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## Sustainability analysis on Urban Mobility based on Social Media content

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### Abstract

Urban transport became an important element in the promotion of strategies towards sustainability, in fact one of the challenges posed by booming urban populations is the question of mobility. Traditional travel survey methods used to study urban mobility are very expensive, and the data collected are of poor quality. This is mainly explained because of the difficulty of getting a representative sample of the population, and the lack of motivated participants. Therefore, travel surveys are carried out less and less frequently, and the result is that good travel data is not available to develop mobility and travel behaviour studies. Information and Communication Technologies (ICT) offer the opportunity to improve traditional travel survey methods, decreasing bias in the data, reducing respondent burden, and increasing data quality. On the other hand, nowadays the User Generated Content (UGC) is growing very fast in Internet. Social media have become a valuable source for knowledge but there is a big gap in the automatic Sentiment Analysis with Semantic taxonomy annotation of online textual content. The aim of this research is to identify sustainability issues related to urban mobility based in the perceptions and experiences that underlie in the UGC. The methodology follows a quantitative and qualitative content analysis using Sentiment Analysis techniques. This paper demonstrates empirically the feasibility of the automatic identification of the Sustainable Urban Mobility problems in the discourses generated by the UGC, through a powerful ad-hoc software combining Natural Language Processing and Sentiment Analysis field tools. The main contribution of this work is the development of a tool and methodology on sustainability analysis on urban environment. Our approach enriches the data of the traditional surveys, extends traditional analysis with Big-Data methods, using data mining algorithms and Natural Language Processing techniques to extract urban mobility information from Social Media data. These data include important information about activities and travels, and can help to improve our understanding of urban mobility.

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### 1. Introduction

Cities are drivers of economic development and growth, in fact about 85% of EU's GDP is generated in urban areas. Moreover, 40% of all CO<sub>2</sub> emissions and 70% of emissions of other pollutants are caused by urban traffic. As stated by the European Commission (EC) Action Plan on urban mobility, cities are a critical part of the transport system as

more than 72% of Europeans live in an urban area (UN, 2007) and this percentage has a tendency to increase. This is acknowledged in the Sustainable Urban Transport Plans report<sup>1</sup> (2010).

According to J. B. S. O de Andrade Guerra et al. (2015), one estimate suggests that by 2055, 75% of the world population will be living in urban areas. Currently, 50% of the world population lives in large cities (de Oliveira et al., 2013), and cities generate 70% of global GDP (Global City Indicators, 2012). Viewing climate change forecast, cities will have to take steps to avoid economic and environmental degradation.

Primary concern of EU citizens is Urban Mobility. In a survey conducted by Eurobarometer<sup>2</sup> in July 2007, the 90% of Europeans said that the traffic situation in their area should be improved (Eurobarometer, 2007).

On the other hand, the opinions and experiences are central to almost all human activities and are key factors in influencing our behaviour. Our beliefs and perceptions of reality, and the decisions we make, are largely conditioned by how others see and evaluate the world. For this reason, when we have to make a decision often seek the opinions of others (Liu, 2012). The user-generated content UGC (User Generated Content), and in particular, the online comments have allowed substantial changes in the dynamic of entire sectors. Furthermore, the number of topics related to mobility is relevant on Traveller social networks like Minube, TripAdvisor, since social media is a great tool for communication and meeting point. Therefore, the analysis of that type of information can be very important for travel behaviour analysis.

Information and Communication Technologies (ICT) offer the opportunity to improve traditional survey methods to collect travel behaviour data, decreasing bias in the data, reducing respondent burden, and increasing data quality. Nowadays the User Generated Content (UGC) is growing very fast in Internet. Social media have become a valuable source for knowledge but there is a big gap in the automatic Sentiment Analysis with Semantic taxonomy annotation of online textual content.

The aim of this research is to identify sustainability issues related to urban mobility based in the perceptions and experiences that underlie in the UGC. The methodology follows a quantitative and qualitative content analysis using Sentiment Analysis techniques. This paper demonstrates empirically the feasibility of the automatic identification of the Sustainable Urban Mobility problems in the discourses generated by the UGC, through a powerful ad-hoc software combining Natural Language Processing and Sentiment Analysis field tools.

The main contribution of this work is the development of a tool and methodology on sustainability analysis on urban environment. Our approach enriches the data of the traditional surveys, extends traditional analysis with Big-Data methods, using data mining algorithms and Natural Language Processing techniques to extract urban mobility information from Social Media data.

The structure of the paper is as follows: section 2 presents an overview of research in the field of sustainable urban mobility, as well as the contributions of this article. After that, section 3 explains the methodology followed in this study. Section 4 outlines the case study, section 5 shows the results, and in the last section, conclusions and future lines are explained.

## 2. Related Work

It is noteworthy that are fairly recent investigations of Social Media analysis in the field of urban transport to explore from another perspective urban mobility. Lately, substantial increase in research in this area is appreciated.

Focusing on sustainable urban transport, Silvia Gabrielli et al, (2014) identified several challenges related to motivating change towards sustainable urban mobility. They reviewed the literature to support a larger adoption of sustainable mobility choices (e.g., use of public transport services) by urban travellers, several forms of persuasive solutions have been proposed (Dourish, 2010; Fogg, 1998, 2003). Also, some critical analyses of the key assumptions and limitations of the persuasive sustainability systems developed so far are explained (Brynjarsdottir et al., 2012; DiSalvo, Sengers, & Brynjarsdóttir, 2010; Dourish, 2010; Brynjarsdottir et al., 2012).

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<sup>1</sup> <http://www.europarl.europa.eu/studies>

<sup>2</sup> [http://ec.europa.eu/public\\_opinion/flash/fl\\_206b\\_en.pdf](http://ec.europa.eu/public_opinion/flash/fl_206b_en.pdf)

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