

Chapter 11

Digital Transformation and Archaeology: Innovating Using the Cloud and Artificial Intelligence

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ABSTRACT

In the era of digital archaeology, the communication of archaeological data/contexts/work can be enhanced by Cloud computing, AI, and other emergent technologies. The authors explore the most recent and efficient examples, ranging from some intrinsic properties of AI, i.e. capabilities of sense, comprehend and act, and looking at their application in communication both among specialists of the archaeological sector and from them to other recipients. The chapter will also provide a high-level overview of knowledge extraction solutions from tons of structured and unstructured data, to make it available through software applications that perform automated tasks. Archaeologists must be ready to go down in trenches and communicate their studies with a deep consciousness of chances given by these technologies, and with adequate skills to master them.

INTRODUCTION

There is today the chance to live in a very exciting era. After many important milestones in the history of humanity such as becoming farmers after being nomads, after creating cities, machines and internet, it is now the time of the ‘cloud era’. ‘Cloud’ refers to a global network of server computers globally distributed around the world and that operate as a unique ecosystem to run applications, store data, manage contents, services etc. Businesses can leverage a potentially limitless compute power availability without

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the need to buy hardware but just paying-per-use like happens for a power or gas supply and only for the time they need it, resulting in low initial investments, cost saving and better return of investment.

Cloud computing has grown, and is continuing to grow, exponentially over the years and has opened new possibilities for everyday life, for every kind of business and have a rich field of application in every scientific sector, including humanistic disciplines and in particular in archaeology. It enables technologies like Artificial Intelligence (AI), Internet of Things (IoT) and Big Data and the combination of these components is believed to be the future of technology itself, disclosing scenarios that were simply impossible to realize a few years ago.

Despite the fact that AI has been around for many years - not unknown in humanistic disciplines, in particular in archaeology (first real experiences and applications date back to the 80s; see Zubrow, 2006, p. 17) - it's just now that real and tangible AI solutions are concretely witnessed. They are mainly driven by what technology makes available today. AI today leverages the following three megatrends:

1. *Data*. Thanks to the IoT, social networks and mobile phones, tons of data are being produced and this is increasing year over year. In 2013 one of Europe's largest independent research organisations of researches and development projects asserted that 90% of the digital data has been produced during the previous two years (SINTEF, 2013). More recently, the meaningful named report *Data never sleeps*, in its 6th edition, showed incredible numbers illustrating in a chart what happen every minute in the internet concerning creation of data.
2. *Computational power in the cloud*. Produced and collected data can be easily stored and analyzed in the cloud with unprecedented computational power and at scale.
3. *Analytical capabilities*. Rich analytical capabilities and algorithms are constantly being generated and improved.

In the last several decades, humans have had to understand how to use computers, how they were programmed and how software was supposed to work. With AI, instead of being humans understanding computers, computers can understand humans and our world with vision and perception through comprehension. In fact when drilling down into AI, three main capabilities can be found: sense, comprehend and act.

First, 'Sense'. It is the ability to use what is natural to human beings: sight, vision and audio processing to acquire and process images and sounds. That is about acquiring, processing, analysing and understanding images and sounds that can be collected using cameras or microphones.

- **Computer Vision:** Acquiring, processing, analysing and understand images captured using cameras;
- **Sensor Processing:** Analysing information from sensors other than cameras and microphones, such as temperature, humidity, light, weight, etc.;
- **Audio Processing:** Identifying, recognizing and analysing sounds and speech.

Second: Comprehend. This capability deals with how to get a meaning of captured data and extract useful knowledge out of it. For example, Natural Language Processing (NLP) can enable AI to understand the information collected from an utterance from a user.

- **NLP:** Understanding the main intents in spoken and/or written form.

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