

Haskell Communities and Activities Report

<http://www.haskell.org/communities/>

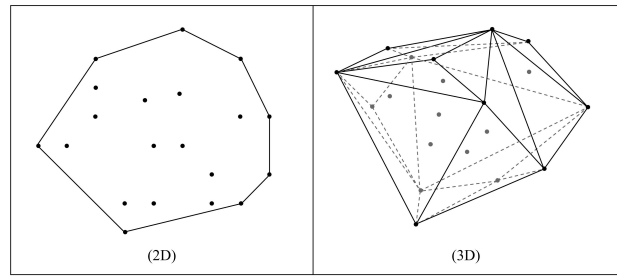
Fifteenth Edition — November 2008

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6.6.6 Simplex-Based Spatial Operations

Report by:	Farid Karimipour
Participants:	Andrew U. Frank
Status:	active development

The project is to implement spatial operations independent of dimension. There is much need in computational geometry and related fields to extend 2D spatial operations to 3D and higher dimensions. Approaches designed for a specific dimension lead to different implementations for different dimensions. Following such approaches, the code for a package that supports spatial operations for both 2D and 3D cases is nearly two times the code size for 2D. An alternative is dimension independent approaches. However, they are still implemented separately for each dimension. The main reason is lack of efficient data structures in the current programming languages. This research goes one step up the ladder of dimension independency in spatial operations. It implements dimension independent spatial operations using the concept of n-simplex. This n-dimensional data type is defined as a list, and its fundamental operations (e.g., dimension, orientation, boundary, clockwise and anticlockwise tests, etc.) are developed as higher order functions over lists, which are treated efficiently in functional programming languages. Some spatial operations (e.g., distance and convex hull computations) have been implemented as case studies. A graphical user interface written with wxHaskell functions has been developed to illustrate the graphical results. The following figure shows the results of the convex hull computation for some 2D and 3D points.



Further reading

- F. Karimipour, M.R. Delavar, and A.U. Frank. A Mathematical Tool to Extend 2D Spatial Operations to Higher Dimensions, Proceedings of the International Conference on Computational Science and Its Applications (ICCSA 2008), (O. Gervasi, B. Murgante, A. Lagan, D. Taniar, Y. Mun, and M. Gavrilova, eds.), Perugia, Italy, June 30 – July 3, 2008, Lecture Notes in Computer Science, Berlin: Springer, Vol. 5072, pp. 153–164.
- F. Karimipour, A.U. Frank, and M.R. Delavar. An Operation-Independent Approach to Extend 2D Spatial Operations to 3D and Moving Objects, Proceedings of the 16th ACM SIGSPATIAL International Conference on Advances in Geographic Information Systems (ACM GIS 2008), Irvine, CA, USA, November 5–7, 2008.