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Comparison Between Thermal and Hyper-spectral Image Analysis: White-tailed Deer Population Monitoring in the Binghamton University Nature Preserve

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UAV-Based Monitoring to Track Deer Overpopulation in Upstate New York

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Introduction

- There is severe white-tail deer overpopulation across the northeastern United States
- Associated public health/environmental problems:
  - Ecological harm
  - Vehicular accidents
  - Lyme disease spread
- UAV imaging can be used to gain an accurate representation of population density

Methods

March 2020 Data Collection

- DJI Matrice 600 hexacopter was used in the Binghamton Nature Preserve at 100 m AGL at 10 m/s
  - Camera: FLIR Vue Pro R 13mm
  - 4 separate flights: 80,000 frames total of thermal image data collected
- Manually counted deer using Thermoviewer

Figure 1: Flight Paths

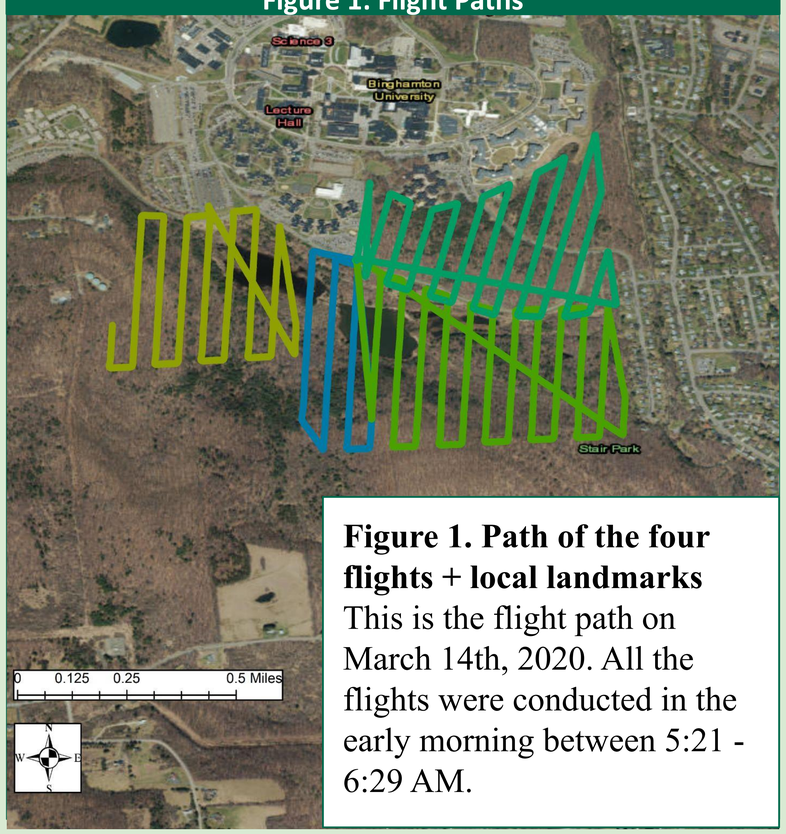

Figure 1. Path of the four flights + local landmarks This is the flight path on March 14th, 2020. All the flights were conducted in the early morning between 5:21 - 6:29 AM.

Methods cont.

Image Processing

- Thermal images are being processed using pix4D & Agisoft
- Cleaning algorithms were used to increase the signal, reduce the noise ratio & reduce instrumental error in individual images

Figure 2: Thermal Image Layers

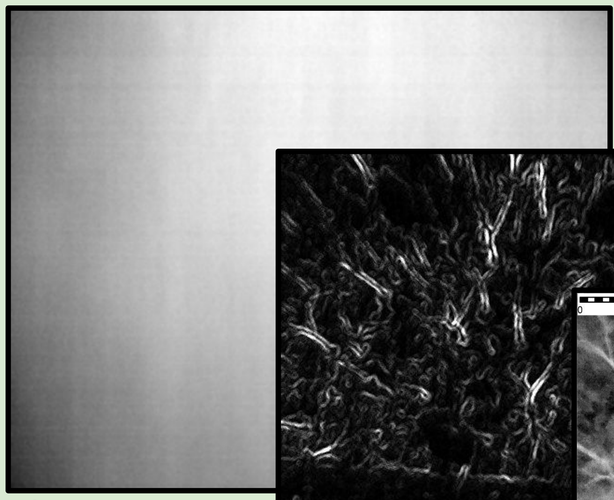

Figure 2a.

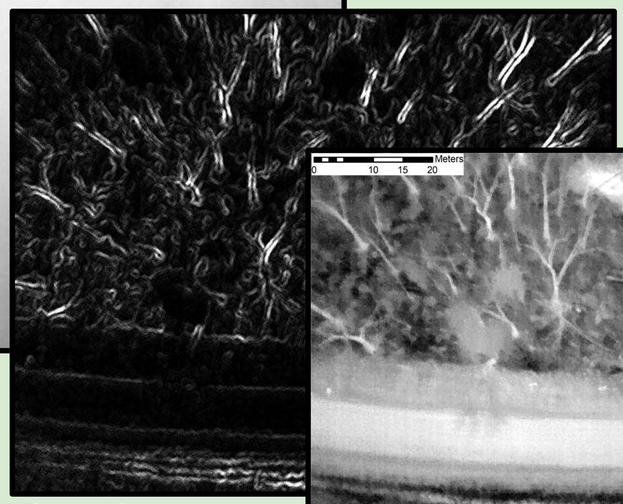

Figure 2b.

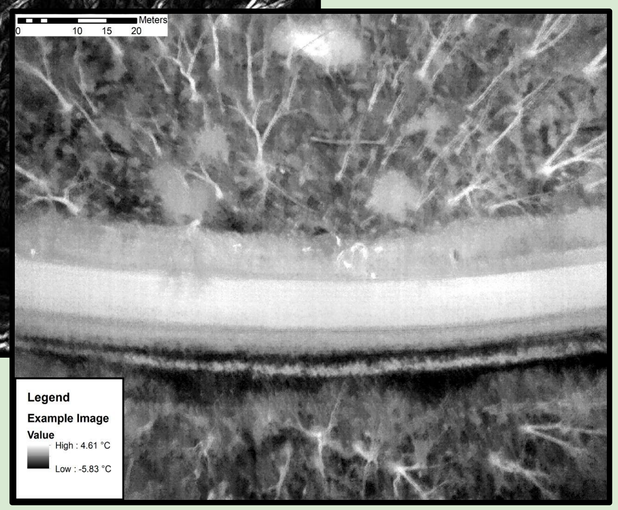

Figure 2c.

Image Processing Figures

Figure 2a. Example image of thermal mask used to lessen the "vignette effect" and reduce instrumental error. A python script was developed in order to remove the "cold corners" from the raw thermal images.

Figure 2b. Example image of different cleaning algorithms applied to the "de-masked" image. Using imageJ, we are able to apply filters in order to bolster the clarity of the signal (in this case, the trees within the image). A python script is being developed to apply these cleaning filters to all the flight files.

Figure 2c. Example of a single thermal IR image used to count the deer in the nature preserve. This is an example of a raw image used to count the number of deer in the nature preserve.

Preliminary Results

- 74 deer found within 1.15 km²
  - 64 deer/km²
  - Estimated 185 - 205 deer in whole preserve as of March 2020
  - In the undeveloped land there is an estimated 194 deer
- Another flight is planned for February/March 2022
- Plan to use the deer density & spread to estimate correlations with biodiversity & forest health

Discussion

- To reduce costs & hours of required labor, we flew over ~40% of the total area of the nature preserve
- Low sidelap creates difficulties in establishing tie points between images
- Additional cleaning algorithms may be applied to the images for further clarity
- Once an orthomosaic is developed, we will be able to conduct a population analysis
- We are considering collecting RGB data in addition to thermal data

References & More