

Lost?

Geotagging and Organizing Oblique Aerial Digital Photographs in a GIS



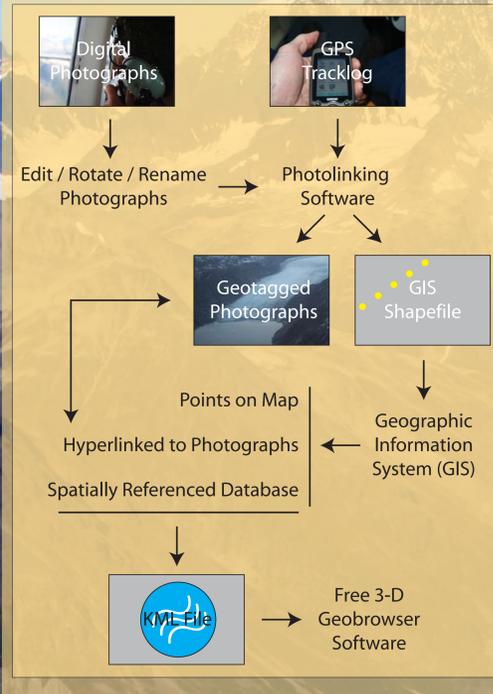
Background

It's easy to shoot hundreds of digital photographs in just a few hours from a small aircraft. However, effectively organizing 100s to 1000s of digital photographs is challenging. The Southwest Alaska Network has developed a procedure for geotagging and organizing oblique aerial digital photographs in a Geographic Information System (GIS) to support glacier extent mapping. This procedure may be applicable to other field studies that rely on the collection of large numbers of digital photographs to document the landscape.

Overview

A recreational-grade Global Positioning System (GPS) receiver is used to collect positional information while photographs are taken. Photolinking software is used to store locations in the photograph's metadata (geotagging) and create a GIS shape file. Photographs are plotted as points on digitized topographic maps or satellite imagery in a GIS. Hyperlinks create clickable links that show the digital photograph. Automatically generated and user defined attribute fields form a spatially referenced database that includes photograph location, altitude, velocity, orientation, subject, and caption. An open-source GIS software extension generates output in Keyhole Markup Language (KML). This allows a non-GIS user to search and view the photographs using simple 3-D geobrowsing software like Google Earth.

Flowchart



Geotagging

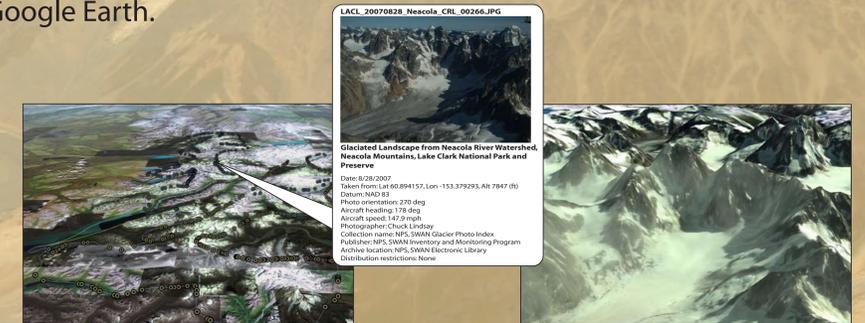
Sometimes called "geocoding", this is the process of adding geographical metadata to various media, like photographs. Newer GPS-enabled digital cameras are capable of geotagging. Software can be used for geotagging photographs taken on a standard digital camera.



Geotagged photograph of Yalik Glacier, Kenai Fjords National Park. Inset is screen capture from the EXIF (information created by digital cameras and stored with JPEG and TIFF files). Photolinking software was used to embed GPS coordinates - geotagging the photograph.

KML Output

A free software extension is used to output GIS shape files in Keyhole Markup Language (KML), a computer language for expressing geographic annotation and visualization in 3-D geobrowsing software. During output, simple HTML code is written so that photographs and attributes can be displayed in feature "balloon" descriptions. Multiple KML files and all photographs are combined into a single KMZ (compressed) file. This KML output allows a non-GIS user to interactively view the digital photograph atlas in popular geobrowsing software like Google Earth.



KML output viewed in Google Earth. Left: photo points from Lake Clark National Park and Preserve plotted on mosaic of satellite imagery. Center: Pop-up balloon opens when point is clicked. Photograph, caption, and attributes are displayed. Right: Close-up of 3D terrain visualization from Google Earth.

Equipment

Camera

- Digital SLR
- Fixed focal length (zoom)
- Set time to GPS (local or UTC)

GPS

- Recreational grade
- External Antenna
- Track log (1-second sampling interval)

Software

Batch File Namer

- FineBytes Magic File Renamer Pro (\$30)

Batch Photo Editor

- IrfanView with graphic viewer plugins (free)

Photolinking

- GPS-Photo Link Pro (\$329)

GIS

- ESRI ArcGIS

KML Extension

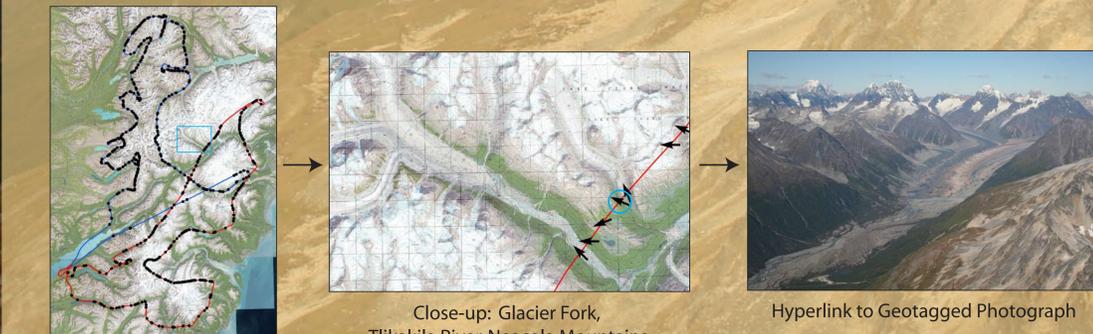
- Export to KML (free)

3-D Geobrowser

- Google Earth (free)

Organizing Photos in a GIS

Photolinking software uses time stamps to reference photographs to GPS positions. This software outputs a GIS shape file with features (points) representing each photograph. Attributes contain information related to each photograph. Automatically generated attributes include information from GPS (velocity, altitude) and camera (exposure, focal length). User defined attributes (azimuth, mountain range, watershed, geographic names, and keywords) are manually populated. Attributes are combined to generate photograph captions. Photo points are plotted on digitized topographic maps or satellite imagery. Hyperlinks are created that open corresponding photographs when points are selected. Feature symbology is changed to an arrow and rotated to reflect camera orientation. A shape file (line) is generated from the GPS tracklog and represents the flight line. Hundreds to thousands of oblique aerial photographs can be organized this way - in a digital photographic atlas.



GIS - Digital Photographic Atlas (Lake Clark National Park and Preserve)

Close-up: Glacier Fork, Tlikakila River, Neacola Mountains

Hyperlink to Geotagged Photograph

ATTRIBUTE FIELD	VALUE
FID	188
SHAPE	Point
ORIGINAL	LACL_20070829_Neacola_CRL_00224.JPG
PICTURE	LACL_20070829_Neacola_CRL_00224_small.jpg
THUMB	LACL_20070829_Neacola_CRL_00224_small.jpg
PICT_GE	LACL20070829CRL00224.JPG
LAT	60.803103
LONG	-152.858009
DATUM	NAD 83
ALTITUDE	7054
SPEED	147.9
HEADING	221
DATE	2007/2007
LOCALTIME	29 Jun 2007 10:26:08
PHOTO DIR	263°
PARK_CODE	LACL
LOC_1	Neacola Mountains
LOC_2	Tlikakila River
GLAC_NAME	Glacier Fork
GEOG_NAME	Glacier Fork Glacier
KEYWORDS	Neacola Mountains, Tlikakila River, Glacier Fork Glacier
CAPTION	Glacier Fork Glacier from Tlikakila River Watershed, Neacola Mountains, Lake Clark National Park and Preserve
PHOTOGRAPHER	Chuck Lindsay
COLL_NAME	NPS, SWAN Glacier Photo Index
ARCHIV_LOC	NPS, SWAN Electronic Library
PUBLISHER	NPS, SWAN Inventory and Monitoring Program
DIST_BSTR	None