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GEOTAGGED PHOTOS FROM SOCIAL NETWORKS AND URBAN TOURISM: NEW SOURCES, NEW CHALLENGES

Luis Encalada Abarca; Carlos Cardoso Ferreira; Jorge Rocha
Institute of Geography and Land Planning, University of Lisbon

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Structure

Introduction: Measuring urban tourism

Methodology procedures

- Downloading and storing geotagged photos from Panoramio;
- Differentiating photos taken by Locals and Tourists;
- Exploring and visualizing visitors geotagged photos;
- Analyzing visitors geotagged photos.

Results

- Tourists hot spots in Lisbon city (using spatial and spatiotemporal contexts);
- Paths of visitors within the city.

Conclusions

Urban tourism: *Measuring how tourist use cities*

Given the quantitative importance of urban tourism, it is curious that very little attention has been given to questions about how tourists actually use cities (Ashworth & Page, 2011).

Examine how tourists use cities; Identify the patterns of behavior of tourists in cities; Examine the linkages between attractions and how they disperse tourists within urban tourism destinations.

The supply side of urban tourism was mapped, but the demand side is still not fully understood on behalf of missing data (Pearce, 2001).

- Traditional sources to record tourist activities in Urban context:
  Surveys, Sketch maps, Collecting stories and experience of critical incidents, etc.

- Techniques range from questionnaires on past behaviour, which tend to unreliability, diaries to reveal space-time activities, which are labour intensive and result in very small samples, to aerial photography and more recently global positioning systems and satellite tracking.

Urban tourism: *Measuring how tourist use cities*

New sources, Non-traditional sources:

- Alongside the development of new information and communication technologies, less traditional data sources have been considered in the analysis of urban tourism, particularly for assessing the spatial behavior of tourists.

- Photo-sharing and instant messaging services, consumer review websites and other Web 2.0 platforms are examples of these new sources, characterized by the prominent participation of users, the volume of user-generated content and its open access.

- Such crowdsourced data provides could be used to complement authoritative data. The new data is certainly enriching our experiences [and knowledge] of how cities function (Batty, 2013).

- Some of the most promising sources are social networks for sharing geotagged photographs (Leung et al. 2013).

Objectives

Underline the relevance and the opportunities of social networks for a better understanding of urban tourism;

Examine mobilities and preferences of tourists - and thus the dynamics and tensions of tourism demand - from geotagged information;

Identify some critical elements (technical and conceptual) arising from the use of such information (relevance, adequacy, complexity) and should be taken into consideration when handling the raw information and analysis of results;

Contribute to better informed decision-making processes by managers of tourism and urban territory, by using and boosting the possible space-time readings from social media.

Photos from Panoramio®

Selecting the data source

Panoramio is different from other photo sharing sites because the photos illustrate places. As you browse Panoramio, notice that there aren't many photos of friends and family posing in front of places… Panoramio's all about seeing the world.

Better positional accuracy of photos dataset (Zielstra and Hochmair, 2013). Panoramio requieres geotagging information during the upload process, photos are reviewed in order to be accepted for been published in Google maps.

Understanding popularity in Panoramio®

When you explore the world by using Panoramio's map or Google Earth, you want to see the best photos of a place first! That's why the most popular photos are visible at higher zoom levels. You'll see the other photos as you zoom into a location, with the least popular photos appearing only at the lowest zoom levels.

Retrieving data from Panoramio®
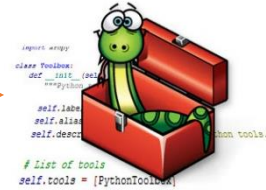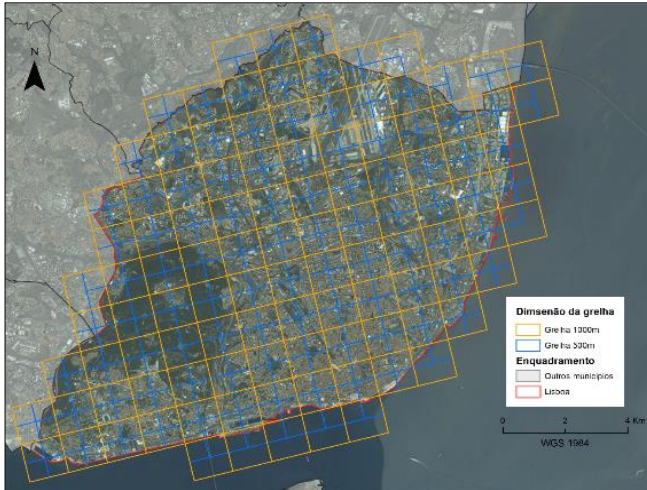
Lattice bounding boxes coordinates
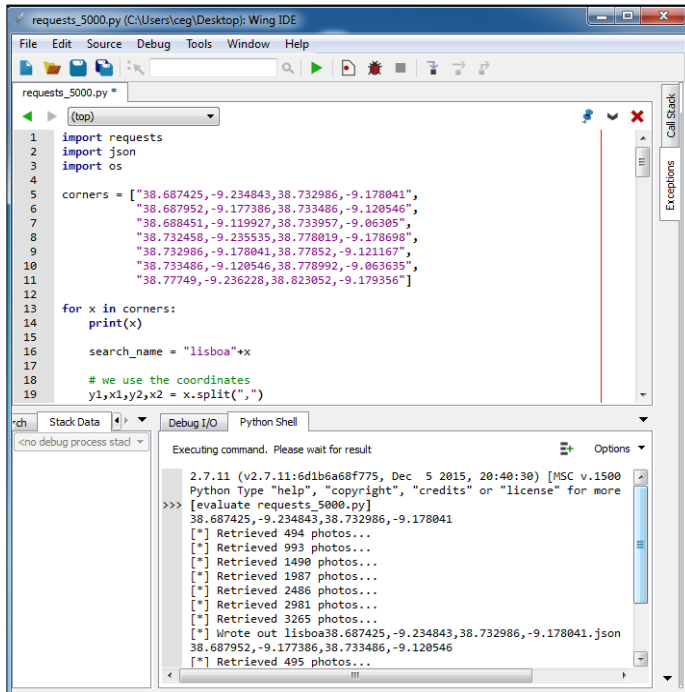
.json files

Retrieving data from Panoramio®

Summary of retrieved photos

Grid Resolution(m)	Photos					
	Retrieved	Repeated	Unique	New	Accumulated	%
5,000	14,144	195	13,949	0	13,949	18.6
4,500	14,181	145	14,036	2,826	16,775	3.8
4,000	17,471	138	17,333	3,267	20,042	4.3
3,500	20,992	204	20,788	3,688	23,730	4.9
3,000	24,694	335	24,359	3,762	27,492	5.0
2,800	24,098	538	23,560	1,953	29,445	2.6
2,600	28,274	402	27,872	2,726	32,171	3.6
2,400	29,982	612	29,370	2,529	34,700	3.4
2,200	36,341	716	35,625	6,270	40,970	8.3
2,000	38,014	518	37,496	4,322	45,292	5.8
1,800	38,407	762	37,645	1,614	46,906	2.1
1,600	38,579	790	37,789	1,846	48,752	2.5
1,400	41,566	809	40,757	1,574	50,326	2.1
1,200	48,902	967	47,935	2,867	53,193	3.8
1,000	49,048	5,996	43,052	4,535	57,728	6.0
900	52,095	978	51,117	2,047	59,775	2.7
800	55,208	757	54,451	2,076	61,851	2.8
700	57,253	705	56,548	2,101	63,952	2.8
600	58,400	791	57,609	1,464	65,416	1.9
500	55,229	6,773	48,456	1,014	66,430	1.3
400	63,824	1,043	62,781	2,628	69,058	3.5
300	66,151	8,627	57,524	6,054	**75,112**	8.1
						100

Geotagged photos dataset

Differentiating photos taken by Locals and Visitors

Girardin *et al.* (2008), calculate the difference between the time-stamps of the users' first and last images taken in the area.

García-Palomares *et al.* (2015); Kádár (2014) also used this approach to differentiate the photos.

```
SELECT bd.owner_id, Min([upload_dat]) as min_date, Max([upload_dat]) as
max_date, DateDiff('d',Min([upload_dat]),Max([upload_dat]),1,1) AS n_dias,
Year([upload_dat]) AS ano, Count(bd.upload_dat) AS n_fotos
into bd_diffdata
FROM bd
GROUP BY bd.owner_id, Year([upload_dat])
```

SQL
Structured Query Language

bd_diffdata

owner_id	min_date	max_date	n_dias	ano	n_fotos
1000263	10/12/2007	10/12/2007	0	2007	1
1000970	10/13/2007	10/13/2007	0	2007	3
100104	3/3/2010	3/4/2010	1	2010	19
1001089	3/11/2008	4/4/2008	24	2008	20
1001089	1/11/2009	9/12/2009	244	2009	15
1001089	12/7/2012	12/7/2012	0	2012	3
1001089	1/30/2014	1/30/2014	0	2014	1
100111	9/23/2007	9/23/2007	0	2007	1
1001158	8/18/2011	8/18/2011	0	2011	2
1001158	3/20/2012	3/20/2012	0	2012	1
1002668	10/4/2008	11/29/2008	56	2008	57
1002668	2/8/2009	2/22/2009	14	2009	14
1002668	10/24/2011	11/1/2011	8	2011	76
1002668	3/4/2012	3/4/2012	0	2012	3
10038	10/30/2012	11/29/2012	30	2012	11

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fotos_users1t_inf3

photo_id	owner_id	latitude	longitude	photo_titl	photo_url	upload_dat	grid
105902583	8134587	38.728629	-9.184648	Restaurante Panor\u00e2mico de	http://www.panoramio.com/	4/20/2014	2800
105902593	8134587	38.728629	-9.184648	Restaurante Panor\u00e2mico de	http://www.panoramio.com/	4/20/2014	2800
105903521	6158525	38.723313	-9.148668	Hotel Marqu\u00eas de Pombal;	http://www.panoramio.com/	4/20/2014	700
105903524	6158525	38.730229	-9.154595	Parque Eduardo VII; Lissabon; Po	http://www.panoramio.com/	4/20/2014	1200
105928950	4913401	38.714021	-9.133893	Lisbonne depuis les remparts	http://www.panoramio.com/	4/21/2014	300
105929016	4913401	38.714023	-9.13389	Lisbonne depuis le ch\u00e2teau	http://www.panoramio.com/	4/21/2014	300
105929073	4913401	38.714031	-9.133895	Depuis le ch\u00e2teau	http://www.panoramio.com/	4/21/2014	300
105930106	4913401	38.724844	-9.150925	Place Marquis de Pombal	http://www.panoramio.com/	4/21/2014	800
105930250	4913401	38.725949	-9.150555	Parc Edouardo	http://www.panoramio.com/	4/21/2014	800
105930276	4913401	38.725924	-9.150517	Bus devant les jardins	http://www.panoramio.com/	4/21/2014	800
105930362	4913401	38.742386	-9.14718	Campo Pequeno	http://www.panoramio.com/	4/21/2014	2600
105938389	4913401	38.693206	-9.207734	Le pont et monument	http://www.panoramio.com/	4/21/2014	400
105938457	4913401	38.693239	-9.207948	P\u00eacheurs	http://www.panoramio.com/	4/21/2014	400
105938501	4913401	38.693055	-9.215469	La tour de B\u00e9lem	http://www.panoramio.com/	4/21/2014	600

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Geotagged photos from Visitors

- Users that have uploaded photos just in one year (First time visitors);

- Number of days between the first and last photo uploaded, less or equal to 3 days (*short-break*);

- Almost 25% of the original dataset.

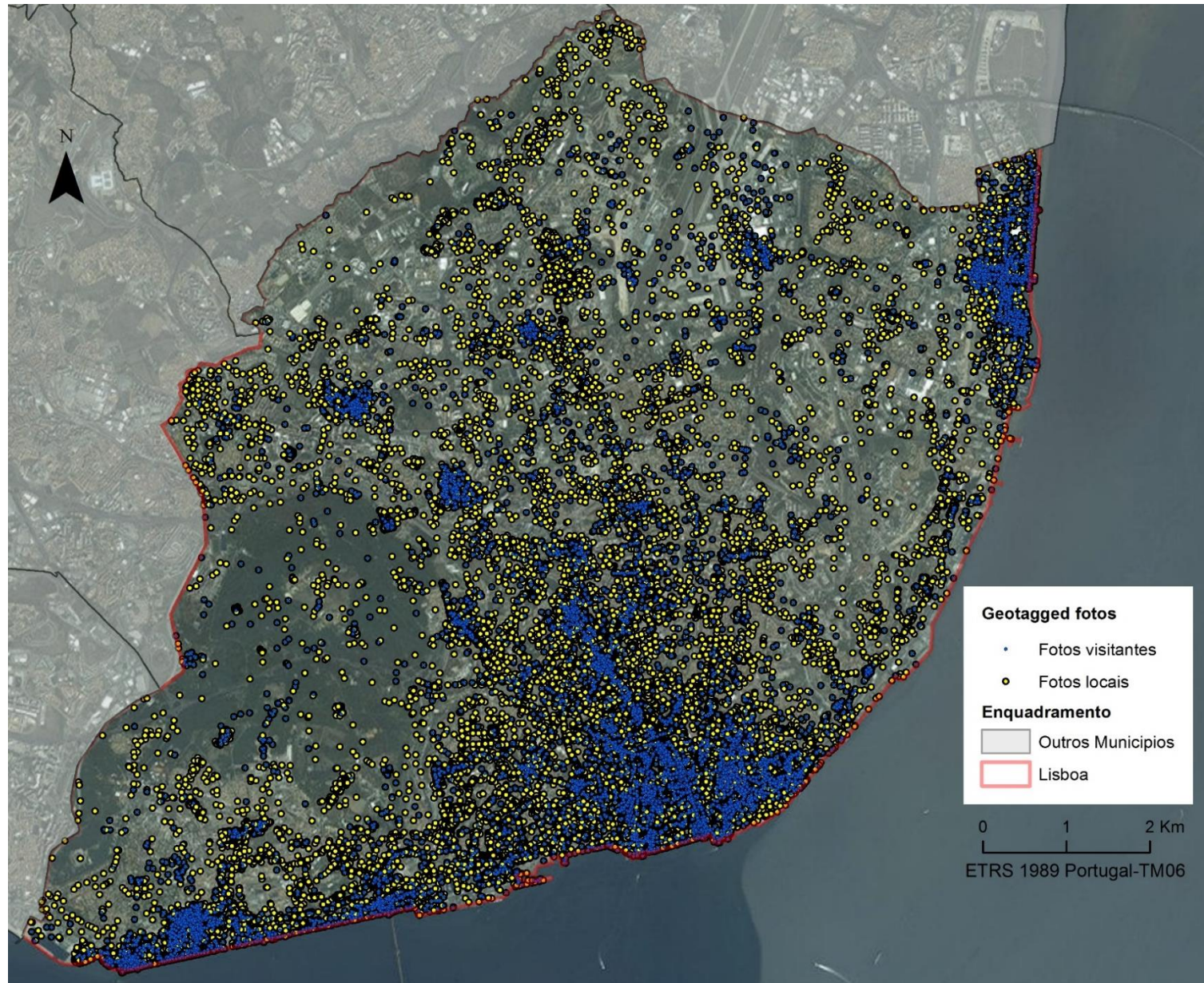| Visitors dataset	
Nº photos	18,168
Nº users	5,235

Geotagged photos from visitors by year and months:
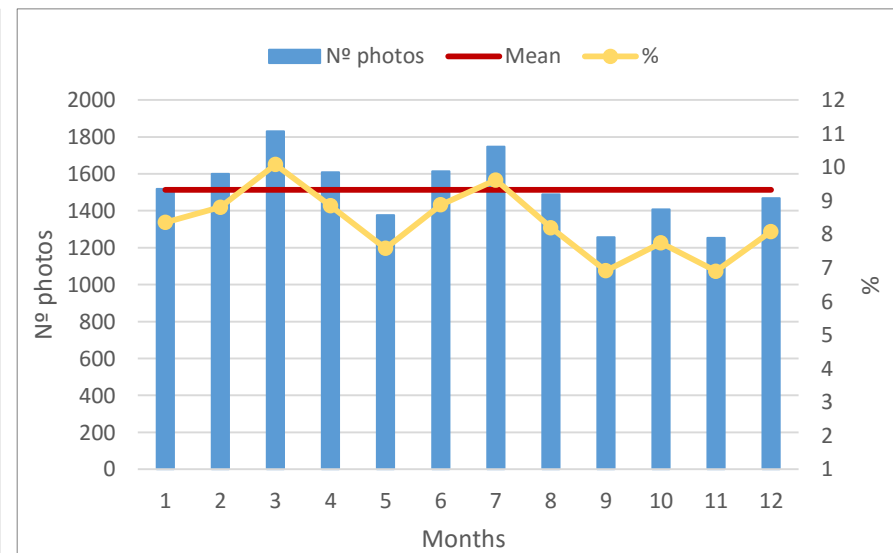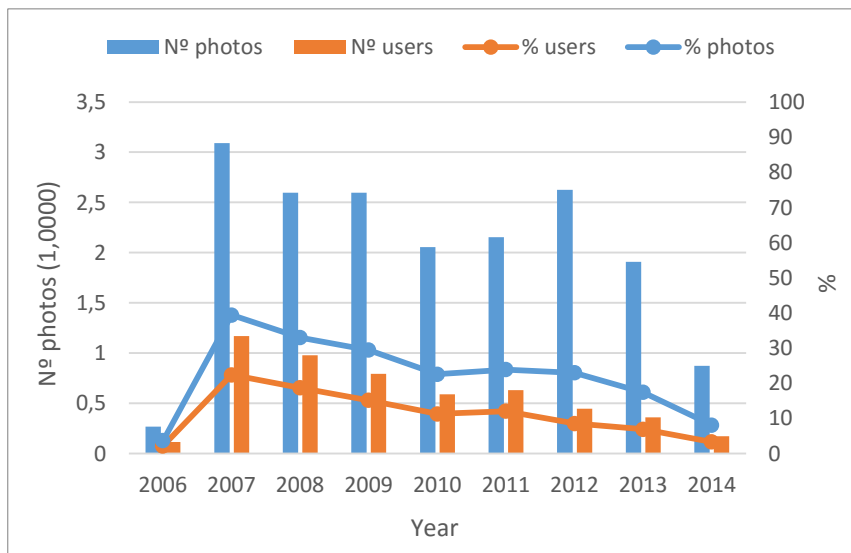
Geotagged photos dataset from Visitors

Geotagged photos dataset (Locals vs. Visitors)

Geotagged fotos

- Fotos visitantes
- Fotos locais

Enquadramento

- Outros Municipios
- Lisboa

0 1 2 Km

ETRS 1989 Portugal-TM06

Data exploration and Visualization

Data aggregation by parishes

The parishes in the center of the city: Castelo and São Nicolau, present the most concentrated rates of photos per Km².
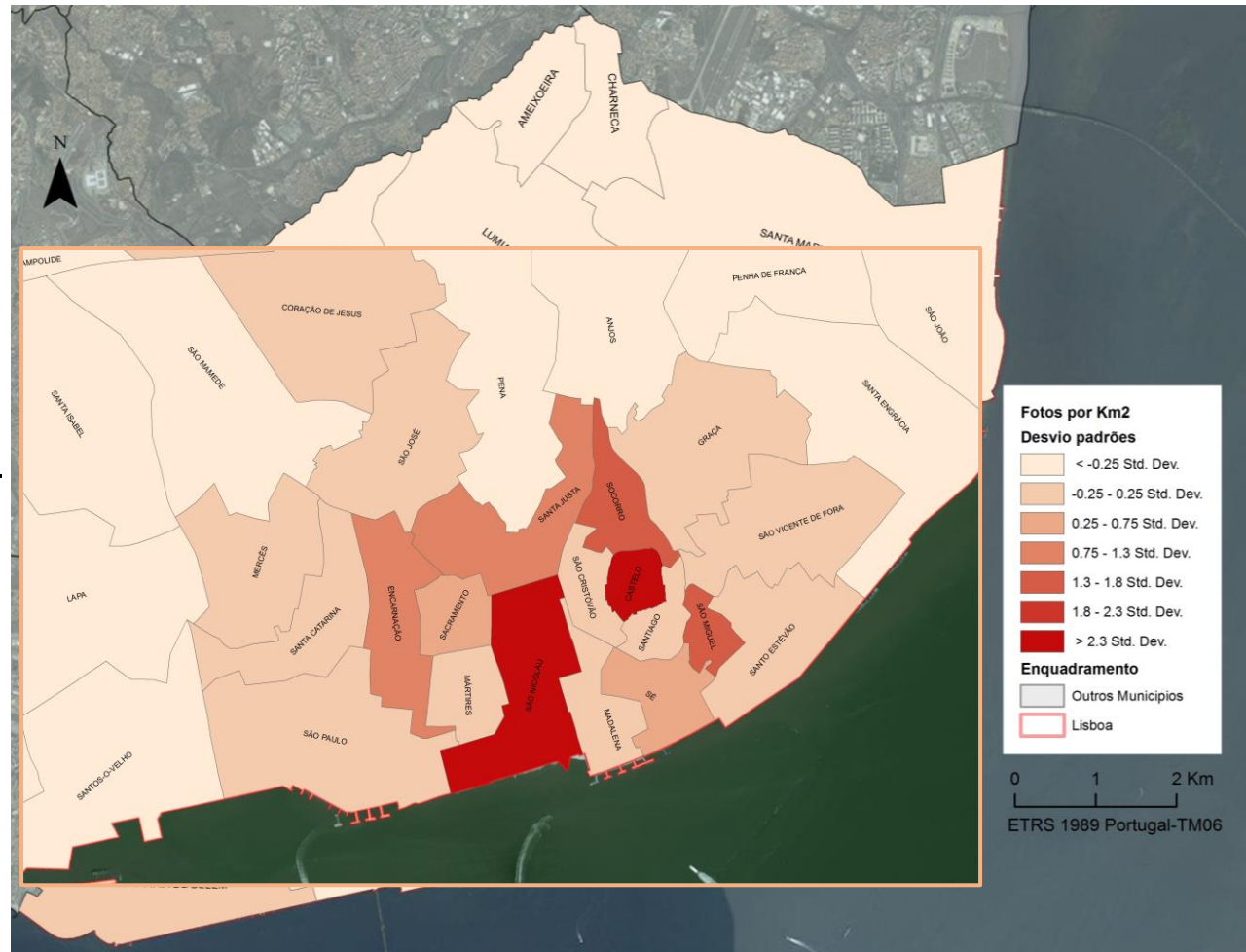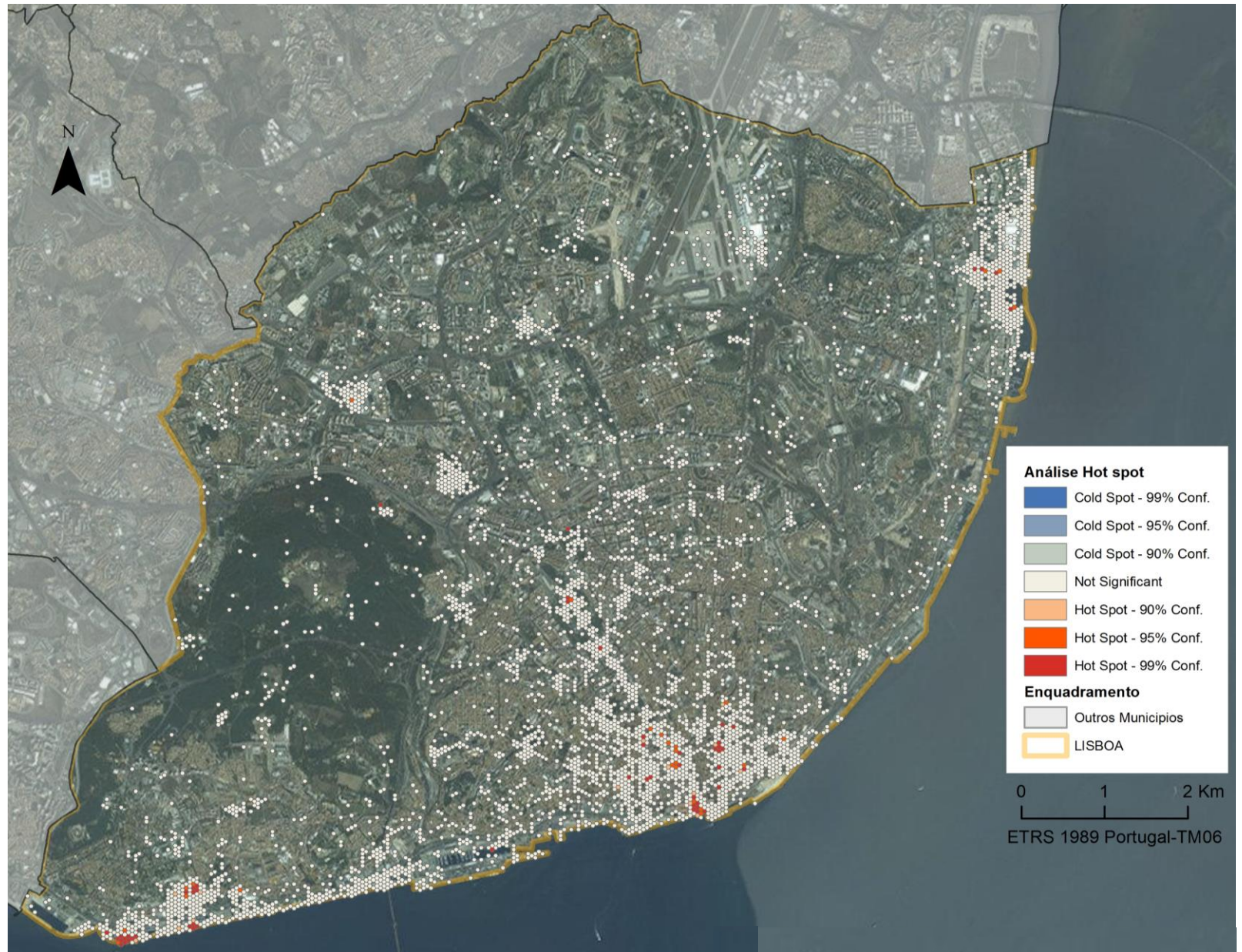
Hot spot analysis

Data aggregation by regular grid
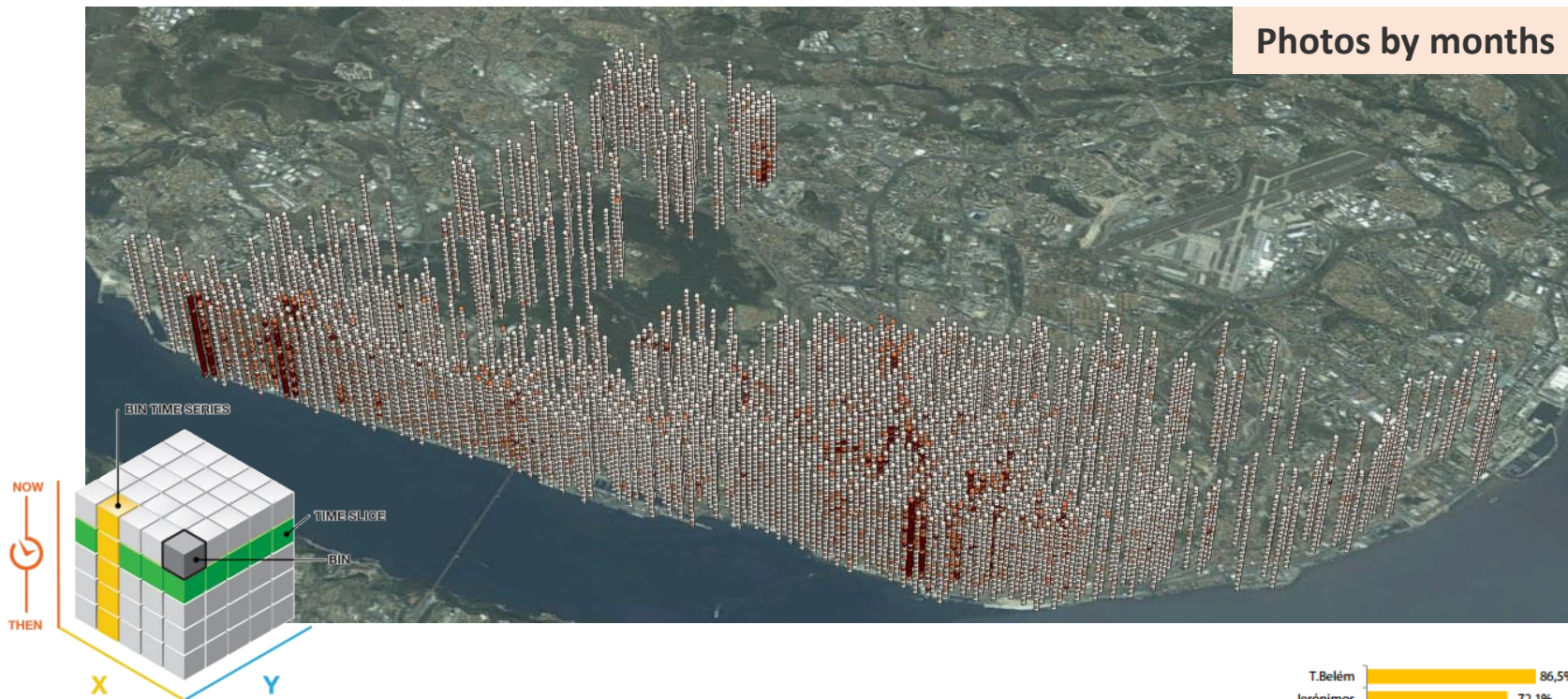

Area ≈ 2,165 m^2
Side ≈ 29 m

Hot spot analysis – Spatial

Spatiotemporal data visualization
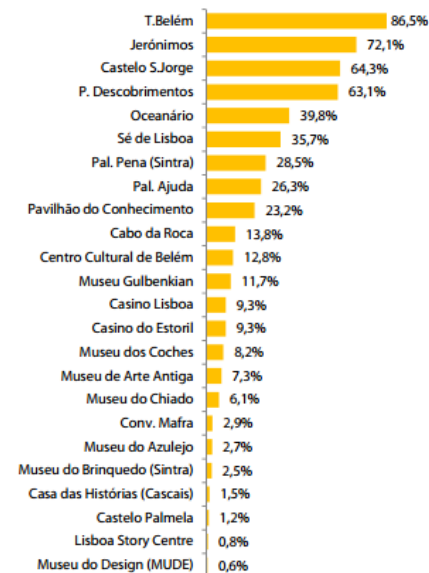

Photos by months

Survey apply to tourists about their activities in Lisbon
(Source: *Inquérito às actividades dos turistas,* 2014)

Comparing the data retrieved from Panomario with data from surveys:

The six most visited places in Lisbon according to the survey, also present high number of photos (taken by visitors throughout the year).

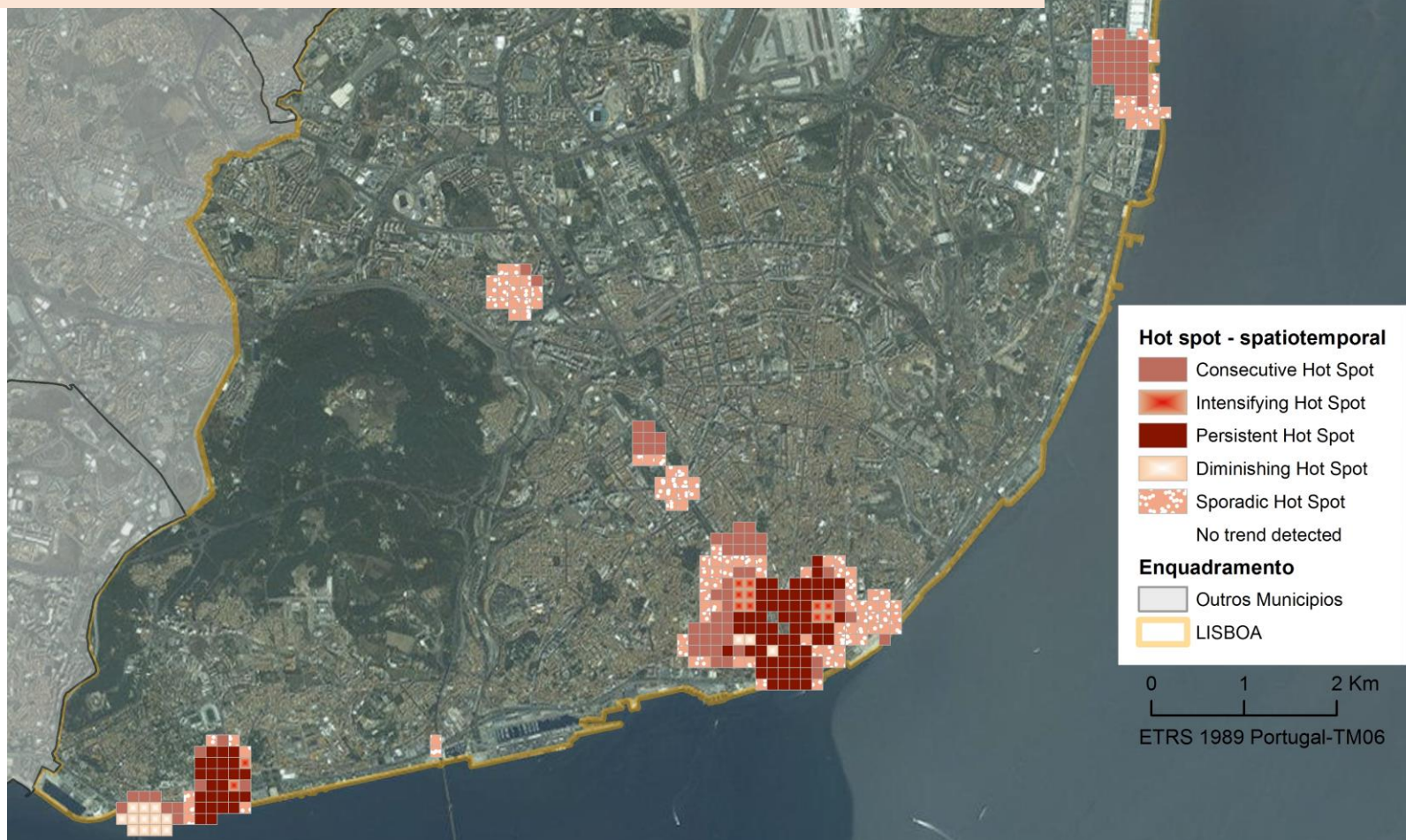| Place	%
T.Belém	86,5%
Jerónimos	72,1%
Castelo S.Jorge	64,3%
P. Descobrimentos	63,1%
Oceanário	39,8%
Sé de Lisboa	35,7%
Pal. Pena (Sintra)	28,5%
Pal. Ajuda	26,3%
Pavilhão do Conhecimento	23,2%
Cabo da Roca	13,8%
Centro Cultural de Belém	12,8%
Museu Gulbenkian	11,7%
Casino Lisboa	9,3%
Casino do Estoril	9,3%
Museu dos Coches	8,2%
Museu de Arte Antiga	7,3%
Museu do Chiado	6,1%
Conv. Mafra	2,9%
Museu do Azulejo	2,7%
Museu do Brinquedo (Sintra)	2,5%
Casa das Histórias (Cascais)	1,5%
Castelo Palmela	1,2%
Lisboa Story Centre	0,8%
Museu do Design (MUDE)	0,6%

Hot spot analysis – Spatiotemporal

Intensifying Hot Spot: The intensity of clustering of high counts in each time step is increasing overall.

Persistent Hot Spot: A statistically significant hot spot with no discernible trend indicating an increase or decrease in the intensity of clustering over time.
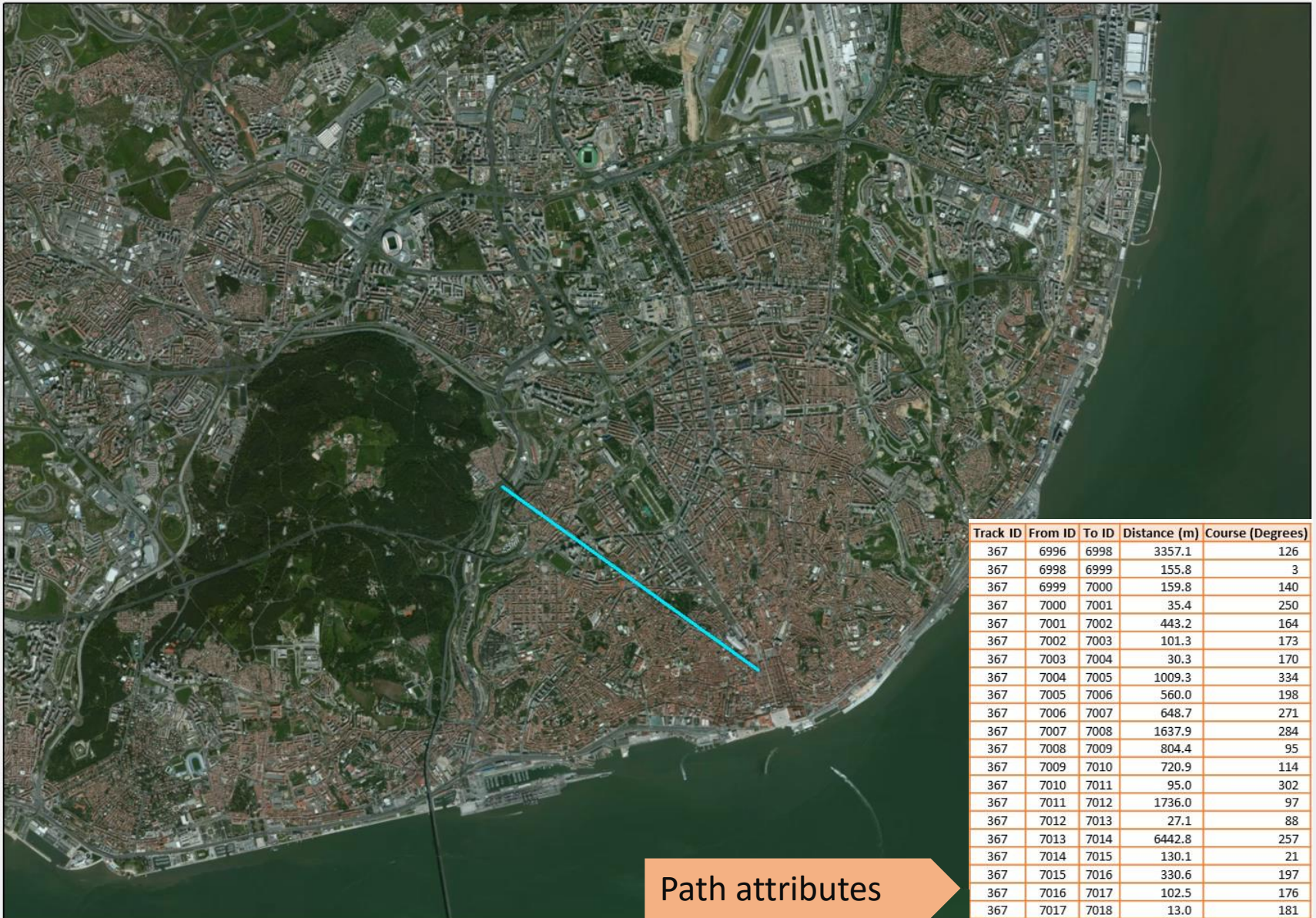
Diminishing Hot Spot: The intensity of clustering in each time step is decreasing overall.

Sporadic Hot Spot: A location that is an on-again then off-again hot spot.

Consecutive Hot Spot: A statistically significant hot spot in the final time-step intervals.

Examples of a path

Track ID	From ID	To ID	Distance (m)	Course (Degrees)
367	6996	6998	3357.1	126
367	6998	6999	155.8	3
367	6999	7000	159.8	140
367	7000	7001	35.4	250
367	7001	7002	443.2	164
367	7002	7003	101.3	173
367	7003	7004	30.3	170
367	7004	7005	1009.3	334
367	7005	7006	560.0	198
367	7006	7007	648.7	271
367	7007	7008	1637.9	284
367	7008	7009	804.4	95
367	7009	7010	720.9	114
367	7010	7011	95.0	302
367	7011	7012	1736.0	97
367	7012	7013	27.1	88
367	7013	7014	6442.8	257
367	7014	7015	130.1	21
367	7015	7016	330.6	197
367	7016	7017	102.5	176
367	7017	7018	13.0	181

Path attributes

Conclusions

- Crowdsourced data from social networks drives to a better understanding of the consumption of urban tourism destinations. Data from photo sharing services (Panoramio) can provide more detailed information for detecting patterns of tourism mobility in dense and complex areas.

- Visitor´s geotagged photos from Panoramio, in general terms, match the pattern of tourists' distribution in Lisbon. Moreover, this data makes it possible to identify and analyze the main tourists' attraction areas within the city.

- The photos patterns doesn´t significantly changes over time, i.e. main attractions aren´t seasonal.

- There are several important places but 3 of them emerge as hot spots, Belém, Baixa (downtown) and Parque das Nações. Visitor tend to visit all these 3 places.

- Spatiotemporal behavior of tourists serves as a valuable support for managing and planning tourism. It reveals key issues for organizing facilities and services, impact management, etc.

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