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STUDIES
LUCCA

Learning from the Past and Preparing for the Future: Cases and Tools for Cultural Heritage during Disasters

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XXXI Cycle

Overview

1. Background
2. Research Questions, Material and Methods
3. Main Works: The Past, The Present and The Future
4. Discussion and Conclusions

Background

Something should not have happened!!! Kathmand Darbar Square, a UNESCO World Heritage site, in ruins [#NepalEarthquake](#)



If I hear one more Westerner complaining about the loss of heritage instead of human lives in [#NepalEarthquake](#) I am going to SCREAM.

3:58 PM - 25 Apr 2015



Thieves & smugglers are active, keeping an eye open on our heritage leveled to ground. Our priceless jewels also need rescue. [#NepalEarthquake](#)

RETWEET

1



9:01 PM - 29 Apr 2015

Some Volunteers are required to sort out the debris & to recover save heritage artifacts at Basantapur, Contact 9851198800 [#NepalEarthquake](#)

RETWEETS

3

LIKE

1



6:24 AM - 1 May 2015

[#NepalEarthquake](#) The day after is always more painful, as truth registers. Don't know which is sadder: loss of life, or loss of heritage?

RETWEET

1

LIKE

1



7:50 AM - 26 Apr 2015



Background



Help record the earthquake-affected cultural heritage of Nepal by tweeting photos + location

[#heritagedamagenepal](#) [#culturedamagenepal](#)

1 1 1

Use these tags: [#heritagedamagenepal](#) and [#culturedamagenepal](#) to tweet pictures of earthquake affected cultural heritage of Nepal.

3 4

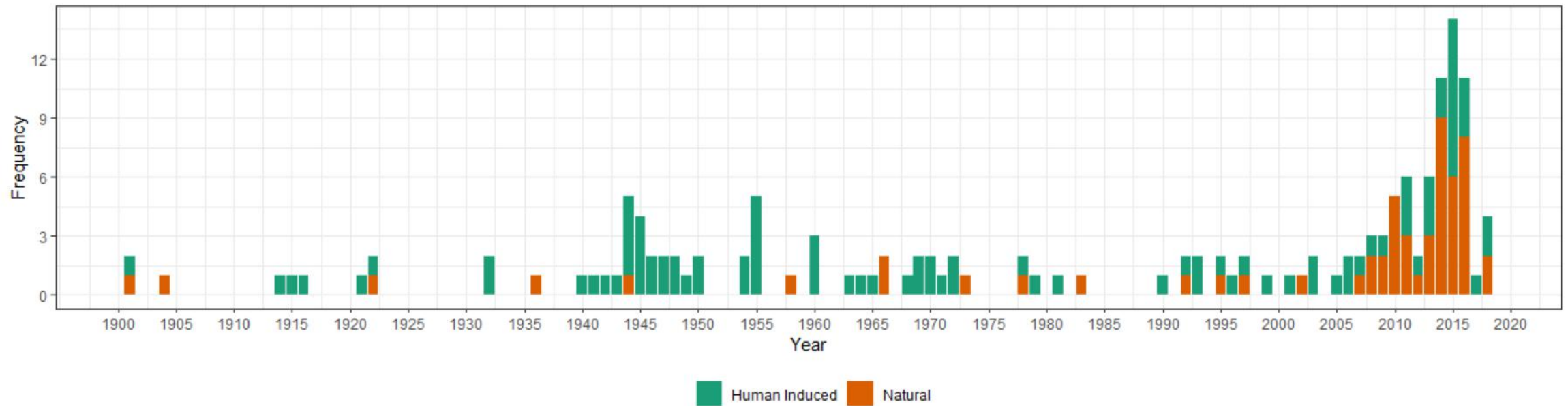
Important- tweet pics of [#earthquake](#) affected heritage sites around u [#heritagedamagenepal](#) and [#culturedamagenepal](#) [iccrom.org/help-us-collec...](#)

4

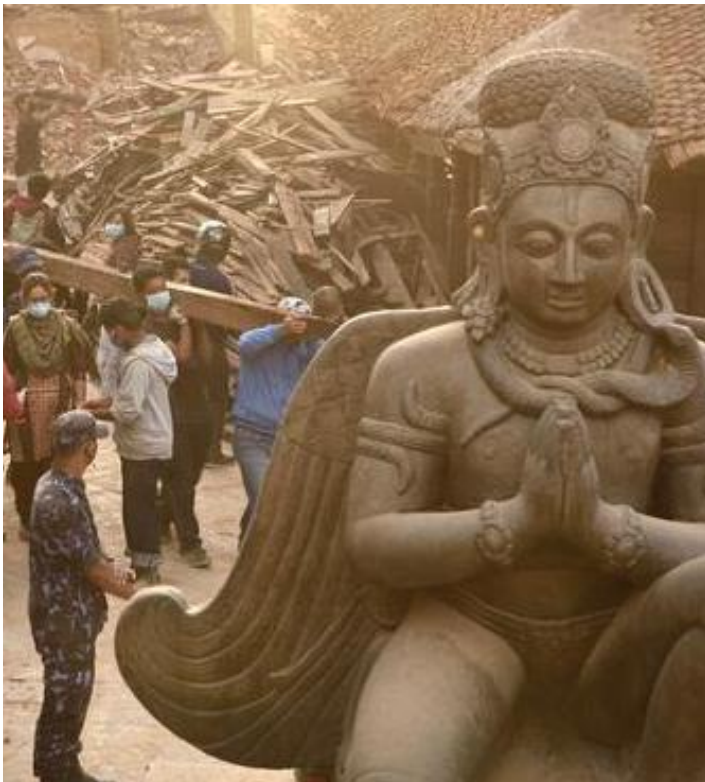
Help Nepal. Rohit Jigyasu send this message: Use [#heritagedamagenepal](#) and [#culturedamagenepal](#) to tweet pictures... [fb.me/3mY1E1Rmv](#)

4

Background



The frequency of disasters affecting cultural heritage has increased in the present times.



The Past

What can we learn about crowdsourcing from the past initiatives?

Case Study

1966 Florence Flood

Data Source

Correspondence from the archives of Fondazione Ragghianti, Lucca

Data Size

180 out of 753 items of correspondence

Method

Transcription, Translation and content analysis

The Present

How do people respond on social media?

Case Study

2015 Nepal Earthquake

Data Source

Twitter

Data Size

201,457 tweets and 6,529 images posted on Twitter

Method

Manual content analysis of text and images

The Future

How can social media data be used for evaluating the situation on the ground?

Case Study

2015 Nepal Earthquake

Data Source

Google and Twitter

Data Size

13,333 images from Google and 6,529 images posted on Twitter

Method

Manual content analysis and deep learning techniques

The Past

The 1966 Florence Flood

Crowdsourcing to Rescue Cultural Heritage during Disasters

Three main themes emerged from the analysis

- 1) Action**
- 2) Memory**
- 3) Sentiment**

Crowdsourcing to Rescue Cultural Heritage

Contribution Type	Number	Percent
Money	145	80.5%
Volunteer	6	3.3%
Knowledge	4	2.4%
Materials	2	1.1%
Money + Volunteer	3	1.7%
Money + Material	2	1.1%
Material + Volunteer	1	0.5%
Promise to Contribute	14	7.7%
Unable to Contribute	3	1.7%
Total	180	100%

Crowdsourcing to Rescue Cultural Heritage

Motivating Factor	Number	Percent
Memory	32	17.7%
Call to Participate	29	16.2%
Media	20	11.2%
Influencer	7	3.8%
Media + Influencer	12	6.7%
Media + Memory	11	6.2%
Influencer + Memory	1	0.5%
Media + Call to Participate	1	0.5%
Not Mentioned	67	37.2%
Total	180	100%

The Present

The 2015 Nepal Earthquake on Twitter

Twitter, Disasters and Cultural Heritage

- 7,989 (~4%) tweets about cultural heritage were extracted from the dataset (201,008 tweets).
- Not every site received equal attention from the public.
- Damaged sites received more attention.

Twitter, Disasters and Cultural Heritage

Category	Number	Percent
Information	7119	89.1%
Sentiment	2034	25.4%
Memory	406	5%
Action	306	3.8%
Noise	306	3.8%

Most of the tweets are hybrid i.e. they followed at least two categories.

The Present

The 2015 Nepal Earthquake in Twitter Images

Analysis on Classified Twitter Images

Category	Number	Percent
Heritage	566	8.7%
Not-Heritage	5,833	89.4%
Maybe- Heritage	71	1.0%
Removed	59	0.9%

Category	Number	Percent
Situation	379	67%
Message	68	12%
Memory	57	10%
Practice	28	5%
Screen-shots and edited images	23	4%
Other country's heritage	11	2%

The Future

Deep Learning to Classify Images of
Damaged Heritage Sites

Classification of Cultural Heritage Images with Deep Learning

Three models...

- **Lexicon-based Model:** matches the tweets text content against a lexicon.
- **Heritage Model-1:** trained on images of heritage and not-heritage sites.
- **Heritage Model-2:** trained on images of heritage and not-heritage sites and damaged heritage sites.

Classification of Cultural Heritage Images with Deep Learning

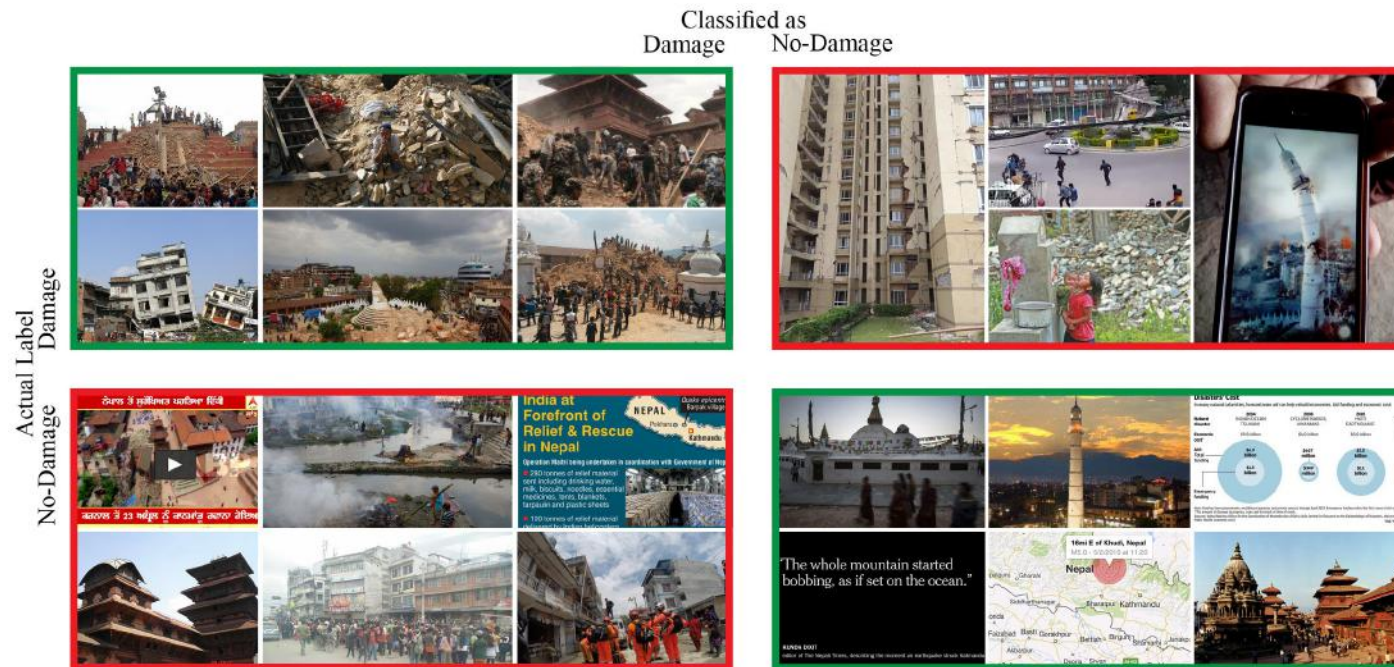
	Precision		Recall	
	Heritage	Not- heritage	Heritage	Not- heritage
Lexicon-based Model	0.55	0.94	0.20	0.99
Heritage Model-1	0.10	0.97	0.87	0.34
Heritage Model-2	0.26	0.98	0.76	0.82

Classification of Cultural Heritage Images with Deep Learning



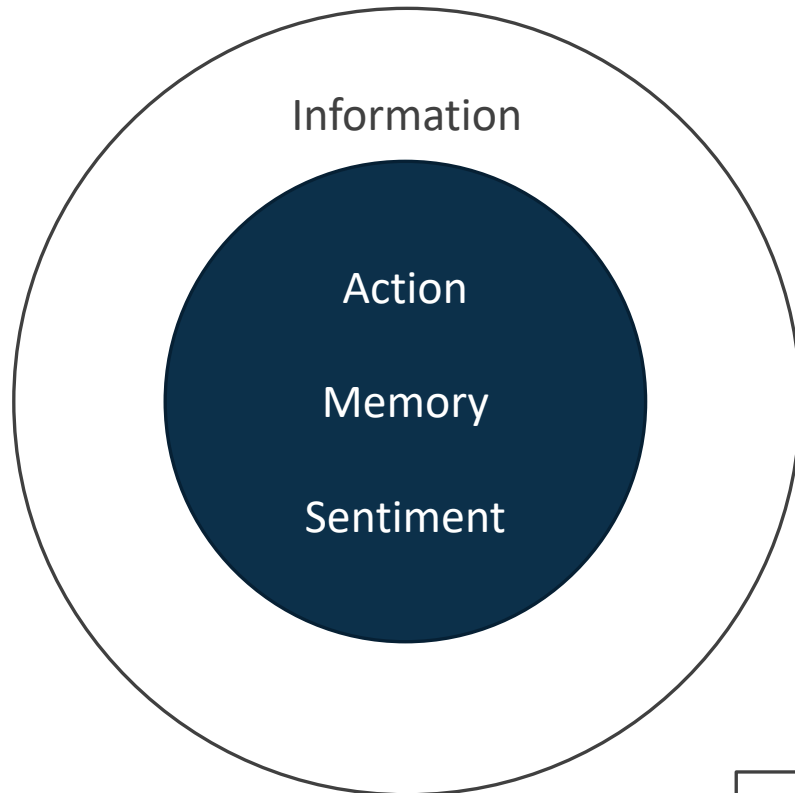
Classification of Images depicting Damage with Deep Learning

	Precision	Recall
Damage	0.81	0.87
No-Damage	0.94	0.92



Discussion and Conclusions

Comparison of Response: 1966 and 2015

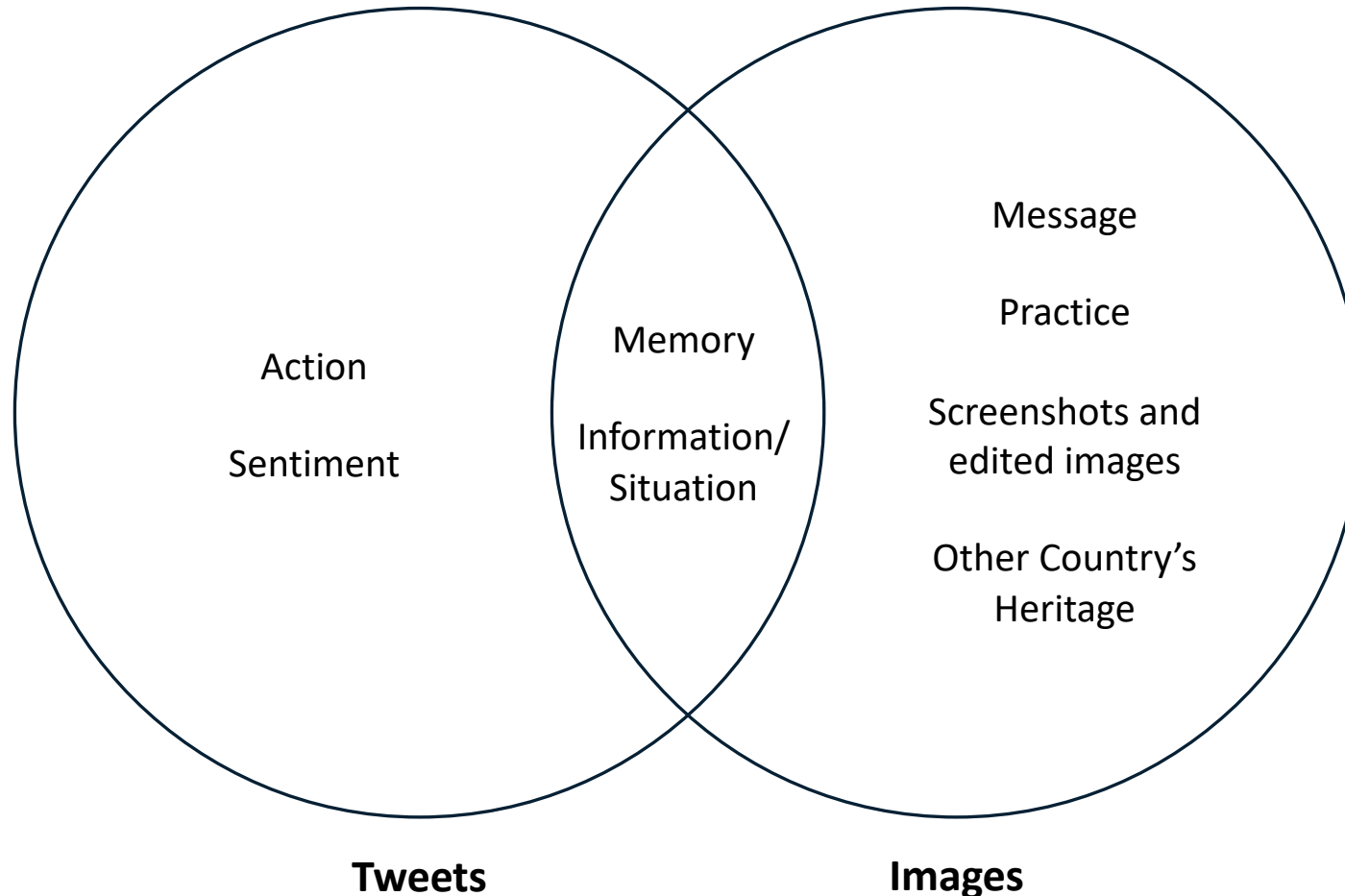


Themes in 2015

Themes in 1966

Memory and sentiment
play an important role
in the response.

Comparison of 2015 Response: Text and Images



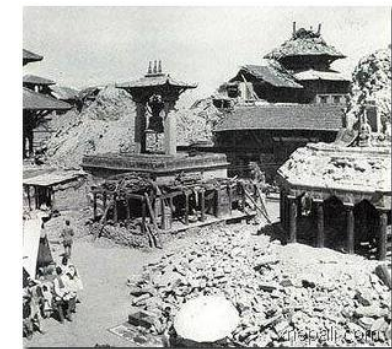
Information and memory
were the only
overlapping themes in
both images and tweets

Comparison of 2015 Response: Text vs. Images

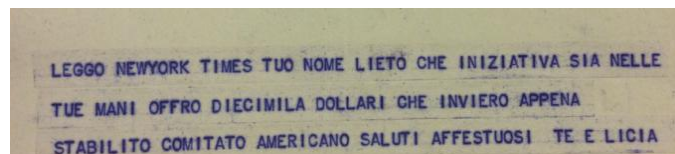
Tweet text tends to be more complicated.

The images posted on Twitter offer a better avenue for assessment of the situation on the ground.

400 yrs old-> MT @JigmeUgen: Patan Durbar Square (#Nepal's Pride & World Heritage Site) BEFORE/AFTER #NepalEarthquake



Technological Context and Media



Type	Most Popular Tweet	Number of Retweets
Mainstream Media	Truly awful sight. Kathmandu's Darbar Square, a UNESCO World Heritage site, in ruins after today's earthquake.	2084
User-generated content	Darbar Square, #Nepal's Pride & UNESCO designated World Heritage Site destroyed by #NepalEarthquake #PrayForNepal	877

Indifference towards Heritage

- Social media which affords a voice to the marginalized population.
- Heritage may not be an immediate need or priority in disaster-struck societies .
- However, it is indeed an integral part of a society.

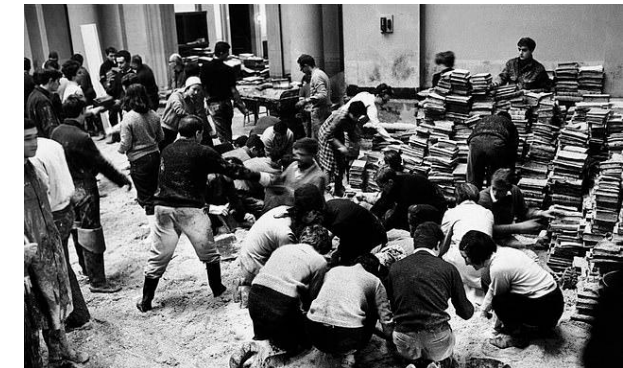
Some tweeters are worried about old Mosques/Temples/UNESCO heritage sites , please grow up world, save humans 1st.

[#NepalEarthquake](#)



Comments on FB - "Oh all that historical heritage lost in Nepal" What about 1,500 lives? Whatever happened to my generation

[#NepalEarthquake](#)



Conclusions

- **Be Prepared!**
 - ✓ Understand the technological landscape.
 - ✓ Know the tools available.
 - ✓ Post-disaster damage assessment can be time-sensitive, it should be planned in-between disasters.
- **Build a community of heritage enthusiasts.**
 - ✓ Memory of cultural heritage is an important factor to invoke sentiments and organize action after a disaster.
- **We can aid the experts.**
 - ✓ Invite the crowd to directly participate in an application.
 - ✓ Use the data from social media.
- **Social media poses many challenges.**
 - ✓ Discovery of information on cultural heritage can be challenging but **it can and should be done!**

Thank You!

Kumar, P. Crowdsourcing to Rescue Cultural Heritage during Disasters: A Case of Florence Flood 1966. *International Journal for Disaster Risk Reduction*. Volume 43, 2020, 101371.
DOI: 10.1016/j.ijdr.2019.101371

Kumar, P. User Response on Twitter regarding Cultural Heritage: A Case of 2015 Nepal Earthquake. Submitted to Special issue on Technological Mediation in Disaster Management.
Under Revision in Journal of Contingencies and Crisis Management.

Kumar, P. Heritage Images on Social Media during Disasters: An analysis of Twitter Images of 2015 Nepal Earthquake.
Manuscript to be submitted.

Kumar, P. Ofli, F., Imran, M., & Castillo, C. Detection of Disaster-Affected Cultural Heritage Sites from Social Media Images Using Deep Learning Techniques.
Under Revision in ACM Journal on Computing and Cultural Heritage.