GIS and Graduate IS Research

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GIS Workshop, ICIS Conference, Auckland New Zealand, December 14, 2014
Agenda

- CGU and GIS
- A Transdisciplinary Science and Practice
- Overview of GIS/IS Concentration
- Current Research Streams
- Future Directions
Historical Background of CGU

• Founded in 1925. The first university in North America to devote itself entirely to graduate study.

• Includes four Schools, and two Centers. Has established an intimate, student-focused environment designed to promote creative collaboration with faculty and fellow students.

• Part of the Claremont Colleges Consortium
The Center for Information Systems and Technology (CISAT) was founded in 1983 by Dr. Paul Gray, an influential pioneer and world-renowned scholar in the field of information systems and technology (IS&T).

CISAT takes an applied transdisciplinary approach to IS&T, with multiple concentration options in both master’s and doctoral program, as well as interfield options with any of the CGU schools.
Geographic (Spatial) information science: is the science behind the technology and considers fundamental questions raised by the use of systems and technologies; GIS-T is the science needed to keep technology at the cutting edge; it is a transdisciplinary field with many disciplines contributing to these issues.

Wave 1: geography, cartography, urban planning,
Wave 2: information/computer science, social sciences, economic and business applications.

(Adapted from Goodchild, 2002)
CISAT Academic Programs

Information Systems and Technology
Masters – 44 Units
PhD – 76 Units

Health Informatics
MPH Concentration

IT Management
MBA Concentration

GIS Solution Development

Cyber Security

Social Technologies

Health Informatics

Claremont Graduate University
A Brief History of GIS and Esri at CGU

1998 - Spatial Cognition of Neighborhoods Study
2000 - GIS Course Offered at CISAT
2003 - First Spatial Information System Development Dissertation
2006 - GIS Concentration Started
2008 - Named one of three inaugural EDC’s by Esri
2009 - SafeRoadMaps achieves 10 million visits
2010 – First Esri MOU signed
2011 – CISAT Refines Concentrations, Accelerates GIS
2012 – Advanced GIS Lab formed to Enhanced CGU Research
2013 - Renewed Esri MOU and Scholarship Program
2013 - Horan and Hilton Invited to White House
2013 - GIS Becomes Top CISAT Concentration
2013 - CISAT Expands GIS Efforts Across CGU
2013 – Esri Visit for GIS Day and Student GIS Club Formed
2014 – Board of Trustees Approve Additional GIS Positions
The CGU Focus: Video

Location Analytics at CGU

http://is.cg.edu
Figure 1: The three sub-domains comprising the GIS&T domain, in relation to allied fields. Two-way relations that are half-dashed represent asymmetrical contributions between allied fields.
The Advanced GIS Lab in CISAT focuses on advanced location analysis and the research and development of advanced GIS solutions. The Lab stresses an integrated approach to knowledge, research, and problem-solving that takes the core ideas, methods, and concepts from several disciplines and uses them to study a broad range of problems.
Esri Partnership and Development Center (EDC)

One of the founding Esri Development Centers, (EDC).

New MOU supports education, research and training collaboration.

Applied focus unites research on pressing issues with new platforms, tools, and techniques.
GIS Concentration Highlights

Foundation Courses (Required)
- IST 370: Geographic Information Systems: Essential Concepts
- IST 371: GIS Solution Development

Advanced Courses (Choose 1)
- IST 372: Advanced GIS Analytics and Solution Development
- IST 380: Geospatial Business Intelligence
- IST 380: Health Geoinformatics
- IST 380: Spatial Thinking and Statistics (planned)

Specialized Topics (Choose 1)
- IST 380: Cloud Computing
- IST 380: Mobile Applications

Practicum (Required)
- IST 373: GIS Practicum

360 student enrollees in GIS Concentration Courses, 204 since 2011
### Current Lab Projects Underway

<table>
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<tr>
<th>Topic and/or Organization</th>
<th>PI</th>
<th>GIS Lab Role</th>
<th>Students</th>
<th>Domain</th>
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<tr>
<td>Freight Rail BNSF / Esri</td>
<td>Horan / Hilton</td>
<td>Lead</td>
<td>Yaser Khouja, Ziyun Xu (Riki), Watanyoo Suksa-Ngiam</td>
<td>Transportation</td>
</tr>
<tr>
<td>Tribal Transportation Safety / Esri</td>
<td>Horan</td>
<td>Lead</td>
<td>Ziyun Xu (Riki), Rachel Camacho</td>
<td>Transportation</td>
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<tr>
<td>Health Spatial Decisions Inland Empire / Esri</td>
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<tr>
<td>Spatial De-identification / Esri</td>
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<td>Abdullah Murad</td>
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<td>Personal Safety Spatial Decision Making</td>
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<td>Retail Food Environment Index</td>
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<td>Montana Native American Voting</td>
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<td>Energy Infrastructure</td>
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<tr>
<td>Community College Engagement</td>
<td>Cecilia Rios-Aguilar</td>
<td>Support</td>
<td>Maria Reyes</td>
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</tr>
<tr>
<td>GIS in High School Teaching - CHS</td>
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<td>Lead</td>
<td>Sarah Osailan</td>
<td>Education</td>
</tr>
<tr>
<td>Upland USD Spatial Data Analysis</td>
<td>Hilton</td>
<td>Lead/Support</td>
<td>Rachel Camacho, Marco Antonio Cruz</td>
<td>Education</td>
</tr>
<tr>
<td>Las Vegas Real-time Spatial Social Analysis</td>
<td>Horan / Hilton / Zak</td>
<td>Lead/Support</td>
<td>Sarah Osailan, Yaser Khouja, Omar Aboulola</td>
<td>Economics</td>
</tr>
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</table>
Design Science is an outcome based information technology research methodology, which offers specific guidelines for evaluation and iteration within research projects.

Design science research requires the creation of an innovative, purposeful artifact for a special problem domain.
The artifact must be evaluated in order to ensure its utility for the specified problem. In order to form a novel research contribution, the artifact must either solve a problem that has not yet been solved, or provide a more effective solution.

Both the construction and evaluation of the artifact must be done rigorously, and the results of the research must be accepted from both presented effectively both to technology-oriented and management-oriented audiences.
GeoHealth Informatics Ecosystem

Community

Patient

Insurer

Provider

Policy

Policy
GIS is similar in that it:

- Provides highly robust capabilities in most of these areas, and extends visualization and predictive modeling beyond traditional BI systems.

- Allows for the leveraging of the spatial component of data, which is not a native component of traditional BI systems.

- Maps and other visualization can help tell a story that is otherwise difficult to realize in traditional scorecards, charts, tables, etc.

Gartner: 8 essential components of BI

- Reporting
- Dashboards
- Ad hoc query
- Search-based
  - OLAP
- Interactive visualization
- Scorecards
- Predictive modeling
- Data mining

GIS as a Business Intelligence Tool
Michael McElroy
Research Questions

How can spatially enabled data inform healthcare decision making at the community and clinical service delivery level?

What current healthcare business imperatives could benefit from a spatial perspective?

What are the range of organizational decisions that might be affected by introducing GIS-based IT artifacts?
Model specific business processes that have an impact on decision making

Extract, from those processes, datasets that have a spatial component

Use the identified processes and spatial data to build IT artifacts which showcase how geospatial technology can improve decision making

Action Design Research
Process Modeling

- Identify business imperatives
- Model current process
- Identify spatial components
- Define opportunities for use of GIS
- Prototype application
Behavioral Health Assessment
San Bernardino County Behavioral Health

- Visualization of mental health client density
- Overlay existing resources
- Useful to plan where to place new resources
Childhood Asthma Risk
Loma Linda University Health (LLUH)

- Map environmental factors in real time
  - Wind
  - Air Quality

- Overlay location of children with history of asthma

- Develop a risk score for potential attack

- Send targeted notifications
  - Parents
  - School Nurses
Spatial Analysis of Freight Economy and Supply Chain
The purpose of this study was to focus the nation’s attention on the economic role of freight system in the US.

The focus of the study is on industry clusters in Minnesota and the relationship of these geographic economic clusters on the freight rail system.

The study has interwoven research and outreach elements.
Study Methods

- **Economic and Related GIS Data Analysis**
  - Industry cluster, GSP shift-share, and GIS analysis

- **National and Regional Expert Interviews**
  - Class 1 and shortline railroads; federal, state and local policymakers; system users; economic development officials.

- **Report Reviews and Synthesis**
  - Various sources: NCFRP, SHRP, economic research, Minnesota state freight and rail plans.

- **Outreach and Feedback**
  - Interim/ Final Presentations, TPEC Advisory Committee.
Minnesota Industry Cluster Story Maps

Metal Mining Industry Cluster
Iron ore has been one of Minnesota’s most abundant natural resources for many years...
Click to open story map

Agriculture Industry Cluster
Agricultural products have been a staple of the Minnesota economy...
Click to open story map

Food Processing Industry Cluster
The food processing industry of Minnesota is one of the most competitive industries...
Click to open story map

Interactive Atlas
Visit our interactive map, loaded with data about freight rail’s impact... (high bandwidth required)
Click to open interactive atlas

http://freighteconomy.org
Rail Critical to Supply Chain and Industries in Midwest
“The Best Single Map..”

Understanding and Enhancing the Value of Freight Economy in Minnesota

Freight rail is important to Minnesota’s economic competitiveness and plays a vital role in key Minnesota industries. State GDP has been higher than the national average in a few key areas - some of which are directly linked to freight.
Impact
New Directions

BIG DATA, BETTER WORLD?
Toward Predictive Analysis via Social Media, Big Data, and GIS

Anthony J. Corso
Claremont Graduate University

Introductions

Social Programs vs. Income

Social Media vs. Income

Collective Data

Objectives

In the title, the social media provide a new tool for understanding the mechanisms by which social programs impact income and, thus, the effectiveness of social programs. The objective of this paper is to develop a methodology for analyzing the relationship between social programs and income using social media data.

Methods

We collected data on social programs and income from a variety of sources, including government databases, online surveys, and social media. The data were then analyzed using statistical techniques, including regression analysis and machine learning algorithms.

Results

The results of our analysis show that social programs have a significant impact on income, and that this impact is mediated by social media. Specifically, we found that social programs tend to be more effective in areas with higher levels of social media activity.

Discussion

Our findings have important implications for policymakers and social program administrators. They suggest that social programs may be more effective when targeted to areas with higher levels of social media activity. However, further research is needed to understand the mechanisms by which social programs impact income through social media.

Conclusion

In conclusion, our analysis suggests that social programs and income are closely linked, and that this link is mediated by social media. These findings have important implications for policymakers and social program administrators, and suggest that social programs may be more effective when targeted to areas with higher levels of social media activity. Further research is needed to understand the mechanisms by which social programs impact income through social media.

References


Contact

e-mail: acorso@calbaptist.edu
Emerging Hot Spot Analysis
A Space-Time Approach to Pattern Mining
Lauren Bennett

Aggregation
- MAUP
- Temporal equivalent?

Conceptualization
- Relationships in space
- Relationships in time

Interpretation
- Categorizing locations
- Incorporating temporal trend statistics

Communication
- Visualization in 3D
- Value of categories for storytelling

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For More Information

Acknowledgements

Brian Hilton
Mike McElroy
Lee Munnich
Yaser Khouja
Lauren Bennett
Anthony Corso
Sean Bjurstorm

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