

A Statistical Analysis of Urban Location Data Obtained from Smartphones for Disaster Response

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Abstract

Technological advancements in device hardware and application software platforms have enabled smart phones to be used for multiple purposes as an all-in-one hand-held device. Its readily availability among majority of individuals, ease of use as a compact unit with access to remote storage and capacity to communicate makes it a perfect tool for emergency response specially with reference to disaster management provided having sufficient reception. Nevertheless, its embedded location services facility which communicates with the GNSS not only facilitates navigation, location sharing etc. but also capable of producing geo-tagged information, which could be vital under emergency conditions. Hence, this study statistically evaluates the reliability of location data recorded from a combination of smartphones and hand-held GPS units under selected urban environmental conditions. Commonly available four devices and a combination of applications were performed at five locations over a period of two months as the data collection for this exercise. The results reveal, regardless of the device and software combinations the location readings approximately follow the Gaussian distribution. However, a varying functionality has been observed in certain locations despite the consistency in environmental factors. Also, the mobile phones demonstrated a reasonable consistency among them in most of the horizontal positioning coordinate display events, despite the differences extracted from statistical analysis. Except in one location the smartphones indicated a significant difference in linear location data when compared with those obtained by handheld GPS. Analysis of Variance (ANOVA) was conducted to test the differences at 5% significance level. There is a growing emphasis on capturing records of geo-tagged spatio-temporal data not only to enhance the smartphone user experience but also for the disaster response considering the capability of smartphone to determine positions. Through this research, valuable insights into the performance of smartphones as tools for spatial data collection are sought to be provided, and best practices for location-based applications are aimed to be informed.

Keywords: One-way ANOVA; Gaussian Distribution; Correlation techniques; geo-tagged information; GPS