

ΓAB LAB: The Knowledge and Uncertainty Research Laboratory at the University of Peloponnese

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Abstract. Founded in 2014 and formally established in 2017, the Knowledge and Uncertainty Research Laboratory examines the role of knowledge and of its absence in the theory and application of information technology. Our main theoretical tools are fuzzy mathematics and the semantic web, while fields such as information visualization, artificial intelligence, information retrieval, adaptation to the user, cultural informatics, social networks and smart cities also have an important role in the teams research. The laboratory is unconventional, in the sense that it deviates from the typical notion of research laboratory and follows a more open approach.

Keywords: knowledge · uncertainty · research laboratory · cultural informatics · semantic web · artificial intelligence

1 Short description

ΓAB LAB is a research laboratory, established at the Department of Informatics and Telecommunications of the University of Peloponnese. It comprises more than 40 members, including professors, researchers, doctoral candidates, post-graduate and undergraduate students, laboratory staff and volunteers.

The character of the Laboratory is highly unconventional and interdisciplinary, with the research interests of its professors and researchers embracing various fields of computer science as well as psychology, pedagogy, archeology and history and cooperations spanning from research groups to private and public entities of various domains.

Given the number of members and the variety of their research interests, it follows naturally that ΓAB LAB pursues a wide range of research (and other) goals. Still, cultural informatics, or more specifically the utilization of technology towards better understanding and accessing our cultural heritage, is the leading and core field of work.

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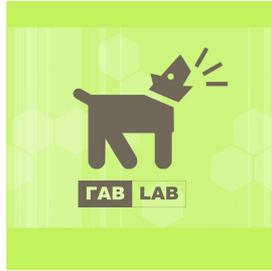


Fig. 1: The ΓAB LAB logo



Fig. 2: A meeting with regional stakeholders of culture

2 Overview

ΓAB LAB is a research lab that primarily focuses on the application of technology in the area of broader area of cultural heritage. We participate in a number of related projects, but also pursue independent research goals regardless of funding; often as part of graduate, doctoral and post-doctoral studies. Most research efforts evolve around the topics of

- mobile applications for the contact-less exchange of data between exhibits and visitors,
- VR and AR applications that enrich the museum experience,
- applications that gather data and visualize information regarding a museum tour or exhibition experience, and
- the role of big data and social media in cultural informatics.

Research efforts outside cultural informatics include smart cities, citation analysis, education and the handling of uncertainty. Of course, it is not uncommon for these research efforts to at times find common ground or application in the cultural domain as well.

Some of our recent and ongoing projects in the area of cultural informatics include:

2.1 CrossCult

“CROSSCULT: Empowering reuse of digital cultural heritage in context-aware crosscuts of European history” is an H2020 project that aims to make reflective history a reality in the European cultural context, by enabling the re-interpretation of European (hi)stories through cross-border interconnections among cultural digital resources, citizen viewpoints and physical venues.

The project has two main goals. The first goal is to lower cultural EU barriers and create unique cross-border perspectives, by connecting existing digital historical resources and by creating new ones through the participation of the public. The second goal is to provide long-lasting experiences of social learning and entertainment that will help towards the better understanding and re-interpretation of European history.

2.2 Kalamata 1821

“Kalamata 1821: Roads of Freedom” is a national project that aims to study and exhibit to the wider public important local parameters of the 1821 era and their interconnections with the present through roads of history, culture and trade. Emphasis will be given to specific aspects of the 1821 revolution beginning in Kalamata, with important historic significance and strong interrelation with the wider area (e.g. preparation for the uprising, economic life of the region, beginning of the revolution, Navarino naval battle), in order to describe the 200 years of history and the historic correlations.

By using new vision and multimedia technologies, it will be attempted to interactively depict the historic moments to the citizens/visitors of Kalamata, on a permanent basis. Through the multimedia platform that will be created, the interested person will not only be able to be informed of the historic events, but also, he/she will be motivated to move to several locations of interest in the city or the area (geo-monuments), to 'live and feel' the life style of the era and to participate in the interactive games that will be developed.

2.3 exhiSTORY

In this work we examine how opportunities arising from technological advances in the fields of IoT and semantics can be used to develop smart, self-organizing exhibits that cooperate with each other and provide visitors with comprehensible, rich, diverse, personalized and highly stimulating experiences. These notions

are included in the design of a system named “exhiSTORY”, which also exploits previously ignored information and identifies previously unseen semantic links. We present the architecture of the system and discuss its application potential.

2.4 Tripmentor

“Tripmentor: interactive tourist guide” is a national project that concerns the development of a bilingual service (English, Greek) in the form of a web-interactive platform/ application that will provide a personalized, integrated and unique travel experience to the visitor of the Attica region. Alternative map routes will be proposed to the traveler connected to the app for recreational purposes, including stops at the selected points of interest with real time information on cultural, recreational and athletic events. Suggestions and relative recreational proposals will match the traveler’s preferences. Each route includes stops that have meaningful, cultural, chronological or thematic relevance to each other, optimum duration of visit, optimal way of travel and total duration of the journey, creating personalized narration- storytelling and incorporating gamification elements, depending on the characteristics of the visitor and the weighting of her/ his personal interests.

For foreigners, non having prior knowledge of the entertainment- artistic-cultural- sporting ecosystem of the region and of Greece in general, and accounting for the fact that the relevant information is mainly communicated in Greek by the relative media (websites, events in social media, etc.), it is almost impossible for them to match their preferences with the numerous and varied events offered in the Attica. The Tripmentor platform aims to fill the gap of easy-to-access and systematic touristic information availability, creating relevant narrative routes that fit to the preferences of each visitor.

2.5 PaloAnalytics

“PaloAnalytics: A platform for large-scale analysis of web mentions, in a multilingual context, for identification of business opportunities” is a national project that aims to develop a platform that will allow international companies to manage their reputation and compare it with the competitors. It will also allow them to investigate the impact of their products on consumers across different countries and this will be achieved with the analysis of content from sites, blogs, social networks and open data. The developed services will allow companies to identify both positive and negative comments and reports about their brand name and products and the individual features that formed the public opinion.

The project partners will explore, design and develop a range of algorithms and tools: 1) to collect and manage large amounts of data (text, multimedia and links) from online news sources, social networks and open sources, 2) to extract knowledge from textual references e.g. emotions, trends, influences, impact, results and interactions in a multilingual environment, 3) to link exported knowledge together and present it using infographics and user friendly visualisations. The collaborating research organizations will design and exploit state-of-the-art

technologies in the fields of data mining, deep-learning and social networking analysis and will give PaloAnalytics the competitive advantage over its international competitors.

Other activities

In addition to the research efforts, ΓAB LAB performs a series of student-centric, pupil-centric and citizen-centric actions, in an effort to bring research and science closer to the public and contribute more to its surrounding community. These actions range from “open day” events and seminars for students to educational visits for schools and from the organization of innovation competitions to the development of a network of innovation centers for the general public.

Given that this is our core expertise, culture and cultural informatics have a central role in these side activities, as they typically form the basis upon which the following discussion is built and provide the working tools.

3 Partnership

We believe that a lot can be gained by combining expertise and examining different points of view. Thus, in every domain that we are energized we strive to partner with the people, institutions and stakeholders that are the most relevant, so that we can exchange know-how and combine efforts. Some of our long lasting partnerships are listed below, while more partnerships are currently being set up or have been established recently.

3.1 Ephorate of Antiquities

Our partnership with the Ephorate of Antiquities of Arcadia is central to our research in cultural informatics. It allows us to have access to real museums, of different volumes, budgets and types, as well as insight regarding the way archaeologists and museologists see their field and the challenges they face.

Through this partnership our students get to work on theses that are not only considered from a theoretical point of view but are also applied and tested in a real life setting.

3.2 Regional Directorate for Education

We strongly believe that, whilst administratively three distinct levels exist, in essence education is one. We aim to work closely with primary and secondary education schools, providing insight regarding what university really is and what pupils should expect to find there or get from it. We also invest a lot of effort towards stimulating pupils towards science and innovation.

Our partnership with the Regional Directorate for Primary and Secondary Education of Peloponnese gives us access to a huge number of schools and pupils. It also brings us closer to the educators, facilitating our research in education and educational software systems, as we have the opportunity to see and incorporate the teacher’s view and insight already from the phase of theoretical design.

3.3 City of Tripolis

One of the laboratory's research topics is that of smart cities. Of course there is little point in researching smart cities without having a city whose point of view to examine and on which to apply the results of the research. Our partnership with the municipality of Tripolis allows us to focus on research for smart cities of small budget and limited existing infrastructure; a niche that has received little attention so far, but can be expected to come to focus in the future as it relates to the majority of cities in the world.

3.4 Innovation center

We believe that a university offers the most when it is not secluded away from society but rather in close connection with it. In this direction, we are developing a network of innovation centers throughout the region of Peloponnese.

The goal of these centers is to serve as the connecting point between the laboratory and the society. The place where citizens can come asking for solutions to practical problems, businesses can come looking for marketable innovations and hopeful startup-ers can come for consulting and support.

3.5 HCI-VR laboratory

The The Human Computer Interaction and Virtual Reality Lab [1] of the University of Peloponnese is our sister laboratory. We share resources, projects and occasionally members. We have similar goals, particularly in the direction of cultural informatics, and we find we achieve much more when combining powers.

3.6 LAIQDA laboratory

LAIQDA is a research laboratory of the Technological Educational Institute (TEI) of Peloponnese, located in Kalamata. Kalamata is another city in the prefecture of Peloponnese that has an extremely rich history and culture.

Through our cooperation with LAIQDA we have workspace and colleagues in Kalamata, as well as direct access to the local stakeholders and authorities. As there is talk of joining the TEI of Peloponnese and the University of Peloponnese in the near future, there is even a possibility of the two laboratories merging into one.

3.7 Laboratory of Archaeometry

The Laboratory of Archaeometry (established in 2007, in operation since 2010) is based at the Department of History, Archaeology and Cultural Resources Management, University of the Peloponnese in the city of Kalamata.

This is the other laboratory of the University of the Peloponnese that works in the broader area of culture. Via our collaboration we can approach projects with a more holistic perspective, combining the points of view of engineering and humanities.

4 Lessons learned

Whereas the senior members of the lab all have experiences from the more “conventional” way of operation of research laboratories, at ΓAB LAB we have opted to follow a different, highly unconventional approach. Core areas of differentiation from the norm include:

- Involving undergraduate students in large numbers in the core operation of the laboratory, even the research related tasks.
- Establishing and investing in collaborations with non-research organizations.
- Directing laboratory resources towards popularization of science, both for schools and the broader public.
- Sharing findings and tools rather than following the typical path of patenting and financial exploitation.

Our main finding is that the “open” laboratory works, in the long run.

Involving undergraduate students in the research process requires considerably more time and effort from the part of the senior researchers to achieve the same goals. Thus, we would not recommend it as a short term approach. But, in the long term, this works wonders for the development of the students, not only as regards their technical know-how but also with regards to their confidence and ability to develop initiative and contribute more to research in the future. We have found that it also makes it easier to have many and capable senior students; this is typically an area in which our regional university is lacking.

Involving stakeholders and non-researchers early in the research process also requires time and effort from the part of researchers, and often leads to great delays as when a common ground and language cannot be found they need to be developed from scratch. But in the long run, this creates a network of people that provide valuable and previously unavailable insight into what would be useful, what might work, what limitations and special conditions need to be taken into consideration. We find that being truly interdisciplinary, i.e. involving people with a common interest but vastly different backgrounds, is the only way to move forward in a field such as cultural informatics. The combination of different backgrounds, we should point out, does not refer to the cooperation between researchers of different scientists - in the end all are researchers; it refers to the vivid discussion between researchers, entrepreneurs, practitioners, NGOs, public bodies and the general public.

5 Open challenges

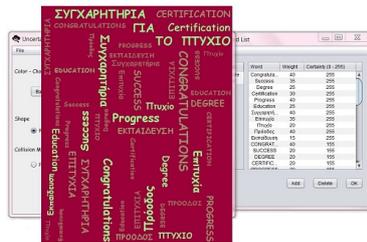
The unconventional nature of the laboratory is both its strength and its weakness. Whilst the open approach contributes technically to achieving our goals, it makes funding the pursuit of these goals harder. Available funding schemes are designed to support the typical operation of research entities. Thus, when a research entity hopes to venture to new, atypical operations, no funding schemes are available to support it.

Our main challenge is how to continue supporting actions such as working with primary and secondary schools, and fund efforts such as the network of innovation centers, through our income generating operations such as the participation in RTD projects, in a more sustainable and extensible way.

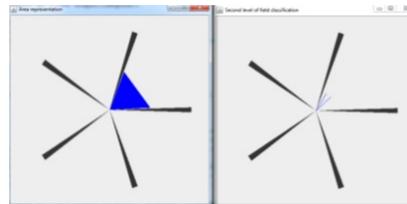
With respect to research in cultural informatics, the challenges that we are currently working on include the documentation and re-utilization of the narratives of museum visits[2], the rapid personalization of museum guide software based on information gathered from social media[3], the utilization of IoT technologies for smart cultural venues[4], the use of low end devices for high end experiences[5] and finding the optimal balance between entertainment and education in software for educational visits to venues of cultural interest.

6 Tools

The lab's policy is to make all applications and code freely available, as soon as technically and legally possible - limitations may be in place for components developed cooperatively in the framework of joint projects.



(a) The Uncertain Tag Cloud



(b) Impact Analyzer interface



(c) Google Scholar Retrieval interface



(d) Sort My Pictures interface

Fig. 3: Tools

The list of tools includes a. Tate Analyzer, b. The Uncertain Tag Cloud, c. Impact assessment and visualization and d. Citation retrieval.

Tate Analyzer tool processes and analyzes metadata from Tate Gallery's collection <https://github.com/tategallery/collection> in order to find "hidden" interconnections between the objects of the collection. The tool produces clusters of similar objects based on ontological information. The tool's key concepts as well as its practical application are discussed in [4]. The tool and its code are freely available under a CC0 1.0 Universal license. The Uncertain Tag Cloud - a Java based application - provides a user friendly user interface through which a user can easily specify and develop tag clouds. The application is based on the Kumo library, which it extends with the addition of support for the notion of uncertainty. It implements the concepts discussed in [6]. The application and its code are freely available under a GPLv3 license. Impact assessment and visualization implements the concepts discussed in [7]. It accepts as input a list of publications in an XML file (as exported by our citation retrieval software) and, by examining the publication media, estimates the sciences and scientific fields they are related to. Its intended use is to process lists of citations in order to estimate a researcher's impact in different fields of science; other uses are easy to envisage. The application and its code are freely available under a GPLv3 license. Finally, "Citation retrieval" retrieves the complete list of an author's citations from the Google scholar database. It works by simulating a human user (sending HTML queries and parsing the resulting pages). Self-citations are identified and tagged and full results are conveniently exported in XML format. The application and its code are freely available under a GPLv3 license. People who take large numbers of digital pictures know how hard it is to keep them organized, so that they can be retrieved at will. This Java based application processes EXIF, IPTC and XMP in order to organize photos in folders. Users can use a predefined organization method or design their own through an intuitive interface. An interesting feature is the use of location information, recorded and stored together with the photos taken by most modern devices, in order to tag the photo with the location in which it was taken. The application and its code are freely available under a GPLv3 license.

7 Contact

We strongly believe in partnerships and we will be happy to hear from anyone interested in joining forces and pursuing common goals. You can reach us at:

- Email: gav@uop.gr
- Web: <http://gav.uop.gr>
- Facebook: <http://www.facebook.com/gavlab>

To meet us in person and visit our facilities, you will find us at the campus of the University of Peloponnese, in Tripolis, at:

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Or you can altogether skip talking to us and get our tools and code directly from GitHub.

– GitHub: <http://github.com/gavlab-gr>

Acknowledgment

This work has been partially funded by the project CrossCult: Empowering reuse of digital cultural heritage in context-aware crosscuts of European history, funded by the European Union’s Horizon 2020 research and innovation program, Grant#693150

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