

2011

Wavelet-Kruskal Solution to the InnoCentive Boston Pothole Challenge – Software Release

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Recommended Citation

Aboufadel, Edward; Marculis, Nathan; Parsons, SaraJane; and Bowman, Clark, "Wavelet-Kruskal Solution to the InnoCentive Boston Pothole Challenge – Software Release" (2011). *Undergraduate Research*. 1.
<http://scholarworks.gvsu.edu/mathundergrad/1>

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Wavelet-Kruskal Solution to the InnoCentive Boston Pothole Challenge – software release
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In 2011, the City of Boston partnered with InnoCentive, along with researchers at the Worcester Polytechnic Institute and the Santa Fe Complex, to seek a solution to the problem of efficiently identifying potholes. They challenged InnoCentive “Solvers” to predict where potholes are located on the streets of Boston, using data collected by an app called “StreetBump” that runs on Android smart phones and can be used by volunteers traveling the city. The StreetBump app addresses the dynamic nature of potholes by recording acceleration, orientation, location, and other data. See <http://www.innocentive.com/mayor-menino-launches-contest-enhance-smart-phone-app-detects-and-reports-potholes>.

Our solution to the problem uses wavelets, Kruskal's algorithm, and other mathematical tools to identify potholes. The steps of our solution are as follows: (1) apply rotation matrices to the accelerometer vectors of data collected by the StreetBump app, so the data is consistently oriented; (2) apply a high-pass wavelet filter to the transformed accelerometer data, followed by thresholds on the filter output and the speed data, which will identify accelerometer spike locations (via GPS) where a pothole is likely to occur; (3) cluster these spike locations through an application of Kruskal's algorithm to a carefully-defined graph of nodes and weights; (4) calculate an average position within a cluster, and adjust this position due to the lag in recording of GPS data, in order to locate the position of each pothole; and (5) estimate the severity of each pothole by a function we have created for this application.

In this release is our C++ source code for our algorithm, which is made available through the GNU Lesser General Public License. A detailed report of our algorithm will be made available in the future.

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December 12, 2011