

Humanitarian AI Roundtable Crisis Mapping and Super-Resolution

Kris Sankaran and Pablo Fonseca
(Work with Rifat Arefin, Anthony Ortiz, Jason Jo, Vincent Michalski,
and Samira Kahou)

January 31, 2019

Crisis response



Figure: Dam collapsed near Brumadinho on January 25, 2019

Mapathons: Volunteers Mapping

Instructions Map Validate Questions and Comments

Instructions

Entities to map
Buildings

Changeset Comment
#osmose-project-5703 #osmose-project-5702 #BrumadinhoDam #Brazil - Adding buildings to basemap

Imagery
osm[22]:https://switch:a,b,c,d] tiles.mapbox.com/v4/digitalglobe/21/314c9a2e/zoom/10/0/0.png?
access_token=token&pk_eyJ1j0zGInakRhbGdsb2JlIiwYSH6mNqZGFz2z2tFIMWgyDzHdm
MDBENzYfTQ SPi3XOOB2aX3dfrhV2B9Pg

Project Specific Mapping Notes

- We are only requesting to map buildings in this project. If you are proficient in OSM, please map other features 'traditionally' (i.e. not via task manager with specific tracking hashtags)
- Some of these tasks may have existing mapping, please preserve previous mappers' work whenever possible; improve if necessary, only delete if it actually does not exist.
- DigitalGlobe Premium appears to be the best imagery for the area, you will likely need to align it with GPS or existing roads.

Legend

- Ready
- Mapped
- Bad imagery
- Validated
- Invalidated
- Locked
- Locked by you

ACTIVITY AND STATS

MAP

© OpenStreetMap contributors

Figure: Pre-disaster basemap useful for planning search and rescue

Improving Sensing

- ▶ Map Annotation
 - How to augment human volunteers, and scale annotations?
 - Use case: Pandemic response planning



Figure: Exampling crowdsourcing session, from the MissingMaps websie.

Research Problems: Map Annotation

- ▶ **Conditional U-Net:** Models robust across a variety of environments
- ▶ **Interactive Corrections:** Leverage human volunteers efficiently
- ▶ **Useable Uncertainties:** Streamline validation and correction processes
- ▶ **Incremental Annotations:** Learn across a hierarchy of annotations

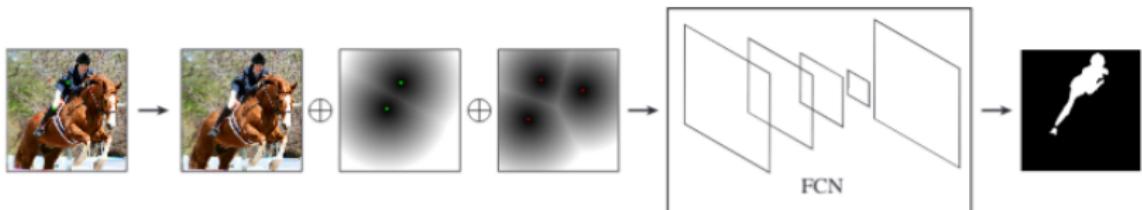


Figure: One approach to more interactive image segmentation, from “Deep Object Selection.”

Improving Sensing

- ▶ Super-Resolution
 - How to end monopolies on high-res maps?
 - Use case: Quantifying extent of violence in Darfur



Figure: A high-resolution image of a street in Khartoum.

► Super-Resolution

- How to end monopolies on high-res satellite images?
- Use case: Quantifying extent of violence in Darfur



Figure: Corresponding low-res views.

► Super-Resolution

- How to end monopolies on high-res satellite images?
- Use case: Quantifying extent of violence in Darfur

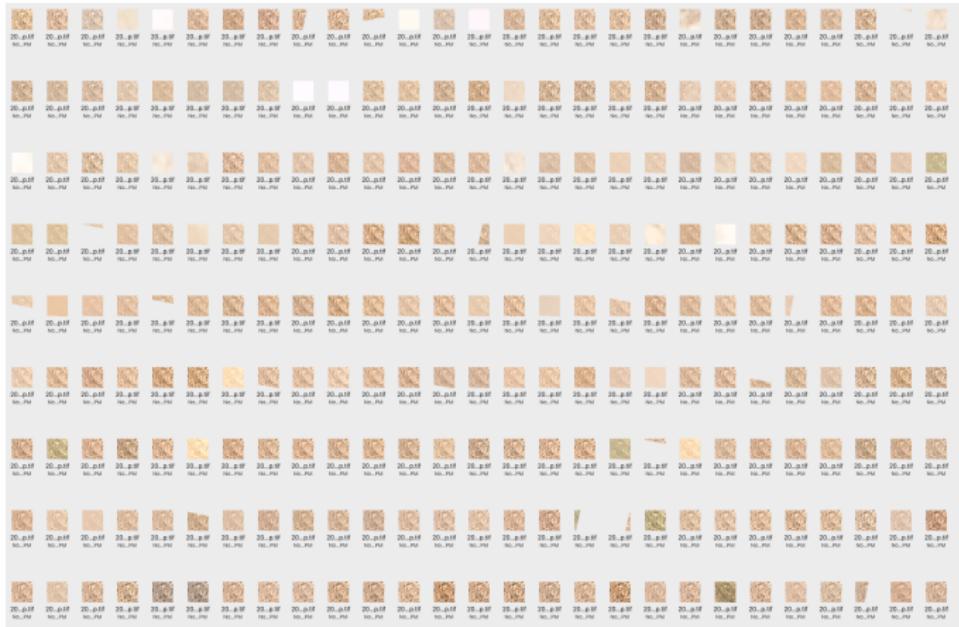


Figure: Corresponding low-res views.

Research Problems: Super-Resolution

- ▶ Conditioning: How to incorporate metadata into super-resolution?
- ▶ Multiframedness: Dealing with alignment and using multiple inputs (Knowledge Graphs, multichannel, and recurrence)

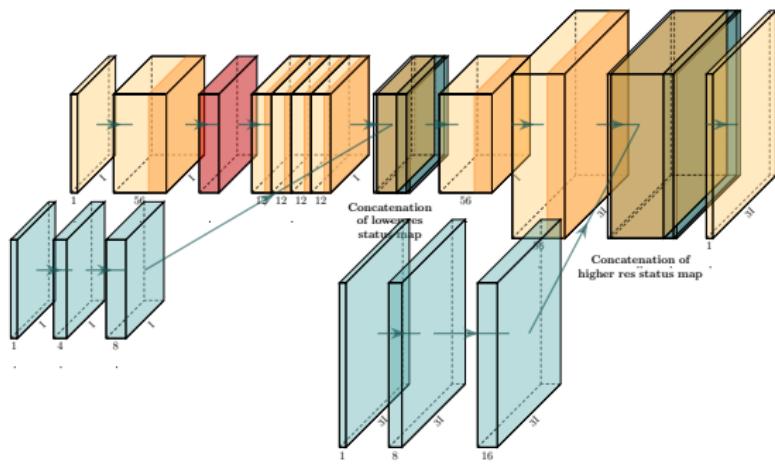


Figure: Example of conditioning architecture used for super-resolution.

Conclusion

- ▶ Challenges
 - Narrowing on problems – schools or bridges? Myanmar or Uganda?
 - Getting data!
 - Abstractions vs. applications
- ▶ Lesson Learned
 - Decide on your own MNIST
 - Define intermediate successes
 - There are more venues than you think