VENICE TIME MACHINE
The Venice Time Machine, an international scientific programme launched by the EPFL and the University Ca’Foscari of Venice with the generous support of Fondation Lombard Odier, aims at building a multidimensional model of Venice and its evolution covering a period of more than 1000 years. The project ambitions to reconstruct a large open access database that could be used for research and education. Thanks to a partnership with the Archivio di Stato in Venice, kilometers of archives will be digitized, transcribed and indexed setting the base of the largest database ever created on Venetian documents.

In complementary to these primary sources, the content of thousands of monographies will be indexed and made searchable. The information extracted from these sources will be organized in a semantic graph of linked data and unfolded in space and time in an historical geographical information system.
About a hundred researchers and students currently collaborate on this international programme. A doctoral school is organized every year in Venice and several bachelor and master courses already use the data produced in the context of the Venice Time Machine.

THE HERITAGE: 80 km of Interconnected Documents

The State Archives of Venice contain a massive amount of hand-written documentation in languages evolving from medieval times to the 20th century. An estimated 80 km of shelves are filled with over a thousand years of administrative documents, from birth registrations, death certificates and tax statements, all the way to maps and urban planning designs. These documents are often very delicate and are occasionally in a fragile state of conservation.
The diversity, amount and accuracy of the Venetian administrative documents are unique in Western history. By combining this mass of information, it is possible to reconstruct large segments of the city’s past: complete biographies, political dynamics, or even the appearance of buildings and entire neighborhoods. The documents are intricately interweaved, telling a much richer story when they are cross-referenced.
THE VISION: Accessing the Venice Time Machine from the Cloud

At the moment, historians from around the world have to physically travel to Venice in order to consult a select number of documents in the State Archives. But could these documents be accessed from any computer in the world? Could we search these historical archives using automatically extracted keywords, especially considering that the documents themselves are hand-written? Could we cross-reference architecture plans across the ages and reconstruct Venetian streets and canals as they stood hundreds of years ago?

THE TECHNOLOGY: Big Data for the Archives

The Venice Time Machine will give the archives a new, virtual existence on the Web. It will reanimate Venice's past life from them by re-creating social networks and family trees, and visualizing urban development and design. An open digital archive of Venetian treasures will provide an entirely new research environment.
THE WORKFLOW: MASS DIGITIZATION WITH AUTOMATED TEXT RECOGNITION

SCANNING. Paper documents are turned into high-resolution digital images with the help of scanning machines. Different types of documents impose various constraints on the type of scanning machines that can be used and on the speed at which a document can be scanned. In partnership with industry, EPFL is working on a semi-automatic, robotic scanning unit capable of digitizing about 1000 pages per hour. Multiple units of this kind will be built to create an efficient digitization pipeline adapted to ancient documents. Another solution currently being explored at EPFL involves scanning books without turning the pages at all. This technique uses X-ray synchrotron radiation produced by a particle accelerator.

TRANSCRIPTION. The graphical complexity and diversity of hand-written documents make transcription a daunting task. For the Venice Time Machine, scientists are currently developing novel algorithms that can transform images into probable words. The images are automatically broken down into sub-images that potentially represent words. Each sub-image is compared to other sub-images, and classified according to the shape of word it features. Each time a new word is transcribed, it allows millions of other word transcripts to be recognized in the database.

TEXT PROCESSING. The strings of probable words are then turned into possible sentences by a text processor. This step is accomplished by using, among other tools, algorithms inspired by protein structure analysis that can identify recurring patterns.

CONNECTING DATA. The real wealth of the Venetian archives lies in the connectedness of its documentation. Several keywords link different types of documents, which makes the data searchable. This cross-referencing of imposing amounts of data organizes the information into giant graphs of interconnected data. Keywords in sentences are linked together into giant graphs, making it possible to cross-reference vast amounts of data, thereby allowing new aspects of information to emerge.
THE ARCHIVIO DI STATO’S HERITAGE

The State Archives of Venice contain an estimated 80 km of shelves filled with administrative information, documenting Venetian life and spanning over a thousand years. These include birth and death registries, wills, tax statements, architectural designs, urban planning, maps, travel guides to foreign lands, peace treaties, and others. The State Archives is also home to many unique treasures. The Venice Time Machine intends to capitalize on its massive amounts of information and the inherent link between documents.

Some unique moments in time at the State Archives in Venice:

• The oldest document dates back to the 9th century: the will of a woman leaving 30 baskets of olives to her successors.

• A map from the 14th century shows irrigation plans to divert fresh water away from the sea in order to maintain its salinity and prevent the proliferation of harmful water-borne microbes.

• A drawing depicts the 17th-century Venetian attack on the Ottomans in Athens that led to the unfortunate destruction of the Parthenon.

• Hundreds of thousands of letters, written by Venetian ambassadors traveling abroad, tell of the political, religious and royal intrigues in Europe and the Orient.

• A hand-written document by Galileo, Professor of Mathematics in the University of Padua, requesting financial support from the Venetian senate to develop the telescope, in which he describes its various uses.

• Napoleon’s treaty, which put an end to the Venetian Republic.
Partner institutions
Archivio di Stato di Venezia, direttore Raffaele Santoro
École Polytechnique Fédérale de Lausanne, president Patrick Aebischer
Università Ca' Foscari di Venezia, rettore Michele Bugliesi; rettore uscente Carlo Carraro

Director
Frédéric Kaplan, École Polytechnique Fédérale de Lausanne

International board
Bernard Aikema, Università di Verona
Patricia Fortini Brown, Princeton University
Donatella Calabi, Istituto Universitario di Architettura di Venezia
Tracy Cooper, Temple University
Christina Dondi, University of Oxford
Filippo di Vivo, Birkbeck, University of London
David Freedberg, Columbia University
Paula Findlen, Stanford University

with the support of
Fondation Lombard Odier

Administrative Coordination
Alicia Foucart, École Polytechnique Fédérale de Lausanne
Veronica Gusso, Università Ca' Foscari

Concetta Iannuzzelli, Archivio di Stato di Venezia

Project Management
Giovanni Colavizza, École Polytechnique Fédérale de Lausanne
Isabella di Lenardo, École Polytechnique Fédérale de Lausanne
Katerina Kunz, École Polytechnique Fédérale de Lausanne
Andrea Mazzei, École Polytechnique Fédérale de Lausanne
Giovanni Caniato, Archivio di Stato di Venezia
Simone Levis Sultam, Università Ca’ Foscari di Venezia
Dorit Raines, Università Ca’ Foscari di Venezia

Communication Management
Samantha Elliott, École Polytechnique Fédérale de Lausanne
Lionel Pousaz, École Polytechnique Fédérale de Lausanne
Hilary Sanctuary, École Polytechnique Fédérale de Lausanne
Veronica Gusso, Università Ca’ Foscari di Venezia

Investigators
Fauzia Alberti, École Polytechnique Fédérale de Lausanne
Paola Benussi, Archivio di Stato di Venezia
Patrizia Bortolozzo, Archivio di Stato di Venezia
Giovanni Colavizza, École Polytechnique Fédérale de Lausanne
Olivier Dalang, École Polytechnique Fédérale de Lausanne
Monica Del Rio, Archivio di Stato di Venezia
Isabella di Lenardo, École Polytechnique Fédérale de Lausanne
Mélanie Fournier, École Polytechnique Fédérale de Lausanne
Andrea Pelizza, Archivio di Stato di Venezia
Dorit Raines, Università Ca’ Foscari di Venezia
Andrea Rinaldo, École Polytechnique Fédérale de Lausanne
Franco Rossi, Archivio di Stato di Venezia
Lorenzo Tomasini, Université de Lausanne

Partner projects
“Garzoni project”, coordinator Valentina Sapienza, Université de Lille
“Visualizing Venice”, Steering Committee: Caroline Bruzelius, Donatella Calabi, Andrea Giordano, Mark Olson, Andrea Rinaldo, Victoria Szabo, Guido Zucconi.

Technical support
4DigitalBooks, Ivo Iossiger, scanner provider, Ecublens, Switzerland
Bread and Butter, digital media, Lausanne, Switzerland
AMstudio, 3D modelling, Venezia, Italy
Olivo Bondesan, foto-riproduzione, Archivio di Stato di Venezia

Collaborators