Project Geollery.com: Reconstructing a Live Mirrored World With Geotagged Social Media

Ruofei Du, David Li, and Amitabh Varshney
{ruofei, dli7319, varshney}@umiacs.umd.edu | www.Geollery.com | Web3D 2019, Los Angeles, USA
Introduction

Social Media
Introduction

Social Media + Topics
Motivation

Social Media + XR
Motivation
Social Media + XR
Motivation

2D layout

image courtesy: pinterest.com
Motivation
Pros and cons of the classic
Motivation

Pros and cons of the classic
Placing Flickr Photos on a Map

ABSTRACT

In this paper we investigate general methods for placing photos uploaded to Flickr on the World map. A few applications are given as examples for any method.

April 5-10, 2008 - Florence, Italy

Related Work

2D Geospatial Visualization

Pavel Serdyukov
Database Group
University of Twente
PO Box 217, 7500 AE
Enschede, The Netherlands
pserdyukov@cs.utwente.nl

Vanessa Murdock
Yahoo! Research
Diagonal 177
08018 Barcelona, Spain
vmurdock@yahoo-inc.com

Roelof van der
t
Yahoo! Research
Diagonal 177
08018 Barcelona
roelof@yaho

Hanan Samet
Marek O. Adamo
Michael O. Lieberman
Brendan Rentz
Center for Automation Research
Institute for Advanced Computer Science
University of Maryland
College Park, MD 20742 USA

Content Visualization and Management of Geo-located Image Databases

Matteo Cristani
Università degli Studi di Verona
and Google Inc.
Department of Computer Science
Di Paolo 15, 37134 Verona
Italy
matteo.cristani@gmail.com

Vittorio Murdock
Università degli Studi di Verona
Scuola di Informatica
Di Paolo 15, 37134 Verona
Italy
vittorio.murdock@uni ver.it

Alexandre Petros
Università degli Studi di Verona
and Google Inc.
Department of Computer Science
Di Paolo 15, 37134 Verona
Italy
alexandre.petros@gmail.com

Ulrich Castellani
Università degli Studi di Verona
Department of Computer Science
Di Paolo 15, 37134 Verona
Italy
ulrich.castellani@gmail.com

Abstract

In the last years, several algorithms and platforms for photo sharing have been developed. Usually, in order to index huge quantities of images for a fast and intuitive retrieval, additional textual tags attached to the images are considered. In this paper, we present a set of solutions for an effective management of geo-located images. In particular, we describe the techniques for searching geospatial coordinates of acquisition, techniques for retrieving content from the tag database, and management of large pre-indexed image databases.

Keywords
Image categorization, on-demand images, indexes.

ACM Classification Keywords
1.5.3. Information storage and retrieval systems (e.g., HIS): Information retrieval. 3.4.3. Content analysis and indexing (including methods).

Introduction

The widespread dissemination of personal digital images on the Internet and the wide adoption of personal digital cameras has made digital images an essential part of everyday life. These images are often categorized and stored in personal digital photo albums, which can be shared with friends and family over the Internet. However, it is often difficult to find specific images among the large number of images stored in personal digital photo albums. Furthermore, it is often difficult to find images that were taken in specific locations, such as beaches, parks, or landmarks.

To address these problems, several methods have been proposed for organizing and searching digital images. These methods include tag-based search, location-based search, and content-based search. Tag-based search involves assigning tags to images, such as keywords or geographic locations. Location-based search involves using geographic information, such as GPS coordinates, to retrieve images. Content-based search involves using image features, such as color and texture, to retrieve images.

In this paper, we propose a new method for organizing and searching digital images. Our method involves using a combination of tag-based search and location-based search. We first use tag-based search to retrieve images that are similar to the query image. Then, we use location-based search to retrieve images that were taken in the same location as the query image. Our method is able to effectively organize and search digital images, and it is able to retrieve images that are similar to the query image and images that were taken in the same location as the query image.
Related Work

2D Geospatial Visualization
Related Work

3D Geospatial Visualization

Photo Tourism: Exploring Photo Collections in 3D

Abstract

We present an approach for automatically converting and exploring large photo collections of photographs of a site using a novel 3D technique. Our system consists of an image-based model from which automatically computed the geometry of the model. The system can be used to explore the virtual environment, allowing users to navigate through the data and view images from different perspectives. The system has been evaluated through extensive user studies and found to be effective and efficient in exploring large photo collections.

Keywords: image-based modeling, 3D geospatial visualization, photo tourism.

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This paper describes an approach for creating a 3D model of a site from an image-based model. The approach is based on the assumption that images are taken from the same vantage point and that the images are taken at the same time. The system has been tested through extensive user studies and found to be effective and efficient in exploring large photo collections.

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Keywords: image-based modeling, 3D geospatial visualization, photo tourism.
Related Work
Social Street View, Du and Varshney
Web3D 2016 Best Paper Award
Related Work

Social Street View, Du and Varshney
Web3D 2016 Best Paper Award
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Social Street View, Du and Varshney
Web3D 2016 Best Paper Award
Related Work

3D Visual Popularity

Bulbul and Dhyot, 2017
Related Work

Virtual Oulu, Kukka et al.
CSCW 2017
Related Work

Immersive Trip Reports
Brejcha et al. UIST 2018
Related Work
High Fidelity, Inc.
Related Work

Facebook Spaces, 2017
What may a social media platform look like in mixed reality?
What's Next?
Research Question 2/3

What if we could allow social media sharing in a live mirrored world?
What use cases can we benefit from social media platform in XR?
Geollery.com
A Mixed-Reality Social Media Platform

- virtual avatars and live chats
- 3D buildings with 360° images
- geotagged framed photos
- geotagged street art
- geotagged virtual gifts
Conception, architecting & implementation

Geollery

A mixed reality system that can depict geotagged social media and online avatars with 3D textured buildings.
Extending the design space of 3D Social Media Platform

Progressive streaming, aggregation approaches, virtual representation of social media, co-presence with virtual avatars, and collaboration modes.
Conducting a user study of Geollery vs. Social Street View by discussing their benefits, limitations, and potential impacts to future 3D social media platforms.
System Overview

Geollery Workflow
System Overview

Geollery Workflow

2D polygons and metadata from OpenStreetMap

2D ground tiles

shaded 3D buildings with 2D ground tiles

added avatars, clouds, trees, and day/night effects

virtual forms of social media: balloons, billboards, and gifts

Geollery fuses the mirrored world with geotagged data, street view 360° images, and virtual avatars.
System Overview

Given (latitude, longitude)
System Overview

2D Map Data
System Overview

2D Map Data
System Overview
+Avatar +Trees +Clouds
System Overview
+Avatar +Trees +Clouds +Night
System Overview
Street View Panoramas
System Overview

Geollery Workflow
System Overview

Geollery Workflow
<table>
<thead>
<tr>
<th>Variable</th>
<th>Geollery</th>
<th>Social Street View</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mesh</td>
<td>Ground, 3D Buildings, trees, and clouds</td>
<td>Sphere</td>
</tr>
<tr>
<td>Textures</td>
<td>Geollery v1: No texture</td>
<td>Textured by 360° street views</td>
</tr>
<tr>
<td></td>
<td>Geollery v2: With 360° street views</td>
<td></td>
</tr>
<tr>
<td>Availability</td>
<td>Almost always available</td>
<td>Only available for the locations with</td>
</tr>
<tr>
<td></td>
<td></td>
<td>360° street view data</td>
</tr>
<tr>
<td>Motion</td>
<td><strong>6 DoF</strong></td>
<td>3 DoF + Teleport</td>
</tr>
<tr>
<td>Virtual Avatar</td>
<td>Available</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Collaboration</td>
<td>Available</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Social Media</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Location Accuracy</td>
<td>Almost the exact location in the world</td>
<td>Estimated by distance and orientation</td>
</tr>
<tr>
<td>Virtual Representation</td>
<td>Billboards / Balloons / Framed photos / Doodles / Gifts</td>
<td>Billboards (v2: added balloons and gifts)</td>
</tr>
<tr>
<td>Aggregation</td>
<td>Based on spatial relationship</td>
<td>Based on direction and distance</td>
</tr>
</tbody>
</table>
Rendering Pipeline

Close-view Rendering

(a) initial spherical geometries
(b) depth correction
(c) intersection removal
(d) texturing individual geometry
(e) texturing with alpha blending
(f) rendering results in fine detail
Rendering Pipeline

Gap Alignment

(a) without gap alignment  (b) with gap alignment
Rendering Pipeline

Seam Blending

(a) without seam blending
(b) with seam blending
Rendering Pipeline

Street View vs. Satellite Images

(a) texturing with street view images
(b) texturing with satellite images
Rendering Pipeline

Gaussian Filtering

(a) without Gaussian filtering  (b) with Gaussian filtering
Rendering Pipeline

Occlusion Test

(a) without occlusion test

(b) with occlusion test
[ Introduction ]

[Start timing!] Hello, my name is __________. I’m __________ in __________ at the __________. First, I would like to thank you for your participation. Today, you will be a participant in a user study with a semi-structured interview. Our goal is to explore your experience using Geollery and Social Street View, the challenges and limitations of the interfaces, as well as the types of decisions it could influence and potential impacts it might have. Then, we will compare and rate the advantages and disadvantages of both systems in different aspects.

Before we begin the interview, we need to complete a consent form. After this, we will begin. Your data will be kept anonymous. Additionally, as a researcher I have no position on this topic and ask that you be as open, honest, and detailed in your answers as possible. Do you have any questions before we begin?

[ Begin Interview Study ]

→ The interview is broken down into three components:
  ⇣ Your background in using social media platforms.
  ⇣ User study of the Geollery and Social Street View platforms
  ⇣ Survey about future of 3D social media platforms.

[ Background ]

Main goals:

1. Get people comfortable with answering questions and creating a rapport.
2. Assessing how they are accessing social media in real life, and gain an understanding of their experience.

1. What are your views on social media platforms like Twitter and Facebook, how important are they to you?
2. Can you talk about your social media experience? How often do you use social media platforms? And how often do you post on social media websites?
3. What do you usually use social media platforms for?
4. Have you ever viewed social media in a map?
User Study
Quantitative Evaluation

Please compare the two systems and indicate the degree to which you agree with the following description. For example, for the first question, 4 is most immersive, -4 is most unengaging, 0 is neutral.

<table>
<thead>
<tr>
<th>Geology</th>
<th>Immersive</th>
<th>Straightforward</th>
<th>Creative</th>
<th>Pleasant</th>
<th>Practical</th>
<th>Simple</th>
<th>Appealing</th>
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</thead>
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<tr>
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<td>-3</td>
<td>-2</td>
<td>-1</td>
<td>0</td>
<td>1</td>
<td>2</td>
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<tr>
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<td>-1</td>
<td>0</td>
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<td>2</td>
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<td>-2</td>
<td>-1</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Unpleasant</td>
<td>-4</td>
<td>-3</td>
<td>-2</td>
<td>-1</td>
<td>0</td>
<td>1</td>
<td>2</td>
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<tr>
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<td>2</td>
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<tr>
<td>Complicated</td>
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<td>-2</td>
<td>-1</td>
<td>0</td>
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<td>2</td>
</tr>
</tbody>
</table>

Social Street View

<table>
<thead>
<tr>
<th>Unengaging</th>
<th>Prone</th>
<th>Creative</th>
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<tr>
<td>Immersive</td>
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<td>-3</td>
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</tr>
<tr>
<td>Creative</td>
<td>-4</td>
<td>-3</td>
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<tr>
<td>Pleasant</td>
<td>-4</td>
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<td>-1</td>
<td>0</td>
</tr>
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</table>
Suppose that we have a polished 3D social media platform like Geollery or Social Street View, would you like to use it? If so, how much time would you like to spend on it?
High-level Attitude Towards 3D Social Media Platform

- Supporters: 75.0%
- Followers: 20.0%
- Protester: 5.0%
I would like to use it every day when I go to work, or travel during weekends.
If it’s not distracting like Facebook and Instagram, I would use it every day on a couple of things.
I am a follower on most social media sites. I would only join a 3D social media platform once my friends are there.
If my friends are all on this, I can see myself spend a couple of hours every week.
I don’t think I will use this. I prefer to use Yelp to see comments [of nearby restaurants]
Can you imagine your use cases for Geollery and Social Street View? What would you like to use 3D social media platforms for?
I would like to use it for the food in different restaurants. I am always hesitating of different restaurants. It will be very easy to see all restaurants with street views. In Yelp, I can only see one restaurant at a time.
[I will use it for] exploring *new places*. If I am going on vacation somewhere, I could *immerse myself* into the location. If there are avatars around that area, I could *ask questions*. 
I think it (Geollery) will be useful for families. I just taught my grandpa how to use Facetime last week and it would great if I could teleport to their house and meet with them, then we could chat and share photos with our avatars.
... for communicating with my families, maybe, and distant friends, [so] they can see New York. And, getting to know more people, connecting with people based on similar interests.
If you were a designer or product manager for Geollery or Social Street View, what features would you like to add to the systems?
A mapping of the texture, high-resolution texture, will be great.
if there is a way to unify the interaction between them, there will be more realistic buildings [and] you could have more roof structures. Terrains will be interesting to add on.
I would like to see **kitties** and **puppies** running around, and **birds** flying in the air.
I could also add a bike, add a vehicle, a motorcycle in Geollery, this will add some fun.
High-quality content and seed users play key roles
Interactivity and panoramic textures matter.
Customization of avatars, diversity, and accessibility are crucial.
Discussion

Use Case: Audio Tour

How about going to MOMA this weekend?
Discussion
Taking the Feedback: Geollery v2, Web3D & VR 2019

Geollery: A Mixed Reality Social Media Platform

Experiencing a Mirrored World with Geotagged Social Media in Geollery

Geollery creates an interactive mixed reality world in real time, in which users are immersed with 3D buildings, like shops, and geotagged social media. The social media are visualized as balloons, billboards, framed photos, and gift boxes, all in real time.

Figure 1: Geollery creates an interactive mixed reality world in real time, in which users are immersed with 3D buildings, like shops, and geotagged social media. The social media are visualized as balloons, billboards, framed photos, and gift boxes, all in real time.

Figure 4: Visual feedback on the happiness of the virtual environment. The happiness score is calculated based on user interaction. The interactive mixed reality space is created and maintained through the interaction between the user and the virtual environment.

Figure 5: The mixed reality environment is created and maintained through the interaction between the user and the virtual environment. The happiness score is calculated based on user interaction. The interactive mixed reality space is created and maintained through the interaction between the user and the virtual environment.

Figure 6: The mixed reality environment is created and maintained through the interaction between the user and the virtual environment. The happiness score is calculated based on user interaction. The interactive mixed reality space is created and maintained through the interaction between the user and the virtual environment.

Figure 7: The mixed reality environment is created and maintained through the interaction between the user and the virtual environment. The happiness score is calculated based on user interaction. The interactive mixed reality space is created and maintained through the interaction between the user and the virtual environment.

Geollery, on the other hand, is an interactive mixed reality social media platform that combines the power of social media with the immersive experience of mixed reality. Geollery enables users to interact with virtual environments, share content, and experience social media in a new and engaging way.

Geollery is designed to be visually appealing and interactive, with a focus on user engagement and social interaction. The platform allows users to create and share their own virtual environments, interact with other users, and explore a variety of social media content.

Geollery’s mixed reality environment is created and maintained through the interaction between the user and the virtual environment. The happiness score is calculated based on user interaction, which allows for a more personalized and engaging experience.

ACKNOWLEDGMENT

Acknowledgments: We would like to thank our team for their hard work and dedication to making Geollery a reality. Special thanks to [team members’ names] for their contributions.

REFERENCES


Discussion

Taking the Feedback

coarse detail

360° images

fine detail

building polygons

depth maps
Discussion
Taking the Feedback

(a) initial spherical geometries
(b) depth correction
(c) intersection removal
(d) texturing individual geometry
(e) texturing with alpha blending
(f) rendering results in fine detail
Challenge
Global Market Constraints:
Weak Content for XR
Research Goal
Fuse the information from physical and virtual world

Social Street View
Best Paper Award
ACM Web3D ’16

Video Fields
ACM Web3D ’16

Spherical Harmonics Saliency
Best Student Poster Award
ACM I3D ’18
Under Review, TVCG ’19

Haptics and Gestures
- VRSurus (CHI EA ’16)
- HandSight (ECCV ’14, TACCESS’16, SIGACCESS ’16)

Foveated Rendering
- Kernel Foveated Rendering (I3D ’18)

Learning Sketchy Scenes
- Sketchy Scenes (ECCV ’18)
- LUCCS (Under Review, TOG ’19)

Visualization and Cryptography
- AtmoSPHERE (CHI EA ’15)
- TVC (VR ’19)

Geollery
ACM CHI ’19

Multiview Videos

Meshes

Montage4D
ACM I3D ’18
JCGT ’19

PANORAMAS

SOCIAL MEDIA
Future Directions

Fuses Past Events
Future Directions

With the present
Future Directions
And look into the future
Future Directions
Change the way we communicate in 3D and consume the information
Future Directions
Consume the information throughout the world
Thank you!

Greetings!

Hi, friends!

Hello!

Ruofei Du, David Li, and Amitabh Varshney
{ruofei, dli7319, varshney}@cs.umd.edu | www.Geollery.com | CHI 2019
Geollery: A Mixed Reality Social Media Platform

Ruofei Du, David Li, and Amitabh Varshney
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Collaborators, advisors, labmates, and committee members

Amitabh Varshney  varshney@cs.umd.edu
Matthias Zwicker  zwicker@cs.umd.edu
Furong Huang  furongh@cs.umd.edu
Joseph F. JaJa  joseph@umd.edu
Ming Chuang  minghuang@umd.edu
Hugues Hoppe  hhoppe@gmail.com
Jon Froehlich  jof@cs.washington.edu
Leah Eindlaster  leah@wisc.edu
Rama Chellappa  rch@umiacs.umd.edu

Liang He  edigahe@gmail.com
Wayne Chang  wechang@microsoft.com
Sameh Khamis  sameh.khamis@gmail.com
Shahram Izadi  shahram.izadi.ah@gmail.com
Spencer Fowers  sfowers@microsoft.com
Jeff Kramer  jkramer@microsoft.com
Ben Cutler  bcutler@microsoft.com
Sujal Bista  sujal@cs.umich.edu
Changqing Zou  aaronzou2125@gmail.com

Eric Krokos  ekrokos@cs.umd.edu
Xiaoxu Meng  xmxng@umiacs.umd.edu
Hsueh-Chien Cheng  hcheng@cs.umd.edu
Gregory Kramida  algomorph@gmail.com
Xuetong Sun  xtsun@cs.umd.edu
David Li  ericlee@umiacs.umd.edu
Sida Li  sidal@umiacs.umd.edu
Eric Lee  ericlee@umiacs.umd.edu
Sai Yuan  syuan@umd.edu