Drones for Humanity

1.1

Milestone Three

November 2020

By: Michael Mascari

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1. Team Information

1.1. Names and Emails of Project Members

Name	Email	Position
Michael Mascari	mmascari2017@my.fit.edu	Programmer (Computer Vision/AI)
Ballard Barker	bbarker2017@my.fit.edu	Project Manager/ Structures
Matthew Backert	mbackert2017@my.fit.edu	Systems Engineer
Nicholas Davis	davisn2017@my.fit.edu	Avionics/ Propulsion/ Aerodynamics
Brendan Sanders	bsanders2017@my.fit.edu	Production/ Structures
CJ Gagni	cgagni2019@my.fit.edu	Avionics
Justin Williams	justin2017@my.fit.edu	Propulsion
Hamdan Alblooshi	halblooshi2016@my.fit.edu	Propulsion

1.2 Faculty Advisor

The CS faculty advisor for the project is Dr. Debasis Mitra. dmitra@cs.fit.edu

1. Faculty Advisor Meeting Dates

- Friday, November 20th

1.3 Client

The client is the project team ourselves

1.3.1 Client Meeting Dates

- Friday, October 30th
- Friday, November 6th

- Friday, November 13th
- Friday, November 20th

1.3.2 Client Feedback

- Client is very happy with the progress made developing a neural network.

2. Project Details

1. Progress of Milestone 3

Task	Completion %	To do
1. Upgrade NN	100%	none
2. Test Corsican database	100%	none
3. Data Augmentation	100%	none
4. Explore efficiency methods	N/A	none

*all tasks were done by Michael Mascari

2.2 Discussion of Tasks in Milestone 3

Task 1:

The dataset used for the CNN was the Corsican fire database, which is a collection of images of different environmental fires. Corsican images were classified as 0, and CIFAR10 images were used as a baseline. CIFAR10 was classified as 1.

LeNet Model:

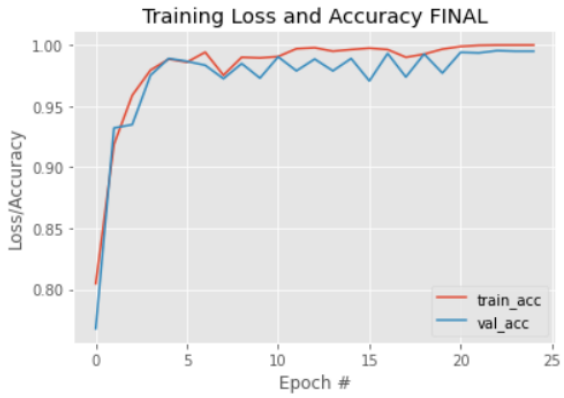
- Layer 1: convolutional layer with 20 5x5 filters and a 2x2 max pooling layer
- Layer 2: convolutional layer with 50 5x5 filters and a 2x2 max pooling layer
- Layer 3: convolutional layer
- Layer 4: fully-connected layer
- Layer 5: softmax classifier

CNN went very well getting an accuracy of 99%:

```
[1.]]
              precision    recall  f1-score   support

         0.0       0.99      1.00      0.99      1370
         1.0       1.00      0.99      0.99      1354

    accuracy                           0.99      2724
   macro avg       0.99      0.99      0.99      2724
weighted avg       0.99      0.99      0.99      2724
```



The skeleton of the CNN was programmed using Keras so it can be considered efficient. The accuracy does seem a bit high, I used CIFAR10 as the non-fire images in the example. In future milestones I will try to find a forest database to compare against.

Task 2: The Database was a bit smaller than anticipated, with only 1200 images of fire. It did come equipped with a subset of images that included people, and the database said they were labeled, but only 4 were labeled, and only ~20 existed. So, it does not seem that the database can be used to train the NN on identifying building, vehicles, or people.

Task 3: Data augmentation methods went well. There were 1200 images to start and using 3 augmentation methods of horizontal flip, horizontal shift, and vertical shift, there became 6800 usable images.

Task 4: Most of the computational power of a NN is in fitting the NN, not running it, so it should be fine to run as long as the image size and frame rate of the camera is low.

2. Plan for Milestone 4

Task 1: Ensemble methods. Build 2 more CNN and take the average result of an image as the classification. Increases accuracy.

Task 2: Find better dataset to compare against Corsican database. An accuracy of 99% sounds too high, so I need a more difficult (realistic) dataset to use as the other classification for future tests. This can be made.

3. Faculty Advisor Tasks

3.1. Faculty Advisor Feedback

Task 1:

Task 2:

Task 3:

Task 4: Provide sample image of Corsican/other images for success/failure cases.

For future, you may like to take cell-phone pictures of small fires (from above)/no-fire of same place, and try those with your net.

Faculty Advisor Signature: ___Debasis Mitra _____ Date: _12/02/20_____