GeoJabber

Finding Significant Analytic Events in Collaborative Visual Analysis Sessions

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Outline

• Demo
• Background
• Research Objectives
• Methodology
• Conclusions – Future Work
Demo
Demo – Dessert Before Dinner!
Background
Background

• Scientific research using geospatial data is usually carried out by teams.

• Software has often been a limiting factor in collaboration.

• We need to extend geovisual analysis software to enable geographic collaboration over the network.
• Type of collaboration being investigated – Different place, same time collaboration – For example, people coordinating response to a flood or other emergency
Research Objectives
Research Objectives

- Communication
- Typology
- Persistence
- User Analysis
- Technology Choices
Communication

• Provide a communication channel inside geospatial visual analytics software, supporting synchronous contact, including message sharing and knowledge sharing.
Typology

- Provide a typology of what should be shared between collaborators.
Persistence

• Provide a means of making analysis sessions and analysis artifacts persistent and accessible.
User Analysis

• Explore how user-entered text (chat) can serve as markers to find significant points in an analysis session.
Technology Choices

• Understand how technology choices affect human-human collaboration when using geospatially enabled software.
Methodology
Methodology

- Communication
- Typology
- Persistence
- User Analysis
- Technology Choices
Communication – Jabber

- Jabber is an open Instant Messaging (IM) protocol, like closed protocols defined for AOL’s AIM, ICQ, Yahoo and Microsoft’s MSN Messenger. Google Chat uses Jabber.

- There are a number of free and open source client and server Jabber programs available.

- Jabber messages are based on XML, and so can be used to pass Java objects or geographic coordinates.
Communication – Jabber

- Sample XML Jabber message from Juliet to Romeo

```
<jabber:msg xmlns:jabber='urn:ietf:params:xml:ns:jabber:client' xmlns:tr='urn:ietf:params:xml:ns:jabber:transaction' to='romeo@montague.net' from='juliet@capulet.com' mode='chat' id='I123456'><tr:start id='I123456'/><tr:end id='I123456'/><body>My love for you is like the sun, always shining.</body></jabber:msg>
```
Communication – Jabber

- Sample XML Jabber message from Juliet to Romeo

```xml
<message from='juliet@capulet.com' to='romeo@montague.net' id='message22'>
  <body>
    Wherefore art thou, Romeo?
  </body>
</message>
```
Sample spatial extent message in GeoJabber

<message id="V2HVe-5" to="hyangja">
  <body>extension</body>
  <SpatialExtent xmlns="geoviz">
    <width>902.049560546875</width>
    <height>558.5320739746094</height>
    <y>-289.28460693359375</y>
    <x>-316.7908935546875</x>
  </SpatialExtent>
</message>
Communication – Marshal Software Objects to XML

• Marshaling java objects converts them to XML. Marshaling is roughly equivalent to serialization.
• XML and Java are a good (not great) fit.
• This strategy leverages component-oriented and event-driven software development as seen in GeoVISTA Studio and the GeoViz Toolkit
Typology

• Partially Implemented
• What visual analytic states should we pass over the wire as XML?
  – Data
  – Display
  – Category
Typology - Data

• The units of analysis
  – Spatial data
  – Temporal data
  – Numerical data
  – Textual Data
  – Derived data (via calculation)

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<th>SUM_PACIFI</th>
</tr>
</thead>
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<td>14</td>
</tr>
<tr>
<td>496</td>
<td>84</td>
</tr>
</tbody>
</table>
Typology - Display

• How data is represented visually
  – Static properties
    • Color, location, size,
    • Typologies from MacEachren, Wilkenson, Bertin, others
  – Dynamic properties
  – Other sensory properties
Typology - Category

- Defining sets on data
  - Classifying
    - Univariate
      - Quantile
      - Equal Interval
    - Multivariate
      - K-Means
      - SOM
  - Extent
    - Attribute
    - Spatial
    - Temporal
Persistence

• Partially Implemented
• We can persist the program state, or artifacts of the program state, such as visual representations, and textual annotations
• Since the program state is preserved as XML, we can think of many way it can be stored, used, and accessed
  – On local disk
  – On a remote site
  – In a database
User Analysis

• Implementation begun, but not functional yet.
• HCI (Human-Computer Interface) researchers have focused on examining patterns in user behavior.
• One shortcoming of this work is determining where a significant event in the analysis took place (what does insight look like?)
• GeoJabber has the potential to help identify significant events in analytic sessions.
Technology Choices

• For Jabber -> OpenFire and Smack

• For marshaling -> XStream

The alternatives…
Technology Choices

- Alternative Implementation Options for Collaboration
  - Sockets
  - JXTA
  - RMI
  - Jabber
- Alternative Options for Marshaling
Alternative – Sockets

• Sockets let you send raw streams of bytes back and forth between two computers, giving you low-level access to the TCP/IP or UDP protocols.

• Java Sockets are a mechanism for communication built into most versions of Java.
Alternative – Sockets

- Disadvantage – sockets are too low level, and therefore do not support the concept of objects.
Alternative – JXTA

• A set of open peer-to-peer protocols.

• Allow any connected device on the network to communicate and collaborate in a P2P manner.

• Create a virtual network where any peer can interact with other peers and resources directly.
Alternative – JXTA

- JXTA Network Overview
Alternative – JXTA

- Disadvantage – complicated and unfamiliar. Did not work out of the box (at least for me). Because JXTA does not use TCP/IP or UDP, programmers need to learn an entirely new set of networking protocols to debug JXTA networking problems.
Alternative – RMI

- Remote Method Invocation (RMI)

- An object running in one Java Virtual Machine (VM) invokes methods on an object running in another Java VM.

- Remote communication between programs written in the Java programming language.
Alternative – RMI

**Step 1:**
- a. Upload Stub to Registry
- b. Bind to Name

**Step 2:**
- a. Lookup Name
- b. Download Stub

**Step 3:**
Interface object communicates with remote Implementation object via Stub
Alternative – RMI

• We selected this solution for our first implementation for ease of use.

• RMI is part of the standard Java distribution
Alternative – RMI

• Disadvantages of RMI
  – Fragile against change. Versions must be kept tightly in synch. If one client updates and another does not, the application will fail.
  – For peer-to-peer applications, each node must be a client and a server, increasing developmental effort.
Alternative Jabber Implementations

• Tigase – Java. Easier to extend, but harder to get started.
• eJabberd – Written in Erlang. High concurrency.
• Many more
• Cisco bought Jabber, Inc. for no reason I can tell.
Alternatives to XStream

- JAXB
- XMLBeans
- Many others....
Conclusions – Future Work
Conclusions – Future Work

• Conclusions
• Future research
• Acknowledgements
Conclusions

• GeoJabber provides a working method for allowing synchronous collaboration in Visual Analytics.

• GeoJabber is extensible, both in what types of analytic operations are supported, and what is done with the analysis artifacts.

• Much work to be done....
Future Research

• Support more types in my typology.
• Integrate with annotation facilities.
• Provide search over previous sessions.
• Publish to G-EX portal
• Publish to Penn State Annotations DB
• In the misty future, provide interoperation with ArcGIS, Open Layers, etc…
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The GeoVISTA Center

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However, any opinions, findings, and conclusions or recommendations in this document are those of the authors and do not necessarily reflect views of the U.S. Department of Homeland Security.

Workshop Organizers