

Smart cities tales and trails

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ABSTRACT

Cities have been transformed to experimental platforms at which data produced capture everyday activities, pulse, and interactions. Placing humans at the centre of smart cities has motivated several efforts under the vision of having citizens at the forefront of the Internet of Everything. Cities though have been largely impacted by their own historic, cultural and past stories which drive todays city life and experiences. The proposed approach enables applications and platforms development which will merge the past with the present in an innovative manner by placing emphasis on the cultural content as a drive for todays dynamic city and social interacting. The focus is placed on people who navigate in the city and who are enabled to act as tales receptors and trails broadcasters. People receive cultural content (emphasis here is on film and cities) in the form of city relevant annotated storylines which trigger people's reactions expressed at the city's virtual spaces which may be enhanced by several dynamic (such as city trail reviewing, city offers outreach, etc). The proposed process targets an open platform which can be extended to integrate multi-domain (sensors, social networks, etc) recommendations towards humanizing city experimentation and navigation experiences.

KEYWORDS: apps for society, social innovation, city platform, participation, liveable city, empowerment, education apps, public spaces, geo information, Entrepreneurship, data analysis, cultural change

1 INTRODUCTION AND BACKGROUND

Most recent and groundbreaking scientific and technological innovations bear significant potential for evolving and redefining people's lives and interactions with cities. Smart cities have the potential to use technology-driven service provision to evolve rapid solutions for new challenges stemming from citizens. Embedding cutting-edge devices, networks and services into cities' centuries-old streets impacts citizens' daily lives in terms of their movement, habits and behavioral patterns. However, the design of such "smart city" solutions needs to be driven from the "*bottom-up or citizen-led approach*" as highlighted in the major theme of the recent "Re.Work Future Cities Summit" [Re.Work 2014] and a related Guardian article [Guardian 2014]. It should be noted that Re.Work conference concluded in: "*whatever the smart city might be, it will be acceptable as long as it emerges from the ground up*".

The proposed work is inspired by the need to identify new qualitative criteria (such as attention, identity, and culture) which will support validation of culture's impact on today's cities dynamics, by utilizing information technologies and medium (such as mobile devices), in the daily experience of public spaces. Public spaces are all places publicly owned or of public use accessible and enjoyable by all for free and without a profit motive. Each public space has its own spatial, historic, environmental, social and economic features. Public spaces are the environments of shared living experience. For example, squares -also called piazzas- receive a focus in the everyday public life, because even since antiquity, they represent in European history the places where public life was staged and European culture and identity was and still continuous to be based. At such places, but also at other not so known ones many forms of cultural content (such as films) have captured daily life, architectural progress, societal interactions etc. At exactly those same places today, sensors are installed, social networks enable check in declarations and people interact socially at real and the corresponding virtual city spaces. A question arises therefore: how are these places experienced today in a heavy digitized world ? To which extent these places are still exercising on us impact such as feelings of repose or identification or experiences of aesthetic excitement?

1.1 Cities of today with people on the move

People with mobile devices move on public spaces with a predefined view of the place, given recommendations and guidelines by others who also influence their opinions and sentiments. Moreover, public or private authorities and other stakeholders analyse and monitor social media communities as they emerge in Local Based Social Networks (LBSNs). Digitization and heavy hyper-connected reality is public spaces is primarily relevant with the next major research fields:

- **LBSNs structure analysis.** So far, there has been limited research on LBSN structure analysis. An early work (Li & Chen, 2009) employed unsupervised clustering for finding groups of: i) mobility patterns and ii) users based on their activities, while in (Scellato et al., 2010) graph analysis on some well-known LBSNs studied the correlation of geographic distance with the users' social network, considering only one static location per user. Same authors in (Scellato & Mascolo, 2011) analyzed the complete social network of Gowalla and identified the existence of the small world phenomenon and of a high clustering coefficient. However, analysis indicated that as time goes by, the frequency of making checkins and visiting new places decreases much steeper than the frequency of making friends. This possibly indicates that it may be difficult for users to find new interesting places in their area. A statistical analysis (Esuli & Sebastiani, 2006) on checkins from various LBSNs broadcasted to Twitter focused on how human mobility patterns vary in time and geographic area by correlating mobility patterns via social & content-based features.
- **Location-aware recommendations** in a broader perspective. GeoLife is a recent LBSN service that analyzes users' uploaded GPS trajectories off-line to provide: a) travel recommendations, by identifying interesting locations and travel sequences using a method similar to HITS with experienced users serving as hub

and interesting locations as authority nodes (Zheng et al., 2009), and b) personalized location & friend recommendations, combining content-based with user-based collaborative filtering and determining users' similarity from location history (Zheng et al., 2011). As GeoLife manages raw GPS trajectory data, it faces problems such as the identification of spatial areas constituting distinct landmarks.

- **Sentiment analysis.** Humans throughout their everyday activities are experiencing a wide range of emotions. Inevitably such emotions are imprinted in the content generated by them in their online social activities, which is often geolocated or it refers to a specific city / region. Consequently the capturing of the sentiments expressed in social media content could provide valuable insights about the city such content refers to. To this end, for instance, (Chesñevar et al. 2102) proposed an argument-based approach, where via considering sentimental knowledge expressed in social media (Twitter, Facebook), arguments' extraction and policy making processes can be better supported. In order to successfully support such processes they proceeded with text and opinion mining techniques for initially detecting the content generated in social media about a specific topic, and then analyzing the extracted content with respect to its opinion connotation. Finally, (Johansson et al. 2012) exploited social media (Twitter, Facebook, Flickr, YouTube) content and applied sentiment and emotion detection approaches, for empowering the authorities' effectiveness when dealing with crisis situations within a city.

Several factors influence the residents of a city to visit a place, and can be leveraged for the dynamic segmentation of the city into *functional* regions. Intuitively, a segmentation of the city into geographic regions based on people's activities is expected to reflect more accurately the existing dynamics and behavioral/activity patterns, compared to a static city segmentation (e.g. based on population demographics, or fixed limits established by the municipality. In this sense, (Cranshaw et al. 2012) proposed Livehoods, a clustering methodology for segmenting a city into dynamic areas, based on the everyday check-in activity of citizens on Foursquare and by exploiting both spatial (i.e. geographic proximity of places) and social (i.e. proximity of places based on the distribution of users that check-in to them) attributes of various places. Also, (Rösler and Liebig 2013) proposed an approach for segmenting a city dynamically, based on temporal (i.e. temporal distributions of check-ins in a region) and spatial characteristics. Moreover, the data acquisition process (i.e. searching on diverse social media sources based on tags, keywords, and time / location based attributes) initiates when the city's authorities have an indication about a crisis event. Then, sentiment and affective analysis processes take place for classifying the obtained content based on the expressed sentiment and emotion, respectively.

1.2 Cities identity and cultural profiles (Historic Background)

Cultural and historic content has been closely related to cities. It is important to notice that all European cinemas of the 20th century were primarily experienced as an urban phenomenon, which was both developed and consumed in an urban environment, as the majority of Greek movie halls were located in the cities). Furthermore, after the Second World War an important shift occurred in European cinema in certain locations

such as in Greece which began to establish a functioning film industry (frequently characterized as the “golden era” for Greek national cinematography). Next, we focus on the Greek film industry impact on cities as an indicative paradigm of large impact on today's city transformations and shifts.

One of the most important issues raised by Greek popular cinema was the **representation of the city**, which reflected the emerging urban character of Greek society, the effects of economic reconstruction of the country, together with the rapid transformations of the cityscape. Following the paradigm of the city's depiction as a “**cinematic city**” with its own distinct qualities, Greek popular cinema of the 1950s and the 1960s served as a thorough study of the cinematic Greek city, since the adulthood of Greek cinema coincided with Athens' rebuilding and urban renewal. Greek feature films were dealing with the historic present of their time and were mainly shot in big cities (Athens and Thessaloniki), where thousands of internal migrants who have abandoned the countryside were in search of a profession and a better life.

Greek popular cinema of that time offered to its viewers an exceptional way to **tour around the history, culture and memory of the Greek city**, while witnessing existing and familiar urban settings, which were subject to the unprecedented transformations of the cityscape and the process of modernization in post-war Greece (new housing models, new consumer habits, new patterns of social behavior). Spaces in Greek films popular films of the 1950s and the 1960s “symbolized the post-war tourist growth of the city or, consequently became indicators of the tradition-modernity dichotomy, appointing optimism for the city's modernized image” (Nikolaidou 2008). New Greek cinema of 1970s and 1980s took a different approach from its predecessor in that it was not focusing on the city's representational value, but it would draw/direct its attention to questions of memory and it would thus make use of **dedramatized spaces**, which could operate as distinct memory places (“lieux de memoire”). During the 1990s there was an important shift of gaze towards urban space on behalf of contemporary Greek filmmakers, who would return to the city and who would be interested to explore themes and places of the everyday life. Since then, Greek films continue to play an important role in depicting various aspects of the city image, in the sense that they emphasize on new cultural values of the ever-growing cityscape.

The idea of utilizing content, such as films archives, is presented in this paper. Given a public city space of historic and cultural value with parallel hyper-connected intensities, the proposed approach identifies, analyses and addresses reciprocal influences of city stories. The cultural content exploitation in the city context was motivated by the use case of Greek cinema and the city's strong cinematic profile. The motivation of this work originates from the fact that Greek (as other European and International) film archives embed valuable city stories of long lasting impact on cities formation and transformation. The novelty of this work is justified by its re-using of films content to generate innovative cultural digital assets via Web or mobile applications. Next section highlights the main characteristics of cities content, and proposes a flexible methodology which is exploited to deliver the CineMetro mobile application (discussed in Section 3), with details for its impact and feasibility at the city of Thessaloniki, Greece. Section 4 discussed the impact potential of the proposed work and finally Conclusions are summarized in Section 5.

2 CITY'S CONTENT AS AN INNOVATIVE ASSET

Delivering, re-using and enriching content collections and archives (such as film archives) through the use of new technologies in cities brings city's stories, locations, and facts at the forefront of todays city navigation. The intention to make such archives easily accessible to new audiences and, at the same time, to highlight their influential role on predominant aspects of heritage communication, such as history, culture, memory and identity is crucial for advancing citizens awareness and common sensing. To achieve so, emphasis in this work is placed on the following :

- *propose* to the users/viewers an innovative form of interpreting and exchanging film/audiovisual data, which will in turn bring new perspectives in the field of audiovisual collections that could be viewed in new, attractive ways;
- *provide* a new outlet of promotion and propagation of film archive material, and also highlighting the value of a multi-layered audiovisual heritage in the consolidation of a European cultural identity¹;
- *emphasize* on film's unique significance as “reflection and articulation of European cultural identities” and, in parallel, it would best showcase cinema's competence to “exploit the fundamental relationship between seeing and understanding, and recognizes the centrality of visual images to the formation of identity, whether personal, regional, national or European”².

This work's ambition is to proceed to the next advances in terms of :

- advancing earlier approaches which have considered aspects of **time and location separately**, so propose an innovative new approach which will jointly consider the criteria of location, time, emotion and frequency of public spaces visiting;
- provide a methodology for detecting citizen emotions and phenomena as they emerge in LBSNs via exploiting public spaces culture and history similarities, comments, etc, in an enjoyable and organized manner. User communities as **they emerge in the real life experimenting** may leverage on recommendation processes at which they can also interact;
- provide an **easily-deployable apps toolkit** that enables both trajectory analysis as well as people emotional standing for the case of humans physically moving and interacting within public spaces, as well as appropriate tools for searching in longer-term analysis. This will operate with full anonymization of estimated trajectory, demographic, and emotional personalized data.

2.1 A methodology for city content and its dynamics management

The proposed work is based on the need to capture real, virtual experiences and interactions in public spaces by primarily involving a *methodology* which will be used

¹ “This «cultural fortress Europe» and the nationalist reactions could be opposed by highlighting the history of Europe as a laboratory of especially equipped for cultural interchange, with the incidence of multiple extra-European elements, all historically consolidated and forming part of the “cultural identity of Europeans”. Enrique Banus. “Cultural policy in the EU and european identity”. In: M. Farrel, S. Fella and M. Newman (eds). European Integration in the 21st century. Unity in Diversity, London-Thousand Oaks: Sage, 2002, p. 171.

² W. Everett. “Introduction: European film and the quest of identity”. In: W. Everett (ed). European Identity in Cinema. Bristol: Intellect Books, 1996, p. 8.

to leverage on archival cultural content (such as films) and at the same time it will enable data collecting and gaining input from citizens who are on the move and who can rate, interact, gain information, etc. Such an approach is proposed also in (Vakali et al. 2014 and 2013) with emphasis on how different data sets can be merged towards delivering innovative applications and services.

Figure 1 summarizes the methodology which can operate on some specifically defined building blocks which involve five specific flows inline with the objective to exploit city (past) stories with todays actual city navigation and experiencing. Next more details are given for each of these numbered flows.

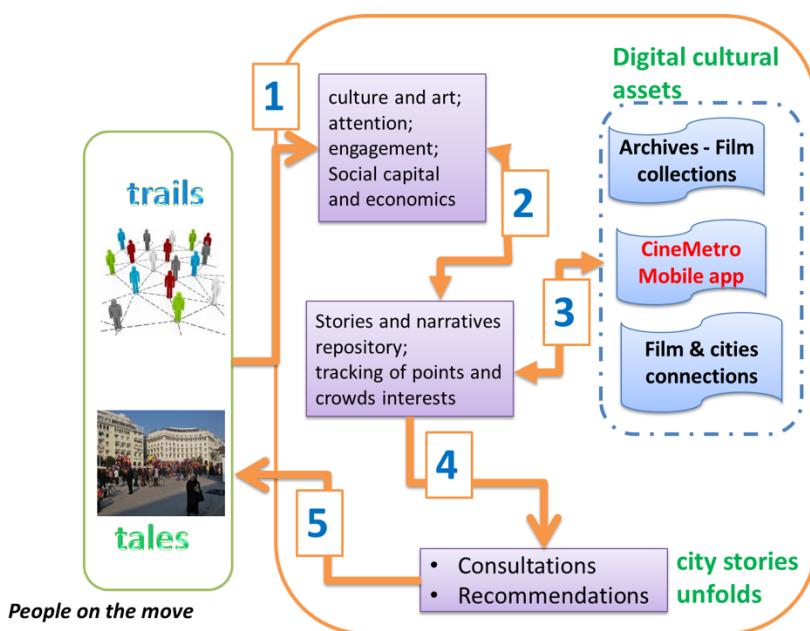


Figure 1. A framework for cities tales unfolding

1. Defining the public spaces real and virtual settings is required to enable city-driven trails and tales integration. Initially, specific data flows are needed as input to support relevant city's priorities (e.g. culture and art, attention, etc) to address the city's data integration under a particular dimension focus. This is the initiating and triggering flow to set the public space's particular priorities which can also be related with specific city's areas at which cultural content can be located.
2. Then, a process to inter-connect the building blocks of disciplines and methods in a bi-directional fashion is followed since disciplines are mutually respected for identifying the appropriate methods and for the completion of a city experiencing activity. This flow is in line with both city's fundamental and technical objectives since the decisions made should be supported by appropriately designed technical solutions.

3. Methods are realized by specific multi-faceted instruments. The methods chosen for an activity along with their implementation procedures are employed in public space real and virtual settings, with people who are hyper-connected or physically interacting. This flow is also bi-directional since the methods can be refined and revised according to the actual activity and can run again in an iteration of an activity, for example at another public location.
4. Methods analytics and observations can be utilized since they lead to the formation of guidelines. Guidelines will be drawn from specific conclusions summarization, recommendations, and consulting synopsis which will be formulated according to involvement of stakeholders' and through addressing their needs in a transferable results form.
5. This last process flow delivers outcomes to the key city stakeholders, in an open manner, such that the city tales and trails can contribute to improving and promoting the human-centric emphasis of the proposed idea.

3 CINEMETRO : AN IMPLEMENTATION FOR CITY STORIES AND PLACES INTERACTIONS

Unfolding city stories was enabled, based on Figure 1 outline processes, to enable correlations and integration of existing city spaces, city relevant cultural content along with city trails. Based on this processes an innovative application (“app” for short) was developed which merges past city tales with today’s real experiencing trails.

3.1 Cinemetro application principles and implementation

Inspired by the availability of Greek film archives, the idea of exposing and delivering film content appropriate text, images, and metadata in the city context has addressed needs to introduce to contemporary audiences the many different ways in which the image of the city and everyday life is depicted in film. Implementing a mobile application to do so was an immediate choice due to the penetration of mobile apps and devices to all city audiences. The goal is to further explore themes that are linked to the “*cinema-city*” relationship, which would not only give new research potentials to existing film archives, but it would also create new ways of reading our cultural heritage in terms of history, memory and identity.

The application developed was visualized as a so called CineMetro to deliver a familiar real metro-like experience with stops, hubs and people on the move trails. The virtual metro-like app informs and familiarizes the public about Thessaloniki’s rich cinematic history through a modern navigation experience in the city. Various city’s landmarks, which are linked to films shot in Thessaloniki, are used as “stations”, where citizens can step by in order to see what’s available (e.g. photos, texts, videos, podcasts, etc). At those stops virtual spaces people on the move can deliver their experience summary (posts), their rating, their own suggestions, etc. At the same time social media interactions are enabled with connections to most popular social media check ins in the LBSNs manner of interacting.

Exploiting film and city innovative application: Adding to this scope, the AUTH research group has already introduced an innovative application regarding Thessaloniki's film history, the "CineMetro"³ app, with some of its screenshots depicted in Figure 2.

The "CineMetro" app visualizes the **rich cultural heritage** of Thessaloniki's film history, which is represented in three major "metro"-like lines and their respective routes that pass through the city's historical centre:

- Line 1 (films urban scenery). It deals with films that were shot in Thessaloniki and it thus promotes Thessaloniki through fiction film, proposing a filmography for the city.
- Line 2 (cinemas locations). It includes references to old and new cinemas (movie halls) in Thessaloniki, which provide a concise history of the film viewing experience in Thessaloniki.

Line 3 (film festival timeline). It is exclusively dedicated to the Thessaloniki International Film Festival and its history since its foundation in 1960 as a local film festival until today. The Thessaloniki International Film Festival is "the top film festival of South Eastern Europe, the presentation platform for the year's Greek productions, and the primary and oldest festival in the Balkans for the creations of emerging film makers from all over the world"⁴.

The "Cine Metro" app attempts to offer to its users a unique digital tour in Thessaloniki's film history, which unfolds stories about the city and the cinema for more than a century, by linking people, spaces, places and memories on film culture⁵.

Consequently, the "Cine Metro" app could easily be employed as an innovative digital tool for an extensive exploration of the "city-cinema" relationship established by Greek popular films, in which Thessaloniki maintained such a key role as highlighted by Milonaki and Y. Grosdanis (2012). It could also pinpoint an extensive consideration of specific historical and cultural contexts, in which "Greek film production as a whole could be considered as a database, as an audiovisual archive, which is a significant source of the city's urban memory, regardless of any other cultural values it might possess"⁶.

³ The "CineMetro" app was designed and developed voluntarily for educational purposes by a student team of the Department of Informatics of the Aristotle University of Thessaloniki, under the guidance of professor Athena Vakali and in collaboration with film historian Dr. Angeliki Milonaki and film critic Yannis Grosdanis. More details on the team and the app are given at : <http://oswinds.csd.auth.gr/CineMetro>

⁴ The profile of the Thessaloniki International Film Festival as outlined in its official website: <http://www.filmfestival.gr/default.aspx?lang=en-US&page=586>

⁵ The app is available for download in the following link in Google Play: <https://play.google.com/store/apps/details?id=cinemetroproject.cinemetro>

⁶ A. Poupou. "Cities shapes: Film prologues, introductory sequences and urban iconography" (in Greek). In: E. Sifaki, A. Poupou and A. Nikolaidou (eds). City and cinema. Athens: Nissos, 2011, p. 86.



Figure 2. CineMetro app screenshots

4. IMPACT POTENTIAL AND ADOPTION FEASIBILITY

CineMetro is primarily addressing the interaction of citizens with a mobile app and ICT experiencing, but it further builds on the impact of cultural digitized content exposing in the ways people behave and interact in public spaces. City virtual spaces and leveraging trails by using simple and user friendly software modules design, enables future development of tools for data collection, various data threads integration, new smart cities installations cross-referencing etc.

In the collaborative economy, especially innovative ICT Services in smart cities have a strong business potential, as a result of the increasing urbanization which comes with a host of challenges for cities, local governments, businesses and citizens. The CineMetro extended apps can serve as a valuable tool for smart city application service providers (including SMEs) that are active in offering added-value to existing social, sensor networks and services to urban regions.

Such novel knowledge of a city's tales and trails will facilitate software tools implementation, intending to develop processes of data acquisition which will enable:

- **Social media monitoring and semantics analysis** through the collection of multimedia content shared through the CineMetro social networks and mapping of a number of different social networks to a single representation (to support hyper-connected virtual interactions cases).
- **Data collection from activities** to support, even in real time, events and experiences of life in public spaces, on the basis of the cultural content which is attached at the particular public spaces. As an example, an **online gaming experience** can be build on the basis of CineMetro and in relevance to cinematic city stories and their todays influence. The CineMetro mobile app will allow information gathering with respect to specifically chosen public spaces. The content gathered will then be classified and entered into a data repository, structured to provide specific keywords and ensure the necessary information to inform sociological analysis of complex social phenomena.
- **Physical sensing technologies** may additionally support highly useful capabilities, including: people participation dynamics, social proxemics (distances between people, people's trajectories, interactions' identification), as well as estimation of demographics (age, gender) and emotional state of people for some closed groups cases which will agree on particular purpose city experimenting. The targeted such advances may enable public spaces absolutely anonymous trajectory to maintain highest ethical standards and fully preserve privacy.

	Cities Services	City apps	Urban planning	ICT apps
SMEs	**	*	*	**
Startups	**	***	*	***
Entrepreneurs	**	***	*	***
Authorities; Policy Makers	***	**	**	*

Table 1. CineMetro stakeholders impact

Table 1 indicates the level of CineMetro and its extension expected impact to each market stakeholder according to the segment targeted (top row covers the market segments) mostly relevant to the proposed work, and left column addresses the target stakeholders' categories. The level of impact is marked with a respective number of asterisks (*) correlating stakeholders and segments targeted (i.e. the more asterisks the higher impacted markets).

Aristotle University has a strong academic audiences appeal since Aristotle University is the largest University in Greece and it covers all fields of study⁷. In CineMetro both computer scientists and film studies experts are involved and project's progress and results are already disseminated accordingly. All these academic audiences are encouraged to participate in any relevant events, activities and tasks. Aristotle University's groups OSWINDS which has implemented CineMetro, maintains close connections with other local non-academic organizations who promote innovative city experimenting and practices. As a proof of concept, In terms of its impact and future adoption, CineMetro has already been communicated to the next two Thessaloniki's popular SMEs/startups which are involved in the CineMetro dissemination plans :

- **Thessaloniki Walking Tours** team to discover the city of Thessaloniki, its history, its gastronomy, its people and their habits, its secrets and legends. This startup invites you to experience the authentic aspects of the city through well-designed theme walks specifically aimed at providing the information and the means to spend a fascinating day in the life of this 2 thousand year old city. Connecting past and present, we walk together through the streets of Thessaloniki, its sights, its markets, its neighborhoods and its secret corners. With us, you will discover the human stories behind its important monuments, its art and its culture, the micro-history associated with the major events that shaped the complex character of Thessaloniki and its unique adventure through time (<http://thessalonikiwalkingtours.com/>)
- **Parallaxi** during the 24 years of its creative presence in the editing landscape of the country organized and continues to organize big events that alter the everyday life of the city. Like the exhibition of Greatest Kitsch at the Center of Contemporary Art, the Cinema on the Street in five cities of the district, a rural summer cinema at ten characteristic monuments and neighborhoods around the city and a giant urban experiment for a city in a Different View in June 2010 entitled "Thessaloniki Allios"(Differently). From the experiments of urban activists team "Thessaloniki Allios" was established and today still continues its engagement and action, with already 28 actions for design, architecture, environment, social inclusion etc. which have brought 150.000 citizens to its projects⁸.

⁷ Aristotle University of Thessaloniki <https://www.auth.gr/en/uni>

⁸ Thessaloniki Allios <http://www.parallaximag.gr/thessaloniki/thessaloniki-allios>

5. CONCLUSIONS

In the collaborative economy, innovative ICT applications, tools, and services for smart cities have a strong societal and business potential, as a result of the increasing urbanization which comes with a lot of challenges for cities, local governments, businesses and citizens.

As it is evident from the proposed work, citizen ground up groups have already addressed the need to proceed on more humanizing the city efforts, integrating cultural content, todays actions, and peoples perceptions. The proposed CineMetro mobile application materializes an approach which reveals city's film content relevance with city's spaces. Under an extended application further improvements involving analytics can be applied, offering a valuable tool for smart city application service providers (including SMEs) which are active in offering added-value to existing social networks and services.

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