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SAMA-VTOL Aerial Image Dataset (SVAID): A New UAV Image Dataset for Advanced Remote Sensing Research †

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Abstract: SAMA-VTOL aerial image dataset (SVAID) is a new open unmanned aerial vehicles (UAV) image dataset for a wide range of scientific projects in remote sensing (i.e. 3D object modeling, rural/urban mapping, digital elevation/surface model processing, etc.). Open high-quality UAV images play an important part in providing and expanding spatial data processing methods. The SVAID includes 120 rural/urban scene images with 80% overlap between images (forward overlap) and 60% overlap between flight lines (side overlap) from part of Esfahan province, Iran. The characteristics that make the SVAID an excellent scientific dataset are: (i) very high ground sampling distance (GSD) due to suitable fly height selection; (ii) GNSS-PPK (Post Processing Kinematic) system for improving the spatial accuracy without ground control points (GCPs); (iii) various landscape types (i.e. different types of roofs for commercial/residential buildings, vegetation, etc.), and (iv) uses of the new UAV-photogrammetry platform, named SAMA-VTOL (2019) has been developed by TAREQH Corporation. Additionally, The Agisoft Metashape software was used to analyzing images and produce point clouds, digital surface model (DSM) and orthoimage for evaluating SVAID quality and quantity.

Dataset: https://doi.org/10.6084/m9.figshare.8216576.v1

Keywords: SVAID; remote sensing; UAV; SAMA-VTOL; TAREQH

1. Introduction

Low-altitude remote sensing or aerial photogrammetry based on unmanned aerial vehicle (UAV) has been widely adopted in many hot fields of science research (i.e. 3D textured modeling of cultural heritage objects and places, affordable and accurate mapping, multi-temporal change detection, agricultural planning, etc.), and it has become a key geospatial data acquisition system [1–3].

Preparing UAV image datasets and free data sharing, plays an important role in geospatial data analysis and algorithms development [4]. UAV image dataset can be costly due to involvement of the special personnel (i.e. remote sensing specialist), use of expensive equipment (i.e. UAV platform), and providing optimal flight conditions (i.e. weather conditions). Therefore, TAREQH Corporation has produced a dataset with use of a new platform, called SAMA-VTOL aerial image dataset (SVAID). SVAID is a high-quality UAV image dataset for advanced remote sensing research with

focused on high-precision orthophoto generation and 3D building modeling. Summarizing information about SVAID characteristics is provided in the Table 1.

Table 1. SVAID characteristics.

Creating by	TAREQH Corporation
Thematic categories	remote sensing [5], photogrammetry [6], geospatial data analysis [7], computer vision [8], machine learning [9]
Research sub-fields	3D building modeling, point cloud processing, image matching, digital elevation/surface model processing
Aircraft	SAMA-VTOL (Vertical Takeoff and Landing and fixed-wing)
Sensor type	Fujifilm X-A3
Image size (pixel)	6000×4000
Focal length (cm)	27
Ground sampling distance (mm)	2.5
Flying altitude (m)	179
Date	7 Sep 2018
Location	Esfahan province, Iran

2. Data Description

2.1. Original RGB UAV Images

The original RGB UAV images were captured by SAMA-VTOL are provided for case study. These dataset consist of 120 rural/urban scene images with 80% forward overlap and 60% side overlap, where the SVAID uses the WGS 84 (EPSG::4326) coordinate system, as do most GNSS units. A data inventory is provided (Supplementary Material, File 1). Figure 1 shows the study site in the various landscape types with six samples of datasets collected from Esfahan province.

Figure 1. Various landscape types in SVAID. (**a-b**) vegetation; (**c-d**) residential; (**e-f**) commercial.

2.2. Coordinates of Center of Images (CCIs)

The coordinates of the image center points are provided for each SVAID's images by GNSS-PPK (Post Processing Kinematic) system on the SAMA-VTOL. Figure 2 illustrates the information available in txt file (Supplementary Material, File 2) with each column description given as follows:

First col. *Image No*: Assigning a unique ID for each image.
Second col. *Lat*: Latitude.
Third col. *Lon*: Longitude.
Fourth col. *Elevation*: Altitude.

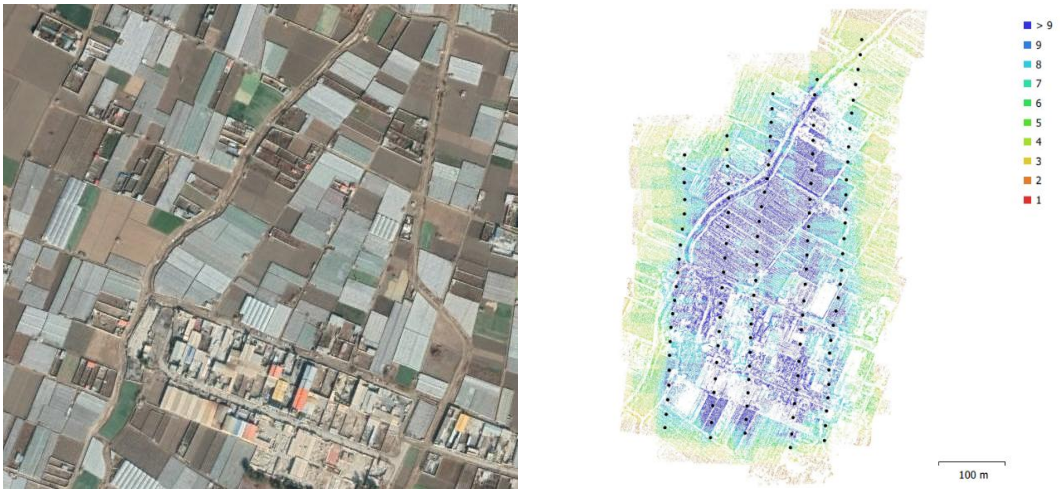
Image No	Lat	Lon	Elevation
DSCF3997.JPG	32.569856020	51.563181692	1775.350200
DSCF3998.JPG	32.570036768	51.563203482	1776.844800
DSCF3999.JPG	32.570236151	51.563227297	1776.212300
DSCF4001.JPG	32.570434552	51.563244481	1775.045500
DSCF4002.JPG	32.570638338	51.563251703	1773.949300
DSCF4003.JPG	32.570840151	51.563255020	1772.807700
DSCF4004.JPG	32.571026857	51.563266199	1771.325600
DSCF4005.JPG	32.571219630	51.563280763	1771.280000
DSCF4006.JPG	32.571406472	51.563306081	1772.832400
DSCF4007.JPG	32.571588704	51.563338157	1773.732600
DSCF4008.JPG	32.571775757	51.563366714	1773.895900
DSCF4009.JPG	32.571964175	51.563388386	1773.988700
DSCF4010.JPG	32.572148845	51.563410915	1773.503300
DSCF4011.JPG	32.572341801	51.563431436	1772.751000
DSCF4012.JPG	32.572556434	51.563462491	1772.014400
DSCF4013.JPG	32.572763995	51.563495118	1771.239100
DSCF4014.JPG	32.572958593	51.563501881	1769.858800
DSCF4015.JPG	32.573191848	51.563493688	1768.001600
DSCF4016.JPG	32.573378786	51.563488809	1767.366300
DSCF4017.JPG	32.573567147	51.563499388	1767.827700
DSCF4018.JPG	32.573828168	51.564180038	1772.572300
DSCF4019.JPG	32.573640195	51.564179017	1772.436900
DSCF4020.JPG	32.573412921	51.564191257	1772.065800
DSCF4021.JPG	32.573177688	51.564204457	1772.175200
DSCF4022.JPG	32.572981734	51.564208396	1773.341300
DSCF4023.JPG	32.572785616	51.564203689	1774.930300
DSCF4024.JPG	32.572591071	51.564189684	1775.418900
DSCF4025.JPG	32.572360798	51.564169034	1775.156200
DSCF4026.JPG	32.572164122	51.564148721	1774.697000
DSCF4027.JPG	32.571970795	51.564125436	1775.023600
DSCF4028.JPG	32.571759717	51.564100241	1775.183200

Figure 2. Sample CCIs in txt file.

3. Methods

2.1. Data Collection

The research site is part of the Esfahan province, Iran (Figure 3). The land cover consists of agricultural land and urban areas.



(a) **(b)**

Figure 3. Google Earth imagery of the study area. (**a**) Research site; (**b**) Camera locations and image overlap.

In this work, SAMA-VTOL was equipped with a Fujifilm X-A3 camera to acquire images (Figure 4). Additionally, the Agisoft Metashape software was used to analyzing images and produce dense point clouds, digital surface model (DSM) and orthoimage for evaluating SVAID quality and quantity and QGroundControl software was used to mission planning and flight control.

Figure 4. SAMA-VTOL.

2.2. Data Processing

The data processing, includes automatic aerial triangulation based bundle block adjustment with camera calibration and model generation by Agisoft Metashape. Figure 5 shows the results of the DSM and orthophoto from the SVAID. Also, Tables 2-3 shows the camera location error and point cloud generated specifications.

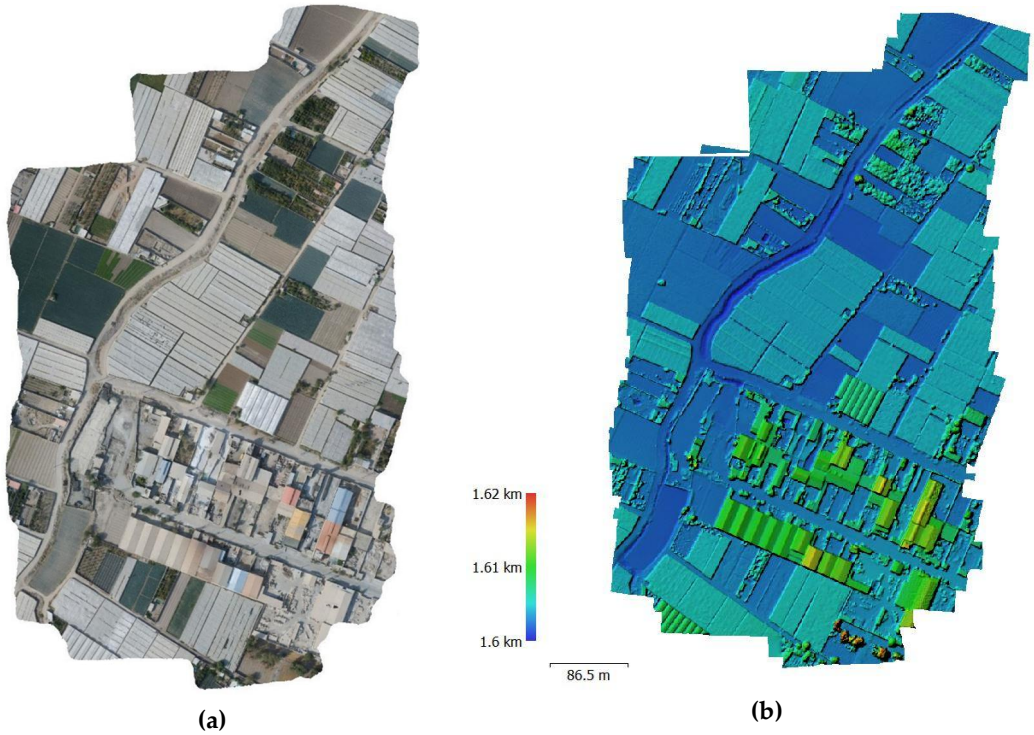


Figure 5. Products generated by the SVAID. **(a)** orthomosaic, and **(b)** DSM.

Table 2. Average camera location error.

X (cm)	Y (cm)	Z (cm)	XY (cm)	Total (cm)
1.26172	0.33944	1.77279	1.30658	2.20226

Table 3. Point cloud generated specifications.

Points	RMS reprojection error (pix)	Max reprojection error (pix)	Mean key point size (pix)	Point colors
696,962	0.501547	27.1304	4.22775	3 bands, uint8

Author Contributions: Mohammad Reza Bayanlou proposed the conceptual design and building the SAMA-VTOL. Mohammad Reza Bayanlou and Mehdi Khoshboresh Masouleh performed the experiments and analyzed the data. Abbas Ebrahimi revised the paper and provided valuable advices for the experiments.

Conflicts of Interest: The authors declare no conflict of interest.

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