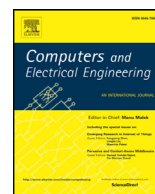




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journal homepage: [www.elsevier.com/locate/compeleceng](http://www.elsevier.com/locate/compeleceng)A survey on context in modern humanistic computing<sup>☆</sup>

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## ABSTRACT

This survey paper attempts to study the existence, importance and impact of the notion of context in modern humanistic computing. Given its inherent diversity, the term is nowadays widely acknowledged among computer science tasks and has become a major topic of interest in several of its sub-fields, ranging from contextual semantics to social networks, social media and recently emerged innovative applications, such as travel routing. We start by presenting a brief review of contextual semantics as nowadays they are considered suitable for most common content analysis problems. Focus is also given within the next survey sections on the impact of context within the social networks and media field that came into sight over the last years. A short, closing discussion on the identified challenges and potential future research directions concludes this survey.

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## 1. Introduction

We may well claim that, from the computer scientist's point of view, our era is rather dominated by modern computing applications and systems that place human beings in the center of their attention. In general, the next big thing in computer science is *information handling* and, in particular, the type of information deriving from human-generated actions or tasks that are interconnected by definition. Thus, it is easy to understand that information no longer arise in seclusion, leading to new, innovative ways of interpreting them. In this framework the term *context* came into serious play within relevant computer science tasks a little more than 15 years ago, although its true origins date back to the beginnings of computation [5].

In the field of humanistic computer science, which ranges from the theoretical branches of computer science and information theory to artificial intelligence and multimedia analysis tasks, contextual information plays an ever increasing role. To the best of our recent knowledge researchers and students are eager to obtain comprehensive and insightfully written reviews of related studies on modern computing information handling. This survey attempts to provide a rich source of ideas for them and a good point of reference for those who want to start studying contextual information in depth within the framework imposed by the latest computer science advances. Among its goals is the identification of different types of contextual information in humanistic informatics and the provision of an overview on the definition and utilization of context variations exploited within semantics and the modern social media/networks content analysis approaches and applications.

The structure of the rest of this paper is as follows: in [Section 2](#) we explain in brief detail the motivation behind investigating context in modern computing tasks and applications. [Section 3](#) discusses contextual semantics, whereas the most recent trends in the social media world are summarized in [Section 4](#). [Section 5](#) discusses the resulted findings, conclusions

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and future perspectives of each one of the contextual building blocks of the survey, whereas Section 6 concludes this work and presents potential future directions of expanding the current survey research.

## 2. Motivation

It would not be absurd to acknowledge that we currently live within a world dominated by "humanistic computing". This observation clearly motivated researchers to focus their research on humanistic computing tasks, in an attempt to provide solutions to the - mostly digital - problems that arose. Within a very limited time-frame of a few years, humans, either in the form of researchers or in the form of content users/producers/consumers, came into the need of efficiently storing, organizing, searching and retrieving huge amounts of information.

In the seek of scalable ways to handle this rather chaotic pile of data in a semantic meaningful and efficient manner, an ever increasing amount of researchers and computer scientists has fled to the *contextual aspects of information* to help with the effort. Taking into account respective social human interactions, we may identify and categorize different contextual information categories while social networking sites users generate, produce, share and publish their own digital content online. Research shifted towards advanced exploitation of metadata information and/or additional kinds of knowledge. The latter is nowadays clearly encompassed by the broad term *contextual information*, which although might increase complexity, e.g., of retrieval tasks [17], it allows for a more scalable, semantically enriched, digital ecosystem.

In the following sections of this manuscript we attempt to present related research works deriving from the field of humanistic computing, roughly classified based on the exploitation of the notion of context they perform and the utilization of all kinds of metadata and targeted applications in the process. More specifically, in an effort to understand the meaning of information, the combination of contextual parameters extracted from low-level features with high-level concepts and interpretation (e.g., fuzzy sets) to facilitate additional semantic knowledge processing tasks is also of great importance, and thus, works that tackle the notion of contextual semantics are discussed in Section 3 of this paper. In addition, it is rather self-evident, that social networks' popularity has rapidly increased over the past few years and it would not be radical to claim that they have changed our digital world in an unprecedented manner. Social networks provide many kinds of services and benefits to its users like share opinions with like-minded people and stay in touch with old friends and colleagues, thus constituting the related contextual researches discussed within following Section 4 a trending topic and definitely a field of future research.

## 3. Contextual semantics

One of the characteristics of human nature that current humanistic computing applications and systems are here to engage is the ability to perceive, mingle, process and respond to information in real-time. Especially in the framework of modern computing, content semantics play a crucial role in this process, by, among others, including all interactions and contextual cues that by definition are full of ambiguities. We may identify these traits ranging from the multimodal nature of expressions [4] to intra- and interpersonal relational context [9]. Nowadays, ontologies, the current, modern form of Semantics, which is utilized as the main building block of Web 3.0, are still typically built in an inefficient, manual, rather than automated, manner, heavily involving humans in the process up to an extent. Researchers invested in automated development of contextual information in the form of the so-called domain ontologies [28,16] that consist of concepts, semantic relations among them and sets of inference rules.

Still, without any further doubt the role of context in semantics is today applied to a broader range of modern computing tasks. Starting with the very basic building block of computing, i.e., programming, contextual semantics do influence the composition, location and flows of operative code within a programming task. There are also cases where contextual information is interpreted from a unified architectural model and a taxonomy for context data distribution perspective. Within the new framework of social computing the need for better social communication capabilities motivates the introduction and utilization of context in tasks like intelligent information accessing from/to social media [10], as well as their respective semantics mining. In another interesting work closely related to the scope of contextual semantics [27], authors conduct a user survey on the impact of user-contributed contextual information in archival research. Being in the spotlight of attention lately, the field of personalized services provision is dominated by works utilizing semantic context in the process, like for instance the one [22] focusing on the grounds of a smart home environment; the latter being also the field of expertise for [19], where the challenge of integrating spatiotemporal contextual information with human and technical sensor information is discussed. In an attempt to illustrate the basic components of aforementioned approaches, Table 1. summarizes their primitive tasks, methodologies, as well as their pros and cons, in addition to the depiction of a utilized dataset.

## 4. Context in social networks

Over time the interference of computational semantics evolved towards the main building block of today's modern humanistic computing, i.e., social media and networks. In an attempt to define and identify them, we may refer to the corresponding Wikipedia<sup>1</sup> article, which mentions that "social media are computer-mediated tools that allow people or com-

<sup>1</sup> [https://en.wikipedia.org/wiki/Social\\_media](https://en.wikipedia.org/wiki/Social_media).

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