

## Heuristic Automatic Georeferencing of Digitally Captured Sketch Maps for Community and Participatory GIS

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**Abstract:** Inventory of resources, planning and decision making are crucial processes for community development. These processes usually require geospatial information such as coordinates, routes and areas, which are represented in the form of maps. Often, members of community are involved or participate in generating these data, since they have specialized local knowledge. In many cases, residents produce maps by hand drawing, that is, as sketch maps. For example, a local resident may draw a map to show polluted areas in a community or the shortest path from a village to the nearest hospital, information which does not yet exist on any formal, published map.

Unfortunately, it is difficult to use these hand-drawn maps in conjunction with traditional GIS systems because data from sketch maps include many types of distortion. In order to incorporate these data into existing geographic maps, it is necessary to have proper tools and an integration process called “georeferencing” which transforms elements on sketch maps into a well-defined geospatial coordinate system. Although georeferencing can be performed manually, the process requires significant time and effort, and results are unlikely to be consistent or reproducible.

This paper describes our computer-based system which allows non-technical users to easily and comfortably draw sketch maps on a tablet, then automatically georeferences the map features. We use many aspects of the digital sketch map including coordinates of drawn map elements, drawing sequence, shape, convexity, proximity, spatial relationships and other cues to match sketch map features to existing geographic features in an underlying metric representation. We then use these matches to perform georeferencing of the unknown or new features in the sketch map. We also investigate the use of heuristics including machine learning to recognize symbols drawn by the user.

In this paper we describe the philosophy, architecture and implementation of our system. We then present our results from evaluating the tool using individuals from a rural area who are representative of the target users.

**Keywords:** sketch map, georeferencing, digital sketching, community GIS, participatory GIS