Autonomous Aerial Assistance for Search and Rescue

Team F

Progress Review

March 22, 2017

Tasks

- Data collection: RGB, Thermal, and Sound
- Test human detection on new data
- Test other signature detection on new data
- Functionality to log flight data
- Test signature GPS location reporting algorithm
- Code migration to Python

Data Collection

- ~15 flights: collected RGB, thermal, and sound data
- Tested various configurations of:
  - Microphone
  - Camera
- Tested various flight parameters
- Included multiple signatures and human poses

Thermal and RGB algorithm integration

- Modification
  - Combine ROIs from both algorithms
  - Classify all ROIs by both RGB and thermal classifiers
  - Choose those bounding boxes classified as humans by both of the algorithms
- Output
  - Information of human bounding boxes in each frame
  - Timestamps which are in accordance with the bounding boxes
  - Images with human bounding boxes Video

	1	2	3	4
1	164	1	17	32
2	163	1	20	38
3	160	1	23	46
4	158	1	27	54
5	159	4	25	54
6	159	11	25	54
7	159	11	25	54
8	159	17	26	56
9	159	24	26	56
10	158	31	26	57

```
11:44:33.100
11:44:33.200
11:44:33.300
11:44:33.400
11:44:33.500
11:44:33.600
11:44:33.700
11:44:33.800
11:44:33.900
11:44:34.000
```

Bright regions detection

- HSV thresholding
  - Value threshold = 0.9
  - Saturation threshold = 0.3
- Suitable to detect tents, air mattresses

Video

Hot regions detection

- Intensity thresholding
- First step to detect other thermal signatures
- Reduce false positives in human signature detection

Video

Signature GPS location reporting algorithm (1/3)

- Input: [628, 530, '11:45:27.689655']
- Locations:
  - Drone: 40.472267, -79.966124
  - Mattress(cal): 40.472320339270574, -79.96603301939723
  - Mattress(actual): 40.47232217624828, -79.96601281695064
- Distances between locations:
  - Drone-Mattress(cal): 9 meters NE (52°)
  - Drone-Mattress(actual): 11 meters NE (56°)
  - Mattress(cal)-Mattress(actual): 1 meters E (83°)

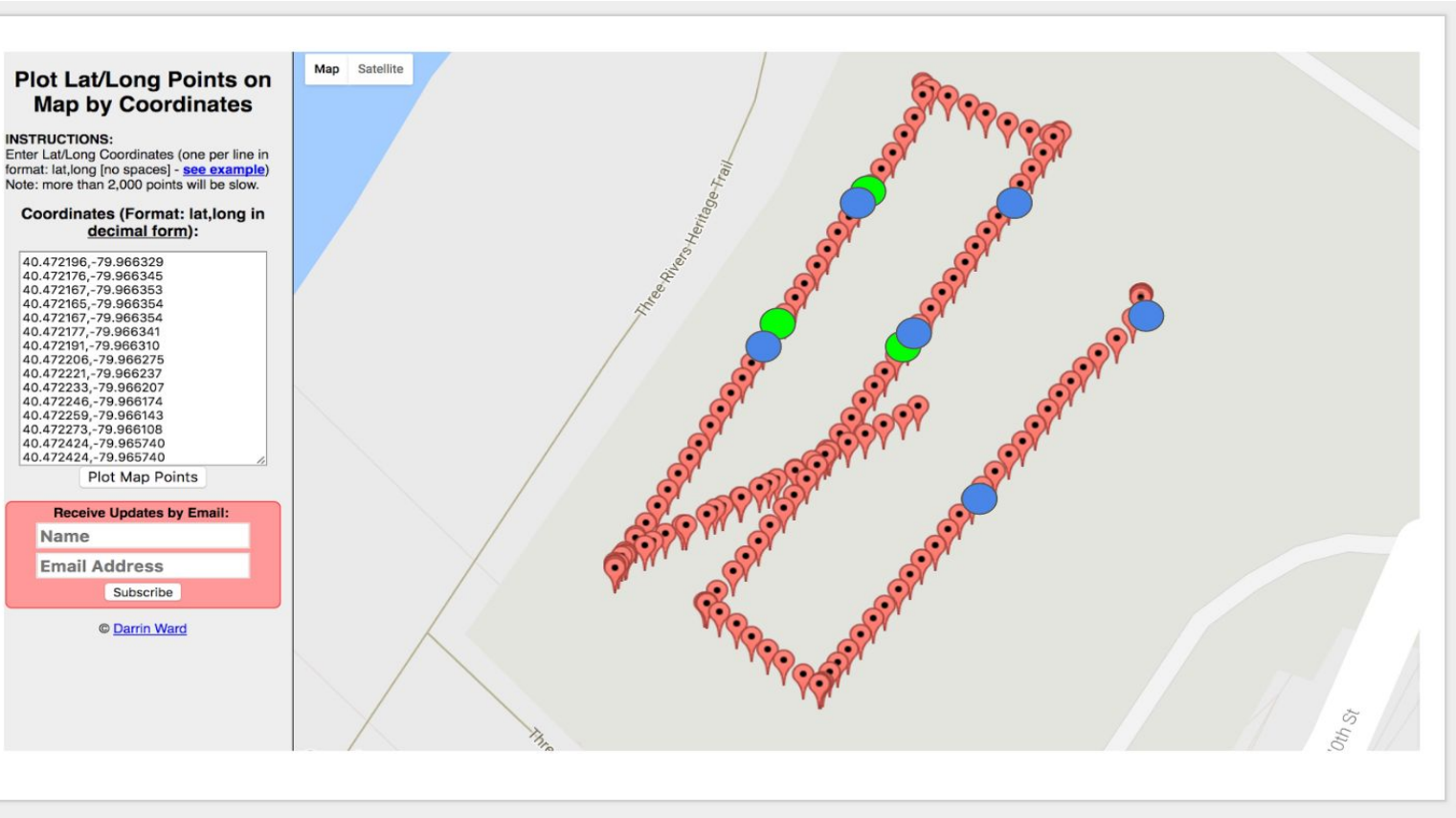
Signature GPS location reporting algorithm (2/3)

- Input: [847, 439, '11:45:01.793103']
- Locations:
  - Drone: 40.472196, -79.966329
  - Human(cal): 40.47210993039628, -79.9663917235796
  - Human(actual): 40.47232230197682, -79.96626913554962
- Distances:
  - Drone-Human(cal): 10 meters SW (209°)
  - Drone-Human(actual): 14 meters N (19°)
  - Human(cal)-Human(actual): 25 meters NE (23°)

Signature GPS location reporting algorithm (3/3)

- Input: [1421, 472, '11:45:45.000000']
- Locations:
  - Drone: 40.472284, -79.966083
  - Mattress(cal): 40.47231216286925, -79.96596290714584
  - Mattress(actual): 40.47237301249101, -79.96585213586684
- Distances:
  - Drone-Mattress(cal): 9 meters NE (52°)
  - Drone-Mattress(actual): 10 meters E (72°)
  - Mattress(cal)-Mattress(actual): 11 meters NE (54°)

Sound Signature



Code migration to Python

- Default settings for skimage.feature and sklearn.svm

```
In [31]: run test-object-detector
Calculating the descriptors for the positive samples and saving them
Positive features saved in ../data/features/pos
Calculating the descriptors for the negative samples and saving them
Negative features saved in ../data/features/neg
Completed calculating features from training images
Training a Linear SVM Classifier
Classifier saved to ../data/models/svm.model
Testing our classifier on positive images
0.830588235294
Testing our classifier on negative images
0.832075471698
```

- Adjust parameters for hog

```
In [1]: run test-object-detector
Calculating the descriptors for the positive samples and saving them
Positive features saved in ../data/features/pos
Calculating the descriptors for the negative samples and saving them
Negative features saved in ../data/features/neg
Completed calculating features from training images
Training a Linear SVM Classifier
Classifier saved to ../data/models/svm.model
Testing our classifier on positive images
0.894117647059
Testing our classifier on negative images
0.868867924528
```

Parameters for hog

```
[hog]
min_wdw_sz: [32, 64]
step_size: [10, 10]
orientations: 9
pixels_per_cell: [8, 8]
cells_per_block: [2, 2]
visualize: False
normalize: True

[nms]
threshold: .3

[paths]
pos_feat_ph: ../data/features/pos
neg_feat_ph: ../data/features/neg
model_path: ../data/models/svm.model
```

Thanks!