The Journal of Open Source Software

psi-collect: A Python module for post-storm image collection and cataloging

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DOI: 10.21105/joss.02075

Software

- Review
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Submitted: 03 February 2020
Published: 05 February 2020

Summary

Major storms along the coastline can damage infrastructure and leave deposits of sediment and debris. Synoptic aerial imagery is often used to assess damage and impacts from storm events. A key source for this imagery in the US is the Emergency Response Imagery (ERI) collected by the the National Geodetic Survey (NGS) Remote Sensing Division of the US National Oceanographic and Atmospheric Administration (National Geodetic Survey, 2020). This imagery aids in recovery efforts as well as rapid assessment of storm impacts along developed and undeveloped coastlines (Madore, Imahori, Kum, White, & Worthem, 2018).

Post-event imagery is typically large, both in terms of the number of individual image files and the size of each file. For example, Hurricane Florence (2018) has over 29,000 JPEG images, with an average size of 7.7 Mb. The first steps for extracting information from this data requires acquiring and processing images. NOAA ERI is currently available as a Web Map Tile Service or via download using a graphical user interface (directing users to the relevant tar and zip files). To enable users to download NOAA ERI images via command line for use in reproducible computational workflows, we developed a Python module (`psi-collect`).

The key functionality of `psi-collect` is it allows users to download specific tar and ZIP archives based on storm name, date of image acquisition (day, month, and/or year), image type (JPEG, TIFF). Users can also filter and select specific files using regular expressions. The module includes an automatic resumption feature in the event that a download is interrupted. Each tar and ZIP archive is checked for integrity of contents upon download completion to ensure that data is accurate and intact.

The module also functions as a tool for managing a user's library of images — users can quickly understand which storms they have downloaded. A cataloging tool is also supplied, which allows users to build CSV files that display key information for each image such as image name, acquisition data, file size, and latitude and longitude for each corner of image (extracted from the associated `.geom` file). This catalog can be used for statistical and spatial analysis.

Statement of Need

`psi-collect` enables scientists to download NOAA Emergency Response Imagery via Python in a variety of ways (via date, storm),and obtain metrics on downloaded images though the cataloging functions. We envision that `psi-collect` could be used to develop reproducible computational workflows to analyze post-event imagery. For example, images can be used to: assess damage to the built environment (e.g., Thomas, Kareem, & Bowyer, 2014), measure impact using the Sallenger Jr (2000) Storm Impact Scale (e.g., Liu et al., 2014; Goldstein et al., 2020), evaluate forecasts of storm impact (Morgan, Plant, Srockdon, & Snell, 2019), measure the morphology of storm deposits (e.g., Overbeck, Long, Stockdon, & Birchler, 2015; Lazarus, 2016), and study how human development controls the shape of sediment and debris deposits (e.g., Rogers et al., 2015).

Acknowledgements

EBG acknowledges funding from NSF (Award #1939954), The Leverhulme Trust (RPG-2018-282), and an Early-Career Research Fellowship from the Gulf Research Program of the National Academies of Sciences, Engineering, and Medicine. The content is solely the responsibility of the authors and does not necessarily represent the official views of the Gulf Research Program of the National Academies of Sciences, Engineering, and Medicine.

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