How Machine Learning and Neural Networks Can Be Used In The Diagnosis Of Canine Eye Diseases
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1. Introduction

* Convolutional neural network s [CNN] are a part of machine learning that can be used in the examination of visual data

*A CNN is composed of different layers these consist of a convolutional, subsampling and connected layer

*Brachycephalic breeds have an increased risk in the development of eye diseases when compared with   other breeds (3.63 times)

*Examples of the breed include: boxers, bulldogs and pugs.

3. Research Objectives

* This research aims to exam the effectiveness of using machine learning and neural networks for classifying eye diseases in dogs.

* From this it will be possible to determine the best machine learning model for classification

5.Methodology

*The project utilizes a deep learning structure that relies primarily on a convolutional neural network (CNN)

*The images will be processed before being ran through any CNNs this means they will be accurately labelled and processed

* The most suitable machine learning models for classification will need to be compared

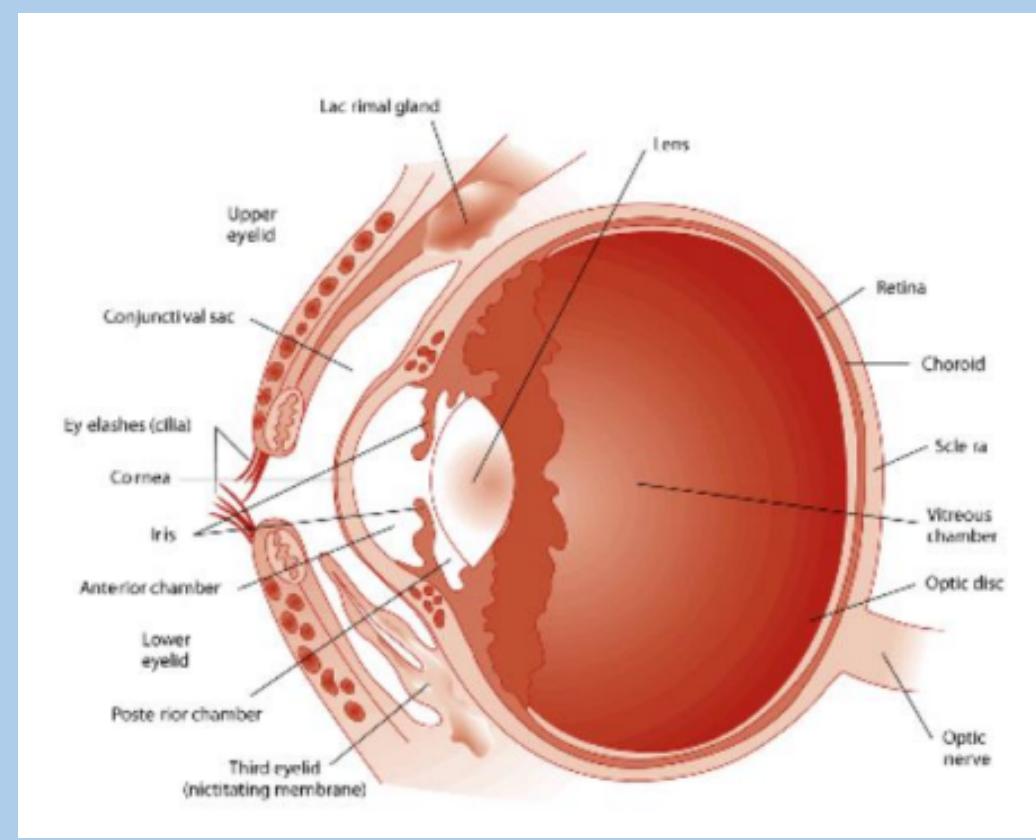* Then determine the best set of hyper-parameters and compare ML models.

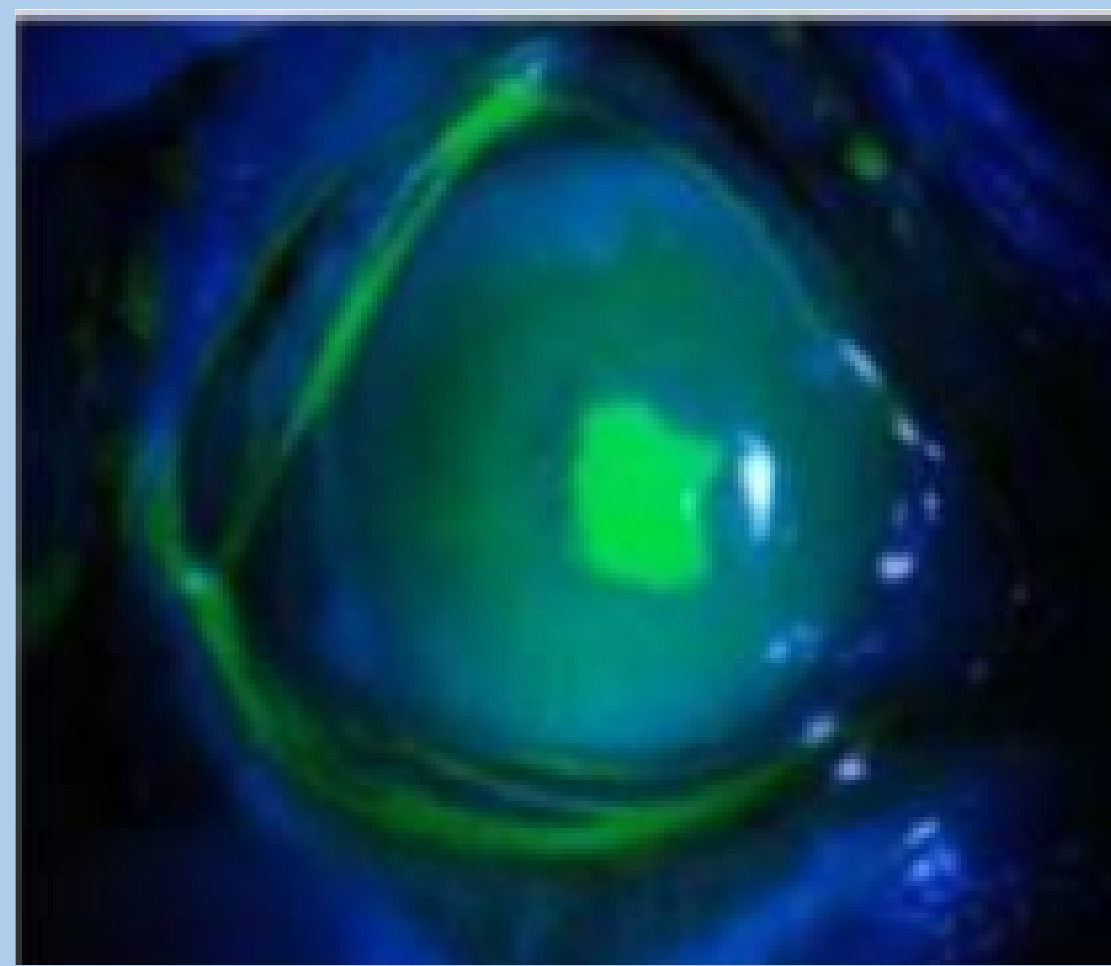Figure 1. A canine eye diagram (MSD Veterinary Manual, 2024)

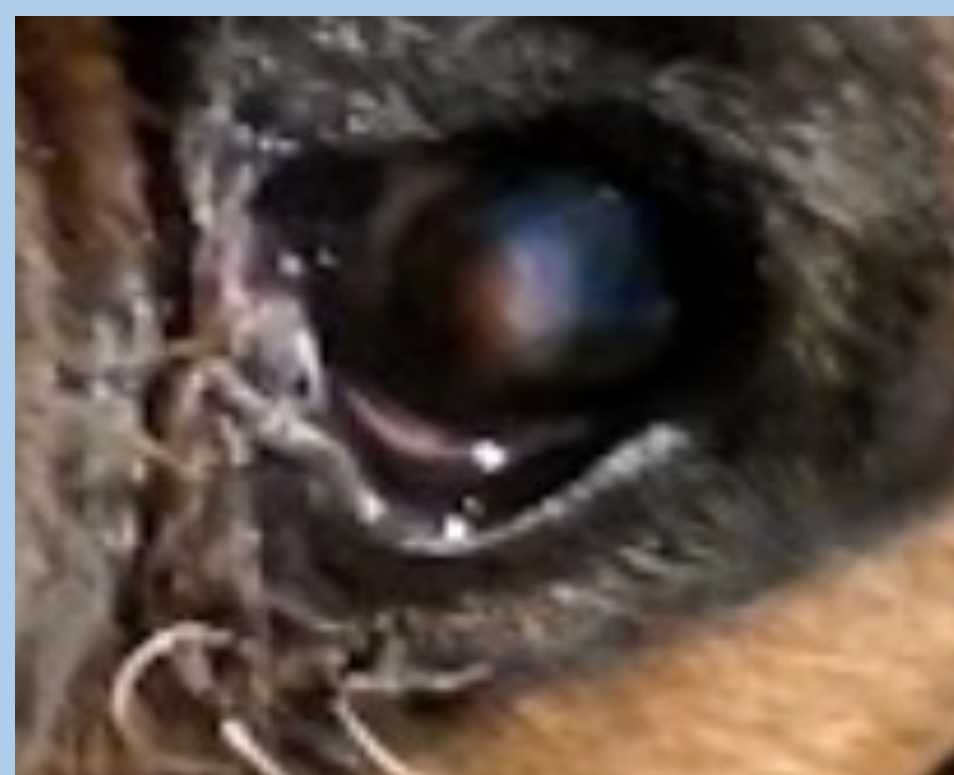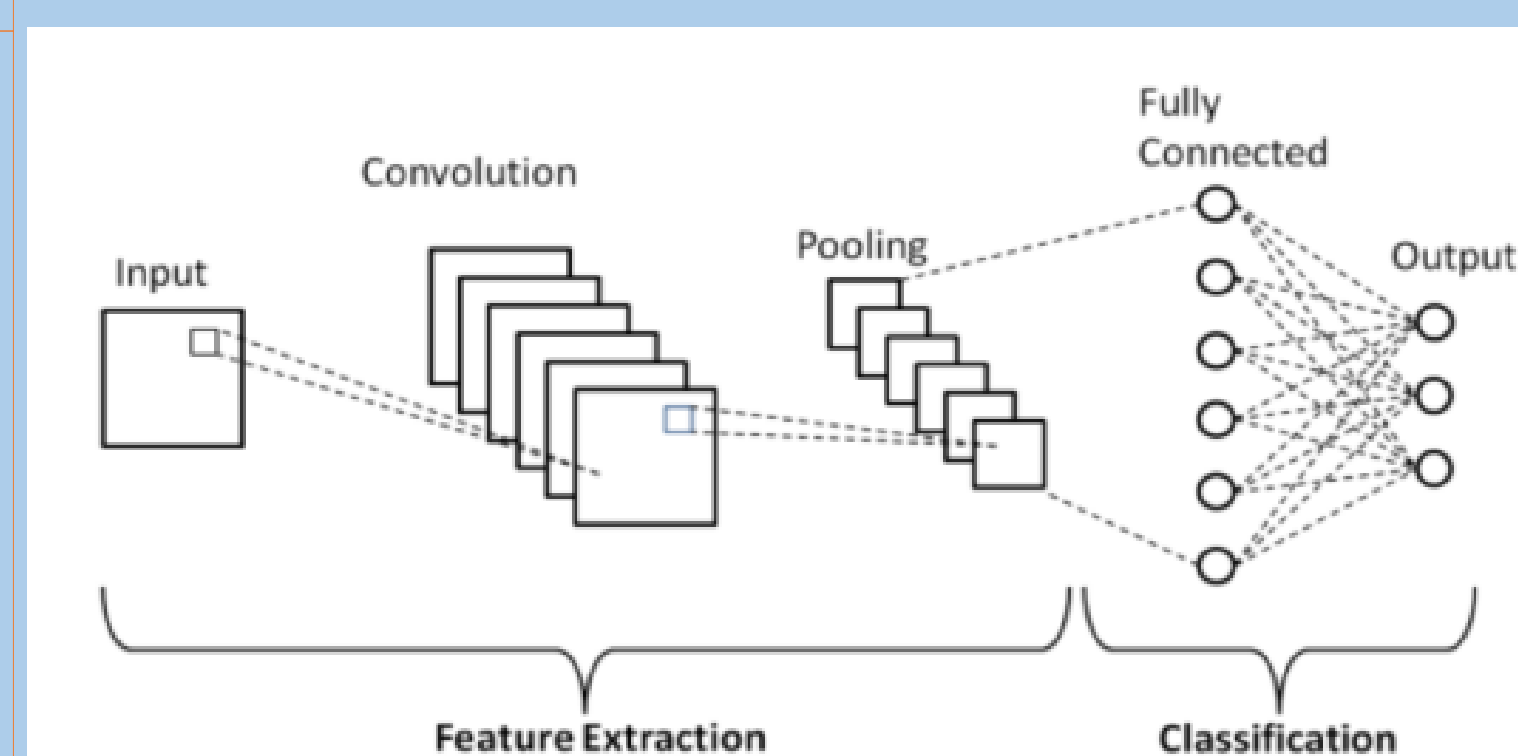Figure 2. A positive fluorescein stain test on an eye ulcer

Figure 3. A corneal ulcer

Figure 4. Diagram of a simple CNN

2. Literature Review

* CNN's are a superior method of machine learning for image classification [1]

* It takes object features from an image and it then tries to detect these object features in similar images to perform classification [2]

* Both traditional machine learning and deep learning are able to suitable methods in image classification

*The Irish veterinary journal reports that in a study brachycephalic breeds eye issues it was found that of the dogs researched 44% had   corneal ulcers, 22% had entropion [3]

4. The Data

The data for the project is collected from various sources such as GitHub and Roboflow Universe. The dataset contains over 14,000 images

Table 1. Lists the types of eye diseases being examined

Normal eyes	Conjunctivitis	Cataracts
Mastopathy	Entropion	Nuclear Sclerosis
	Corneal Ulcer	

6. Next Steps

* If needed augmentation tools can be used to increase dataset

* Compare the performance of ML models with different hyperparameters

* Determine the best model for classification of image dataset

* Potentially look into transformers for image classification

Technologies Used

References:

[1]Lorenete,O. Riera Smolinska,I. and Rana,A.(2021).Image Classification with Classic and Deep Learning Techniques.

[2]Kim,J. Han,M. Chen,J. Huh,E. and Lee,S. (2022) Developing a diagnosis model for dry eye disease in dogs using object detection. Scientific Reports 12, 21351

[3] Costa,J. Stenimetz,A. and Deldado,E. (2021). Clinical signs of brachycephalic ocular syndrome in 93 dogs. Irish Veterinary Journal 74:3

[4]MSD Veterinary Manual (2024). Anatomy of the eye, [online], available: https://www.msdvetmanual.com/multimedia/table/anatomy-of-the-eye [accesed:28 January 2024]