HARTE RESEARCH INSTITUTE FOR GULF OF MEXICO STUDIES

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Corpus Christi, January 19, 2017

Dr. Lakshmanan Valliappa
Program Manager for the Google Cloud Platform
Big Data and Machine Learning Professional Services
Google Inc.
601 N. 34th Street
Seattle, Washington 98103

Dear Dr. Valliappa:

This letter gives Google Inc. the right to use low-altitude aerial photography of Texas shorelines, hereafter referred to as Images, and there associated classification table for the purpose of demonstrating and evaluating image classification machine learning algorithms. If the results from the machine learning algorithm look promising we would like to further collaborate and develop a peer-review publication that entails the process and results. These Images and classification can be used for educational purposes to train people how to uses Google's cloud services and machine learning algorithms but cannot be sold.

The Images mentioned above were acquired in an airplane flying at a low-altitude. The Harte Research Institute (HRI) commissioned the image acquisition for mapping and verifying shoreline types of the Central and Lower Texas Coast project conducted by the Harte Research Institute and funded by the Texas General Land Office (GLO). In this project, a shoreline dataset was created for the central and lower Texas coast by manually digitizing shorelines using 2009 Texas Orthoimagery Program (TOP) imagery. The entire length of digitized shoreline was classified with Environmental Sensitivity Index (ESI) values in accordance with the ESI scheme (Table 1).

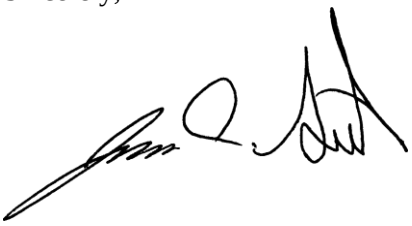
The ESI ranking system was originally established by Research Planning, Inc. (RPI) (Michel et al., 1978). The current shoreline classification for Texas (Table 1) is similar to those used for the other coastal states, which were standardized by NOAA/RPI (Michel and Hayes, 1992). The current Texas ESI classification scheme is a modification by Morton and White (1995) of the classifications proposed for Texas by Gundlach et al. (1981) and Michel and Dahlin (1993). Morton and White (1995) worked with RPI and National Oceanographic and Atmospheric Administration (NOAA) to classify the Texas coast according to standard ESI units used throughout the United States but with annotations pertinent to the Texas coast.

Table 1. Standardized ESI Rankings for Texas from Morton and White (1995)

ESI No.	Shoreline Type
1	Exposed walls and other structures made of concrete, wood, or metal
2A	Scarps and steep slopes in clay
2B	Wave-cut clay platforms
3A	Fine-grained sand beaches
3B	Scarps and steep slopes in sand
4*	Coarse-grained sand beaches
5	Mixed sand and gravel (shell) beaches
6A	Gravel (shell) beaches
6B	Exposed riprap structures
7	Exposed tidal flats
8A	Sheltered solid man-made structures, such as bulkheads and docks
8B	Sheltered riprap structures
8C	Sheltered scarps
9	Sheltered tidal flats
10A	Salt- and brackish-water marshes
10B	Fresh-water marshes (herbaceous vegetation)
10C	Fresh-water swamps (woody vegetation)
1OD	Mangroves

The shoreline dataset ESI classifications were determined by expert interpretation of the following sources: (1) 2009 TOP imagery; (2) 2012 low-altitude oblique aerial photography; (3) wetland maps from the National Wetlands Inventory and the Bureau of Economic Geology; and (4) field observations. The classification table supplied with the Images was derived by spatial joining the approximate geographic location of the each photo with the closest ESI classified shoreline. Images were included in this dataset if the approximate location of the image was within 100 meters of a shoreline. In total there are 11,713 Images.

Sincerely,



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