DISASTER MANAGEMENT:
Generating Imagery Intelligence Products Quickly Using Machine Learning and Distribution via the Cloud

BILL VETETO
RECORD DAMAGE FROM HURRICANES IN U.S. IN 2017

Source: https://weather.com/storms/hurricane/news/hurricane-maria-irma-harvey-three-united-states-category-4-landfalls
QUICK REPORTING AND INFORMATION SHARING IS ESSENTIAL

• A wide range of interested parties need timely updates and reports, including:
  – State, Federal, Local Agencies
  – First Responders such as police and fire departments, rescuers
  – Utility Companies
  – Hospitals
  – Insurance companies
TEST CASE: HURRICANE HARVEY

• To show the applicability of Textron Systems Geospatial Solutions’ software, a test case was created that uses Digital Globe satellite data from Hurricane Harvey from August 31, 2017, which was one of the days of high flooding. Also, Lidar data for Houston will be used to estimate flooding levels in parts of the city.

• The Textron Systems software suite will be used to show applicability for the following:
  – Organize the remotely sensed data in the cloud
  – Analyze the data in the cloud and desktop environments
  – Show examples of products that could be disseminated to users
PUBLICLY AVAILABLE DATA

Source: https://tnris.org/data-catalog/
DEMONSTRATION AREA

Image Source: Here via ESRI
SIGNIFICANT FLOODING IN THE HEDWIG USGS QUAD

Image source: Digital Globe
TURNING IMAGERY AND LIDAR INTO INTELLIGENCE PRODUCTS
Textron Systems offers a robust set of software that is ideal for storing and analyzing remotely sense data:

- **GEOCATALOG**: Analysis in the Cloud Environment
- **RV CLOUD**: Desktop Analysis pushed to Cloud
- **REMOTE VIEW**: Download for Desktop Analysis
ORGANIZING DATA IN THE CLOUD
IMAGE ANALYSIS IN THE CLOUD

Image source: Digital Globe
MACHINE LEARNING USING FEATURE ANALYST FOR ARCGIS

Image source: Digital Globe
# FEATURE ANALYST RESULTS

<table>
<thead>
<tr>
<th></th>
<th>Total Area Extracted</th>
<th>Elapsed Time</th>
<th>Classification Time per square kilometer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hedwig Village USGS Quad</td>
<td>167 square kilometers</td>
<td>11 minutes</td>
<td>15 square kilometers/minute</td>
</tr>
</tbody>
</table>

Image source: Digital Globe
**LIDAR ANALYST FOR ARCGIS**

![LIDAR Analyst Toolbar](image)

**LIDAR Analyst Toolbar**

**Bare Earth Extraction**

- **Single/last return**: `hgc08-1m_2998124_crop.las`
- **First return**: `None`

**Map Units**

- **Horizontal**: US survey foot
- **Vertical**: US survey foot

**Output Resolution (Point clouds only)**

- **Manually specify cell size**: 1 map units

**Bare Earth Extraction Method**

- Method 1: Raster or Point Clouds
- Method 2: Point Clouds

**Pre-process**

- **Auto-detect no-data regions**
- **Remove spikes and pits before processing**
- **Enhanced interpolation for sharper edges**

**Post-process**

- **Remove negative nDSM regions**
- **Smooth bare earth using low-pass filter**

**Bare earth output**: C:\Share\testing\FANS2\BatchTesting\Dec_20\hgc08-1m_2998124_crop_bareEarth.tif

- **Reset to defaults**
- **Run Visible Extent**
- **Preview**
- **OK**
- **Cancel**

---

Textron Systems Geospatial Solutions is an operating unit of Textron Systems, a Textron Inc. (NYSE: TXT) company. © 2018 Overwatch Systems, Ltd. ArcGIS is a trademark of Environmental Systems Research Institute, Inc. Amazon Web Services is a trademark of Amazon Technologies, Inc. RemoteView, Feature Analyst, Lidar Analyst, GeoCatalog and RVcloud are trademarks of Overwatch Systems, Ltd.
LIDAR ANALYST PRODUCTS FROM POINT CLOUD FOR HOUSTON STUDY AREA

Data source: https://tnris.org/data-catalog/
FLOODING CALCULATION AT EACH BUILDING

- Bare Earth
- Building Base Height
- Flood Depth
- Reinterpolated Water Height as DEM
FLOODING IMPACT ON INDIVIDUAL BUILDINGS

Image source: Digital Globe