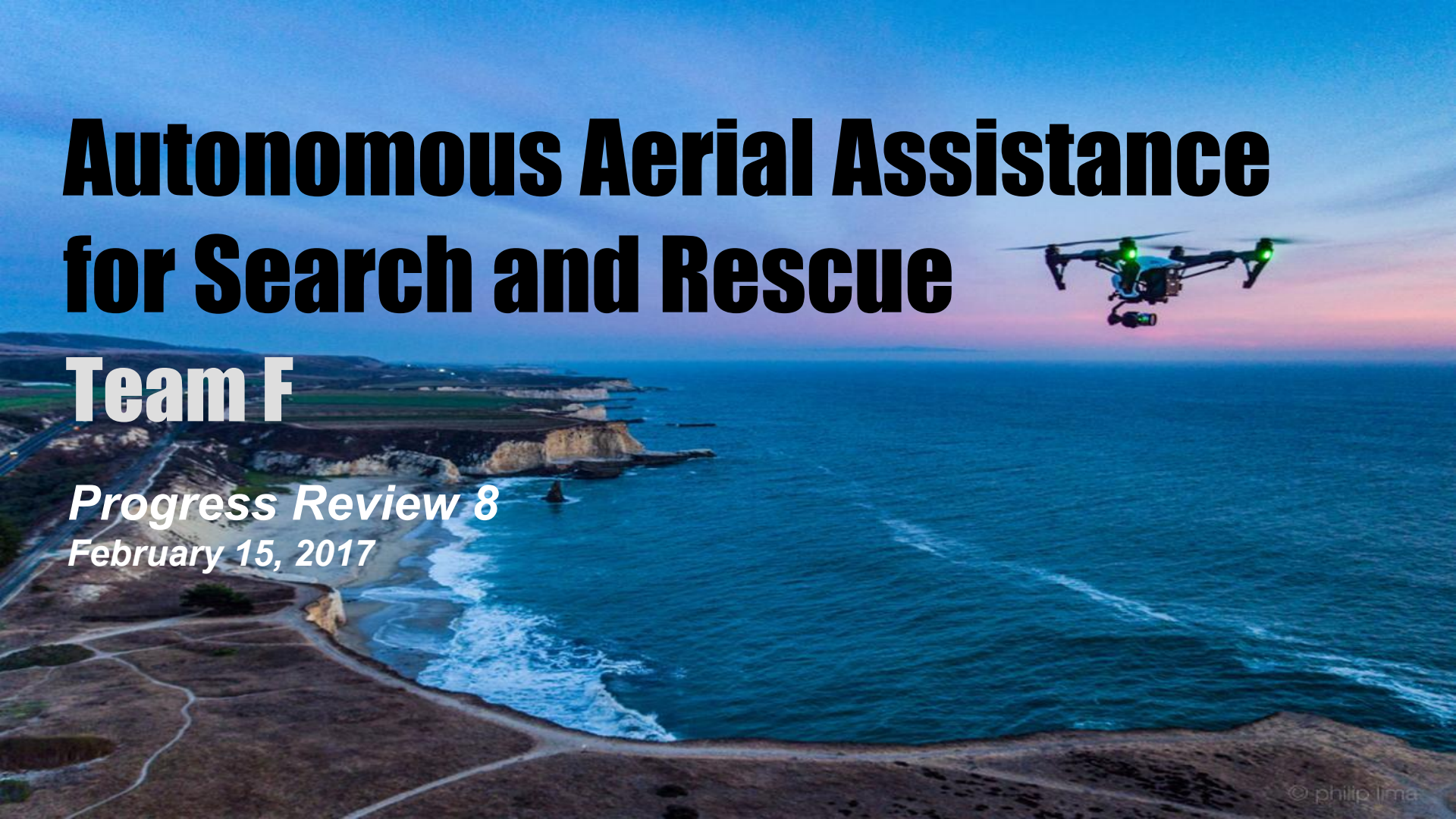
Autonomous Aerial Assistance for Search and Rescue



Team F

Progress Review 8

February 15, 2017

Tasks

- Test of revised RGB-based human detection algorithms
- Explore Signature Detection On Thermal Images
- Neural Network using Tensorflow
- Improvement on sound signature detection
- HSV thresholding to detect bright regions

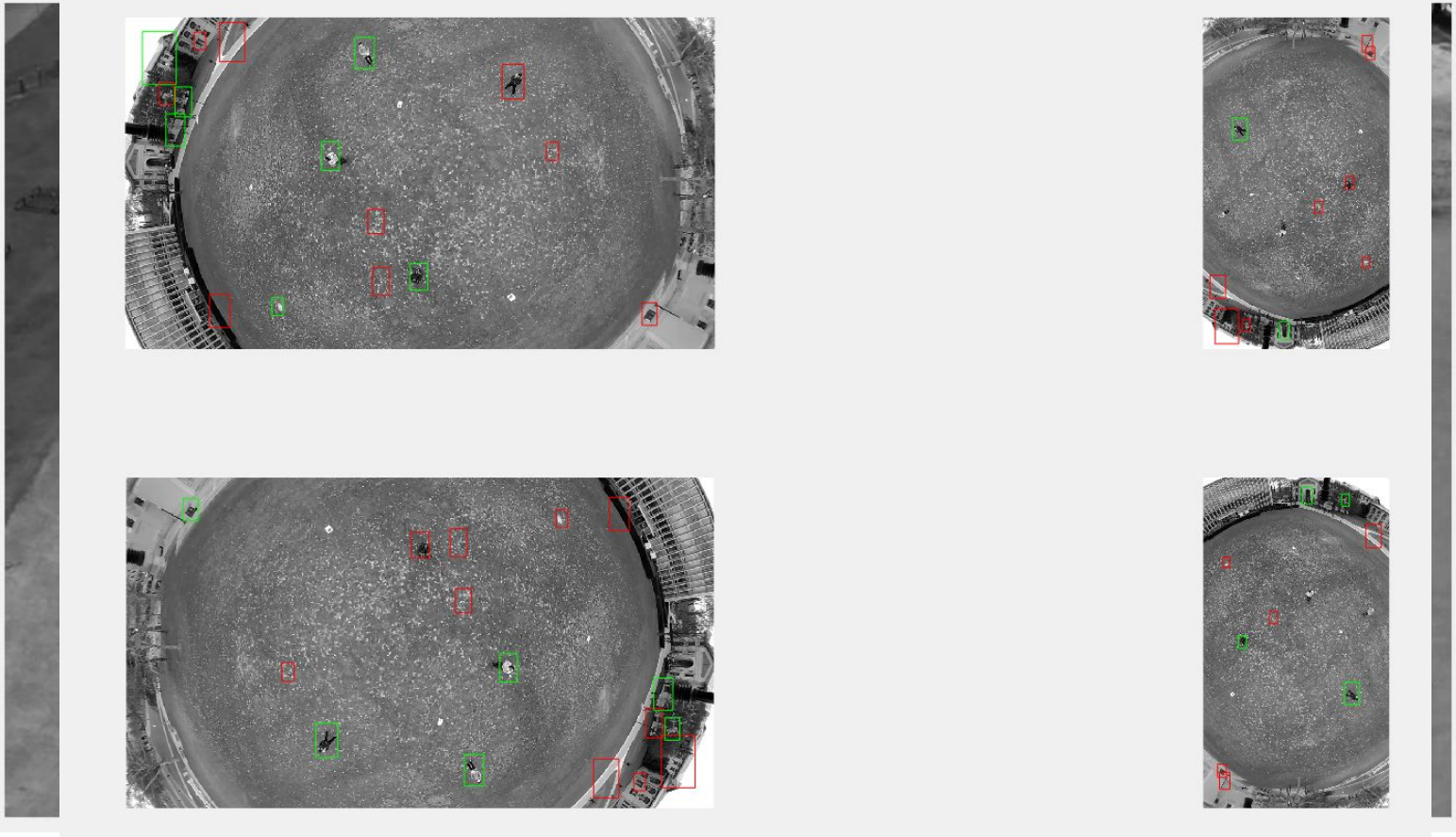
Test of revised RGB-based human detection algorithms

- Method
  - HOG feature extraction
    - Each image 288 features
  - Feedforward Neural Network (compared to the original SVM classifier)
    - Test set = 229 images
    - Training set = 504 images
    - Validation set = 167 images
    - Network parameters :
      - 288 200 150 2
- Result
  - Test on FNN
    - 90.41%(compared to the original SVM accuracy 84.50%)

Test of revised RGB-based human detection algorithms

- Result
  - Test on HOG + FNN
    - 20 online aerial images
      - Accuracy: 66.7%(compare to the original 65.6%)
    - 20 self-taken aerial images
      - Accuracy: 63.5%(compare to the original 61.9%)
    - Overall result
      - Accuracy: 65.1%(compare to the original 63.8%)
- Conclusion
  - FNN has a better performance on the accuracy of classification.
  - FNN has less false positives.

Test of revised RGB-based human detection algorithms



Explore Signature Detection On Thermal Images

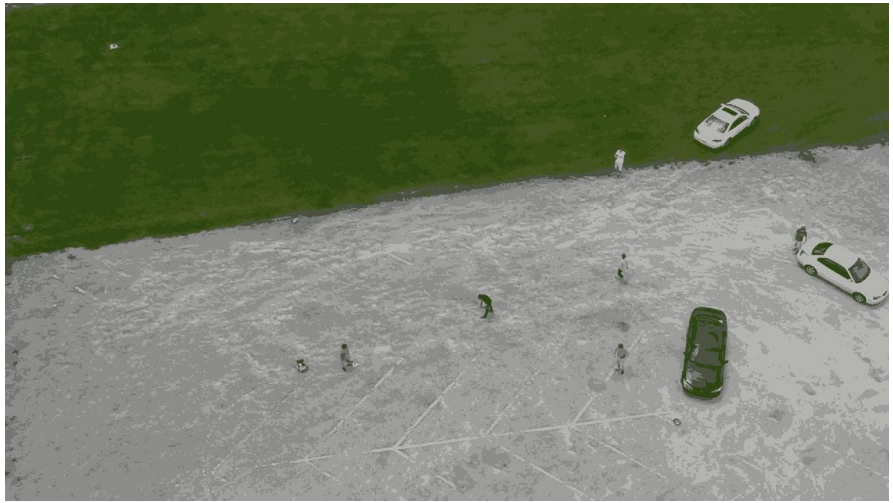
Haar+AdaBoost

- Hard to select parameters for training(haar feature selection and structure for AdaBoost)
- Training takes a long time(will do this part later)
- Reference (http://coding-robin.de/2013/07/22/train-your-own-opencv-haar-classifier.html)

Image Segmentation as Preprocessing

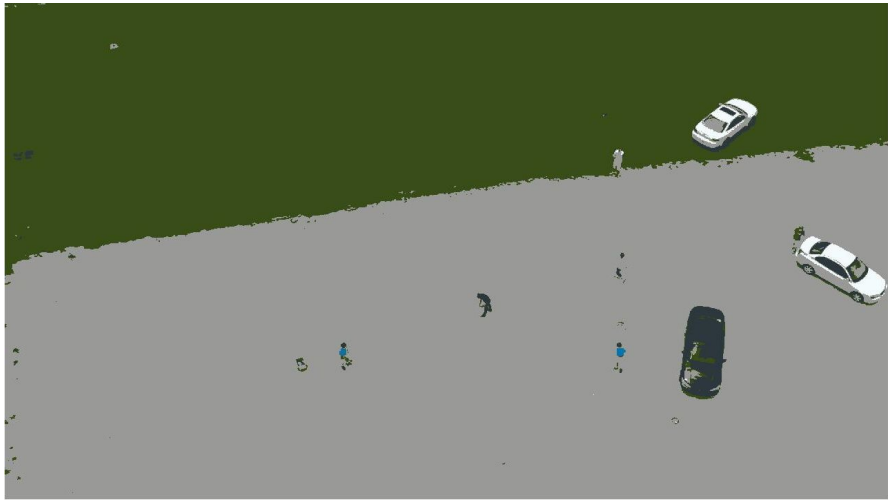
- K-means or Mean-Shift
- Both take too much time
- Not useful in our case

Experiments On Image Segmentation



```
>> tic
Ikm = Km(I,K);
toc
Elapsed time is 149.307509 seconds.
```

Result of K-means on
1920x1080 image



```
>> tic
Ims=Ms(I,bw);
toc
Elapsed time is 86.551881 seconds.
```

Result of Mean-shift on
1920x1080 image

Experiments On Thermal Signature Detection

Experiment1: Downsample the dataset

- Downsample the dataset from 64x32 to 32x16 (similar to the real case)
- Accuracy drops from 89% to 86%

Experiment2: Test on thermal images

- Gaussian Blur(instead of segmentation)+Edge Detection to find potential candidates
- Apply HOG+SVM on candidates for classification

Neural Network using tensorflow

Tried 2 layer and 3 layer neural networks: fed the images directly

- **Training set:** 250 positive and 250 negative
- **Validation set:** 49 positive and 49 negative
- **Test set:** 108 positive and 108 negative

2 layer NN:

- 100 ReLus as hidden units: Accuracy: 85%

3 layer NN:

- Tried different configurations: (100,50), (50,25), (100,25)
- Applied Regularization, Dropout
- Accuracy about the same as 2 layer NN

Neural Network using tensorflow

Caveats:

A simple logistic regression also gave accuracy of 84%
Not a significant improvement with Neural networks

- Test data does not seem very diverse
- Testing on data we collect will be a true test

Advantages:

- Should work well with more data
- Can be easily modified to a CNN in a week’s work

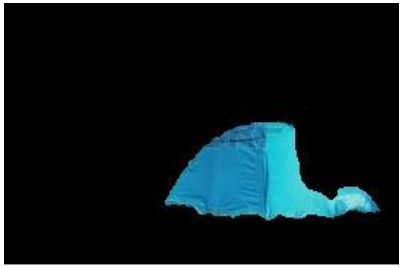
Sound signature detection

- Performed initial tests capturing samples from Tassccom microphone with background noise and human subject 5 feet in front .
- Cardioid microphone works well in picking sound sources in the front and suppressing sources behind the microphone.
- Explored winch mounting mechanism for microphone

HSV thresholding to extract bright regions

Can be used for identifying if an image has a **bright-colored tent, clothes, or air mattresses**

- **HSV thresholding**
- **removed relatively small features**



Thanks!