Drones for Humanity

1.0

Milestone Two

October 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

1.2.1 Faculty Advisor Meeting Dates

- Monday October 12th

1.3 Client

The client is the project team ourselves

1.3.1 Client Meeting Dates

- Friday, October 2th
- Friday, October 9th
- Friday, October 16th
- Friday, October 23th

1.3.2 Client Feedback

- Client is happy with the progress made developing a neural network but were not happy with the low accuracy. After explaining what might be causing the low accuracy and possible solutions, I believe the clients are okay with it.

2 Project Details

2.1 Progress of Milestone 2

Task	Completion %	To do
1. Order hardware	100%	none
2. Program neural network	100%	The first draft of the nueral network is completed, but there are a lot of changes I would like to make to it. I would like to upgrade it to a CNN, and there are some extra preprocessing methods I have to look into.

2.2 Discussion of Tasks in Milestone 2

Task 1: The Raspberry Pi and thermal camera have been ordered using the HSDC's Amazon Prime account.

Task 2: Programming the neural network for this milestone took the whole month. The main issue with programming the neural network is that I did not know which hyper parameters would be useful for this type of problem (ReLu vs ELU vs Sigmoid, layer architecture, LASSO vs Ridge regression, cross entropy vs sum of squares), so I tried them all. I also made some functions to preprocess the data using the OpenCV and store the data as numpy files so I don't need to constantly repreprocess the data. The preprocessing methods I went with were to turn the image into grey scale and reduce the image size. The final neural network might not be best to have in greyscale because fire would contrast against the forest very clearly in color, but since the French did not give me permission to use their database yet*, this was a trail run neural network where I tried to get the best accuracy with a similar type of neural network problem (image classification).In the end, the best accuracy I got using all the different configurations of hyperparameters named above was 54% where 50% would be random guessing. 54% accuracy is pretty horrible, but I do not believe it is the fault of the program, but rather the data. Since I tried to choose a dataset that would behave similarly to the actual thermal dataset, I need to choose a better type of neural network for this type of

problem, so the next version of the neural network will hopefully be a CNN written with the help of Keras.

Rewriting the neural network doesn't make this Milestone a waste. Since there is no direct way understand how good a neural network is doing, it is common practice to do "benchmarking" which is where the dataset is passed through a neural network meant for a different type of problem. So long as the specialized neural network gets a higher accuracy, the neural network can be considered pretty good. For this milestone, I used k-nearest-neighbors for benchmarking and got 55%, which led me to know that the FeedForwardNeuralNetwork was not going to appropriately handle real images.

* The Corsican Fire Database is owned by a French university. I currently have access, but when I first went to download the dataset, I was blocked because I needed permission. So while I waited for access, I used a similar dataset.

2.3 Plan for Milestone 2

Upgrade neural network to CNN. I am not sure how the hyperparameters will react to this change so upgrading to CNN also requires retesting the new neural network.

Explore and test the Corsican Fire Database. I didn't try downloading the dataset until this month and it was quite the shock when I realized I couldn't. That setback lead to using the dataset being delayed, so everything within it should be explored and all possible expansion ideas explored.

Expand dataset using "cheating" methods. This is like moving every pixel one pixel over and saving it as a new image. Doing this can expand the dataset 5 times and really does make the final neural network more accurate.

Look into more preprocess methods and efficiency methods. Since this neural network is supposed to run on a Raspberry Pi, it might be beneficial to learn efficient neural network methods.

3 Faculty Advisor Tasks

3.1 Faculty Advisor Feedback

Task 1:

Task 2: Use CNN with Adam optimizer, Activation: ReLU, Sigmoid, tanh, etc.

Use data augmentation for training

Plot accuracy or error against epochs.

Your fire-data may be much easier and/or different than cat/dog recognition, but the cat/dog is interesting I its own right.

Faculty Advisor Signature: __Debasis Mitra_____ Date: ____10-26-2020____