A model for improving access of spatial data in mobile devices
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Volunteered Geographic Information (VGI) data, as a publicly available data resource, has dramatically increased in volume and spatial coverage in recent years. Viewing spatial data, in the form of maps, on mobile devices is seriously hampered by the relatively small screen size. The limited bandwidth of mobile communication networks can mean that transmitting a large amount of spatial data to mobile devices becomes problematic and frustrating for users. Traditional raster-based maps cannot support such dynamic updating, as found in VGI, because it is very resource intensive to constantly process and generate large sets of raster image tiles. Meanwhile, vector-based VGI data is often inhomogeneous in its spatial representation and sometimes can contain too much information for many location-based services (LBS). The principal goal of our work is to develop a model for improved transmission and visualization of spatial data on mobile devices with specific emphasis on VGI datasets. Overall this work will contribute to improving vector data transmission and processing for LBS applications using progressive transmission strategies.

Selective progressive transmission strategies:
Object shape metrics are used for measuring the representation quality of spatial objects to guide the simplification process in Figure 2. We have observed in many user-trail case studies that many spatial data objects or regions in VGI datasets are identified for “over-represented” (examples in Figure 3). Not all of this detail is required. Applying shape analysis techniques we can achieve significant reductions in the overall volume of data transmitted. The data is transmitted progressively where increasing Levels of Detail (LOD) of the requested dataset are provided. Users can download the initial version (coarse, lowest detail) of the map and then allow the software application to refine with the remaining LOD. Open Source tools are used and this provides us with the flexibility to process any other kind of vector based spatial data resource such as ESRI shapefiles.

Mobile system for visualization of progressive maps:
When users perform queries in LBS applications on their mobile devices their context may change from time to time and they become interested in different spatial areas. How do we allow end-users to analyze a spatial dataset too large to visualise on the small screen display? We have designed a framework to predict the user’s view movements and assist users to navigate to the next area of interest. As shown in Figure 4, users download an initial base map low LOD for immediate viewing the “big-picture”. This map is then refined with a sequence of view-dependent LOD in the screen display area (Figure 5 red area) according to their requirements. A multi-frame approach was developed for “pre-fetch” and cache the spatial data for the area highlighted (Figure 6). This work aims to overcome the potential problems associated with network latency when users rapidly switch the context view of the map on their mobile devices (eg during map panning or zooming).