Doctoral Thesis Proposal:

Augmented Valuation of Cultural Heritage through Digital Representation based upon Geographic Information Technologies

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Summary

1. Main Question
2. Hypotheses
3. Objectives
4. Methodology
5. Case Studies (examples)
6. Expected Results and Discussion
7. Estimate timetable
8. Publications
1. Main Question

The Digital Representations augment distinctively the Value of Cultural Heritage, considering the Technology, the Domains and the Agents?
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What Technological means make viable the valuation of cultural heritage (Remote Sensing, GIS, GPS, Geobrowser...)?
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What Technological means make viable the valuation of cultural heritage (Remote Sensing, GIS, GPS, Geobrowser...)?

What are the Agents in the territory and how they value the digital representations of their associated cultural heritage (technical, public, opinion/decision makers)?
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What Technological means make viable the valuation of cultural heritage (Remote Sensing, GIS, GPS, Geobrowser...)?

What are the Agents in the territory and how they value the digital representations of their associated cultural heritage (technical, public, opinion/decision makers)?

What are the different Domains of valuation concerning cultural heritage digitally represented (technical-scientific, social-economic, political-administrative, ideological-symbolic-religious)?
1. Main Question

The Digital Representations augment distinctively the Value of Cultural Heritage, considering the Technology, the Domains and the Agents?
2. Hypotheses

The Digital Representations augment distinctively the Value of Cultural Heritage, considering the Technology, the Domains and the Agents?

Place as HYPOTHESIS that the digital representation augments distinctively the valuation of cultural heritage through the technology resources, the perspectives of the agents and the contributions for the different domains.
2. Hypotheses

Place as HYPOTHESIS that the Digital Representation augments distinctively the Valuation of Cultural Heritage through the Technology resources, the perspectives of the Agents and the contributions for the different Domains.
3. Objectives

Main research objective

The thesis seeks to demonstrate that the digital representation augments distinctively the valuation of cultural heritage through the technology resources, the perspectives of the agents and the contributions for the different domains.
3. Objectives

Secondary objectives

• Recognize acquisition techniques and methods of heritage representations, considering their advantages and disadvantages;

• Identify multi-sources of pertinent information and delineating structures of datasets and databases of information;

• Research the potential to divulgate and use cultural heritage dematerialized (digital/virtual);

• Develop several examples/case studies of approaches to represent virtually the cultural heritage (such as structures with architectonic value, monuments or urban settlements)
3. Objectives

**Secondary objectives**

- Recognise the principal agents associated to cultural heritage;
- Diagnose the value recognized from those agents addressed to the examples of heritage representations developed;
- Comprehend the main usability of technology applied to the several domains (associated with cultural heritage) and analyze the potential increased value through the digital representation.
4. Methodology

Heritage → G.I.T.

Conventions / Scales → Standards / Metadata

(Gather, Store, Manipulate, Divulgate) Information → Technologies, Techniques and Methods → Heritage Representations

- Retrospective Representation
- Present Representation
- Prospective Representation

Case studies of multi-sources → Inquiry and interview the main Agents → Adequate applications to different Domains → Valuation of Cultural Heritage
### 4. Methodology

<table>
<thead>
<tr>
<th>Heritage Representations</th>
<th>2D Cartography</th>
<th>3D Cartography</th>
<th>4D Cartography</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GIS</strong> (produce, process, manage, store, visualise)</td>
<td>2D Cartography Raster/Vector (point, line, polygon)</td>
<td>Raster/Vector (Modelling) 3D Cartography</td>
<td>Historical/Antigen Cartography Actual Cartography Project Cartography</td>
</tr>
<tr>
<td><strong>Geobrowser</strong> (Visualise GI)</td>
<td>2D Cartography</td>
<td>3D Cartography</td>
<td>Historical/Antigen Cartography Actual Cartography Project Cartography</td>
</tr>
<tr>
<td><strong>GPS</strong> (gathering GI or search, request, identify objects)</td>
<td>X/Y</td>
<td>X/Y/Z</td>
<td>X/Y/Z + T</td>
</tr>
<tr>
<td><strong>WMS</strong> (research/Visualise/ disseminate GI)</td>
<td>2D Cartography Raster/Vector (point, line, polygon)</td>
<td>Raster/Vector (Modelling) 3D Cartography</td>
<td>Historical/Antigen Cartography Actual Cartography Project Cartography</td>
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<tr>
<td><strong>Remote Sensing</strong> (gathering, visualise GI)</td>
<td>Satellite Imagery</td>
<td>SI 3D Laser Scan</td>
<td>2D/3D data at different moments in time</td>
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<tr>
<td><strong>Mobile APP</strong> (Virtual/ Augmented Reality: visualise, search, identify from GI)</td>
<td>2D Cartography Raster/Vector</td>
<td>Raster/Vector (Modelling) 3D Cartography</td>
<td>Historical/Antigen Objects/Cartography Actual Objects/Cartography Project Objects/Cartography</td>
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**Secondary Sources / Primary Sources**

- **Heritage Representations**
  - 2D 3D 4D
  - GIS (produce, process, manage, store, visualise)
  - Geobrowser (Visualise GI)
  - GPS (gathering GI or search, request, identify objects)
  - WMS (research/Visualise/ disseminate GI)
  - Remote Sensing (gathering, visualise GI)
  - Mobile APP (Virtual/ Augmented Reality: visualise, search, identify from GI)
5. Case Studies (examples)

Visualisation of the evolution of the Belas Palace and the urban settlement in 3D (at 1830 and 2007)

Belas, Sintra, Portugal (1830-2007)
Ancient cartography georeferenced (year 1830)

Source: IGP / SIPA-IHRU
Ancient cartography georeferenced

Source: IGP / SIPA-IHRU
Ancient cartography georeferenced (3D)

Source: IGP / SIPA-IHRIU
Ancient cartography georeferenced (3D)

Source: IGP / SIPA-IHRU
Ancient cartography georeferenced (3D) / 3D Belas Palace (at 1830)

Source: IGP / SIPA-IHRU
Ancient cartography georeferenced (3D) / Palace and urban settlement 3D (at 1830)

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Source: IGP / SIPA-IHRU
Palace and urban settlement 3D (1830) at 2007

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Palace and urban settlement at 2007

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Palace and urban settlement at 2007

Source: IGP / SIPA-IHRU
Palace (3D) and urban settlement at 2007

Source: IGP / SIPA-IHRU
Palace and urban settlement (3D) at 2007

Source: IGP / SIPA-IHRU
Palace and urban settlement (3D) at 2007

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Source: IGP / SIPA-IHRU
Palace and urban settlement (3D at 2007), comparing with ancient cartography (1830)

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Palace and urban settlement (3D at 2007), comparing with ancient cartography (1830)

Source: IGP / SIPA-IHRU
5. Case Studies (examples)

Visualisation of thematic cartography from Lisbon Downtown at 3D

Source: SIPA-IHRU
Building use (50% or more Residential/Commercial/Abandoned...)

Source: SIPA-IHRU
3D Thematic cartography (with associated alphanumerical information)

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3D Thematic cartography (and inclusion of the buildings façade)

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Laser Scan 3D from Sintra (Portugal) Old Town and Town Palace (2002)

Source: Artscan / SIPA-IHRU
5. Case Studies (examples)

Identification of ancient structures using georeferenced cartography

Case study of “Águas Livres” Aqueduct in Lisbon Metropolitan Area (1797)

Projected, Build and disappeared Structures

Source: SIPA-IHRU
Ancient cartography georeferenced (1797) – “Águas Livres” Aqueduct
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Source: SIPA-IHRU
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Source: SIPA-IHRU
“Águas Livres” Aqueduct (1797) – Vectorization (surface/underground/existing/disappeared)

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Source: SIPA-IHRU
“Águas Livres” Aqueduct (1797) at 2007 (remains vrs. disappeared)

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“Águas Livres” Aqueduct (1797) at 2007 (remains vrs. disappeared)

Source: SIPA-IHRU
“Águas Livres” Aqueduct distribution (capture/transport/store/delivery) in the Lisbon Metropolitan Area
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Source: SIPA-IHRU
“Águas Livres” Aqueduct and associated projected / build / disappeared structures (1797)

Source: SIPA-IHRU
6. Expected Results and Discussion

- Digital Representations of Cultural Heritage ("n" case studies);
- Discussion about the evaluations from the Agents;
- Valuation for the different domains.
7. Estimate timetable

<table>
<thead>
<tr>
<th>Trimesters</th>
<th>1st year</th>
<th>2nd year</th>
<th>3rd year</th>
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<tbody>
<tr>
<td>1st</td>
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8. Publications


