**A Deep Learning Approach to Fine-grained Dog Breed Classification**

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**Abstract**

e.g., Write the abstract in 200 words here. An abstract is a concise paragraph that summarizes the problem, method and conclusions of the article.

…………………………………Note: replace the red text with black text.

**1. Introduction**

**1.1. Problem Specification/Project Description**

This project aims to make a tool that makes it easier for the public to identify the specific sub breeds or mixes of breeds within their dogs to help them have a better understanding of the medical/health issues their dog may face. Using image classification instead of DNA testing is not only a less expensive alternative to breed detection, but it could also have less ecological impact due to not requiring physical objects to be shipped and materials to be used. Our tool to detect breeds in dogs uses …

**1.2. Significance**

Many breeds of dogs have specific health issues that become very prominent as they reach old age. Being able to determine the sub breeds of a mixed breed dog would help dog owners understand the possible health issues their dog may face in their old age. This would allow them to take preventative action and improve their dog’s quality of life.

Similarly breed recognition could help with training by helping determine a dogs interaction behavior and inherent instincts. These behaviors and instincts are heavily linked to a dog’s genetics.

**2. Related Works**

**2.1. Review Several Research Works in Most Recent Years**

Several other deep learning approaches to fine-grained breed classification have been done previously. A paper, published in December 2020 and written by Ding-Nan Zou, Song-Hai Zhang, Tai-Jiang Mu & Min Zhang, discussed the creation of a dataset to train several pre-existing models, Inception B3, WS-DAN, PMG & TBMSL-Net (4 classification deep neural networks) [1]. A paper written by Xavier Higa in April of 2019 discusses the use of two different CNN’s, (VGG-16 & Densenet-201) trained on the Stanford Dogs dataset, to determine a specific breed for a dog [2]. Kaitlyn Mulligan and Pablo Rivas published a paper in 2019 about Breed Identification using the Xception neural network (a CNN) [3].

**2.1. The Most Similar Research Paper**

Note: In this section, from the above related works you will pick one research paper which is most similar to your project topic. You need to introduce its idea, method and experimental results using text, figures, tables.

“Dog Breed Classification Using Convolutional Neural Networks: Interpreted Through a Lockean Perspective”, the paper written by Xavier Higa is most similar to our project topic. The paper discusses using two CNN’s, (VGG-16 & Densenet-201) trained on the Stanford Dogs dataset, to determine a specific breed for a dog [2]. They trained the CNN’s using supervised learning, on labeled image data from ImageNet, then fine tuned each Neural Network using a test set of the Stanford Dogs Dataset [2]. The two CNN’s used were VGG-16 (Figs. 6 & 7) and DenseNet-201(Fig. 8) [2].

Diagram

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Diagram, engineering drawing

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Diagram

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Using MATLAB they gathered results of training and testing on each Network (Figs. 10 & 11) using a standard method for training both Networks.

A picture containing table

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**3. Tasks or/and Preliminary Idea**

e.g., In this project, we will compare the performance of the state-of-the-art methods about XXX problem. Also, we will implement an improved or new method about….. The preliminary idea behind method is ………. The pipeline of the method is shown in Figure 1.

A picture containing clock

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Figure 1. Pipeline of the method.

**4. Data Acquisition**

Our team will obtain data from the Stanford Dogs Dataset as well as data from ImageNet. This data is readily available through Stanford and Princeton Universities [4][5]. We will preprocess the data to be used for object detection and image recognition/classification.

**5. Project Timeline**

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| Task | Time |
| 1. Read related research papers/codes and write research proposal. | 9/1 ~ 9/16 |
| 2. Prepare and obtain the dataset for this project. | 9/17 ~ 9/23 |
| 3. Implement/run the existing models and compare their performance. | 9/23 ~ 9/30 |
| 4. Implement improved or new model. | 10/1 ~ 10/15 |
| 5. Conduct experiments to compare the method with existing models. | 10/15 ~ 11/1 |
| 5. Write the paper, create PPT | 11/1 ~ 11/24 |
| 6. Prepare the final submission of PPT, code, data, user documentation, final paper, etc. | 11/24 ~ 12/5 |

**References**

1. Zou, DN., Zhang, SH., Mu, TJ. et al. A new dataset of dog breed images and a benchmark for finegrained classification. Comp. Visual Media 6, 477–487 (2020). <https://doi.org/10.1007/s41095-020-0184-6>
2. Higa, Xavier. Dog Breed Classification Using Convolutional Neural Networks: Interpreted Through a Lockean Perspective. Diss. Lake Forest College, 2019. https://core.ac.uk/download/pdf/214315107.pdf
3. Mulligan, Kaitlyn, and Pablo Rivas. "Dog breed identification with a neural network over learned representations from the xception cnn architecture." 21st International conference on artificial intelligence (ICAI 2019). 2019. https://www.reev.us/pdfs/mulligan2019dog.pdf
4. Aditya Khosla, Nityananda Jayadevaprakash, Bangpeng Yao and Li Fei-Fei. **Novel dataset for Fine-Grained Image Categorization.** *First Workshop on Fine-Grained Visual Categorization (FGVC), IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, 2011.
5. Deng, J., Dong, W., Socher, R., Li, L.-J., Li, K., & Fei-Fei, L. (2009). Imagenet: A large-scale hierarchical image database. In *2009 IEEE conference on computer vision and pattern recognition* (pp. 248–255).