social Media in a novel integrated focused crawler. The crawler collects Web and Social Media content in a single system and exploits the stream of fresh Social Media content for guiding the crawler.

Usage of Web Archives

Due the initial focus of the Web archiving community on the crawling and preservation of Web content, the usage of Web archives is still at the beginning. None of the Web archive initiatives is able to provide their collections through an interface which comes close to the functionalities we see today on modern Web search engines.

Within the ARCOMEM project we developed first step towards new ways of exploring Web archives. The main logical concepts considered in ARCOMEM extraction and enrichment activities are entities, topics, opinions and events (ETOEs) [Risse et al., 2014]. To create incrementally enriched web archives that allow access to all sorts of web content in a structured and semantically meaningful way, extraction, enrichment and consolidation of ETOEs are of crucial importance. To this extent, the main challenges we face are related to the extraction, detection and correlation of ETOEs and related information in a vast number of heterogeneous web resources. These processes face issues arising from the diversity of the nature and quality of web content, in particular when considering social media and user-generated content, where further issues are posed by the informal use of language.

While entities and events resulting from the automatic extraction processes provide an initial classification and structure for the crawled web documents, they can be heterogeneous, ambiguous and provide only very limited information. Therefore, data enrichment and consolidation follows two aims: (1) enrich and disambiguate extracted entities with related publicly available knowledge; and (2) identify data correlations by aligning entities with reference datasets [Demidova et al., 2014].

Due to the amount of data and the temporal property Web archives the approach has limitations. The ALEXANDRIA project [Alexandria] aims at developing radical new approaches and advances in the state of the art are necessary to move ahead in our abilities of indexing, retrieving and exploring past Web content. Models and algorithms for temporal information retrieval developed in the context of this project will take the unique temporal dimension of Web archives into account. Semantic entity-based indexing will support exploration of temporal Web content and evolving entities in a more user-oriented way than conventional document-based retrieval.

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