USING SPATIOTEMPORAL CONTEXT IN THE MARKETING STRATEGY DECISION PROCESS

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May, 2013

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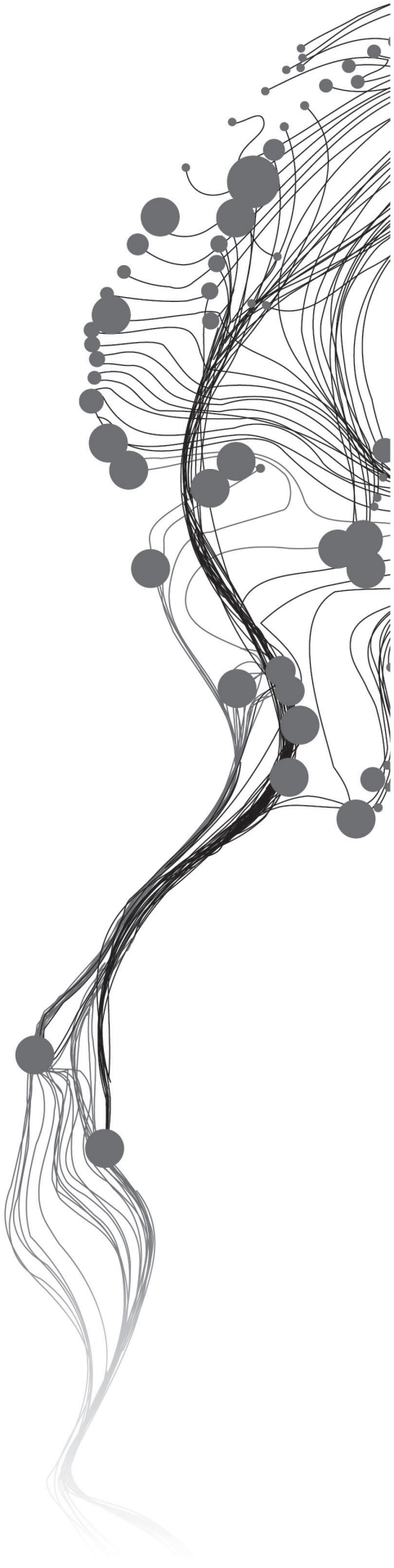

USING SPATIOTEMPORAL CONTEXT IN THE MARKETING STRATEGY DECISION PROCESS

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Thesis submitted to the Faculty of Geo-information Science and Earth Observation of the University of Twente in partial fulfilment of the requirements for the degree of Master of Science in Geo-information Science and Earth Observation.
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ABSTRACT

The use of the spatiotemporal context as a competitive advantage for doing marketing strategies is a rare topic for the companies. The integration of the spatiotemporal context, the use of social media and geoprofiling to create a geomarketing decision system is a uncommonly explored topic in geographic information sciences. In the past, there have been studies regarding marketing using spatial context and social media but with disconnected elements in the marketing decision process. The intention of this research is to analyze the importance of the combination of spatiotemporal context and social media in order to enhance the geomarketing decision process. The innovation of this research will be aimed by including the spatiotemporal context and the social media in a prototype to help the marketing strategy decision process. The geoprofile components enhance the geomarketing decision process giving insights on the consumer and allowing to detect patterns in a certain time and space. The development of a case study sets the context to introduce the city of Delft and the quest to conquer the local beer market. A database model and a prototype were develop as a proof of concept. The result of the prototype lead to the detection of certain spatiotemporal patterns that can give insight on when the company can apply more effectively their marketing campaigns.

Keywords

social media, geomarketing, spatiotemporal context, prototype, marketing strategy, Delft

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Chapter 1
Introduction

1.1 MOTIVATION

The introduction of geographic components into the marketing discipline goes further than the simple space division and the locations of large amount of data in a map (Pride, 1977). Marketing Strategy as established by (Bennett & American Marketing, 1995) is a statement (implicit or explicit) of how a brand or product line achieves its objectives. The strategy provides decisions and direction regarding variables such as the segmentation of the market, identification of the target market, positioning, marketing mix elements, and expenditures. These studies have broadened the understanding of the market and are the base for developing applied geomarketing strategies.

There are several definitions of geomarketing, one of these definitions is the following: *Geomarketing is using the spatial component included in corporate and market data to make intelligent and more effective business decisions* (Latour, 2001). Another definition found was the one of (Hachet & Guitton, 2001) that establishes *Geomarketing aims at the visualization of strategic information e.g. (financial, sociological) on geographical supports for decision making processes.* For the purpose of this research the definition of geomarketing is framed as: Geomarketing is a combination of spatiotemporal components, social media and market data elements that can develop a marketing strategy decision process. Geomarketing allows the determination of potential consumers, the optimization of strategies for decision making, among other uses. Geomarketing in addition to the *Voice of the Consumer*, the understanding of the needs of the costumers and transforming them into key functional requirements (Peng, Sun, Revankar, & Li, 2012), is essential for the strategy decision process.

Geoprofiling, a methodology that uses locations to determine probable areas where an offender lives, has its roots in the criminal law practice; investigators had identified likely culprits based on the method, location, and type of crime committed (Renner et al., 2009). These elements can help develop the goal of having more personalized geomarketing.

The binding element between geoprofiling and geomarketing is the spatial component. Using geoprofiling techniques, such as the understanding of the spatial behavior of an individual, complement the geomarketing analysis and provide strength in generating focused marketing strategies. Enriching the analysis with the spatiotemporal component creates an understanding of the segmentation of the market and places of interest that leads to potential opportunities of detecting business opportunities.

The understanding of the customers, their surroundings, and their emotions can lead to an improvement in our marketing strategy. Social media marketing seeks to engage customers in the online social locations where they naturally spend time. Social businesses pick up what customers are talking about, their interests and connect this information this back where it can be processed and used to create the next round of customer experiences and hence the next round of conversations (Evans, McKee, & Bratton, 2010).

The use of social media, in which receiving valuable feedback from the costumers and trying to answer their demands, helps build customer preferences. With the use of social media we can

discover certain behavior patterns of the customers such as favorite places, favorite brands and favorite foods.

Time has an important role in people's daily activities. It frequently determines the location of the individuals. People move to different places with different purposes depending on the time of the day (for example, in the morning the route to their jobs or school, at lunch time going back home, stopping in restaurant nearby, or visiting their children in school, hanging out at night in a bar, attending a social event or going to the movies). understanding this movement can help companies develop a more focused marketing strategy which is a rarely explored topic in the geomarketing field. The importance of personalization in the marketing campaigns is the ability of a company to recognize and treat its customers as individuals through personal messaging, targeted banner ads, special offers on bills, or other personal transactions (Imhoff, Loftis, & Geiger, 2001). Personalization can help develop long term company customer relationships. Based on the characteristics of individuals (such as hobbies, education and location) groups of common interests are formed to establish profiles. Subsequent divisions of each group can create the personalized data for each individual.

1.2 PROBLEM STATEMENT

The use of the spatiotemporal context as a competitive advantage for doing marketing strategies is a rare topic for the companies. The use of social media can help understand the behavior of the customer and its interest has been increasing in the recent years. The integration of spatiotemporal context, use of social media and geoprofiling to create a geomarketing decision system is a uncommonly explored topic in geographic information sciences.

1.3 RESEARCH IDENTIFICATION

In the past, there have been studies regarding marketing using spatial context and social media but with disconnected elements in the marketing decision process. The intention of this research is to analyze the importance of the combination of spatiotemporal context and social media to enhance the geomarketing decision process.

1.3.1 Research Objectives and Questions

To accomplish this study there are three main objectives and their corresponding questions:

Create a conceptual framework to support the geomarketing decision systems using of spatiotemporal context.

- What is the structure of a geoprofile?
- What information from the spatiotemporal context and social media supports the marketing strategy decision process?

Develop a prototype to help build marketing strategy decision system taking into account the spatiotemporal context and social media.

- What is the conceptual model of the geomarketing decision system?
- Can the use of spatiotemporal context and social media help find patterns?
- Does the prototype help as an input for personalized marketing campaigns?

Use visualization techniques to represent geoprofiles in the marketing context.

- Which visual representations could help interpret the outcome results?

1.3.2 Innovation Aimed At

The innovation of this research aims to include spatiotemporal context and social media in a prototype to help the marketing strategy decision process. The fulfillment of the prototype is tested with real datasets.

1.3.3 Related Work

The increasing interest in using spatial context and social media, and how to incorporate them to the way marketing is done leads to an increasing number of researches in this topic. The work done by (Cliquet, 2000) regarding the use of networks for the location of new stores, utilizes the spatial context to determine where a new store can be located or reallocated to have more customers. This work does not include the use of social media or temporal context in the study for the location of new venues.

The paper in which the Points of Interest are introduced by (Gambs, Killijian, N, & Cortez, 2010) is the start of the clustering of data. This study describes the use of data tracking of the movement of people and introduces identification of Points of Interest and the prediction of movement patterns in individuals. This paper also does not incorporate the temporal context, as well as the social media.

There can be many causes for a business to lose what used to be a solid customer base, but one might be the opening of a new competitor. To determine who is "stealing" the business, we can identify a few factors that correspond to the geoprofiling algorithm (Renner et al., 2009).

The approaches mentioned before try to cluster into different factors, but they do not take into consideration the spatiotemporal context or the social media usage that is a common activity in our era.

In the field of representation of the data (Hern, Ernst, Voss, & Berghoff, 2007), establish importance of the visual analysis in the geomarketing field as well as the problems that can be encountered when trying to pass these elements to low cost and secure platforms. The main challenge when visualizing movement traces is the simultaneous depiction of temporal and spatial data. Despite the long history and ubiquity of maps as visual representations, the effective illustration of time remains a challenge (Peuquet, 1999). In this field the representation of space and time in the context of geomarketing has not been addressed yet.

1.4 THESIS OUTLINE

The thesis is organized in seven chapters:

Chapter 1: Consists of the motivation and problem statement, research objectives, research questions and related work regarding the study.

Chapter 2: Formed by the literature review on each of the geoprofiling components as well as the opinion of user experts.

Chapter 3: About the creation of the case study in Delft as well as the work flows of the different datasets used in the research.

Chapter 4: Relates to the design and construction of the database and the prototype.

Chapter 5: Describes the system architecture, the implementation and the technology selected for the prototype.

Chapter 6: Presents the results of the prototype and how it can help in the detection of spatial patterns.

Chapter 7: The conclusions and recommendations for further work on the subject are given.

Chapter 2

The Influence of Geoprofiles in the Marketing Decision Process

In this chapter several sources are addressed to clarify the basic concepts applied further in this research. The topics include: the components of a geoprofile, information about spatiotemporal context and social media that supports the marketing strategy decision system.

2.1 GEOMARKETING

The geographic element in the context of marketing is not limited to the location of data (Pride, 1977). The connection between geography and marketing helps demonstrate the relevance of spatial decisions in the companies today. The definition of geomarketing as established by (Latour, 2001) is stated as a *specific application of the spatial economy*.

The knowledge of consumers is a fundamental element when trying to establish a marketing approach. Geomarketing contributes in the incorporation of where geographically the consumers exist. The determination of prospect consumers within a given area can be addressed using geomarketing. This discipline can also contribute in the knowledge of the market, discovering the locations of the competitors.

The help in the investigation of where a new location or reallocation can be established is also proportioned by geomarketing. The better comprehension of the relationship between consumers and spaces, leads to better insights and competitive advantages in the market. With this advantages the company can focus their efforts on emerging markets or innovation campaigns that can gain more market share.

2.2 GEOPROFILING COMPONENTS

The division of things in groups generates new perspectives in the way of perceiving information. Segmentation has become one of the main concepts in the marketing theory and practice (Kamakura & Russell, 1989), (Green & Srinivasan, 1990). It is the process of dividing the market into consumer groups of related preferences, behavior patterns, and other factors that develops a marketing strategy suited for specific groups.

The specific groups resulting from the division of the consumers has helped to answer several questions about the marketing strategies such as: when and where a change of price is needed, where is more promotional effort needed, when and where would it be beneficial to offer a new product (Wind & Association, 1978). The answer to the previous questions assists in the prioriza-tion and focus on the market segment that has more potential for the company.

The profiles of the consumer are relevant for the understanding of the market. Profiling is the data processing that consists of applying a profile to an individual in order to take decisions for analyzing or predicting personal preferences, behaviors and attitudes (of Europe, n.d.). The priority of the profiling is the deep understanding of the present and prospective customers. Without this information it is almost impossible to have a clear perspective of the potential value of the

market opportunities. Sources of information such as surveys, social media data and transactional records can help make a clear view of who are the persons the companies are dealing with.

There are several variables to profile the present and perspective customers such as:

- Age, gender, lifestyle, income
- Ethnicity
- Residential address
- Frequency and preferred places

Geoprofiling has its origins in criminal profiling. It used to identify patterns based on the method, location and type of crime. There are two key prerequired elements in order to achieve a geoprofiling analysis. The first one is an understanding of the historical data patterns in criminal activities. The second one is the ability to collect, organize and access data from many different sources (Renner et al., 2009). The understanding of these elements mentioned before leads to the ability of creating a spatiotemporal pattern of each offender.

Information of spatiotemporal pattern constructs the geoprofile of each offendant which normally corresponds to their knowledge of the areas in which they operate, so when the offendant is in an emergency state he/she knows how to escape in a quick and safe way. The offender also wants to achieve a greater amount of crimes without getting caught, so the consideration of all the physical barriers is also a point to take in consideration.

In Figure (2.1) the map shows the geoprofile of a criminal. In the left part of the image is the basic information of the incidents and on the right lies probability of where the next incident may take place. This helps prioritize the areas that need to be more patrolled and also helps in the distribution of elements needed to complete the vigilance task.

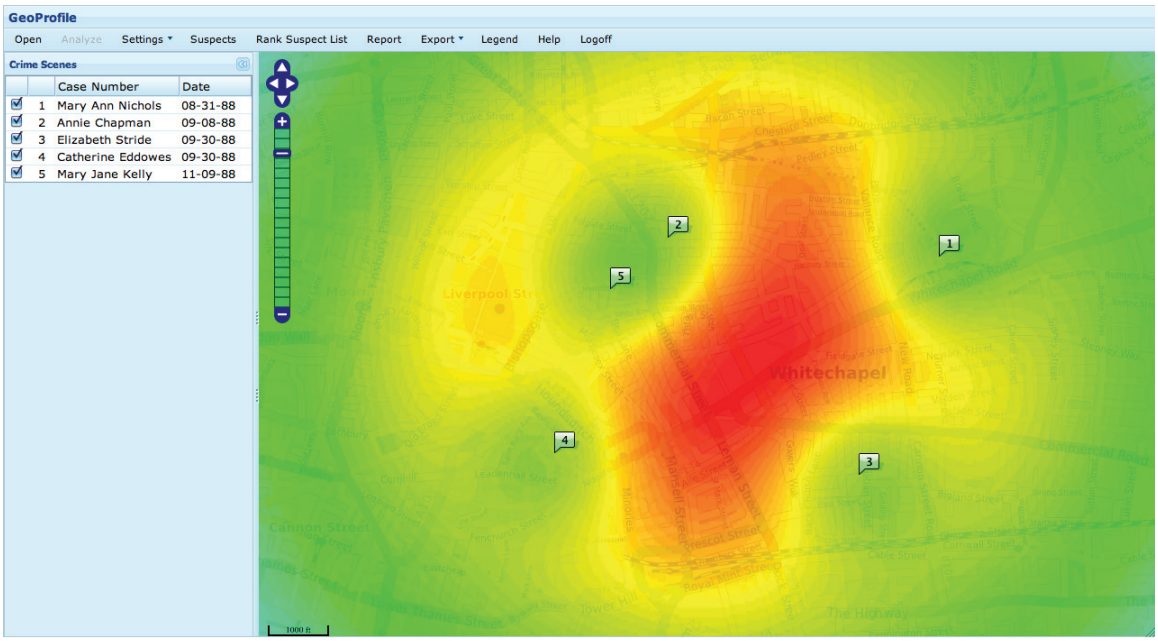

Figure 2.1: Criminal Geoprofiling

The same principle used for criminal geoprofiling was adopted by marketing to help companies increase their knowledge of the consumers. The pattern and the distribution of places are

linked to consumers preferences and describes a geographical behavior. This approach can give an example of a geoprofile analysis, the relation between time, place and the products they prefer.

Due to the lack of a formal definition of geoprofiling in marketing, for the purpose of this study the definition of geoprofiling is as follows: *the grouping of consumers by their personal characteristics (age, gender, ethnicity, lifestyle, home address, etc.) and by spatiotemporal data characteristics gathered from social media (Twitter and Foursquare) and/or GPS information*.

The information that composes a geoprofile is the data gathered from persons in a specific date, time and place, it also includes social media data. The geoprofile is the beginning step to determine what geomarketing strategy to apply according to the company's target market. The marketing campaigns are based on the geoprofiles of the consumers.

Geoprofiles are used in geomarketing to combine spatiotemporal and consumer information to form market segments that contains common profiles that lead to the creation of specific promotions, discounts or advertisement for the segment. It helps get the information of where the customer is and how the profile of the customer changes during the day (for example, in the morning the route to their jobs or school, at lunch time going back home, stopping in restaurant nearby, or visiting their sons in school, hanging out at night to a bar, a social event or to the movies). The consumer mobility has been evolving during the years so this requires a more dynamic approach, developing a spatiotemporal profile with the new ways the consumer moves and all the data produced by the customers.

The understanding of people's spatial behavior, helps gather more insights for trying to determine patterns. This helps to make profiles for specific marketing strategies which may improve the interaction and preferences of the customers.

There are three steps in a geoprofiling marketing strategy:

1. To capture and manage customer data.
2. To analyze data to get insights.
3. Use of the insights to drive efficient marketing strategies and customer interaction.

The common patterns extracted from the data allow the company to link the targeting programs directly to specific geoprofiles that represent the most profitable customers and the prospects of your product; they can help shorten the cycle of knowledge about the customers and respond or even anticipate to their demands in a more efficient way.

The geoprofile structure consists of a combination of different data from diverse sources that creates a unique classification of people. The attributes needed to create a geoprofile are the spatiotemporal information (longitude, latitude, date, time), consumer information (age, gender, ethnicity) and the origin of the information. In case that the social media is the origin of information, the users' text is included.

Companies use geoprofiles to start the process of segmentation of target groups to provide a more personalized type of promotions, advertisements, offers, marketing strategies, categorize each target groups and define priorities according to the company's benefit.

Companies obtain and/or update their data of the geoprofiles by doing on site or online surveys, obtaining data from data provider companies, data from the municipality and data extraction from social media (figure 2.2). All of the previous mentioned elements along with the marketing expert's knowledge are the base for the geomarketing decision system.

2.2.1 Spatiotemporal Context

Spatial data consists of information that can be queried in a geographical way, it can also contain consumer and market variables. The spatial context is an essential aspect nowadays because it uti-

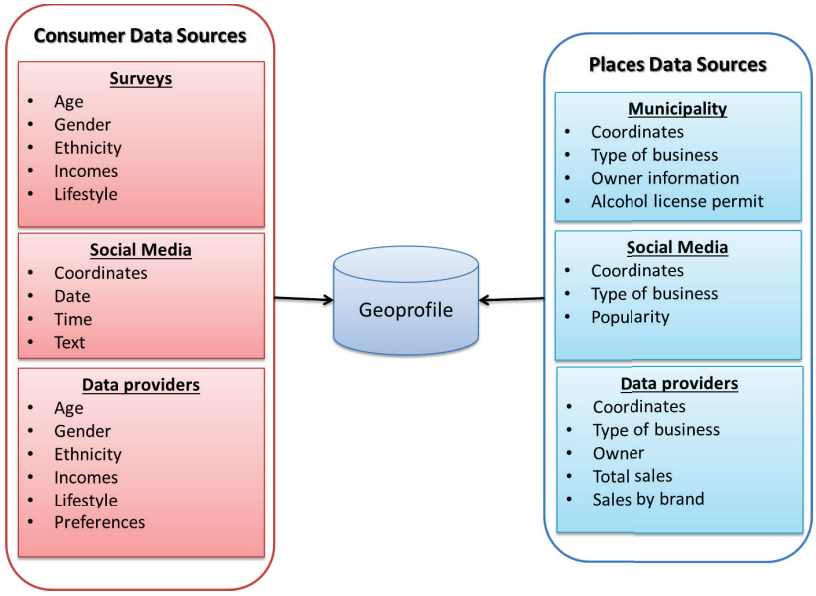

Figure 2.2: Geoprofile Data Sources

lizes statistical modeling and mapping techniques to measure and predict geographic phenomena that can affect business performance (Lam, 1983).

There are several reasons to start spatial analysis in companies: the identification of key customers, performing an assessment of consumers value according to geography and rank opportunities by location, revision of marketing strategies according to their location, and gain competitive advantage on a crowded market by identifying opportunities.

The Central Place Theory (CPT) is a key in urban-economic research. It is a way to identify the spatial content in an area taking into consideration certain characteristics such as *location, size, frequency, economic activities, and the sizes, shapes, and spatial arrangements of their market areas* (Berry & Parr, 1988). The CPT leads to the concept of clustering, a collection of events or things that are happening in a certain area. Suppose a big cultural event is occurring in the city center and people are represented as points in the information obtained, knowing which stand people are more interested visiting is the key information for the analysis. The stands where more people are gathered represent that there are more possible consumers in these areas of the event.

Now that clustering was defined, an example in retail allocation is given. Clustering is a common strategy for retail allocation. Restaurants, stores and bars are normally located close to each other in areas of a town, with the intention to attract more consumers to the area and to create more selling opportunities. The clustering provides a variety of different options for the consumers to get the product of their preference.

Retail clustering has been reviewed in two different perspectives. One is considering that retails are established in an area based on the concentration of the population. The advantage for businesses is that the majority of the consumers do their daily activities in that area. In this perspective population density is the main research factor.

The second perspective refers to consumer research. Several studies have been done to observe consumer patterns specially in single or multiple purpose based trips. A research by (Dellaert & Brabant, 1997) was to analyze changes in consumer behavior when taking into consideration a multipurpose trip and stops. If the consumer has a multipurpose trip it tends to have less time for each task on the trip.

Taking competition into account is important when studying clustering patterns. All the retailers compete to attract consumers to their business in general even if they are not in the same market segment. This competition helps to make a certain area more attractive to the people as in the gravitational theory.

The gravitational theory describes the attraction of people to a certain place because of the amount of businesses there are. Retail gravitation is the calculated level of the consumer attraction to a store based on the size and the distance from the consumer (Reilly, 1931).

Reilly's law of gravitation, states that *two cities attract retail trade from any intermediate city or town in the vicinity of the breaking point, approximately in direct proportion to the populations of the two cities and in inverse proportion to the square of the distances from these two cities to the intermediate town* (Reilly, 1931). This distance is based considering that the moves are along infrastructure. The vicinity of the cities and its population affects the consumers' choice of where to buy the goods (see figure 2.3).

The formula is as follows:

$$D_A = \frac{D_{AB}}{1 + \sqrt{\frac{\mathrm{P}(B)}{\mathrm{P}(A)}}} \tag{2.1}$$

where $\mathrm{D_A}$: Distance from city A to breaking point
$\mathrm{D_{AB}}$: Distance between cities A and B
P(A): Population of city A
P(B): Population of city B

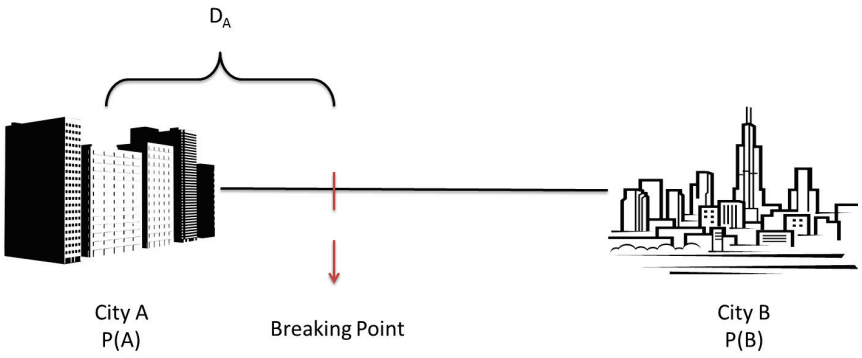

Figure 2.3: Reilly's Gravitational Model

The following example illustrates how the model works. City A has a population of 8000 and City B has a population of 6000. The road distance between the two municipalities is 20 kilometers. The formula is as follows:

$$D_A = \frac{20}{1 + \sqrt{\frac{8000}{6000}}} = \frac{20}{1 + \sqrt{1.333}} = \frac{20}{1 + 1.155} = \frac{20}{2.155} = 9.28 miles \tag{2.2}$$

This means the retail trade area of City B extends 9.28 miles from City B towards City A. The results shows the distance from the smaller community. Consumers who live more than 9.28 miles from City B are assumed to shop in City A rather than in City B. This example illustrates that people are more likely to go to places where there are more businesses and places to do their activities. This model helps when the company is expanding to other cities or countries.

Due to the importance of the spatial context in the retail gravitation theory, the growth and development of geolocation applications has extended the sources of geolocated data. The geolocated data can vary in shape and form but also has some common characteristics. We can identify a moving trace using the following trades:

1. A unique identifier of the device, or social media information
2. A spatial identifier which can be a GPS position, latitude and longitude information from social media or a spatial area
3. A time stamp which determines at what time the event happened

The basic tasks that can be accomplished by having spatial data are: distinguishing between groups of customers (Do all of them buy the same products?), identify the geographical hot spots (Where are the best places to sell my products?), identify new patterns (Where are new places of interest emerging?).

The Reilly's Gravitational Model needs to be enriched with the new way consumers move, building new models of contemporary consumers' spatial behavio. The easier and better access to transport and the media affects the way people manage their space and time. Companies need to rethink the next step towards the search for attracting consumers.

The time element is rarely taken into consideration in the marketing decision process. Time determines the period when certain campaigns need to be executed. Time normally dictates the places where the consumers can be located (e.g. afternoon having lunch near their workplaces, night having a drink with friends in a bar).

Time series elements help marketing to forecast purposes, determine over-time impact of variables (Pauwels, Currim, Dekimpe, & Dominique, 2004). The temporal aspect can trigger events that can contribute in the understanding of consumer behavior. The behavior is likely to vary when there is a holiday in the week.

2.2.2 Social Media

More and more people are using social media as a way to express their daily experiences, thoughts and to record places where their activities take place. This information is notified to the people that are in your virtual network. The most common used social media are Twitter, Foursquare and Facebook.

The importance that social media marketing is raising in companies over the recent years. This is reflected on how they plan the upcoming years budget and are investing more in the digital marketing rather than in the traditional one (see figure 2.4 (Alterian, 2010)).

There are several benefits a company can obtain from the social media such as: *increase brand awareness,traffic, sales and establish thought leadership* (Weinberg, 2009). All these opportunities make social media marketing an important asset to businesses.

The bounce rate, the percentage of visits to the Twitter website that consists of a single pageview, has settled at a relatively high rate of about 37% in 2010 (Alexa, 2012), and Twitter's churn rate (number of persons in a specific period of time) is remarkably high too *with only 40% of users remain[ing] more than one month active*(Laudon & Traver, 2010).

In the case of Foursquare, the community is made of nearly 25 million people and there are over a million businesses registered and two thousand check-ins per minute. The demographics of users are persons between 25 and 44 years that are composed of 40% female and 60% male (the Creative Strategy Agency, 2012).

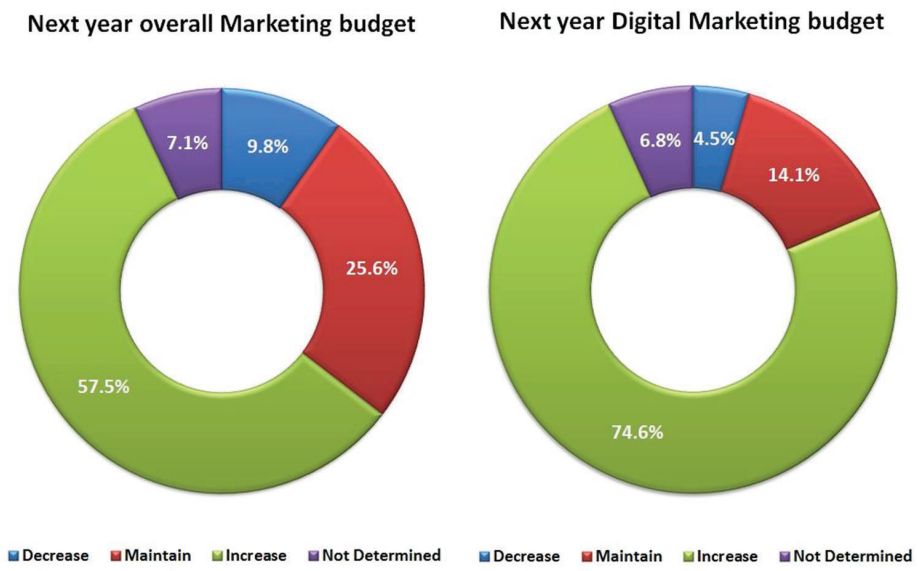

Figure 2.4: Marketing Budgets

The information derived from social media is relevant to companies that want to provide their customers with a complete satisfaction and feedback of their products and services. For most of the companies the use of social media begins in Marketing. Normally they use it to increase awareness in consumers and there are a lot of great ideas that resulted in effective, innovative and measurable social business programs (Evans et al., 2010). Regarding the topic that concerns this study, the focus is fix on the beverage industry, specifically on the beer industry. One of the most important drivers of conversation in the beverage industry is its relevance and the creation a feeling that the brand takes into account consumer opinions. In this way, both parts engage in an interaction that have benefits for all. In the beverage industry, especially in the brewery sector, dealing with new ways to capture market share is part of the marketing strategy as the sector gets more competitive each year.

The social media feedback cycle includes the awareness of products the company wants to impulse. Then comes the social media marketing campaign after the consumer purchases the product and then generates an opinion of the consumed product to give feedback to the company which reacts to it, to start again the based part on the information obtained by the consumer (see figure 2.5 (Evans et al., 2010)).

The use of social media can provide information to gain insights of the consumer such as gender, preferences, location (places they like), and time of the event. These factors help to develop the profile of people and places to feed an input for market segmentation, and for the development of marketing strategies.

To determine the location in the tweet, the user needs to enable this feature in the application, and then the tweets provide a latitude/longitude coordinate where the tweet took place. In the case of Foursquare, the businesses need to register to appear in the app and users can *'check-in'*in the location. This also gives latitude/longitude of the location they are at certain time of the day.

The social media can help understand the movements of people and their preferences with that data we can complement the company's strategies to take competitive advantage over the competitors and to conclude with a profit for the company (Kumar & Mirchandani, 2012), (Wang, Yu, & Wei, 2012), (Stephen & Galak, 2012).

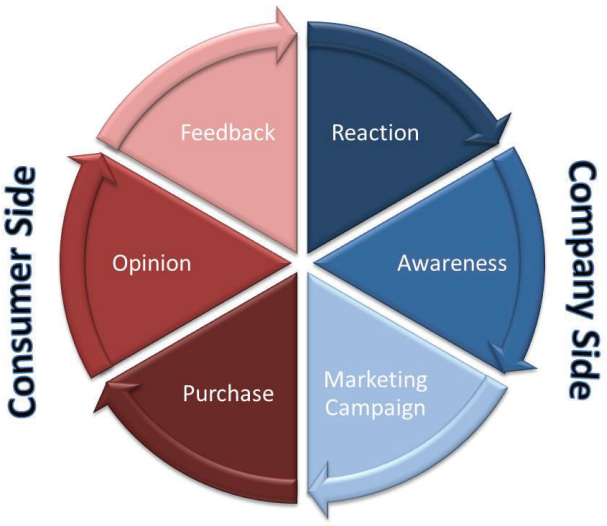

Figure 2.5: Social Media Cycle

2.3 VISUALIZATION OF GEOPROFILES

Information needs to be organized, converted and presented in a meaningful way to the user in order to gain significance. Visualization exploration is the process of extracting insights from data via interaction with visual depictions of that data (Jankun-Kelly, Kwan-Liu, & Gertz, 2007). The need to visualize spatiotemporal contexts leads to the exploration of geovisualization. Geovisualization as defined by (Kraak, 2003): *Geovisualization integrates approaches from visualization in scientific computing, cartography, image analysis, information visualization, exploratory data analysis and geographic information systems to provide theory, methods and tools for visual exploration, analysis, synthesis and presenting geospatial data*.

The main functions of geovisualization are exploring, analyzing, synthesizing and presentation (MacEachren et al., 2004). The geovisualization helps recognize patterns, trends and errors in maps with a large amount of data in a quick way. The information visualization can help complex systems to be understood better and discover new information that otherwise may be remain unexplored (Card, Mackinlay, & Shneiderman, 1999). A better understanding of data can be achieved by grouping it and relating it in a visual way.

The application of geovisualization in the business sector can help recognize patterns (e.g. sales in determined areas, brand penetration, quantity of retail business). Retail organizations have access to spatial data such as: demographics variables, store sales, customer transactions (Byrom, Bennison, Hernandez, & Hooper, 2009). This information can be used, among other things, to support the decision making in an opening of a new retail store or the creation of some promotion event. Geovisualization helps the decision makers to focus on how the market and the consumer composition changes through time to make better decisions for their companies.

2.4 SUMMARY

In this chapter the definition and the components of geoprofiling has been established. Each individual element is relevant in the construction of profiles and is a support for the geomarketing decision system. All this information, brought together, sets the structure in which future geo-

marketing strategies can rely on. By combining the spatiotemporal and the social media elements, consumer data can be accessed to improve approaching strategies for specific groups.

Chapter 3

Conquering Delft Beer Market, A Case Study

In a brewery company the departments involved in the creation of insights of the consumer are the competitive intelligence and the marketing sections. These departments in association with the price-promotion and sales branch, create a part of the company asset and seek to understand the needs of the consumer. These insights can be reflected in gaining market share or in a better brand positioning among consumers. All of these aspects mentioned before, could have a more solid base if the spatiotemporal component is involved in the creation of the marketing strategies. The incorporation of social media information as a part of the marketing strategy creation, helps in the understanding of the consumers preferences and places where they hang out.

The literature review presented in the previous chapter was the introduction to the set up of the case study. This chapter discusses the description, purpose, context, setup and data used in this case study.

3.1 BREWERY COMPANY CONTEXT

The marketing manager has some questions about the market he wants to resolve. He wants to know where the people between 25 and 40 years old are. He wants to know the place where more social media activity is showing. These questions are formulated to know when and where suitable places in the city center are and where they can develop a promotion strategy that consists of price reduction of a brand to capture more market share and see how competitors react to this strategy.

The most valuable asset of any corporation is information. All the attention is given to assure the quality of the information the company is obtaining is the best to certify that the obtained data has taken in consideration the ISO 8000 standard (ECCMA, 2011). The milestone of all the decisions in all the levels of the corporation relies on a having quality data in the correct time to support each decision taken. This is of great importance, however due to the limited time extent of the research is not going to be addressed in this study.

3.2 CASE STUDY DELFT AREA

The area selected for this case study is the city of Delft, located in Midwest of the Netherlands. The city is the scenario to represent how the beer consuming market behaves. The area of interest is the city center, where most bars, restaurants and entertainment centers are established.

In the Netherlands there are three main brewery companies: Heineken, Grolsch and Amstel (BootsnAll, 2008). They are competing to have the biggest market share in the brewery sector. This competition makes each of the participants take different types of strategy to conquer the consumer preference and gain their loyalty. The quicker and better understanding to the changes in the market, the more competitive advantage a company has over their competitors.

3.2.1 Purpose

The main purpose of the case study is to demonstrate how spatiotemporal data and social media information can be used in the geomarketing context to transform them into actionable marketing strategies. The construction of a prototype that incorporates the spatiotemporal element in the creation of marketing strategies can help the cause.

The implementation of a marketing information system is a dynamic and constant process that usually involves data collection, marketing analysis, decision making, implementation, evaluation and update stages (Turki, 2011). The stage of marketing analysis plays the most important role of all stages, due to the fact that, out of the marketing analysis all the decision making, the strategies and the success of the marketing campaigns are formed (Hakhu & Kiran, 2012). This stage is vital in the development of future consumers and in the gain of market share.

To enrich the system it is required to incorporate the geographic component to data collected on field to segment the market in a geographic way. Data coming from surveys, questionnaires and information collected in the social media networks is required. All these data contributes to broad the vision of the system and take into consideration the spontaneous reaction of the customer towards the brand in different times and places.

3.2.2 Spatial dataset

For the purpose of this study a dataset of Delft was used. This dataset was collected by the Faculty of Architecture, Department of Urbanism of the Delft University of Technology. The purpose was to collaborate a European project called Spatial Metro. The contribution was to measure the effects of investments in public places (Van der Spek, Van Schaick, De Bois, & De Haan, 2009). The data purpose was to analyze the characteristics of pedestrian trips within the historic city centers. The data was collected from Wednesday 18th to Saturday 21st of November 2009. The total tracks recorded on this project where 280.

The data collection process consisted in giving pedestrians a GPS to track their trajectories. There were no restrictions for the persons making the tracks around Delft. This data is the actual path the persons chose to take and the time spent in each part of the city.

Two different starting places were used for the beginning of the tracks. Two parking lots were selected: the Phoenix and Zuid Poort, both located in the downtown area of the city. After the the trip the participants answered a brief questionnaire where the participants fill in data such as their age, gender, occupation. The data was then downloaded from the GPS devices. Due to the vast quantity of attributes that are in the table, the next step was doing pre-processing of the data which consisted in selecting only the columns that were useful for the research (e.g.age, gender,occupation, coordinates). This dataset provides the study with the information required to start the analysis and construction of the study database (see figure 3.1).

To make the acquired data useful for the marketing objectives, the decision of dividing the day in 3 parts (morning, afternoon and evening) was made. By making this grouping, each part gets more points of each group and helps in the visualization by providing a specific time to focus on.

The final attributes (e.g. age, gender, occupation) help in the process of grouping people by certain characteristics which will further help in the creation of geoprofiles to make them part of the applied marketing strategy.

3.2.3 Social Media dataset

The social media dataset selected for this study consists of data downloaded from Twitter (Twitter, 2012) and Foursquare (Foursquare, 2012). The Twitter community is composed of 1.6 million

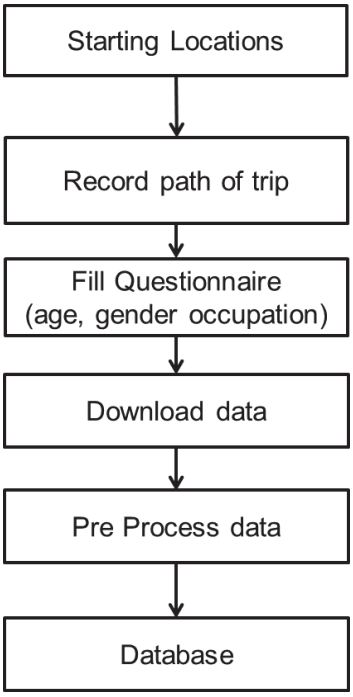

Figure 3.1: Delft Data Acquisition Workflow

active users and growing (Bakshy, Hofman, Mason, & Watts, 2011). The extraction process consisted of using APIs for the specific purpose, after downloading the data, pre-processing consists in selecting from all the downloaded information only georeferenced information and restrict the area to the city of Delft, this workflow on how the social media was gathered can be seen in figure 3.2.

The keywords in the case of Twitter where these: #delft, #grolsch, #heineken, #amstel. These keywords were selected to have an example of how to decide what strategy to apply according to the competitors in the area. There is also social media information that describes events or gathering of people in certain city areas that is why the keyword of delft was chosen (see figure 3.3). The data download was achieved using a Python program (Appendix C) that accesses the Twitter API to get the geolocated tweets with the username and text. Depending on the keywords of the tweets, the topics the consumers are talking about can be tracked.

The data collected from Foursquare is valuable because it helps to understand where are the consumers' favorite places to hang out. The places with more check-ins (number times a person attends to a certain place) can be used as an anchor point to check how the concentrations of consumers behave in particular places (see figure 3.4). This information also helps enriching the profile of the company partners by having an idea of how consumers see that particular partner and the value it has for them.

3.3 VISUAL SUPPORT

Exploration contains tasks that are time consuming, difficult to manage and with unclear outcome (North, 2006). The visualization of large amounts of data in a map can mislead the user towards good decision making. An effective data representation matches the spatial tasks and the cognitive abilities of the decision makers to take more rapid and accurate decisions.

The different types of geovisualization help understand data in different ways. One example is

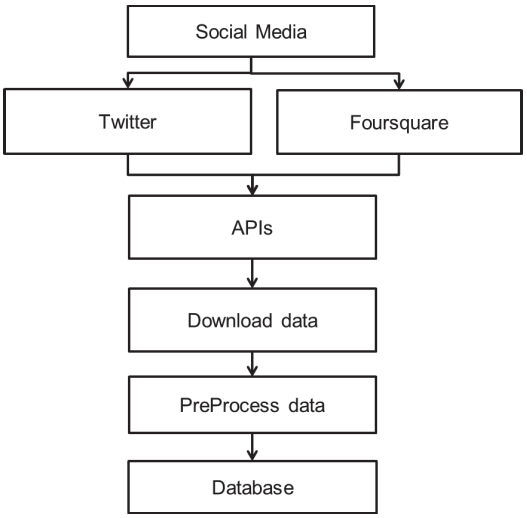

Figure 3.2: Social Media Acquisition Workflow

idtwitter	username	coordx	coordy	timestamp	topic	text
290948420334669000	waarisdebrand	4.356094	52.000599	Mon, 14 Jan 2013 22:28:03 +0000	delft	#LifeLiner2: A1 AMBU MMT02 A20 Li Schiepl Bocht A13ob
290865323811405000	HetLuisterrijk	4.361756	52.013474	Mon, 14 Jan 2013 16:57:52 +0000	delft	@TIPDelft Vlamingstraat om een uur of 16:30 #delft http:/
290858393533562000	MeteoDelft	4.356095	52.000579	Mon, 14 Jan 2013 16:30:19 +0000	delft	Nu nog goed te zien via de camera van MeteoDelft: Sneeu
290857477795373000	Dioooon	4.35728	52.009909	Mon, 14 Jan 2013 16:26:41 +0000	delft	Sneeuw. #delft http://t.co/j4KD9jsW
290853459262050000	paulbreukel	4.351855	51.986235	Mon, 14 Jan 2013 16:10:43 +0000	delft	Tram 1 van #htm reed van #DenHaag naar #Delft trouwen

Figure 3.3: Tweet Example

idfoursquare	username	geom	Place	Date	Text
5	Gino M	0101000020E6100000FC7F444A736C1140B77F491E91014A40	De Oude Jan	25-Jan-11	Het bier drinkt wel lekker weg en geweldig personeel!
7	Eduardo S	0101000020E6100000FC7F444A736C1140B77F491E91014A40	De Oude Jan	25-Aug-11	Lekkere capo
14	Guilaine F	0101000020E6100000FC7F444A736C1140B77F491E91014A40	De Oude Jan	1-Jun-11	6 different draft beer !
16	Wiebe D	0101000020E6100000FC7F444A736C1140B77F491E91014A40	De Oude Jan	22-Mar-11	Brugse Zot op tap :)
19	Jan Willem V	0101000020E6100000C6F989623C70114003E26C10A8014A40	Doerak	5-Mar-11	en af en toe kei goeie live muziek ;)
35	Ruud H	0101000020E6100000C4F582AA95731140DCA12AE481014A40	Billy Beer	16-Nov-11	De Sate bij Billy Beer is gewoon goed. Niets op aan te merken.

Figure 3.4: Foursquare Example

the choropleth map, a type of thematic map where areas have colors to represent the value of the attribute or a group of attributes and is an effective and simple way to understand the information displayed in a map (Hongsheng & Jiafu, 2010).

This type of thematic map can help locate areas that are more populated in a certain time of the day so the focus of the marketing efforts may go in that direction. For this case study the use of choropleth maps is going to be applied. The amount of partners inside a block determines the intensity of the displayed color to prioritize areas.

Another example are the proportional symbols, maps that use scaled icons or symbols to represent the quantity of a certain attribute. The symbol appearance varies in a proportional way according to the data it contains. This type of visualization is simple to read and provides the user a quick overview of which parts of the maps the focus needs to be put on.

3.4 STUDY WORKFLOW

The creation of a geomarketing strategy enables the company to focus their efforts, when and where they are needed, and their corresponding responsibility for the marketing staff of the company. The process starts with the acquisition of data, which was explained (sections 1.2.2, 1.2.3), then the marketing staff is in charge of grouping consumers by characteristics such as age, gender, occupation. This previous step leads the staff to the generation of geoprofiles, on which the company wants to focus on this particular moment. An example of a geoprofile can be focusing on the working people from age 18 to 35 (Appendix B). The spatial data is used with the geoprofile and the result is specific people and places in the different parts of the study area.

The spatial data is the key to evaluate which partners (bars, restaurants, pubs) can be part of the strategy to apply. This depends on characteristics like sales, products available, sell prices, etc. The next step is knowing which products of the company's catalog should be promote, which should go cheaper, which is the best selling brand or which new product to introduce. The company needs to analyze the period and extension of time that the promotion should be applied (weekends, in lunch time or only in late hours?).

This chain of steps leads to the selection of a geomarketing strategy. This has basic information that can help the company's objective of creating a focused effort. Consequences of this process are to save company assets by reducing the quantity of promotion material and react quickly to specific competitors actions.

The company wants to know when and where is the best bar to start a happy hour in the city center. The process starts by consulting the information of the database and grouping the consumers by age, gender and occupation and also by taking into consideration social media data and the time of the day the city center is more crowded. The next step on this case study is selecting the following characteristics: age (18-30), gender (male, female, unspecified), occupation (student), time (night). Then, the intersect this group with spatial data (buffer) of the partners in the city of Delft is made to know which place is the most crowded. After focusing on the first three options ordered by quantity of consumers, comes the checking of which partners are present in the selected parts of the center. The product to be promoted is selected according to the target characteristics of the consumers. In this case, the most popular brand of the company is selected. The promotion is implemented in the selected partners for a period of one month to gain insights on how the geomarketing strategy results (see figure 3.5).

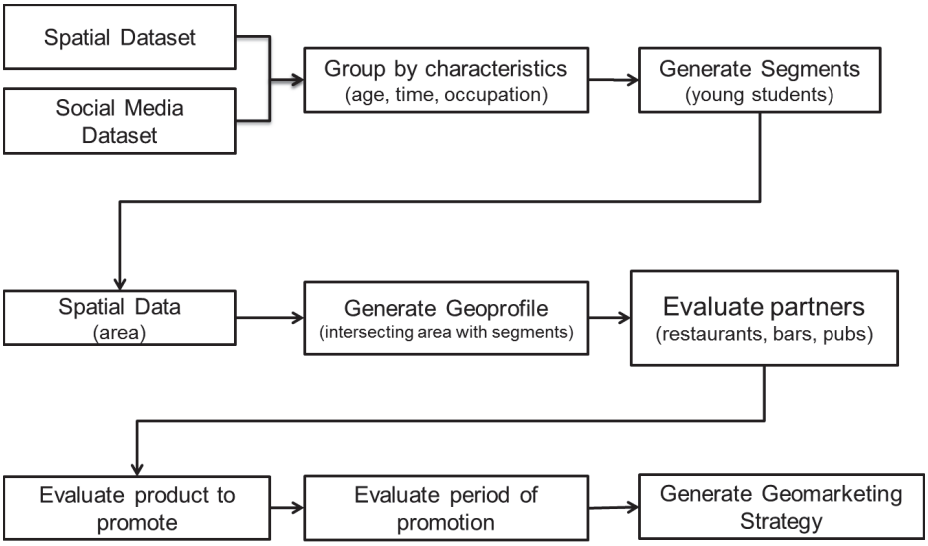

Figure 3.5: Case Example Workflow

3.5 SUMMARY

This chapter presents the case study of a brewery company that is located on Delft. The explanation of the workflows of each data input (GPS Tracks and Social Media). The visual support selected in the creation of the information layers. Inside the geomarketing strategy process the information of the persons and the spatial data leads to the creation of a geoprofile. The more insights we gain with the information gathered, the more robust the geoprofile will be.

Chapter 4
Prototype Design and Construction

The creation of a prototype for the geomarketing strategy decision system is helpful to illustrate how the user can benefit from the concepts and cases mentioned in the previous chapters. System design can be described as the analysis, design and configuration of software and hardware components to support your solution's architecture (Shelly, Cashman, & Rosenblatt, 2009). The design of the geomarketing decision system is based on information gathered information from the different data sources, and from the knowledge gained through literature review and expert's opinions.

In this chapter the conceptual data model and activity diagram is established and described. The following elements are taken into consideration: system design steps, inputs, functions and generated outputs are also supported by several the experts' knowledge and the chosen literature review.

4.1 SYSTEM REQUIREMENTS

The necessity of a Marketing Decision Support System (MDSS) to achieve an integrated geomarketing decision system can lead to improved decision making on the market and the knowledge of the consumers as stated in the previous chapter. There are several aspects that need to be taken into account such as:

- Incorporation of the spatiotemporal element in the MDSS. The incorporation of spatial and temporal elements into the analysis is going to be achieved by the inclusion of layers of street blocks or administrative regions, being also necessary to have a base map Google maps to have the adequate perspective and updated information on the city. The time elements need to be presented in the form of a blocktime of the day (morning, afternoon, evening).
- Creation of a spatial database. The integration of spatial and non-spatial data in a database is required to make the marketing analyses.
- Creation of a geoprofile. The incorporation of a geoprofile to the system is essential to group the consumers into the desired category inside a spatial unit to prioritize the marketing strategies.
- Incorporation of social media information. Involving the social media information to the geomarketing decision system helps in having a broader view of the company's customers and taking into consideration their preferences (most visited places, best hangout hours, etc).
- Creation of visual aids. The integration of a thematic map can help distinguish in a clear and quick manner the zones according to the level of conglomeration of specific geoprofile consumers. The integration of this aspect can save time in focusing efforts on the selection of a targeted zone; in consequence a better time of response or implementation of the selected strategies is achieved.

Table 4.1: Commercial Geomarketing Softwares

Software Name	Software Cost	Software Description
ESRI Business Analyst Desktop (Esri, 2012)	10,463.67 euros	Basic Regional Single Use License. Analyze and compare locations using thousands of demographic and business variables to reduce site selection risks. Gain insights into customers with Esri's Tapestry segmentation based on demographic and socioeconomic profiles.
RegioGraph (Geomarketing, 2012)	7,998 euros	Analyze customer and markets on digital maps. Make more informed location decisions. All maps and GfK Purchasing Power for a European country of your choice

There are commercial tools that help making marketing decisions (see table 4.1), for the purpose of this research the selection made is using open source tools in order to reach small and medium brewery companies that can not spend the amount of money in the marketing research department. The open source tools also gives freedom to the companies to modify and use whatever kind of platform they want.

4.2 INFORMATION SOURCES

The information sources that are used as a base for geoprofilng are divided into two main sources: the consumer and place data sources. Both of them are integrated in the geomarketing decision system. The consumer data sources consists of surveys that can be made by an external provider or by internal personnel as described in the literature review chapter. For the purpose of this case we are going to use data provided in the Delft dataset (Appendix E) (Van der Spek et al., 2009). The social media data source regarding consumer information is the one obtained from Twitter which provides date, time, coordinates and text, and from Foursquare which contains information regarding places where people hangout most often.

4.2.1 Clustering Algorithms

The information from the acquired information of the Delft dataset can be classified using different methods and can lead to a clustering and classification of the data. The steps in the clustering analysis help in the decision of what type of method must be applied (hierarchical, partitioning or two-step clustering method). The next step is to check the number of cluster that can be obtained from the data, as the clustering becomes more specific is more difficult to have the required amount of data for each cluster, and the validation and interpretation of the cluster solution (see figure 4.1(Mooi & Sarstedt, 2011)).

There several softwares of clustering algorithms (e.g. Matlab Statistical toolbox, Cluster 3, CLUTO) that can help in the task of determining the right amount of clusters according to the obtained data. In this research the determination of clustering data is presented in the next section, it relies on the experts' opinion done through interviews.

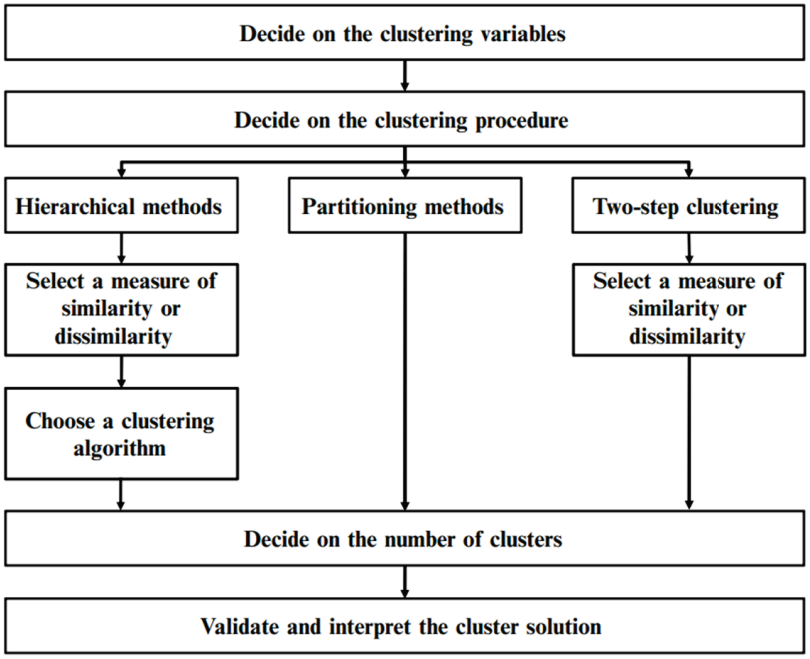

Figure 4.1: Steps in Cluster Analysis

Table 4.2: Persons Interviewed

Company	Name	Position
Rivertrend	Jesus Ramirez Peña	CEO
Heineken México	Rolando Vazquez	Marketing Strategy Manager
Libbey	Reynold Villareal Segura	Marketing Manager
Century 21 Real Estate	Eduardo Perez	Marketing Department
Heineken México	Citlali Torrecillas	Trade Marketing Department

4.2.2 Experts' Opinion

Consulting and taking information from the opinion of experts in the subject was relevant for the research. To have an experts' opinion about the relevance of spatiotemporal, social media elements in the marketing decision process, and how each of them classify geoprofiles, an interview was sent to five of them (see table 4.2). The interview consisted in answering 13 questions. After the interviews where received, the data regarding geoprofiles by age and occupation was collected, the average from the profiling by ages was made as an initial insight for the creation of the geoprofiles (Appendix A).

The interview outputs stated the importance of spatiotemporal context which can allows detect cyclic trends. The use of social media is a way to interact with consumers and receive feedback on their needs. The common attributes they used for geoprofiling were age, gender, occupation, income. The experts' answers support that indeed the use of spatiotemporal and social media elements strengthens the marketing decision process in this chapter have stated.

4.3 DATABASE MODEL

The manipulation and representation of a database system is called data modeling. A data model must record and indicate the rules, shape and size of the data elements used in the different business processes of the organization (Ponniah, 2007). The data model is the abstract representation of reality.

The conceptual model collects information in a high level of abstraction without using a particular DBMS. The choice to represent the conceptual model of the database is UML (Unified Modeling Language) because of its wide acceptance as a universal formalism for object orientated modeling (Dobing & Parsons, 2006). In this step, the conceptual schema is made to analyze and secure that the information requirements are fulfilled. It consists of a description of the requirements of the data, data type, relationships and constraints, not taking into consideration details of its implementation.

The main parts of the data model consist of the type person that has information regarding GPS tracks or social media, the type geoprofile that is entity that groups persons by age, gender, occupation. A geoprofile contains one or more persons of the mentioned characteristics, this helps in the selection of the geomarketing strategies. The influence zone type contains one or more geoprofiles in a certain time and space. The type geomarketing strategy are based on geoprofiles and each geoprofile represents a new strategy, the geomarketing strategy and partner types relate between them in that a geomarketing strategy is applied to one or more partners. The partner includes one or more products in the geomarketing strategy (see figure 4.2).

4.4 USE CASE MODEL

The use case model purpose is to represent the interaction between actors and tasks to achieve a certain goal. Within the use case there is a system boundary that contains the activities that the geomarketing strategy decision system will try to do. To illustrate this study case of the geomarketing strategy decision system, the usage UML is an effective way (see figure 4.3).

The use case description is the way to detail the use cases that are performed by the actor in a more detailed way (see table 4.3).

The activity diagram aims to model the procedural flow of actions of the different use cases. This type of diagrams shows all the sequence flows that are involved in an activity. The next two examples of activity diagrams correspond to the use cases of adding a layer in the map view (figure 4.4) and to the creation of a geomarketing strategy. The creation of a geomarketing strategy starts with the visualization of a geoprofile (composed by social media and GPS track data (figure4.2)), if it is suitable for implementing the marketing strategy, an influence zone is chosen, if a partner is inside the influence zone, then a product(s) is selected for the promotion and a strategy is chosen in a certain period of time to be implemented. In case there are no partners inside the influence zone, a cultural event can take place, an activation strategy starts, involving selected products for the promotion and a strategy is chosen in a certain period of time (figure 4.5).

An example of this is when the marketer sees in the map a specific geoprofile of interest for the company new strategy (conquer areas where the competence is increasing their sales), (s)he selects in the map the geoprofile and check if it is suitable for the according strategy, determine an influence zone to focus on the geoprofile that are in territory to implement the marketing strategy and check if there are partners inside the selected territories, in case there are, check the business type to offer the brands according to their needs. After selecting the brand(s) set a period of time for the strategy to take place. In case there are no partners inside the selected influence zone, the company can do an activation strategy which consists on introducing the brand in a cultural event, so that the consumers be aware of the brand and try it.

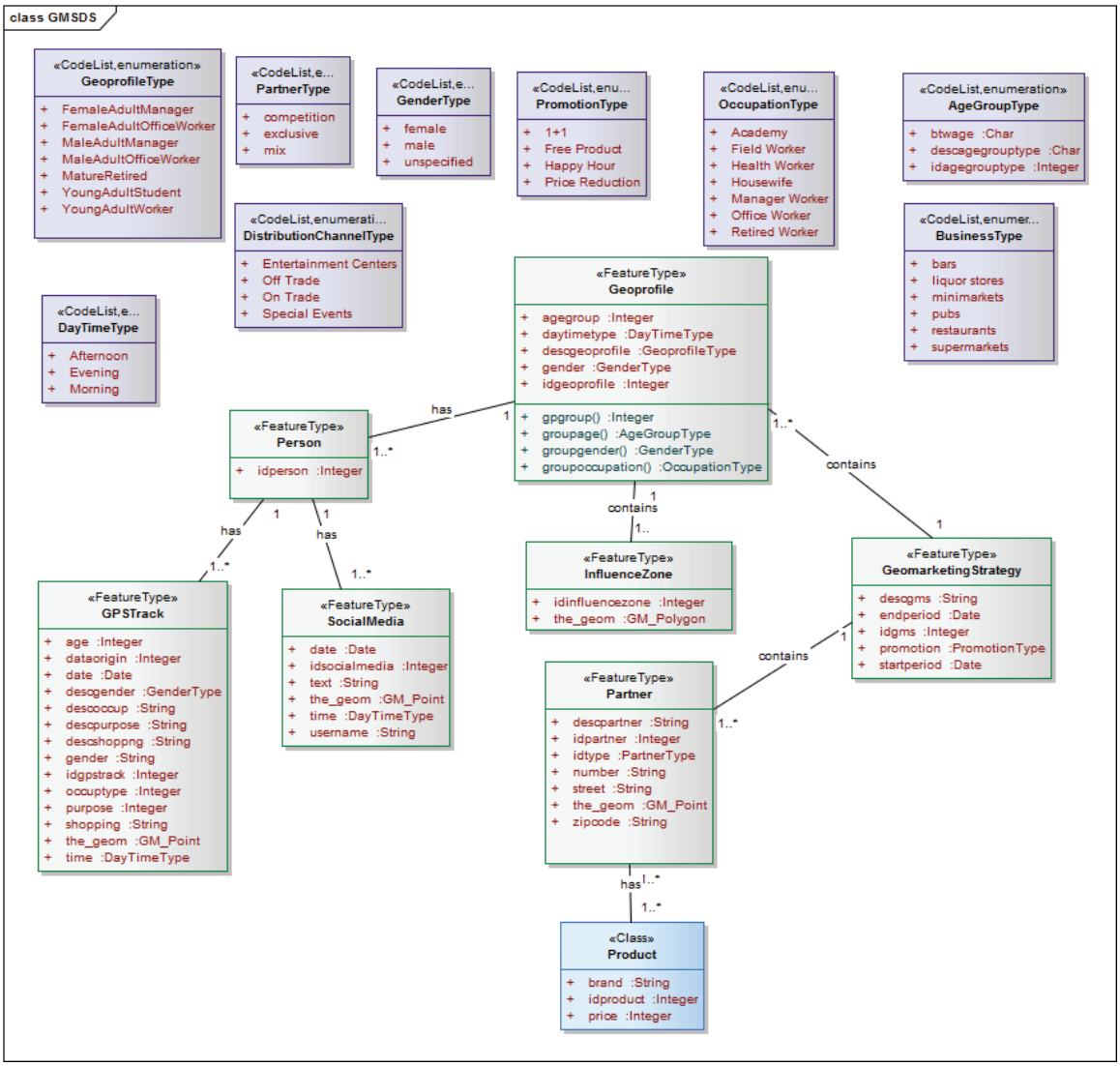

Figure 4.2: Conceptual Data Model

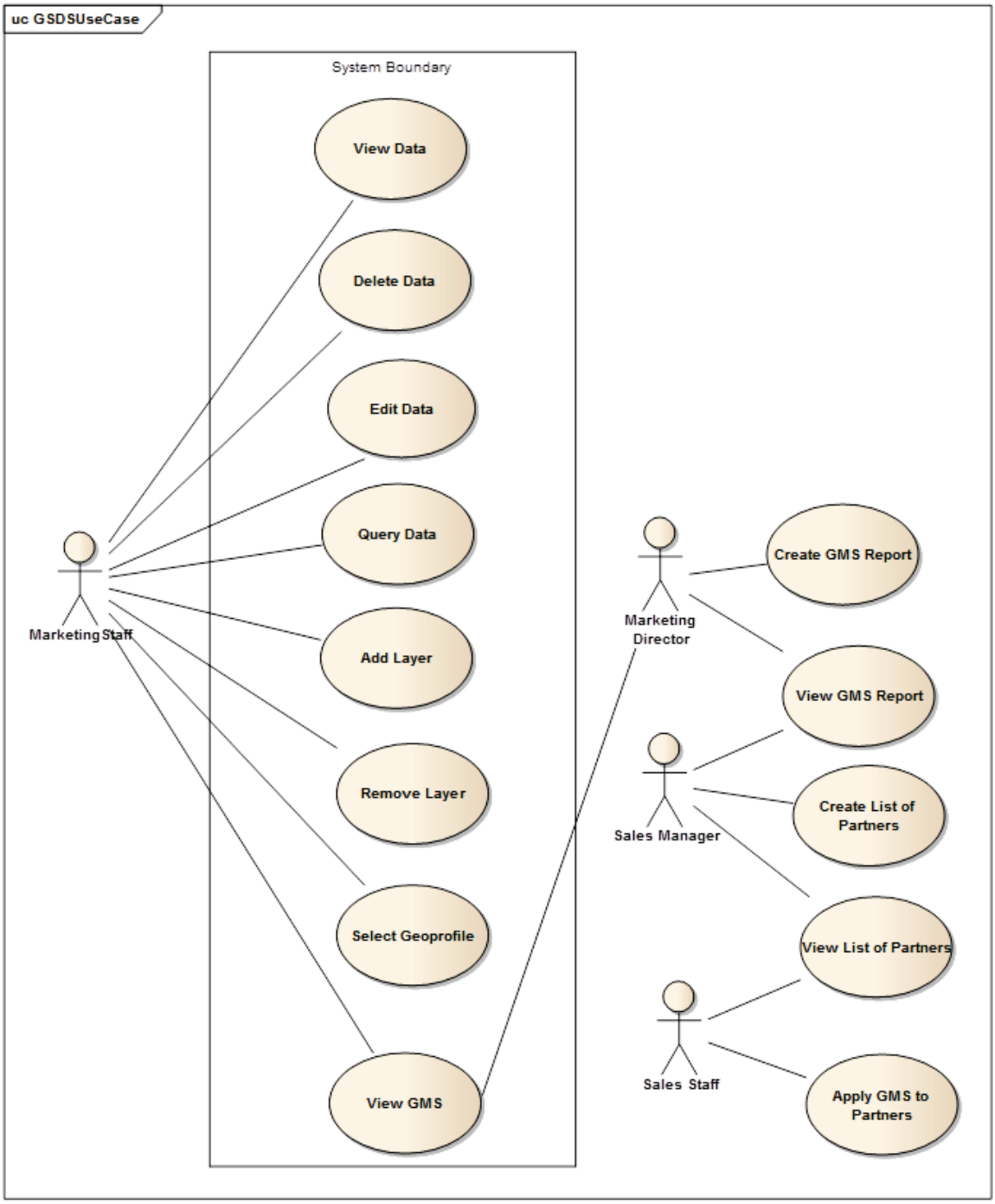

Figure 4.3: Use Case GSDS

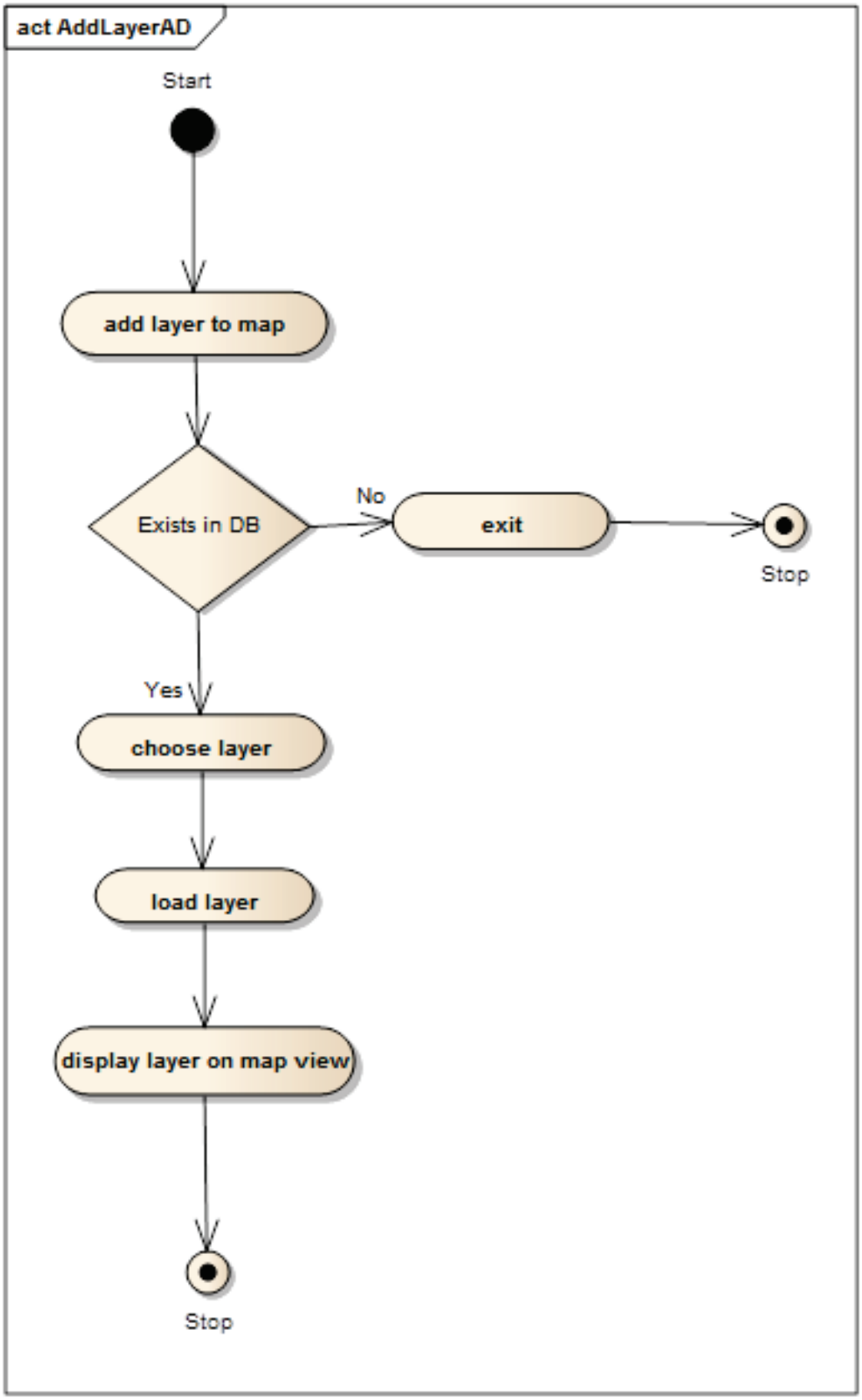

Figure 4.4: Add Layer Activity Diagram

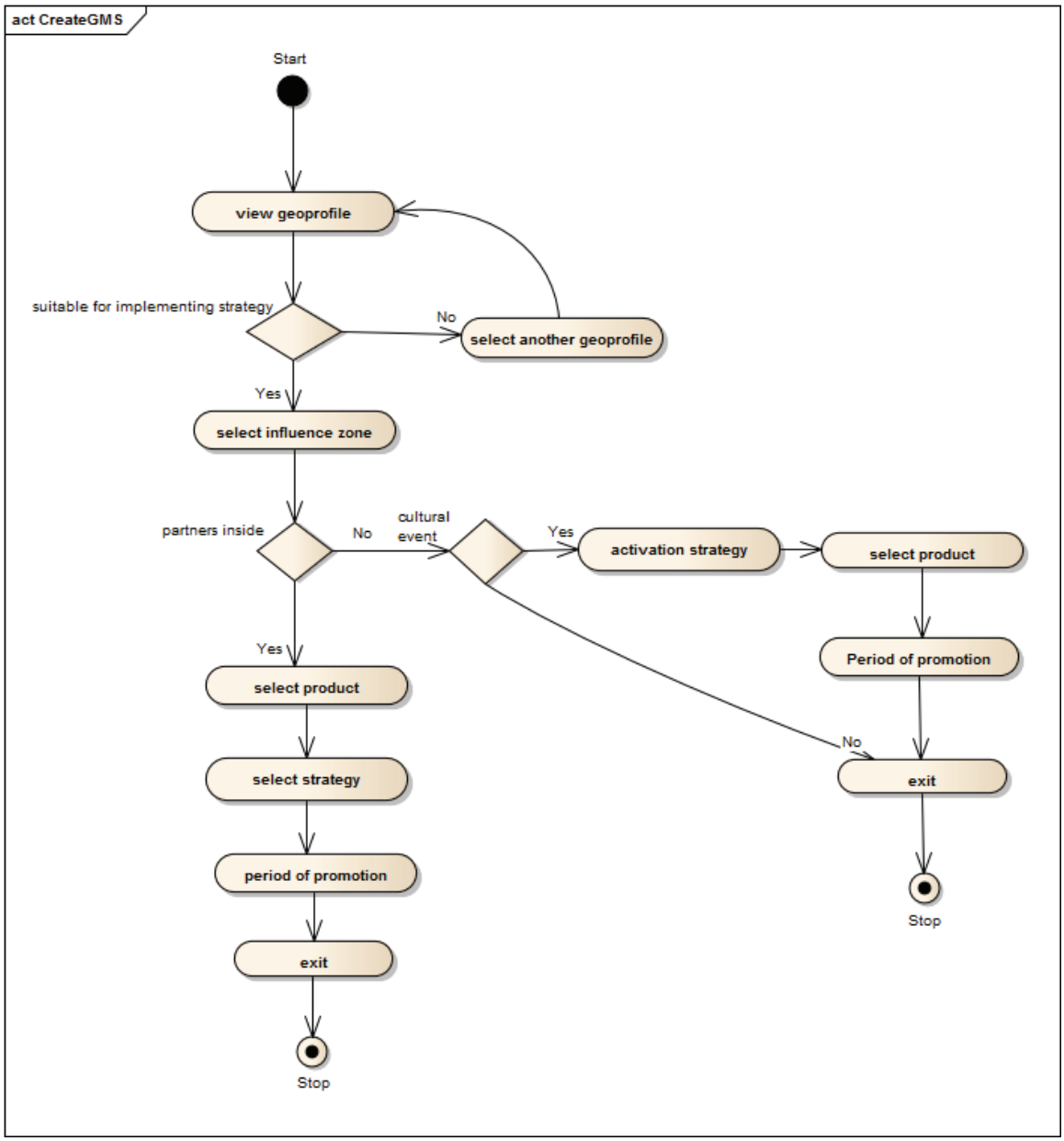

Figure 4.5: Select a Geomarketing Strategy Activity Diagram

Table 4.3: Use Case Description

Actor	Use Case Name	Brief Description
Marketing Staff	Add Layer	The user can add a layer that is on the database to the map.
Marketing Staff	Remove Layer	The user can remove a layer that is on the database to the map.
Marketing Staff	View Data	The user can view the data of the selected feature.
Marketing Staff	Edit Data	The user can edit data into the selected feature.
Marketing Staff	Insert Data	The user can insert data into the selected feature.
Marketing Staff	Query Data	The user can create a sql query from the selected feature.
Marketing Staff	View Geoprofile	The user view a geoprofile that consists of grouping person data with specific characteristics (age, occupation) and group by spatial data (area) to check where the largest amount of persons are in that certain area.
Marketing Staff	Create Geomarketing Strategy	The user can add a layer that is on the database to the map. Depending on what partners are inside the selected administrative units, the marketing strategy can be made with a specific product and promotion
Marketing Staff	View Geomarketing Strategy	The user can add a layer that is on the database to the map.

4.5 VISUAL REPRESENTATION

The visualization of the data is the first step towards understanding the information contained therein. The way to deal with geovisualization problems is to create thematic maps to arrange data in a structured way for the user, so they can analyze the data more easily.

The creation of thematic maps can help in the detection of patterns residing in the data. Some questions that can be answered are: which influence zones are the most crowded in the weekends and which influence zones are the most crowded during lunch time. Capturing this information is important in the understanding of the changes of the market and it's consumers over time.

4.6 PROTOTYPE FUNCTIONS, VIEWS AND INTERACTIONS

A prototype is a development methodology that is constructed to give the user the overall idea of how the functionality, interface, and visualizations are going to work (Zant, 2005).

The application architecture was be designed using three tiers: data, application and user (figure 4.6). The data layer is where the information is stored and retrieved from the database. The application layer contains the business logic and processes the data between the presentation and the data layer. The client layer that is the interface the user will be interacting with. For the purpose of the case study, the software selected for the development of the interface is OpenGeo Suite, this suite provides the tools for developing web applications.

The prototype has the following interactions, functions and views to generate the geomarketing decision process required.

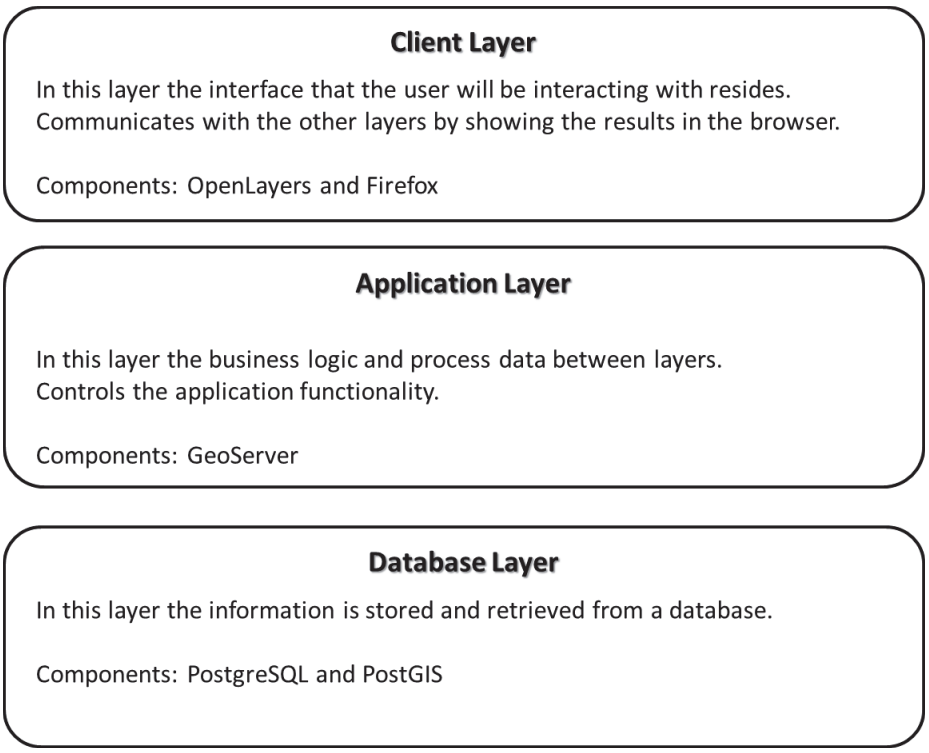

Figure 4.6: System Architecture

Data visualization: The user is able to see each point's attributes in a pop-up window. By clicking the element, all the information regarding this object displays giving detailed information.

Layer Filtering: Due to the different users interest's, a filtering option is provided to show/hide layer(s) for a better interpretation of the information on the map.

Zooming: Visualizes the data in different scales the user zooms in and out to see the information in the different scales this function gives.

Querying: The user is be able to create querys of the layers available to filter the content, so they can focus on certain constraints and display the results in the map.

Thematic mapping: to create knowledge of the information displayed, thematic map layers are provided to focus in the desired area to apply geomarketing strategies.

The user interface consists of the following: in the central panel a map is going to be displayed. In the upper panel the tool bars can be accessed. In the upper left panel, the visible layers can be displayed. In the left center panel the legends of the layers are located. In the bottom panel the detailed information on the selected feature can be displayed (see figure 4.7).

4.7 SUMMARY

This chapter explains the creation of the database through its different stages as well as the prototype requirements to demonstrate the contribution of spatiotemporal and social media in a marketing strategy. The structure of a geoprofile consist of the following: the combination of an area to contain the spatiotemporal data, the geoprofiles resulting from the grouping of age, gender, occupation, time of the GPS tracks social media data from Twitter and Foursquare. The description of the use case and the activity diagrams illustrates in a more visual way all the interactions that exist between the actors and the protoype. Each use case inside the geomarketing strategy decision system is also addressed. The system architecture and the description of each

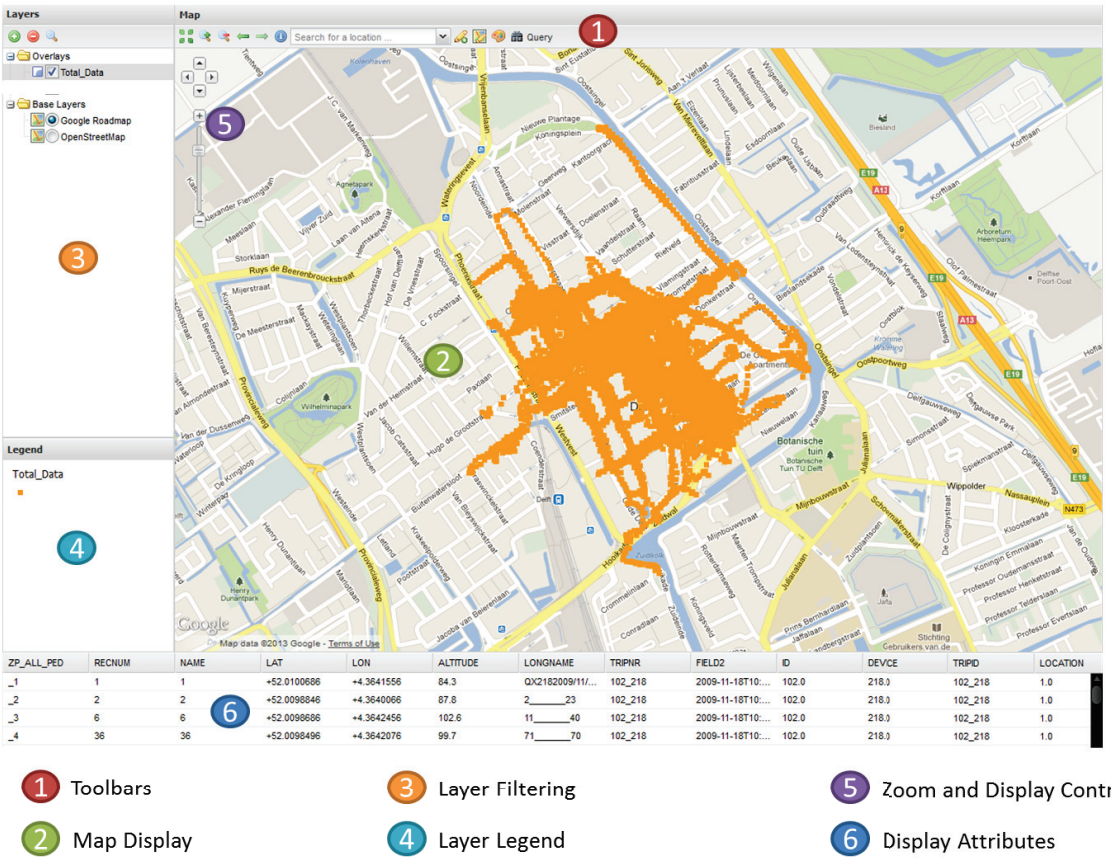

Figure 4.7: User Interface

layer required to build the prototype. The functions, views and interactions of the system are described to achieve the users objectives.

Chapter 5
Prototype Implementation

In the previous chapter, the prototype design and data models where presented. This chapter illustrates the database preparation, as well as the steps, components and implementation process; and later application and user implementation layers are addressed. The presentation of the final view of the prototype and functionality is treated in later sections.

5.1 DATABASE IMPLEMENTATION

To manage and make the data accessible, PostgreSQL database in addition with PostGIS were the option to place the obtained information (Delft GPS tracks, social media and delft buildings). This software was selected because is open source. The option of being focus on open source software is because the small and medium breweries can not afford an expensive geomarketing tool for their needs. The database was constructed following the database model in section 4.3. The geometry and the timestamp columns were added to the tables containing the social media data to match all the data types between the tables.

5.1.1 Time Division

The datasets were divided into 3 parts to illustrate the different locations the consumers are in a certain time. The division is as follows: morning (6:00 to 12:00), afternoon (13:00 to 16:00), and night (17:00 to 5:00). The decision was made to show consumers in all the times of the day in the Delft dataset because there is no record beyond 19:00. The time division results in the creation of the daytimetype table.

5.1.2 Creation of Geoprofiles

The heterogeneous nature of consumers is a reason for brewery companies to diversify its different brands. The creation of a profile according to the characteristics of specific target groups helps to focus the efforts in their marketing campaigns. The criteria for the grouping of the consumers was obtained from the expert interviews, in which each one stated their opinion about age and occupation (Appendix A). Table (5.1) lists some of the geoprofiles created for this case study.

To capture different consumers in a spatiotemporal element the creation of an influence zone (buffer around a partner) was made. The partners help provide the geoprofiles of people inside this area because they also serve as anchor point for developing the influence zone. Zones can vary in size according to the needs of each marketing campaign. With this zones we can also look at individuals inside the areas, it is the beginning of the data used to create personalized marketing campaigns.

The geoprofiles are not used by consumers only, but they are also relevant to the partners. The geoprofile of a partner contains attributes like distribution channel (off trade, on trade, events), types of business (bar, restaurant, theater, supermarket), exclusivity (exclusive, mixed, competitor) and even social media data (Foursquare check-ins). These characteristics determine where the

Table 5.1: Geoprofiles

Id Geoprofile	Geoprofile Name	Geoprofile Description
1	Young Adult Student	Consumers between 18 and 35 years that are realizing their studies regardless their gender.
2	Young Adult Worker	Consumers between 18 and 35 years that are working regardless their occupation and gender.
3	Male Adult Office Worker	Male consumers between 36 and 60 years that work in offices(administrator, bank employee, graphic designer).
4	Female Adult Office Worker	Female consumers between 36 and 60 years that work in offices(administrator, bank employee, graphic designer).
5	Female Adult Manager Worker	Female consumers between 26 and 60 years working in managerial positions (administrative manager, project manager, business leader)
6	Male Adult Manager Worker	Male consumers between 26 and 60 years working in managerial positions (administrative manager, project manager, business leader)
7	Mature Retired	Consumers 61 or more years that are retired regardless gender.

company can drive their strategies to make sure that this action is not affecting their own nearby businesses.

In a broader aspect the information on how many and what type of businesses are in a block (building segment) a geoprofile of the block is created. This helps the decision maker check what expansion strategies can be viable for application (e.g. conquer or mix competitor businesses, invest more in an exclusive one, or if the case there are no businesses nearby construct one).

5.2 APPLICATION LAYER CONSTRUCTION

The tool selected for the the construction of the prototype was OpenGeoSuite (*OpenGeoSuite*, 2012). This suite contains PostgreSQL + PostGIS, Geoserver and OpenLayers. The geospatial data needs to be accessed, processed and edited. Geoserver (*GeoServer*, 2012) is making this operations possible in the application layer. Assigning a name and a URL for the new workspace is the next step. The prototype resides in a localhost.

The first step was creating a working space which contains all the layers needed by the user. After completing the creation of the workspace, the creation and configuration of a data store (selection of the source and type of file to upload to the geoserver) is next and here is where the connection between the PostGIS database and the server resides.

The creation of the layers that are going to be displayed for the user need to reside in the server. In this phase the selection of layers that are important to the user from the database is needed. The layers used from the database are: the footprints of Delft buildings, the person layer (which consists of the geoprofile data capture from different sources), partner and the influence zone.

5.3 USER INTERFACE CONSTRUCTION

The presentation tier is the one that allows the user to interact with the system and extract information from it. For the navigation and visualization of the map OpenLayers was utilized. The base map used for this case study is Google Maps. The interaction with the user was created using GeoExt (ExtJS extension) which connects to OpenLayers. The user has the ability to insert or remove layers from the workspaces created in GeoServer. The coding for the components, the final display and functionality of the interface was done in Javascript (Appendix F).

The user can view the data of the selected layer in the bottom part of the prototype's display screen, in this data navigator residing in the lower panel, the user can select records and display them on the map as a selection. The user can add, edit or remove data from layers to keep the information updated. Embedded is a location search, which allows the user, in case of having layers on different locations type the name of the location, to redirect them to the selected place.

To do some data consultation like displaying the information of certain people in a group age, a query interface can be accessed from the tool bar. This allows the user to do simple queries as the mentioned before from the layer selected to obtain the filtering required.

5.4 VISUAL OUTCOME

The visual part is an important element of the prototype because it helps the user to get information in a quick way. The each layer has its respective visualization. The person layer consists of a qualitative thematic map that distinguishes different attributes by colors. The partner layer consist on a proportional map to indicate by size which partner has more checkins.The delft building layer consists of a choropleth map that is based on the quantity of partners that are in each block. The influence zone layer consists also on a choropleth map to show the amount of persons that are in each zone.

The representation of the data in form of thematic maps can help the user center his/her attention to specific places. These places normally are the ones where the efforts can be made. The more persons in a certain spatiotemporal area, the more likely an impact can be created when applying a geomarketing strategy. Patterns are likely to appear in the information and applying the thematic maps makes this task easier for the user.

5.5 SUMMARY

In the present chapter the components and the implementation of the prototype in its different layers is addressed. The technology that was utilized to construct the prototype is also shown. The description regarding the user interface and the functionality the user can afford with the prototype is explained with verbal and visual aids. The following chapter presents the results of the prototype.

Chapter 6
Results and Discussion

In the previous chapter, the prototype implementation is addressed. This chapter presents the results of the prototype and the marketing staff to discover consumer patterns. The visualization of this patterns lead to decisions on what geomarketing strategy needs to be applied. The discussion section presents the reflections on the contribution of this study to the geomarketing field.

6.1 CONSUMER PATTERN IDENTIFICATION

To sustain a competitive advantage over time, companies need to develop innovative marketing solutions that enhance an organization's competitive position focusing in the customers and the shareholders (Doole & Lowe, 2012). The marketing strategy decision process consists of various steps that can lead to more focused geoprofiles. The detection of patterns inside each geoprofile can produce insights that can be studied separately.

The first step required to achieve a sustainable marketing strategy is knowing where the consumers are. The fact of knowing where consumers normally spend their time can help decide the areas that the company may be interested in. There are several actions that the company can take depending on its objective (expand, conquer, mix or block). The overall view of the consumers in the map can help in the selection of the geoprofile that can be selected for further analysis (see figure 6.1).

The next step is to center the attention on the desired geoprofile (e.g. female adult office worker) and view all the data about it. By doing this, patterns of populated zone(s) can emerge giving insights of a spatial arrangement regardless of time variable (see figure 6.2).

Consequently, taking into consideration the time variable, the patterns of the targeted geoprofiles in each of the time divisions (morning, afternoon and night) can be checked. Focusing on the most crowded places in each division can help decide the area(s) of interest and get information of the locations (see figure 6.3).

The attention on this next step is checking which area(s) have the bigger amount of partners. The more facilities in an area, the more likely the people are attracted to it (Reilly, 1931). This sets the base for the anchor points of the influence zones, the ones that captures the selected geoprofiles (see figure 6.4).

Now that the anchor points for the marketing strategy have been set, establishing the influence zone that is going to be covered for the implementation of the marketing strategy can be framed. The size of the area can vary according to the desired strategy to be activated (see figure 6.5).

The final step on the implementation of the marketing strategy is to determine the type of promotion to be applied, the partner, date, and time the offer is going to be active.

6.2 DISCUSSION

The inclusion of spatiotemporal and social media elements strengthens the way marketing strategy decision processes are made. The recognition of consumer patterns in space and time focuses

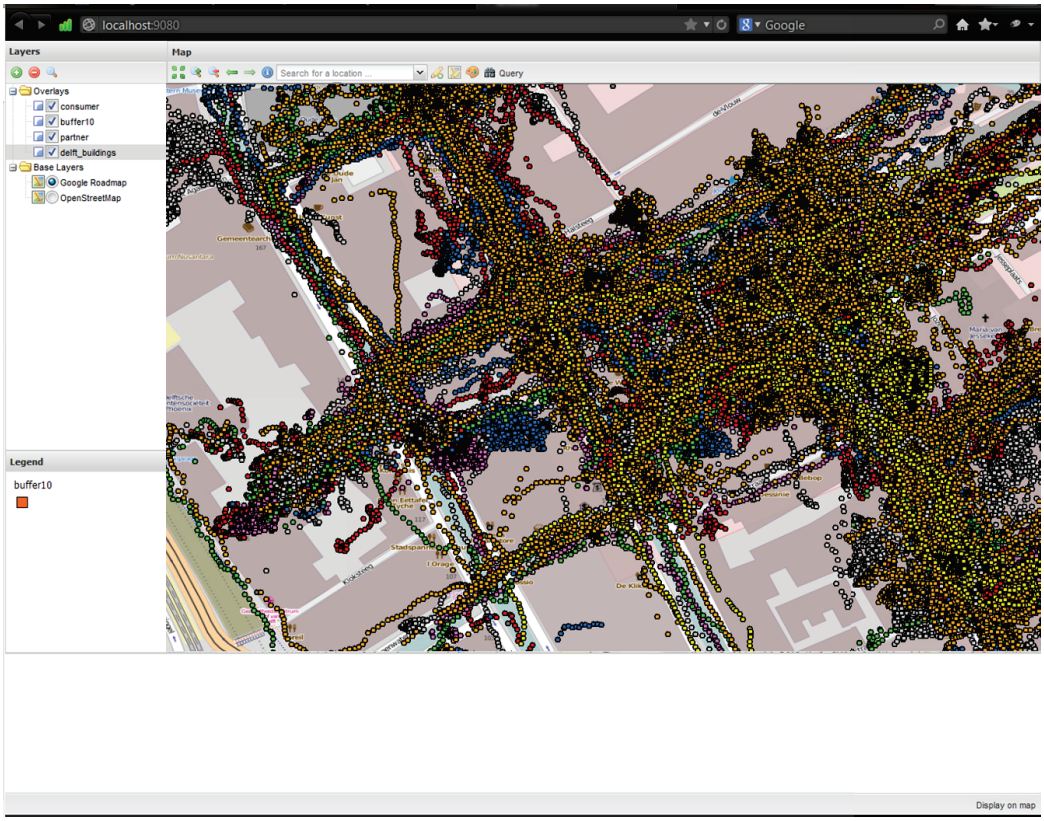

Figure 6.1: Geoprofiles

marketing strategy efforts on the desired targeted geoprofiles. A segmentation approach can add clarity to the process of marketing planning, by highlighting the marketing programme requirements of particular customer groups (Dibb, 1998).

The integration of the social media component helps capturing consumer's habits and is an inexpensive platform. This data is useful because it gives insights such as emerging trends, competitor activities, identifying engagement opportunities without paying for a study in field. There are some geomarketing solutions that offer geomarketing analysis but are too expensive to be afforded by small or medium businesses. Difficulties modifying the source codes were encountered in the process of downloading social media data.

The construction of the prototype was made using exclusively open source software, this option can be accessible to all people. The construction of the prototype represented a challenge because of the use of a new technology used and the few experience as a programmer. There is several functionality in the prototype that can be improved in future work.

In a geovisualization environment, maps are used to stimulate visual thinking about geospatial patterns, relationships and trends (Kraak, 2003). The choropleth map, the qualitative and quantitative visualization techniques were used in order to generate instant knowledge in the user such as: the distinction of geoprofiles, the identification of best selling partner and the most crowded area in terms of partners. The visualization techniques can be expanded if new dimensions of the data are obtained. Due to the limited time span permitted for this study, only some visualization techniques were explored.

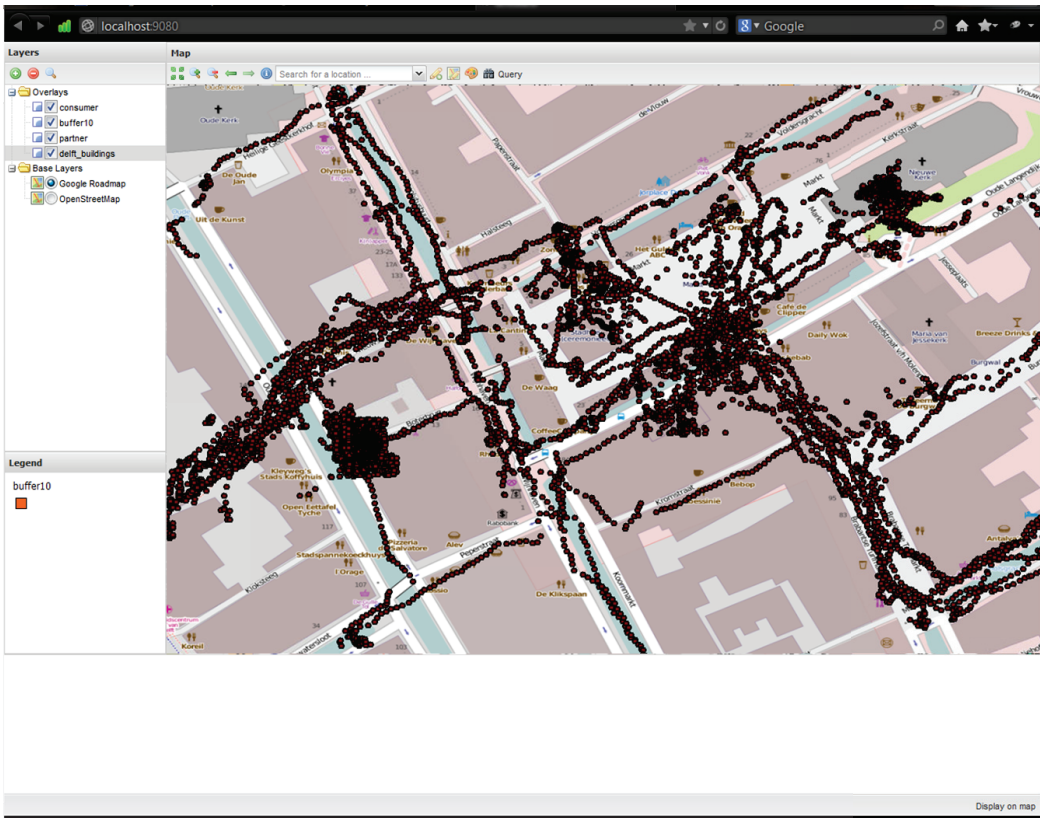

Figure 6.2: Adult Female Office worker

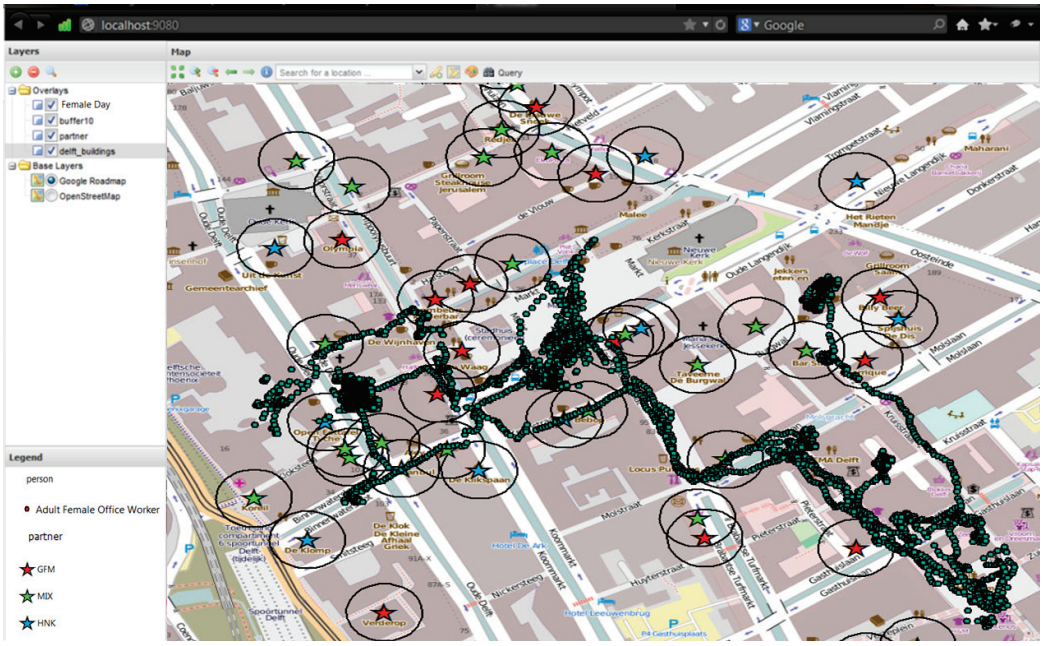

Figure 6.3: Day Adult Female Office Worker

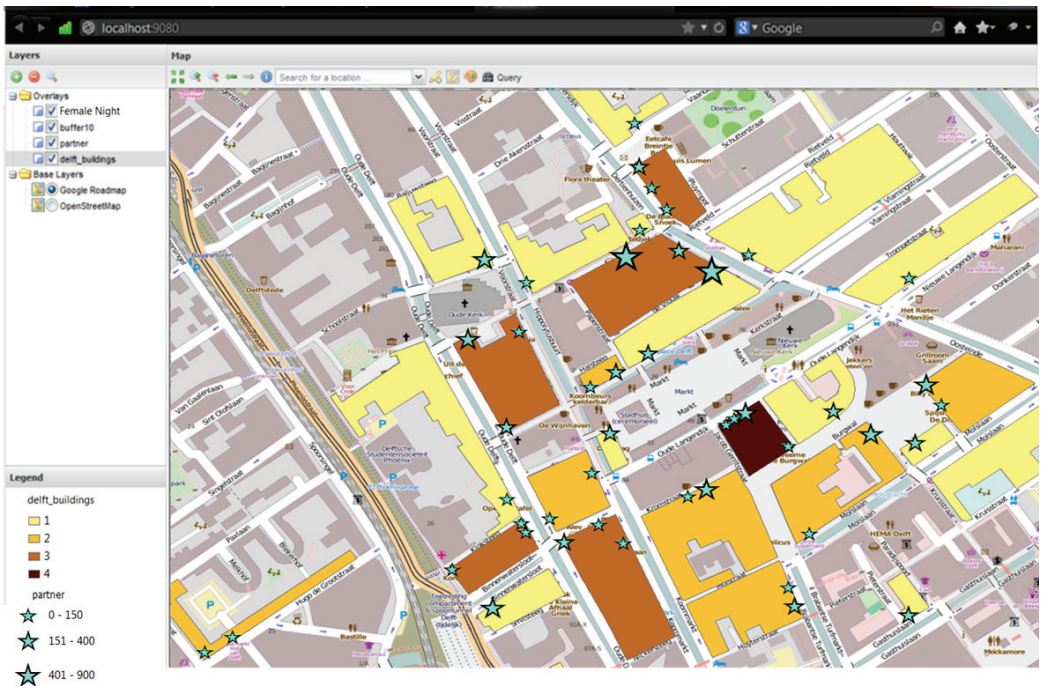

Figure 6.4: Partners Inside Buildings

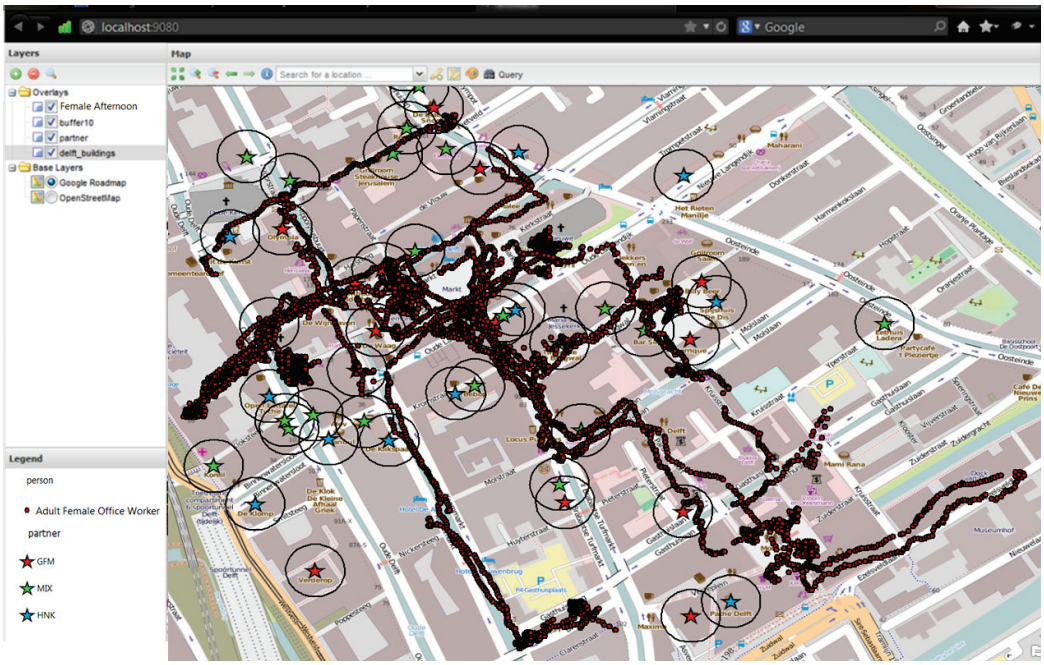

Figure 6.5: Influence Zone

6.3 SUMMARY

In the present chapter the results of the prototype showing patterns that can emerge from the use of spatiotemporal and social media data are exposed. The description regarding the user interface and functionality the user can afford in the prototype were explained with verbal and visual aids. The discussion of this reserach's contribution of the research to the marketing strategy decision process is illustrated. The following chapter presents the conclusions of the study and recommendations for further research and development.

Chapter 7
Conclusions and Recommendations

The main objective of this research is to demonstrate and underline the importance of the incorporation of spatiotemporal and social media data into the marketing strategy decision process. A case study and a prototype were developed as proof of this concept. This chapter shows the results achieved in each of the specific objectives as well as the recommendations for further investigation and development.

7.1 CONCLUSIONS

Each research objective is going to be addressed in the following section along with the outcomes of this research.

Create a conceptual framework to support the geomarketing decision systems using of spatiotemporal context.

- What is the structure of a geoprofile?
- What information from the spatiotemporal context and social media support the marketing strategy decision process?

The literature review was made at the beginning of the research phase and consisted of searching, reading and comprehending what were the elements of a geoprofile and how these elements can help in the definition of the structure of a geoprofile. The structure of a geoprofile consists of the combination of different data from diverse sources to create a profile of the people (e.g.surveys, questionnaires, social media, municipality). The information generated by surveys such as age, gender, occupation as well as the information obtained from the social media (latitude, longitude, date, time) help support the geomarketing strategy decision system giving more insights of the consumers. The definition for geoprofiling in this research was determined as the grouping of consumers by their personal and spatiotemporal data characteristics. The conceptual framework achieved to explain the importance both elements(spatiotemporal and social media)in the geomarketing strategy decision process.

Develop a prototype to help build marketing strategy decisions taking in consideration the spatiotemporal context and the social media.

- What is the conceptual model of the geomarketing decision system?
- Can the use of spatiotemporal context and social media help find patterns?
- Does the prototype help as an input for personalized marketing campaigns?

The first phase of the development of the prototype was investigating, testing and modifying diverse APIs to obtain the data from the two social media sources (Twitter and Foursquare) that met the requirements of the prototype. The next step was developing a case study to set the context of the research, understanding the different datasets and workflows of the Delft, Foursquare and

Twitter datasets. The following step was the design and construction of the prototype. In this phase the conceptual model of the database and the use cases of the geomarketing strategy decision system were illustrated and developed for the conceptual model of the geomarketing strategy decision system. The following phase of the prototype development consisted on the implementation. This phase was achieved using various open source software components. The final phase consisted of checking the results of the prototype by testing it, in this stage the discovering of patterns utilizing the different datasets was addressed, due to low amount of days the suggestion is gathering more data in time to make sure the patterns are consistent and not only a coincidence. The prototype is able to detect individuals that are part of a specific geoprofile, this information can be used as an input for the development of personalized marketing campaigns (Chapter 5).

Use visualization techniques to represent geoprofiles in the marketing context.

- Which visual representations could help interpret the outcome results?

The base maps are an essential part of the visualizaton for this purpose the decision of putting Google Maps for the user was made. The way of representation of the outcome consisted of using qualitative thematic map according to the type of geoprofile of the consumer. For the areas the implementation of choropleth or quantitative thematic maps were used to represent the density of features in each area. This was made so that the marketing staff can quickly locate the areas they want to focus on.

7.2 RECOMMENDATIONS

Certainly there is room for further inquiry and development on the topic. The next recommendations are the ones proposed as the next steps to further improvement of the prototype and further investigation of the topic.

- The creation of a wizard for making geoprofiles on the fly. In the actual research the geprofiles are based on the experts' opinion. This helps improve the user experience having different scenarios each on a separate layer for comparison.
- Provide the option of time aggregation and time splitting. This helps the user to manage periods of time dynamically and in the understanding of consumer patterns in the market.
- The possibility of creating thematic maps on the fly to explore the different visual representations. This helps the different users to make thematic maps according to their needs on the presentation of the data.
- Real time integration of the social media data. This helps detect big events or gatherings in real time, and can help the decision maker apply immediate actions for the specific situation.
- Integration of sentiment analysis. The integration of sentiment analysis to get more insights about the costumer feelings toward the brand.
- Further research on how Location Based Services can be integrated into the system and help attract more consumers. The integration of the LBS to the geomarketing strategy decision system can help in the goal of developing a highly personalize marketing.

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Appendix A
Interview

A.1 INTRODUCTION

Good day. My name is Federico Figueroa and I'm a student of ITC. I'm applying the next interview for my MSc. topic regarding the use of spatiotemporal context, social media and geoprofiling in the marketing strategy decision process.

The objective of this interview is to gain knowledge about the marketing strategy decision process and the importance of profiling customers in the context of location and time of the day using different social media sources. The specific facts I want to learn from this interview are the following: is social media a factor in marketing strategy decision making? Does spatial and temporal context play a role in the marketing strategies? Is profiling used as a tool to personalize marketing strategies?

The outcome is an interface that shows a thematic map by different topics such as age of people, time of the day, types of places, clustering of people. The information of the elements is accessed at any time. The strategy section suggests the user a marketing strategy to develop based on the marketing strategy information learned from experts' advice and literature review. Also with the accumulation of data the user is able to detect patterns and gain insights more quick to apply the best marketing strategy decisions.

All the information gained from this interview is strictly confidential, only for research purposes and supplied on the understanding that it should be held confidentially and not disclosed to third parties.

A.2 INTERVIEW QUESTIONS

1. Is the geographic location an important variable in your profiling? Why?
2. What other aspects do you take in consideration when doing profiling?
3. Which parameters do you take in consideration for customer profiling?
4. According to the following variables (age, gender, occupation) make clusters and specify them.
5. What is the relevance of location and time in your marketing strategy decisions?
6. Is there a department that takes care of social media and interactive marketing?
7. Do you use social media as a way of interaction with your customers?
8. What methods do you apply to detect consumer behavioral patterns?
9. Do personalized marketing play a role as a part of your marketing strategy?

10. How do you incorporate what you do on the social media with the traditional advertising and marketing? Can you give me one example?

11. What is the future perspective of social media in your company and in general regarding its use on the marketing strategy decisions?

A.3 INTERVIEW ANSWERS

Rolando Vazquez (Heineken México)

Is the geographic location an important variable in your marketing segmentation? Why?

Yes, because there are differences in the way that consumer perceives the shopping experience, the image or personality they want to impress with the product.

What other aspects do you take in consideration when doing market segmentation?

Attitudes towards brewery industry, attitudes towards style, shopping style, Consumption style.

Which parameters do you take in consideration for customer profiling?

Socioeconomic level, Age, Gender, Geography, Product type, Product Price, Shopping place, Occupation, Way of consumption: lonely, accompanied.

According to the following variables (age, gender, occupation) make clusters and specify them.

Age: 18-33 Young Adult, 34-60 Adult, 60-more Mature.

Gender: Male, Female.

Occupation: Office Worker, Managerial Worker, Field Worker, Student, Retired.

What is the relevance of location and time in your marketing strategy decisions?

Location is a very important variable because not all the products are for all the places, it means selective distribution.

Time is the other variable is always changing tactical execution it involves promotional period which is a totally controllable variable by the company, but there are other timelines that are uncontrollable like promotional execution partnering with soccer teams: what if they win or loose, what if they are in the fight for the championship.

Is there a department that takes care of social media and interactive marketing?

Yes, and it is a recent creation, in the past their responsibilities were only digital media which were to maintain a website. Today is starting to manage Facebook and Youtube, it is just small part but it is a start.

Do you use social media as a way of interaction with your customers?

Yes and no, Yes because is a future goal, no because now is just listening and publish promotions which means right now social media is treated as another media mass channel but sooner or later the consumer will demand bi-directional and customized interaction, that is why I say in the near future and with a better understanding of Social Media the company will be attending the consumers properly.

What methods do you apply to detect consumer behavioral patterns?

Market research as a result of sales front line feedback, this means, sales reps starts to observe or experiment trends in the local market which makes the sales grow or diminish, based on that hypothesis are built and then Intelligence department start one or several studies (qualitative first, quantitative then) in order to confirm or reject hypothesis and recommend tactical approaches.

Do personalized marketing play a role as a part of your marketing strategy? No, because is very massive product, instead strategy is complemented with micro-targeting which can serves a small part of a city. Can use as many micro-targets as they are needed.

How do you incorporate what you do on the social media with the traditional advertising and marketing? Can you give me one example?

By now is just a few actions: Includes the link to a better explanation of a sponsored or promotional activity. Uploading videos to a brand page in order to win a prize (Independence Day best Mexican scream by Tecate).

What do you think are the non-financial benefits of the social media? Well talking about beer industry always will be financial benefits thru connecting with consumers if we do this perfect we will have more engaged consumers that will love our product or our brands which at the end will be converted into sales due to a solid increase of brand equity building using Social Media.

What do you think is a downside of using social media in the marketing strategy decisions?

As a company you cant't take advantage of the mass media productions, it has to be a very customized and careful communication, the brands must talk all day not only ten or fifteen times a day like the commercials on TV, and should talk in a very creative way giving the same message but in many different forms.

What is the future perspective of social media in your company and in general regarding its use on the marketing strategy decisions?

Social Media is right now a very poor channel to communicate with beer consumer, we have to push a lot to be present in the consumer's social networks this is the real challenge, because consumers don't want to be a part of a company's website, people want to connect with other people and we must do something to be there because the other way around is almost impossible to attract them without spend millions.

Appendix B
Activity Diagrams

B.1 ACTIVITY DIAGRAMS

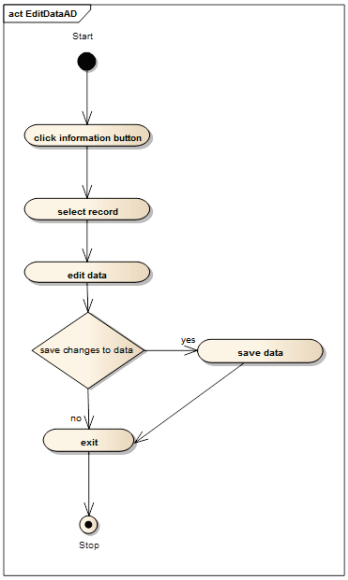

Figure B.1: Edit Record Activity Diagram

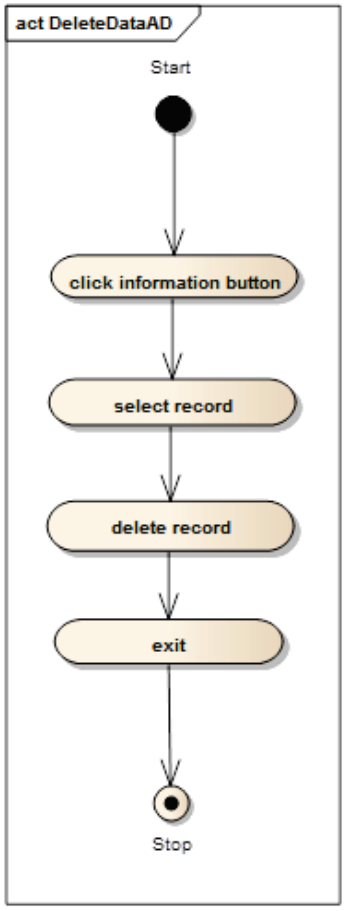

Figure B.2: Delete Record Activity Diagram

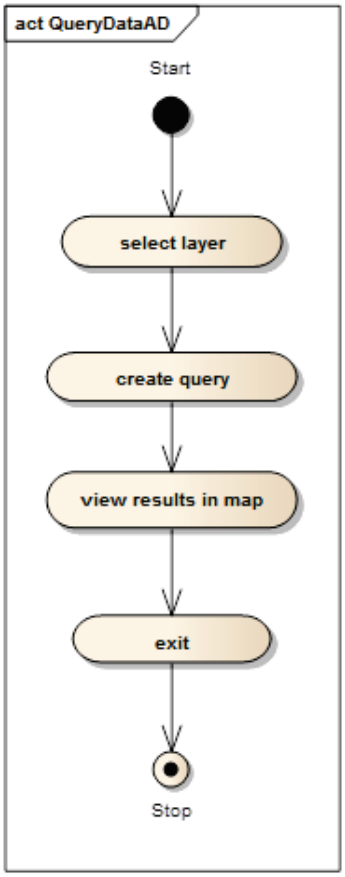

Figure B.3: Query Record Activity Diagram

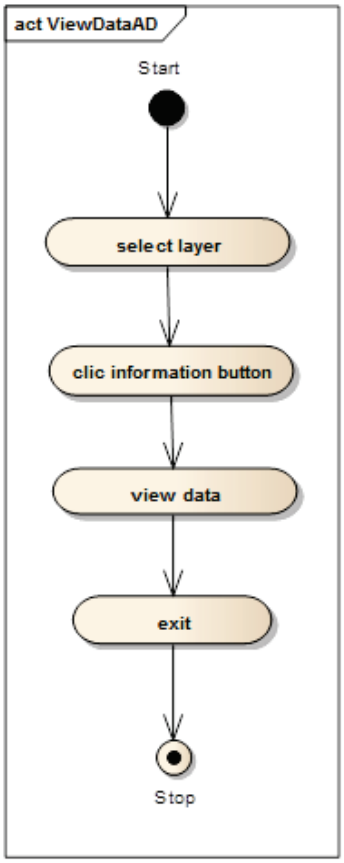

Figure B.4: View Record Activity Diagram

Appendix C
APIs

C.1 TWITTER API

```
import codecs
import csv
import json
import os
import time
import urllib
import urllib2
import urlparse


DEBUG = True

def DEBUG(message):
if DEBUG:
print message

# parse qs for 2.6.
try:
parse_qs = urlparse.parse_qs
except:
import cgi
parse_qs = cgi.parse_qs

def getLastMaxID(fileName):
'''Read  tweet list to see max_id can be.'''
idList = []

for line in codecs.open(fileName, 'r', 'utf8'):
try:
idList.append(int(line.split(',')[0].strip()))
except:
pass

return min(idList)

def json2tuple(tweet):
''' Convert a JSON to a tweet tuple. Change to include more or less data'''
```

```
# Clean geo field
if tweet['geo'] == None:
tweet['geo'] = ""
elif tweet['geo']['type'] == 'Point':
tweet['geo'] = ','.join(map(repr, tweet['geo']['coordinates']))

# Clean text field
tweet['text'] = tweet['text'].replace('"','""').replace("\r","").replace("\n","").replace("\t

return ((tweet['id_str'],# Tweet ID (Essential)
tweet['from_user'],# User
tweet['geo'],# Geostamp
u'"{0}"'.format(tweet['created_at']),   # Timestamp
u'"{0}"'.format(tweet['text']) # Tweet content
))

def doQuery(queryParameters):
'''Execute a query and return the JSON results.'''
queryURL = "http://search.twitter.com/search.json?" + urllib.urlencode(queryParameters)

# continue if possible.
try:
DEBUG("doQuery: Fetching {0}".format(queryURL))
queryResponse = urllib2.urlopen(queryURL, timeout=10)
except urllib2.HTTPError, E:
DEBUG("doQuery: Got an HTTP exception {0}".format(E.code))

if E.code in [400, 420]:

time.sleep(600)
elif E.code == 503:

time.sleep(60)
else:
# quit if none of the above.
sys.exit(-1)

return json.load(queryResponse, encoding="UTF-8")

def doSearch(term, resume = True, delay = 10):
'''Search and download historical data.'''

queryParameters = dict(q=term,
rpp=1000)

nextPage = None
maxID = None
```

```
fileName = "tweets_{0}.csv".format(term.translate(None, '?/\?%*:|"<>.'))
if resume and os.path.exists(fileName):
maxID = getLastMaxID(fileName)

while True:
if nextPage:
'''This means we are currently paging through results.'''
DEBUG("doSearch: nextPage")
nextPageFields = parse_qs(nextPage)
queryParameters['max_id'] = nextPageFields['max_id'].pop()
if nextPageFields.has_key('?page'):
queryParameters['page'] = nextPageFields['?page'].pop()
else:
if queryParameters.has_key('page'):
del queryParameters['page']
else:
if maxID:
'''
This means we either just started downloading
after resuming from file or that we need to start
the paging process over.
'''
DEBUG("doSearch: !nextPage, maxID={0}".format(maxID))
queryParameters['max_id'] = maxID
else:
'''
First time querying!
'''
DEBUG("doSearch: !nextPage, !maxID")

print queryParameters
jsonData = doQuery(queryParameters)


if jsonData.has_key('next_page'):
nextPage = jsonData['next_page']
else:
nextPage = None
if queryParameters.has_key('max_id'):
del queryParameters['max_id']

if queryParameters.has_key('page'):
del queryParameters['page']

tweets = map(json2tuple, jsonData['results'])

tweetFile = codecs.open(fileName, 'a+', 'utf8')
for tweet in tweets:
```

```
tweetFile.write(',').join(tweet) + "\n")
tweetFile.close()

if len(tweets) <= 1:
DEBUG("len(tweets) = 1 => breaking.")
break

maxID = min([int(tweet[0]) for tweet in tweets])

time.sleep(delay)

if __name__ == "__main__":
doSearch("#grolsch")
```

Appendix D

SQL

```
-----------------------------------------------------------------------
--CREATION OF PERSON_TIME (To divide timestamp into day and time (hour))
-----------------------------------------------------------------------
insert into person_time (id_gpstrack,age,idgender,idoccup,no_day, no_hour,
iddataorigin,geom)
select distinct id_gpstrack,age, gender,idoccup,date(day_time) as date,
extract(hour from day_time) as hour,dataorigin,geom
from gpstrack
group by id_gpstrack,age, gender ,idoccup, date, hour,dataorigin,geom

-----------------------------------------------------------------------
--CREATION OF TWEET_TIME (To divide timestamp into day and time (hour))
-----------------------------------------------------------------------
insert into twitter_time (idtweet,username,no_day,no_hour,iddataorigin,
topic,text,geom)
select distinct idtweet,username,date(day_time) as date,
 extract(hour from day_time) as hour,dataorigin,topic,text,geom
from twitter
group by idtweet,username, date, hour,dataorigin,topic,text,geom


-------------------------------------------------------------
--CREATION OF PERSON_TIME (Divide day in 3 segments)
-------------------------------------------------------------
update person_time set iddaytimetype = 1
WHERE
no_hour between 5 and 12

update person_time set iddaytimetype = 2
WHERE
no_hour between 13 and 16

update person_time set iddaytimetype = 3
WHERE
no_hour between 17 and 24

update person_time set iddaytimetype = 3
```

```
WHERE
no_hour between 1 and 4


-------------------------------------------------------------------------------------------
--INSERT DATA OF PERSON
-------------------------------------------------------------------------------------------
SET SEARCH_PATH= public, test;

insert into person (idconsumer,age,idgender,descgender,idoccup,descoccup,
no_day, no_hour,iddataorigin, descdataorigin, iddaytimetype,
descdaytimetype,idagegroup,descagegroup,idgeoprofiletype, descgeoprofiletype,
                    geom, smtopic, smtext)
select p.idperson,p.age,p.idgender,g.descgender,p.idoccup,o.descoccuptype,
 p.no_day,p.no_hour,p.iddataorigin, dd.descdataorigin, p.iddaytimetype,
 dt.descdaytimetype, p.idagegroup,ag.descagegrouptype,p.idgeoprofiletype,
       st.descgeoprofiletype,p.geom, p.smtopic, p.smtext
from gpstrack as p,occuptype as o, dataorigin as dd, daytimetype as dt,
 agegrouptype as ag,geoprofiletype as st, gendertype as g
where p.idgender = g.idgender
and p.idoccup = o.idoccuptype
and p.iddataorigin = dd.iddataorigin
and p.iddaytimetype = dt.iddaytimetype
and p.idagegroup = ag.idagegrouptype
and p.idgeoprofiletype = st.idgeoprofiletype



--CREATE CATALOGS
CREATE TABLE "delft_data"."distchantype"
(
  iddistchantype integer NOT NULL,
  descdistchantype character(50),
  CONSTRAINT pk_distchantype PRIMARY KEY (iddistchantype)
)
WITH (
  OIDS=FALSE
);
ALTER TABLE "delft_data"."distchantype"
  OWNER TO postgres;


CREATE TABLE "delft_data"."partnertype"
(
  idpartnertype integer NOT NULL,
  descpartnertype character(50),
  CONSTRAINT pk_partnertype PRIMARY KEY (idpartnertype)
)
```

```
WITH (
  OIDS=FALSE
);
ALTER TABLE "delft_data"."partnertype"
  OWNER TO postgres;


CREATE TABLE "delft_data"."businesstype"
(
  iddistchantype integer NOT NULL,
  idbtype integer NOT NULL,
  descbtype character(50),
  CONSTRAINT pk_btype PRIMARY KEY (idbtype)
)
WITH (
  OIDS=FALSE
);
ALTER TABLE "delft_data"."businesstype"
  OWNER TO postgres;

CREATE TABLE "delft_data"."gendertype"
(
  idgender smallint NOT NULL,
  descgender character(15),
  CONSTRAINT pk_gendertype PRIMARY KEY (idgender)
)
WITH (
  OIDS=FALSE
);
ALTER TABLE "delft_data"."gendertype"
  OWNER TO postgres;

CREATE TABLE "delft_data"."shoppingtype"
(
  idshoppingtype integer NOT NULL,
  descshoppingtype character(50),
  CONSTRAINT pk_shoppingtype PRIMARY KEY (idshoppingtype)
)
WITH (
  OIDS=FALSE
);
ALTER TABLE "delft_data"."shoppingtype"
  OWNER TO postgres;

CREATE TABLE "delft_data"."purposetype"
(
  idpurposetype integer NOT NULL,
  descpurposetype character(20),
```

```
  CONSTRAINT pk_purposetype PRIMARY KEY (idpurposetype)
)
WITH (
  OIDS=FALSE
);
ALTER TABLE "delft_data"."purposetype"
  OWNER TO postgres;

CREATE TABLE "delft_data"."companytype"
(
  idcompanytype integer NOT NULL,
  desccompanytype character(50),
  CONSTRAINT pk_companytype PRIMARY KEY (idcompanytype)
)
WITH (
  OIDS=FALSE
);
ALTER TABLE "delft_data"."companytype"
  OWNER TO postgres;

CREATE TABLE "delft_data"."brandtype"
(
  idcompanytype integer NOT NULL,
  idbrandtype integer NOT NULL,
  descbrandtype character(50),
  CONSTRAINT pk_brandtype PRIMARY KEY (idbrandtype)
)
WITH (
  OIDS=FALSE
);
ALTER TABLE "delft_data"."brandtype"
  OWNER TO postgres;

CREATE TABLE "delft_data"."producttype"
(
  idcompanytype integer NOT NULL,
  idbrandtype integer NOT NULL,
  idproducttype integer NOT NULL,
  descproducttype character(50),

  CONSTRAINT pk_producttype PRIMARY KEY (idproducttype)
)
WITH (
  OIDS=FALSE
);
ALTER TABLE "delft_data"."producttype"
  OWNER TO postgres;
```

```
CREATE TABLE "delft_data"."geoprofiletype"
(
  idgeoprofiletype integer NOT NULL,
  descgeoprofiletype character(50),
  CONSTRAINT pk_geoprofiletype PRIMARY KEY (idgeoprofiletype)
)
WITH (
  OIDS=FALSE
);
ALTER TABLE "delft_data"."geoprofiletype"
  OWNER TO postgres;

CREATE TABLE "delft_data"."promotiontype"
(
  idpromotiontype integer NOT NULL,
  descpromotiontype character(150),
  CONSTRAINT pk_promotiontype PRIMARY KEY (idpromotiontype)
)
WITH (
  OIDS=FALSE
);
ALTER TABLE "delft_data"."promotiontype"
  OWNER TO postgres;



--INSERT CATALOG DATA
INSERT INTO "delft_data"."distchantype"(
            iddistchantype, descdistchantype)
    VALUES
    (1,'Off Trade'),
    (2,'On Trade'),
    (3,'Entertainment Centers'),
    (4,'Special Events');


INSERT INTO "delft_data"."partnertype"(
            idpartnertype, descpartnertype)
    VALUES
    (1,'Exclusive'),
    (2,'Mix'),
    (3,'Competitor');


INSERT INTO "delft_data"."businesstype"(
            iddistchantype,idbtype, descbtype)
    VALUES
    (1,101,'Liquor Store'),
```

```
    (1,102,'Mini Market'),
    (1,103,'Super Market'),
    (1,104,'C Store'),
    (2,201,'Pub'),
    (2,202,'Bar'),
    (2,203,'Restaurant'),
    (3,301,'Casino'),
    (3,302,'Concert Hall'),
    (4,401,'Event');


INSERT INTO "delft_data"."gendertype"(
            idgender, descgender)
    VALUES
    (1,'male'),
    (2,'female'),
    (3,'unspecified');

INSERT INTO "delft_data"."companytype"(
            idcompanytype, desccompanytype)
    VALUES
    (1,'GFM'),
    (2,'MIX'),
    (3,'HNK'),
    (4,'SAB');

INSERT INTO "delft_data"."brandtype"(
            idcompanytype, idbrandtype, descbrandtype)
    VALUES
    (1,100,'DB'),
    (1,101,'Python'),
    (3,300,'Heineken'),
    (3,301,'Amstel'),
    (4,400,'Grolsch'),
    (4,401,'Pilsner Urquell');

INSERT INTO "delft_data"."producttype"(
            idcompanytype, idbrandtype, idproducttype, descproducttype)
    VALUES
    (1,100,1000,'DB Lager'),
    (1,100,1001,'DB Dark'),
    (1,100,1002,'DB Weizen'),
    (1,100,1003,'DB Premium'),
    (1,101,1004,'Python Stout'),
    (1,101,1005,'Python Lager'),
    (1,101,1006,'Python Kriek'),
    (3,300,3000,'Heineken Lager'),
    (3,300,3001,'Heineken Dark'),
```

```
    (3,301,3002,'Amstel Lager'),
    (3,301,3003,'Amstel Light'),
    (4,400,4000,'Grolsch Lager'),
    (4,400,4001,'Grolsch Light'),
    (4,400,4002,'Grolsch Weizen'),
    (4,401,4003,'Pilsner Urquell');


INSERT INTO "delft_data"."promotiontype"(
            idpromotiontype, descpromotiontype)
    VALUES
    (1,'1+1'),
    (2,'Free Product'),
    (3,'Happy Hour'),
    (4,'Price Reduction');


CREATE TABLE "test"."person_time"
(
  gid serial NOT NULL,
  id_gpstrack character varying(50),
  age smallint,
  idgender smallint,
  idoccup smallint,
  no_day date,
  no_hour double precision,
  timeofday character varying(20),
  iddataorigin integer,
  geom geometry(Point,4326),
  CONSTRAINT pk_person_time PRIMARY KEY (gid)
)
WITH (
  OIDS=FALSE
);
ALTER TABLE "test"."person_time"
  OWNER TO postgres;


set search_path=public,test;
  select * from person



set search_path=public,test;
CREATE TABLE "test"."tgsegtype"
(
  idtgsegtype integer NOT NULL,
  desctgsegtype character(50),
```

```
  CONSTRAINT pk_idtgsegtype PRIMARY KEY (idtgsegtype)
)
WITH (
  OIDS=FALSE
);
ALTER TABLE "test"."tgsegtype"
  OWNER TO postgres;


set search_path=public,test;
CREATE TABLE "test"."dataorigin"
(
  iddataorigin integer NOT NULL,
  descdataorigin character(50),

  CONSTRAINT pk_dataorigin PRIMARY KEY (iddataorigin)
)
WITH (
  OIDS=FALSE
);
ALTER TABLE "test"."dataorigin"
  OWNER TO postgres;


set search_path=public,test;
CREATE TABLE "test"."agegrouptype"
(
  idagegrouptype integer NOT NULL,
  descagegrouptype character(50),
  btwage character(50),

  CONSTRAINT pk_agegrouptype PRIMARY KEY (idagegrouptype)
)
WITH (
  OIDS=FALSE
);
ALTER TABLE "test"."agegrouptype"
  OWNER TO postgres;


--------------------------------------------------------------------------------------------
--CREATION OF GEOPROFILES (Group persons by age, gender, occuptype into
--predefined groups)
--------------------------------------------------------------------------------------------
--------------------------------
--Geoprofile 1 Young Adult Student
--------------------------------
```

```
select p.idperson,p.idagegroup,p.idgender,p.no_day,p.iddaytimetype,
ot.descoccuptype,p.geom
from person as p, occuptype as ot
where p.idoccup = ot.idoccuptype
and p.idoccup = 7
and p.idagegroup = 1

update person set idgeoprofiletype = 1
--select * from person
where idoccup = 7
and idagegroup = 1



-------------------------------
--Geoprofile 2 Young Adult Worker
-------------------------------
select p.idperson,p.idagegroup,p.idgender,p.no_day,p.iddaytimetype,
   ot.descoccuptype,p.geom
from person as p, occuptype as ot
where p.idoccup = ot.idoccuptype
and p.idoccup <> 7
and p.idagegroup = 1

update person set idgeoprofiletype = 2
where idoccup <> 7
and idagegroup = 1


-----------------------------------
--Geoprofile 3 Male Adult Office Worker
-----------------------------------
update person set idgeoprofiletype = 3
--select * from person
where idoccup = 3
and idgender = 1
and idagegroup = 2


---------------------------------------
--Geoprofile 4 Female Adult Office Worker
---------------------------------------
update person set idgeoprofiletype = 4
where idoccup = 3
and idgender = 2
and idagegroup = 2
```

```
-----------------------------------------
--Geoprofile 5 Female Adult Manager Worker
-----------------------------------------

update person set idgeoprofiletype = 5
where idoccup = 6
and idgender = 2
and idagegroup = 2


-----------------------------------------
--Geoprofile 6 Male Adult Manager Worker
-----------------------------------------
update person set idgeoprofiletype = 6
--select * from person
where idoccup = 6
and idgender = 1
and idagegroup = 2


----------------------------
--Geoprofile 7 Mature Retired
----------------------------
update person set idgeoprofiletype = 7
where idoccup = 1
and idagegroup = 3


----------------------------
--Geoprofile 99 Social Media
----------------------------
update person set idagegroup = 4
where idgender = 3


-----------------------------------------------
--Partners inside areas
-----------------------------------------------
SET SEARCH_PATH= public, test;
CREATE TABLE choropleth AS
SELECT b.gid,b.geom, count(*)
FROM partner as p, delft_buildings as b
WHERE st_within(p.geom,b.geom)
GROUP BY b.gid


-----------------------------------------------
--Total Consumers in influence zone
```

```
-----------------------------------------------
SET SEARCH_PATH= public, test;
SELECT bp.idinfluencezone, gp.descgeoprofiletype,count(*)
FROM consumer as gp, influencezone as bp
WHERE st_within(gp.geom,bp.geom)
GROUP BY bp.idinfluencezone, gp.descgeoprofiletype
Order by 3 desc;
```

Appendix E

Delft Dataset

ZP_ALL_PED	RECNUM	NAME	LAT	LON	ALTITUI	LONGNAME	TRIPNR	FIELD2	ID	DEVICE	TRIPID	LOCATION	DATE	DAY
_1	1	1	+52.0100686	+4.3641556	84.3	QX2182009/11/18_1	102_218	2009-11-18T10:11:38Z	102.0000000000	218.0000000000	102_218	1.0000000000	20091118	1.0000000000
_2	2	2	+52.0098846	+4.3640066	87.8	2_______23	102_218	2009-11-18T10:11:40Z	102.0000000000	218.0000000000	102_218	1.0000000000	20091118	1.0000000000
_3	6	6	+52.0098686	+4.3642456	102.6	11_______40	102_218	2009-11-18T10:11:49Z	102.0000000000	218.0000000000	102_218	1.0000000000	20091118	1.0000000000
_4	36	36	+52.0098496	+4.3642076	99.7	71_______70	102_218	2009-11-18T10:12:49Z	102.0000000000	218.0000000000	102_218	1.0000000000	20091118	1.0000000000
_5	53	53	+52.0097815	+4.3644127	98.0	105_______95	102_218	2009-11-18T10:13:23Z	102.0000000000	218.0000000000	102_218	1.0000000000	20091118	1.0000000000
_6	77	77	+52.0100116	+4.3643686	104.5	249_______161	102_218	2009-11-18T10:15:47Z	102.0000000000	218.0000000000	102_218	1.0000000000	20091118	1.0000000000
_7	78	78	+52.0101956	+4.3644797	120.1	251_______183	102_218	2009-11-18T10:15:49Z	102.0000000000	218.0000000000	102_218	1.0000000000	20091118	1.0000000000
_8	83	83	+52.0100666	+4.3643226	103.9	261_______210	102_218	2009-11-18T10:15:59Z	102.0000000000	218.0000000000	102_218	1.0000000000	20091118	1.0000000000
_9	87	87	+52.0100326	+4.3641106	88.4	269_______225	102_218	2009-11-18T10:16:07Z	102.0000000000	218.0000000000	102_218	1.0000000000	20091118	1.0000000000
_10	93	93	+52.0100376	+4.3639026	83.5	281_______240	102_218	2009-11-18T10:16:19Z	102.0000000000	218.0000000000	102_218	1.0000000000	20091118	1.0000000000
_11	102	102	+52.0101406	+4.3637266	77.7	299_______258	102_218	2009-11-18T10:16:37Z	102.0000000000	218.0000000000	102_218	1.0000000000	20091118	1.0000000000
_12	114	114	+52.0101236	+4.3639346	65.4	359_______278	102_218	2009-11-18T10:17:37Z	102.0000000000	218.0000000000	102_218	1.0000000000	20091118	1.0000000000
_13	116	116	+52.0102276	+4.3637406	66.1	363_______297	102_218	2009-11-18T10:17:41Z	102.0000000000	218.0000000000	102_218	1.0000000000	20091118	1.0000000000
_14	121	121	+52.0102636	+4.3635185	67.0	373_______313	102_218	2009-11-18T10:17:51Z	102.0000000000	218.0000000000	102_218	1.0000000000	20091118	1.0000000000
_15	125	125	+52.0105116	+4.3630775	70.6	381_______355	102_218	2009-11-18T10:17:59Z	102.0000000000	218.0000000000	102_218	1.0000000000	20091118	1.0000000000
_16	129	129	+52.0104986	+4.3630915	87.0	1267_______361	102_218	2009-11-18T10:32:45Z	102.0000000000	218.0000000000	102_218	1.0000000000	20091118	1.0000000000
_17	152	152	+52.0105176	+4.3630555	81.4	1327_______417	102_218	2009-11-18T10:33:45Z	102.0000000000	218.0000000000	102_218	1.0000000000	20091118	1.0000000000
_18	161	161	+52.0106807	+4.3629014	81.1	1345_______446	102_218	2009-11-18T10:34:03Z	102.0000000000	218.0000000000	102_218	1.0000000000	20091118	1.0000000000
_19	174	174	+52.0107917	+4.3627154	81.9	1371_______468	102_218	2009-11-18T10:34:29Z	102.0000000000	218.0000000000	102_218	1.0000000000	20091118	1.0000000000
_20	175	175	+52.0104636	+4.3632095	81.4	1393_______518	102_218	2009-11-18T10:34:51Z	102.0000000000	218.0000000000	102_218	1.0000000000	20091118	1.0000000000
_21	181	181	+52.0106197	+4.3629924	73.4	1405_______541	102_218	2009-11-18T10:35:03Z	102.0000000000	218.0000000000	102_218	1.0000000000	20091118	1.0000000000
_22	192	192	+52.0105376	+4.3630234	76.3	1466_______589	102_218	2009-11-18T10:36:04Z	102.0000000000	218.0000000000	102_218	1.0000000000	20091118	1.0000000000
_23	198	198	+52.0106827	+4.3628104	83.3	1478_______613	102_218	2009-11-18T10:36:16Z	102.0000000000	218.0000000000	102_218	1.0000000000	20091118	1.0000000000
_24	222	222	+52.0106867	+4.3630104	80.5	1526_______667	102_218	2009-11-18T10:37:04Z	102.0000000000	218.0000000000	102_218	1.0000000000	20091118	1.0000000000
_25	243	243	+52.0107037	+4.3627794	72.5	1568_______702	102_218	2009-11-18T10:37:46Z	102.0000000000	218.0000000000	102_218	1.0000000000	20091118	1.0000000000
_26	269	269	+52.0106977	+4.3627184	79.9	1628_______752	102_218	2009-11-18T10:38:46Z	102.0000000000	218.0000000000	102_218	1.0000000000	20091118	1.0000000000
_27	270	270	+52.0105266	+4.3630445	79.7	1652_______781	102_218	2009-11-18T10:39:10Z	102.0000000000	218.0000000000	102_218	1.0000000000	20091118	1.0000000000
_28	279	279	+52.0107917	+4.3627794	98.1	1757_______830	102_218	2009-11-18T10:40:55Z	102.0000000000	218.0000000000	102_218	1.0000000000	20091118	1.0000000000
_29	296	296	+52.0106036	+4.3629494	98.0	1804_______896	102_218	2009-11-18T10:41:42Z	102.0000000000	218.0000000000	102_218	1.0000000000	20091118	1.0000000000
_30	298	298	+52.0104596	+4.3632625	115.1	1808_______923	102_218	2009-11-18T10:41:46Z	102.0000000000	218.0000000000	102_218	1.0000000000	20091118	1.0000000000
31	299	299	+52.0105246	+4.3630144	121.8	1812 941	102 218	2009-11-18T10:41:50Z	102.0000000000	218.0000000000	102 218	1.0000000000	20091118	1.0000000000

Figure E.1: Delft Dataset

DEPTIME	RETTIME	PURPOSE	SHOPPING	FIRST	FREQUENCY	POSTCODEA	PO	ORIGINA	ORIGINB	GENDER	AGE	A
1110.00000000000	1357.00000000000	1.00000000000	2.00000000000	0	36.00000000000	2645.00000000000	LJ	2.00000000000	6.00000000000	2.00000000000	22.00000000000	
1110.00000000000	1357.00000000000	1.00000000000	2.00000000000	0	36.00000000000	2645.00000000000	LJ	2.00000000000	6.00000000000	2.00000000000	22.00000000000	
1110.00000000000	1357.00000000000	1.00000000000	2.00000000000	0	36.00000000000	2645.00000000000	LJ	2.00000000000	6.00000000000	2.00000000000	22.00000000000	
1110.00000000000	1357.00000000000	1.00000000000	2.00000000000	0	36.00000000000	2645.00000000000	LJ	2.00000000000	6.00000000000	2.00000000000	22.00000000000	
1110.00000000000	1357.00000000000	1.00000000000	2.00000000000	0	36.00000000000	2645.00000000000	LJ	2.00000000000	6.00000000000	2.00000000000	22.00000000000	
1110.00000000000	1357.00000000000	1.00000000000	2.00000000000	0	36.00000000000	2645.00000000000	LJ	2.00000000000	6.00000000000	2.00000000000	22.00000000000	
1110.00000000000	1357.00000000000	1.00000000000	2.00000000000	0	36.00000000000	2645.00000000000	LJ	2.00000000000	6.00000000000	2.00000000000	22.00000000000	
1110.00000000000	1357.00000000000	1.00000000000	2.00000000000	0	36.00000000000	2645.00000000000	LJ	2.00000000000	6.00000000000	2.00000000000	22.00000000000	
1110.00000000000	1357.00000000000	1.00000000000	2.00000000000	0	36.00000000000	2645.00000000000	LJ	2.00000000000	6.00000000000	2.00000000000	22.00000000000	
1110.00000000000	1357.00000000000	1.00000000000	2.00000000000	0	36.00000000000	2645.00000000000	LJ	2.00000000000	6.00000000000	2.00000000000	22.00000000000	
1110.00000000000	1357.00000000000	1.00000000000	2.00000000000	0	36.00000000000	2645.00000000000	LJ	2.00000000000	6.00000000000	2.00000000000	22.00000000000	
1110.00000000000	1357.00000000000	1.00000000000	2.00000000000	0	36.00000000000	2645.00000000000	LJ	2.00000000000	6.00000000000	2.00000000000	22.00000000000	
1110.00000000000	1357.00000000000	1.00000000000	2.00000000000	0	36.00000000000	2645.00000000000	LJ	2.00000000000	6.00000000000	2.00000000000	22.00000000000	
1110.00000000000	1357.00000000000	1.00000000000	2.00000000000	0	36.00000000000	2645.00000000000	LJ	2.00000000000	6.00000000000	2.00000000000	22.00000000000	
1110.00000000000	1357.00000000000	1.00000000000	2.00000000000	0	36.00000000000	2645.00000000000	LJ	2.00000000000	6.00000000000	2.00000000000	22.00000000000	
1110.00000000000	1357.00000000000	1.00000000000	2.00000000000	0	36.00000000000	2645.00000000000	LJ	2.00000000000	6.00000000000	2.00000000000	22.00000000000	
1110.00000000000	1357.00000000000	1.00000000000	2.00000000000	0	36.00000000000	2645.00000000000	LJ	2.00000000000	6.00000000000	2.00000000000	22.00000000000	
1110.00000000000	1357.00000000000	1.00000000000	2.00000000000	0	36.00000000000	2645.00000000000	LJ	2.00000000000	6.00000000000	2.00000000000	22.00000000000	
1110.00000000000	1357.00000000000	1.00000000000	2.00000000000	0	36.00000000000	2645.00000000000	LJ	2.00000000000	6.00000000000	2.00000000000	22.00000000000	
1110.00000000000	1357.00000000000	1.00000000000	2.00000000000	0	36.00000000000	2645.00000000000	LJ	2.00000000000	6.00000000000	2.00000000000	22.00000000000	
1110.00000000000	1357.00000000000	1.00000000000	2.00000000000	0	36.00000000000	2645.00000000000	LJ	2.00000000000	6.00000000000	2.00000000000	22.00000000000	
1110.00000000000	1357.00000000000	1.00000000000	2.00000000000	0	36.00000000000	2645.00000000000	LJ	2.00000000000	6.00000000000	2.00000000000	22.00000000000	
1110.00000000000	1357.00000000000	1.00000000000	2.00000000000	0	36.00000000000	2645.00000000000	LJ	2.00000000000	6.00000000000	2.00000000000	22.00000000000	
1110.00000000000	1357.00000000000	1.00000000000	2.00000000000	0	36.00000000000	2645.00000000000	LJ	2.00000000000	6.00000000000	2.00000000000	22.00000000000	
1110.00000000000	1357.00000000000	1.00000000000	2.00000000000	0	36.00000000000	2645.00000000000	LJ	2.00000000000	6.00000000000	2.00000000000	22.00000000000	
1110.00000000000	1357.00000000000	1.00000000000	2.00000000000	0	36.00000000000	2645.00000000000	LJ	2.00000000000	6.00000000000	2.00000000000	22.00000000000	
1110.00000000000	1357.00000000000	1.00000000000	2.00000000000	0	36.00000000000	2645.00000000000	LJ	2.00000000000	6.00000000000	2.00000000000	22.00000000000	
1110.00000000000	1357.00000000000	1.00000000000	2.00000000000	0	36.00000000000	2645.00000000000	LJ	2.00000000000	6.00000000000	2.00000000000	22.00000000000	
1110.00000000000	1357.00000000000	1.00000000000	2.00000000000	0	36.00000000000	2645.00000000000	LJ	2.00000000000	6.00000000000	2.00000000000	22.00000000000	
1110.00000000000	1357.00000000000	1.00000000000	2.00000000000	0	36.00000000000	2645.00000000000	LJ	2.00000000000	6.00000000000	2.00000000000	22.00000000000	
1110.00000000000	1357.00000000000	1.00000000000	2.00000000000	0	36.00000000000	2645.00000000000	LJ	2.00000000000	6.00000000000	2.00000000000	22.00000000000	

Figure E.2: Delft Dataset (cont)

AGE_GROUP	GROUP	OCCUP	OCCUP_TYPE	HOUSEHOLD	WTH_	WTH_	WTH_	WTH_	WTH_	DIR_START	DIR_RETURN	CIR_TYPE	DESTINATIO
0.00000000000	1.00000000000	Teaching_assistant	4.00000000000	2.00000000000	0	1	1	0	1	1.00000000000	1.00000000000	1.00000000000	2.00000000000
0.00000000000	1.00000000000	Teaching_assistant	4.00000000000	2.00000000000	0	1	1	0	1	1.00000000000	1.00000000000	1.00000000000	2.00000000000
0.00000000000	1.00000000000	Teaching_assistant	4.00000000000	2.00000000000	0	1	1	0	1	1.00000000000	1.00000000000	1.00000000000	2.00000000000
0.00000000000	1.00000000000	Teaching_assistant	4.00000000000	2.00000000000	0	1	1	0	1	1.00000000000	1.00000000000	1.00000000000	2.00000000000
0.00000000000	1.00000000000	Teaching_assistant	4.00000000000	2.00000000000	0	1	1	0	1	1.00000000000	1.00000000000	1.00000000000	2.00000000000
0.00000000000	1.00000000000	Teaching_assistant	4.00000000000	2.00000000000	0	1	1	0	1	1.00000000000	1.00000000000	1.00000000000	2.00000000000
0.00000000000	1.00000000000	Teaching_assistant	4.00000000000	2.00000000000	0	1	1	0	1	1.00000000000	1.00000000000	1.00000000000	2.00000000000
0.00000000000	1.00000000000	Teaching_assistant	4.00000000000	2.00000000000	0	1	1	0	1	1.00000000000	1.00000000000	1.00000000000	2.00000000000
0.00000000000	1.00000000000	Teaching_assistant	4.00000000000	2.00000000000	0	1	1	0	1	1.00000000000	1.00000000000	1.00000000000	2.00000000000
0.00000000000	1.00000000000	Teaching_assistant	4.00000000000	2.00000000000	0	1	1	0	1	1.00000000000	1.00000000000	1.00000000000	2.00000000000
0.00000000000	1.00000000000	Teaching_assistant	4.00000000000	2.00000000000	0	1	1	0	1	1.00000000000	1.00000000000	1.00000000000	2.00000000000
0.00000000000	1.00000000000	Teaching_assistant	4.00000000000	2.00000000000	0	1	1	0	1	1.00000000000	1.00000000000	1.00000000000	2.00000000000
0.00000000000	1.00000000000	Teaching_assistant	4.00000000000	2.00000000000	0	1	1	0	1	1.00000000000	1.00000000000	1.00000000000	2.00000000000
0.00000000000	1.00000000000	Teaching_assistant	4.00000000000	2.00000000000	0	1	1	0	1	1.00000000000	1.00000000000	1.00000000000	2.00000000000
0.00000000000	1.00000000000	Teaching_assistant	4.00000000000	2.00000000000	0	1	1	0	1	1.00000000000	1.00000000000	1.00000000000	2.00000000000
0.00000000000	1.00000000000	Teaching_assistant	4.00000000000	2.00000000000	0	1	1	0	1	1.00000000000	1.00000000000	1.00000000000	2.00000000000
0.00000000000	1.00000000000	Teaching_assistant	4.00000000000	2.00000000000	0	1	1	0	1	1.00000000000	1.00000000000	1.00000000000	2.00000000000
0.00000000000	1.00000000000	Teaching_assistant	4.00000000000	2.00000000000	0	1	1	0	1	1.00000000000	1.00000000000	1.00000000000	2.00000000000
0.00000000000	1.00000000000	Teaching_assistant	4.00000000000	2.00000000000	0	1	1	0	1	1.00000000000	1.00000000000	1.00000000000	2.00000000000
0.00000000000	1.00000000000	Teaching_assistant	4.00000000000	2.00000000000	0	1	1	0	1	1.00000000000	1.00000000000	1.00000000000	2.00000000000
0.00000000000	1.00000000000	Teaching_assistant	4.00000000000	2.00000000000	0	1	1	0	1	1.00000000000	1.00000000000	1.00000000000	2.00000000000
0.00000000000	1.00000000000	Teaching_assistant	4.00000000000	2.00000000000	0	1	1	0	1	1.00000000000	1.00000000000	1.00000000000	2.00000000000
0.00000000000	1.00000000000	Teaching_assistant	4.00000000000	2.00000000000	0	1	1	0	1	1.00000000000	1.00000000000	1.00000000000	2.00000000000
0.00000000000	1.00000000000	Teaching_assistant	4.00000000000	2.00000000000	0	1	1	0	1	1.00000000000	1.00000000000	1.00000000000	2.00000000000
0.00000000000	1.00000000000	Teaching_assistant	4.00000000000	2.00000000000	0	1	1	0	1	1.00000000000	1.00000000000	1.00000000000	2.00000000000
0.00000000000	1.00000000000	Teaching_assistant	4.00000000000	2.00000000000	0	1	1	0	1	1.00000000000	1.00000000000	1.00000000000	2.00000000000
0.00000000000	1.00000000000	Teaching_assistant	4.00000000000	2.00000000000	0	1	1	0	1	1.00000000000	1.00000000000	1.00000000000	2.00000000000
0.00000000000	1.00000000000	Teaching_assistant	4.00000000000	2.00000000000	0	1	1	0	1	1.00000000000	1.00000000000	1.00000000000	2.00000000000
0.00000000000	1.00000000000	Teaching_assistant	4.00000000000	2.00000000000	0	1	1	0	1	1.00000000000	1.00000000000	1.00000000000	2.00000000000
0.00000000000	1.00000000000	Teaching_assistant	4.00000000000	2.00000000000	0	1	1	0	1	1.00000000000	1.00000000000	1.00000000000	2.00000000000
0.00000000000	1.00000000000	Teaching_assistant	4.00000000000	2.00000000000	0	1	1	0	1	1.00000000000	1.00000000000	1.00000000000	2.00000000000

Figure E.3: Delft Dataset (cont)

Appendix F

Javascript Code Geomarketing Strategy

```
/**
 * Add all your dependencies here.
 *
 * @require widgets/Viewer.js
 * @require plugins/LayerTree.js
 * @require plugins/OLSource.js
 * @require plugins/OSMSource.js
 * @require plugins/WMSCSource.js
 * @require plugins/ZoomToExtent.js
 * @require plugins/NavigationHistory.js
 * @require plugins/Zoom.js
 * @require plugins/AddLayers.js
 * @require plugins/RemoveLayer.js
 * @require RowExpander.js
 * @require plugins/ZoomToLayerExtent.js
 * @require plugins/WMSGetFeatureInfo.js
 * @require plugins/Legend.js
 * @require plugins/GoogleGeocoder.js
 * @require plugins/GoogleSource.js
 * @require plugins/FeatureManager.js
 * @require plugins/FeatureEditor.js
 * @require plugins/SnappingAgent.js
 * @require plugins/FeatureGrid.js
 * @require plugins/Styler.js
 * @require ColorManager.js
 * @require plugins/QueryForm.js
 */

var app = new gxp.Viewer({
    portalConfig: {
        layout: "border",
        region: "center",

        // by configuring items here, we don't need to configure portalItems
        // and save a wrapping container
        items: [{
            id: "centerpanel",
            xtype: "panel",
```

```
            layout: "fit",
            region: "center",
            border: false,
            items: ["mymap"]
        },{
id: "southcontainer",
xtype: "container",
layout: "fit",
region: "south",
border: false,
height: 200
}, {
id: "westcontainer",
xtype: "container",
layout: "vbox",
region: "west",
width: 200,
defaults: {
width: "100%",
layout: "fit"
},
items: [{
title: "Layers",
id: "westpanel",
border: false,
flex: 1
}, {
id: "legendpanel",
height: 250
}]
}],
        bbar: {id: "mybbar"}
    },

    // configuration of all tool plugins for this application
    tools: [{
        ptype: "gxp_layertree",
        outputConfig: {
            id: "tree",
            border: true,
            tbar: [] // we will add buttons to "tree.bbar" later
        },
        outputTarget: "westpanel"
    }, {
        ptype: "gxp_addlayers",
        actionTarget: "tree.tbar"
    }, {
        ptype: "gxp_removelayer",
```

```
        actionTarget: ["tree.tbar", "tree.contextMenu"]
    }, {
        ptype: "gxp_zoomtoextent",
        actionTarget: "map.tbar"
    }, {
        ptype: "gxp_zoom",
        actionTarget: "map.tbar"
    }, {
        ptype: "gxp_navigationhistory",
        actionTarget: "map.tbar"
    } , {
ptype: "gxp_zoomtolayerextent",
actionTarget: ["tree.tbar", "tree.contextMenu"]
}, {
ptype: "gxp_wmsgetfeatureinfo"
}, {
ptype: "gxp_legend",
outputTarget: "legendpanel"
},{
ptype: "gxp_googlegeocoder",
outputTarget: "map.tbar",
outputConfig: {
emptyText: "Search for a location ..."
}
},{
ptype: "gxp_featuremanager",
id: "states_manager",
paging: false,
autoSetLayer: true,
autoLoadFeatures: true
},{
ptype: "gxp_featureeditor",
featureManager: "states_manager",
autoLoadFeature: true,
snappingAgent: "snapping-agent"
},{
ptype: "gxp_snappingagent",
id: "snapping-agent",
targets: [{
source: "local",
name: "usa:states"
}]
},{
ptype: "gxp_featuregrid",
featureManager: "states_manager",
outputConfig: {
loadMask: true
},
```

```
outputTarget: "southcontainer"
},{
ptype: "gxp_styler"
},
{
ptype: "gxp_queryform",
featureManager: "states_manager",
outputConfig: {
title: "Query",
width: 320
},
actionTarget: "map.tbar",
appendActions: false
}],

    // layer sources
    sources: {
        local: {
            ptype: "gxp_wmscsource",
            url: "/geoserver/wms",
            version: "1.1.1"
        },
        osm: {
            ptype: "gxp_osmsource"
        },
google: {
ptype: "gxp_googlesource"
}
    },

    // map and layers
    map: {
        id: "mymap", // id needed to reference map in portalConfig above
        title: "Map",
        projection: "EPSG:900913",
        center: [-10764594.758211, 4523072.3184791],
        zoom: 3,
        layers: [{
            source: "osm",
            name: "mapnik",
            group: "background"
        }, {
            source: "local",
            //name: "usa:states",
name:"GMS:delft_buildings",
            selected: true
        }],
        items: [{
```

```
            xtype: "gx_zoomslider",
            vertical: true,
            height: 100
        }]
    }

});
```