Using Artificial Intelligent Applications in Archaeology

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Introduction

In the last fifty years, the growing use of computer applications has become a main feature of the archaeological research. Since the '90s, when Computer Science was oriented to the creation of work tools and solutions for the archive and management of quantitative data, to the development of virtual models and to the dissemination of knowledge, it quickly changed into a true theoretical approach to the problems of archaeology. It is now, indeed, able to influence the interpretation procedures and to revolutionize the language and contents of the study of the past. This new evidence introduced in several branches of the theoretical debate new scientific themes. There are different views about the integration of computers and archaeology.

The expansion of Internet usage indicated an alternative way to advertise the visitation of archeological sites and museums significant to every nation's history. Therefore, especially for countries such as Greece being characterized by cultural richness, promoting archeological sites by enhancing their digital presence on the Web is a task of significant importance.

Methodology

The goal of this paper is to explore which of the new topics of Information and Communication Technology can be applied in the future to Archaeology. The aim is not to give solutions to archaeological problems, but to present some new areas that can be useful to it. Taking into account the durability of the relationship between archaeologists and computing, it is difficult to effectively summarize the range of digital tools that are available to researchers.

Artificial Intelligence

Artificial intelligence artificial intelligence emerged in the 1950's. It arises from cognitive

psychology and computer sciences and its main interest is to simulate human speech, reasoning and behavior. This discipline has hitherto yielded several methods, such as robotics, pattern recognition, natural language processing, speech recognition, expert systems, and neural networks that have proved to be practical instruments for all kind of tasks.In many fields of research and in our daily life these instruments have already been incorporated. In archaeology, however, they do not (yet) play an important role. (VAN DEN DRIES 1993).

Artificial intelligence can be applied in three different ways to the archeology.

Knowledge Discovery in Databases (KDD), Visual Information Management (VIM) and Multi-agent Systems (MAS), Artificial Neural Networks (ANN)

Knowledge Discovery in Databases (KDD):

At an abstract level, the KDD is concerned with the development of methods and techniques for making sense of data. The basic problem addressed by the KDD process is one of mapping low-level data (which are typically too voluminous to understand and digest easily) into other forms that might be more compact (for example, a short report), more abstract (for example, a descriptive approximation or model of the process that generated the data), or more useful (for example, a predictive model for estimating the value of future cases). At the core of the process is the application of specific data-mining methods for pattern discovery and extraction. *"KDD is an attempt to address a problem that the digital information era made a fact of life for all of us: data overload."* (ETZIONI 1996).It is not possible to make manual knowledge discovery in archaeological databases. We have to automatist it with the supervision of human experts for validating and interpreting the newdiscovered theories.(RAKESH,1996) The goal is to identify *patterns* from data. Patterns are expressions in some language that allow structuring or grouping data: for instance, identifying dependencies among them.

Visual Information Management (VIM)

Visual applications (multimedia) including images, graphics, videos, animations and rich text need to represent, manipulate, store, and retrieve both raw and processed visual data. Existing ordinary manual database systems fail to offer satisfactory visual data management support because they lack the kinds of representations, storage structures, indices, access methods, and query mechanisms needed for visual data. We argue that extensible visual object stores offer feasible and effective means to address the data management needs of visual applications. specially in historical data. (NICHOLAS NEGROPONTE, 1995)

The introduction of multimedia information: specially image and video—to the archaeological databases produce a need to find efficient techniques to store, retrieve and understand that kind of information. When talk about visual information management we distinguish among four categories of information: features, feature space, feature groups and image space Image analysis algorithms can extract some interesting features of a visual object. Examples of some features are: redness, texture, contrast, etc. Image analysis algorithms transform the original visual object by means of projections, applying functions and making distance measures among features.

MAS (Multi-agent Systems):

Currently the computer systems are increasingly complex, often distributed over several sites and consist of software interacting with each other or with humans. The need for model human behavior in specific computer programs has prompted officials to use technology that affected the last decade and whose movements are very remarkable. In this context, designing multi-agent systems (MAS) is complex because they require the inclusion of several parts of the system which can often be approached from different angles. We must identify and analyze all system problems to find models for multi-agents to implement and integrate them into a coherent system. This is the software engineering and well justifies the use of a method of analysis,(S. MAALAL, M. ADDOU, 2011).

An agent is a computer system within an environment and with an autonomous behavior made for achieving the objectives that were set during its design. A multi-agents system is a system that contains a set of agents that interact with communications protocols and are able to act on their environment. Different agents have different spheres of influence, (WOOLDRIDG, 1995) in the sense that they have control (or at least can influence) on different parts of the environment.

Design and development of multi-agents systems Simulation of primitive societies is a well-known area in archaeology. The current interest in the artificial intelligence research community on multiagent systems offers a new opportunity for considering simulation based on agent ideas. an agent is a set of programs that share the following features: autonomy, agents evolve without human operation, they has control over their own actions; sociability, agents interact and communicate among them; reactivity, agents have perception of the environment -physical or virtual (NICHOLAS, 1996) and react to the changes on it.

Virtual Archaeology

VA is the analysis of the procedures of management and representation of the archaeological evidence through computer graphics and 3D and 4D animation techniques. VA and augmented reality in the archaeology is not only important to the archaeologists, but it is also important to the visitors of museums and archaeological sites. Using this computer graphics tool they can see and understand the ancient place in a more interactive and animated way.

The term Virtual Archaeology can be traced to a paper presented by Paul Reilly at the 1990 CAA conference (REILLY,1991). His view centered on excavation recording and the possibilities of virtual re-excavation using technologies such as hypertext, multimedia and three-dimensional solid modeling. "Virtual archaeology can be defined as digital reconstructive archaeology, computational epistemology applied to the reconstruction of three-dimensional archaeological ecosystems, therefore, cognitive ecology" (FORTE,2000). Today, Virtual Archaeology encompasses not only 3D modeling and visualization, but also 'auralization' (*"is the technique of creation and reproduction of sound on the basis of computer data."* using acoustic models (POPE, CHALMERS 2000).

Applications in Virtual archeology

XML (Extensible Markup Language) have been developed in order to address the problems of information interchange and resource discovery in a modern distributed environment. Given this framework, it should come as no surprise that XML-based languages are evolving to provide open formats for modelling, exchange and presentation of data. Examples include the Synchronized Multimedia Integration Language (SMIL), Scaleable Vector Graphics (SVG), and eXtensible 3D (X3D). Each of these languages has much to offer the Virtual Archaeologist.

SMIL (Synchronized Multimedia Integration Language)SMIL is an XML-based language for multimedia presentations, including facilities for controllinglayout, timing and synchronization using in HTML language.

SVG (Scaleable Vector Graphics) Scaleable Vector Graphics (SVG) is an XML-based language for describing two-dimensional vector and mixed vector and raster graphics.

X3D(eXtensible 3D)

The X3D Graphics Working Group is developing an XML language with the geometrical and behavioural capabilities of VRML(*Virtual Reality Modeling Language)*. The intention is that this language will eventually serve as the next generation of VRML.

Conclusion

The use of computers in archaeology has a lengthy history and practitioners within the discipline can claim, with some justification, that both the technology they use and the methods that they've adopted have more of a relationship to scientific practice (including computer science, Artificial Intelligence) than in many other arts and humanities disciplines.Early in the future archaeologists will be able to use the results of these new areas on computer science and artificial intelligence to improve their research. Digital world besides the management techniques of visual information and knowledge discovery in databases will be useful to the understanding of the information sources. Artificial intelligence is especially useful for experience based knowledge.

As a final remark we can see that this relation between Computing and archeology was fruitful.

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