Exploring Weather Effects on Powered-Two-Wheeler Safety on Urban Arterials in Athens

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INTRODUCTION

- The effective treatment of crashes and the proactive transportation safety is a major concern to societies.
- Much research that utilized real-time collected weather data has been carried out recently.
- Powered-Wheeler safety on urban arterials is underrepresented.
- Alternative modeling techniques should also be considered.
- Relevant studies from Europe are rare.

OBJECTIVES

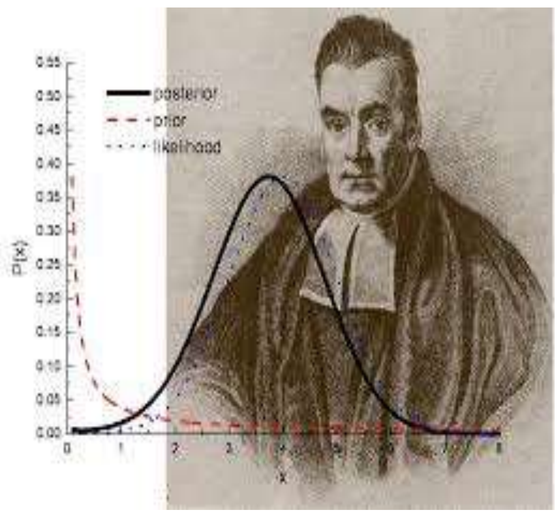
- The main objective is to investigate crash likelihood and severity.
- Powered-Two-Wheelers are the primary focus of the research.
- The feasibility of Bayes Factors (Bayesian t-tests) is examined.
- Real-time weather data from urban arterials in Athens, Greece are considered.

DATA PREPARATION

- The available dataset refers to the period 2006-2011 and come from Kifisias and Mesogeion avenues in Athens, Greece.
- Crash data were collected from the Greek crash database, SANTRA, which is provided by NTUA. Crash characteristics include crash location (intersection/no intersection) and time (day/night).
- Crashes were classified as severe or slight. Another binary variable is created with values 0 (crash without a PTW) and 1 (crash involving a PTW).
- Weather data were collected from the Hydrological Observatory of Athens, which is an online open-access database, covering more than 10 meteorological stations located in the greater Athens area. Weather data include rainfall, temperature, relative humidity, solar radiation, wind direction and wind speed.
- The 10-min raw weather data were aggregated over hour in order to obtain maxima, averages and standard deviations, in the time-slice of 1-hour prior to the time of the crash occurrence.
- For example, if a crash occurred in Kifisias Avenue on 26 August 2011 at 17:00 weather data on the same day and location from 16:00 to 17:00 are considered.

METHOD OF ANALYSIS

- Bayesian t-tests are carried out in order to compare the means of two different groups.
- The mean values of weather parameters are tested a) between crashes with or without Powered-Two-Wheeler involvement and b) between slight and fatal/severe crashes with Powered-Two-Wheelers.
- The comparison is conducted simply by dividing the marginal likelihoods, producing a parameter called a Bayes Factor (BF). The BF is a very good alternative to the traditional t-test and shows the extent to which the data support the H1 hypothesis over H2 hypothesis.
- The parameter BF12 is a very good alternative to the traditional t-test and shows the extent to which the data support the H1 hypothesis over H2 hypothesis
- Values of Bayes Factor higher than 10 indicate a strong evidence for the H1 hypothesis.



RESULTS

	Bayesian Independent Samples T-Test (crash with PTW vs crash without PTWs)	Bayesian Independent Samples T- Test (fatal/severe crash vs slight crash)
Variables	**BF**	**BF**
T_1hr_avg	23.551	0.218
Hum_1hr_avg	146.173	0.216
Rain_1hr_sum	0.162	0.256
W.Sp_1hr_avg	0.391	0.373
Sol_1hr_avg	6.275	0.863

CONCLUSIONS

- This paper contributes to current knowledge, by having a specific consideration of real-time weather data and Powered-Two-Wheelers.
- The approach is considered a good alterative to the traditional t-test.
- Wind speed appears to affect the number of PTW's low severity crashes especially when temperature is higher and there is no intersection.
- Precipitation does not appear to have significance impact on PTW crashes.
- Statistical difference of Temperature and Humidity 1-hour prior to crashes with PTWs and crashes without a PTW.
- In terms of severity, no significant differences were identified between slight and severe PTW crashes, regardless of the weather parameters considered for comparing lower and higher severity crashes.