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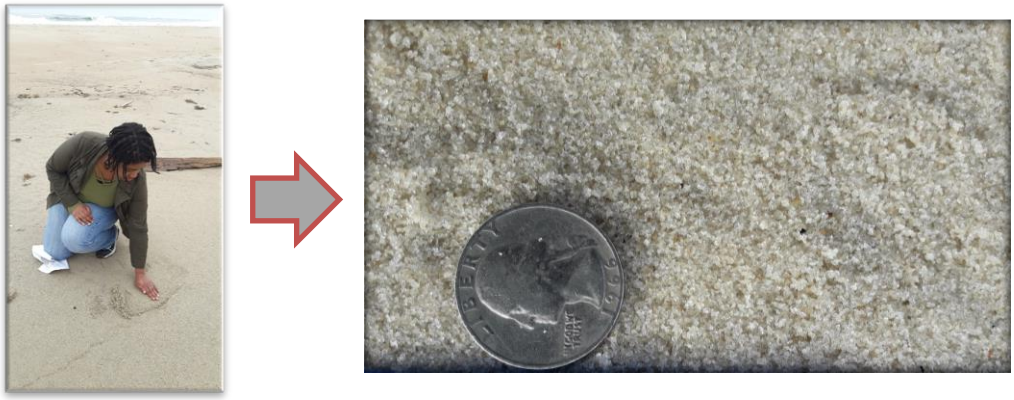
Engineer Research and Development Center

National Regional Sediment Management Program
Coastal and Hydraulics Laboratory (CHL):
SandSnap: Web Application Development

Description

SandSnap is a research initiative to engage citizen scientists to amass a spatial and temporally varying nationwide beach grain size database. This proposed project will build an interactive web application for citizen scientists to upload beach grain images and view the sediment gradation determined from a trained neural network operating on the cloud.



Issue/Challenge To Address

The United States coastline is a data-rich environment. Airborne LiDAR, wave buoys, wave hindcasts, and tide gauges provide excellent information on the position of the beach and the forcing acting upon it. Unfortunately, there is no comprehensive beach sediment data to improve the understanding of the beach composition and thus sediment mobility. Sediment size is a critical factor in all nearshore morphology models, including those widely implemented as decision tools across USACE. Unfortunately, it is entirely unfeasible to collect beach grain size data over a large geographical area with traditional methods (e.g., sample collection and sieve analysis). Consequently, this critical parameter often has the largest uncertainty in sediment transport modeling (Soulsby, 1997). Previous work has demonstrated the feasibility of creating a nationwide database of high-fidelity beach grain size data generated by analyzing sediment imagery obtained from cell-phone equipped citizen scientists via web application (McFall et al., 2020). These images will be analyzed with a deep learning neural network framework operating to determine the sediment gradation and the results will be stored for easy online access. This ongoing effort involves working with universities and Districts to collect sediment samples to train the deep learning neural network. The neural network is being stood up on the USACE's Microsoft Azure cloud resources. This project will create an interactive web interface and continue public outreach for the project.

Successes Lessons Learned

- Tech Note Publication.
- Determined best technique for high-fidelity beach grain size data from imagery.
- Working with more than 20 academic and government partners to collect samples

Estimated Benefits & Cost Savings

- Estimated $1M/year savings for sediment sampling ($100/sample - 10,000 sample/yr).
- Direct use for feasibility studies, beach re-nourishment lifecycle uncertainty analysis.
- Numerous academic and federal partner collaborations.

Expected Products

- Functioning SandSnap web application.
- Processing additional sediment samples w/ sieve analysis to retrain model.
- SandSnap neural network retraining (Quarterly).

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Stakeholders/Users

This project is being developed in collaboration with MARDA Science, James Madison University, and the USGS. More than 20 universities and state organizations are currently collecting sediment samples for the project (University of Southern Florida, Florida Atlantic University, Texas A&M University, Texas A&M University-Kingsville, Pepperdine University, University of Southern California, Naval Post Graduate School, Coastal Carolina University, University of Southern Alabama, etc.), and others will be engaged during FY21. This effort is supported by the American Shore and Beach Preservation Association (ASBPA).

Projected Benefits Value Added

Crowdsourcing the beach grain size data collection is estimated to save $100 per sample, and the fully operational web application is expected to collect 10,000 samples per year based on other successful citizen scientist initiatives. That leads to a direct estimated value creation of $1M/year. This database will support Navigation, Flood Risk Management, and Ecosystem business lines. Other potential uses for the database include: (1) feasibility studies, (2) Regional Sediment Management studies, (3) determining beach compatibility for beneficial use of dredged material, (4) beach re-nourishment lifecycle uncertainty analysis, (5) analysis of spatial and temporal gradation variation, and (6) large spatial/temporal scale geomorphological studies.

Leveraging Opportunities

This project is leveraged with the Coastal Inlet Research Program, and developmental support from James Madison University, Marda Science, and the USGS Santa Cruz office.

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Participating Partners

James Madison University, MARDA Science, USGS

Locations of collaborators in FY20 that are actively collecting sediment samples and imagery for SandSnap. Additional collaborators will be added in FY21.