Veritas AI: CIFAR 10 Image Classification

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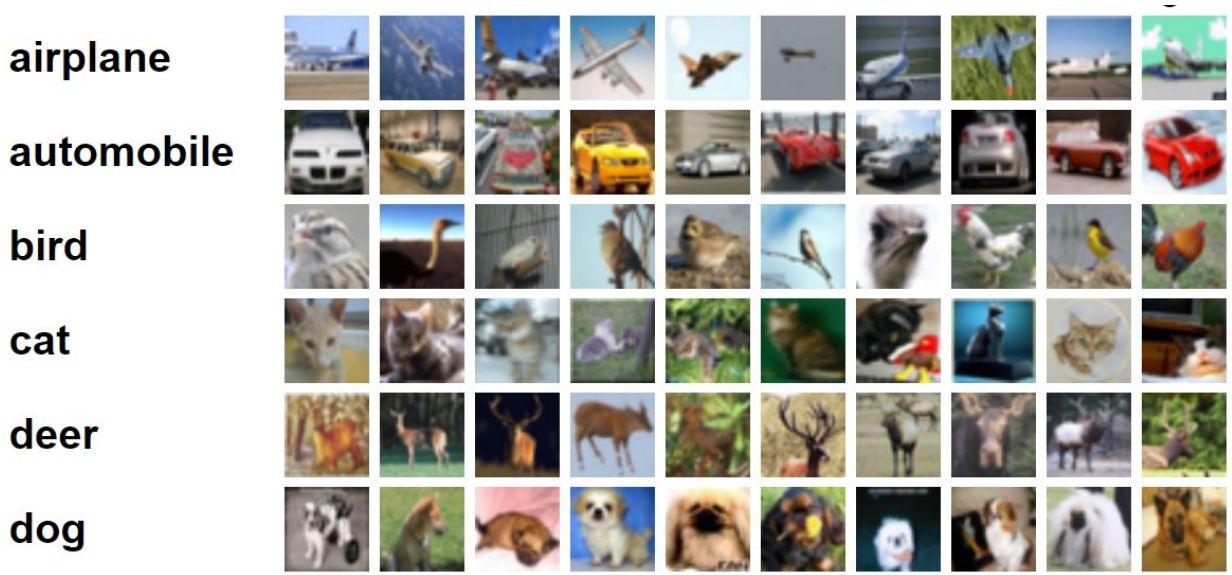
Motivation for Your Project

S - Situation
T - Task
A - Action
R - Result

How do we improve image recognition in the CIFAR-10 dataset?

A key component of self-driving systems is image recognition. The focus of the project is to develop a image recognition machine learning pipeline using the CIFAR-10 dataset. Each image belongs to one of 10 classes, and the model will label the image with its class.



Your Data

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- CIFAR-10 is the most frequently used dataset for object recognition
- It was collected by Alex Krizhevsky, Vinod Nair, and Geoffrey Hinton
- The dataset was collected in 2009.
- The dataset contains color images that belong to 10 classes (airplane, automobile, bird, cat, deer, dog, frog, horse, ship, truck)
- There are 60,000 images - 10 classes of 6,000

Exploratory Data Analysis

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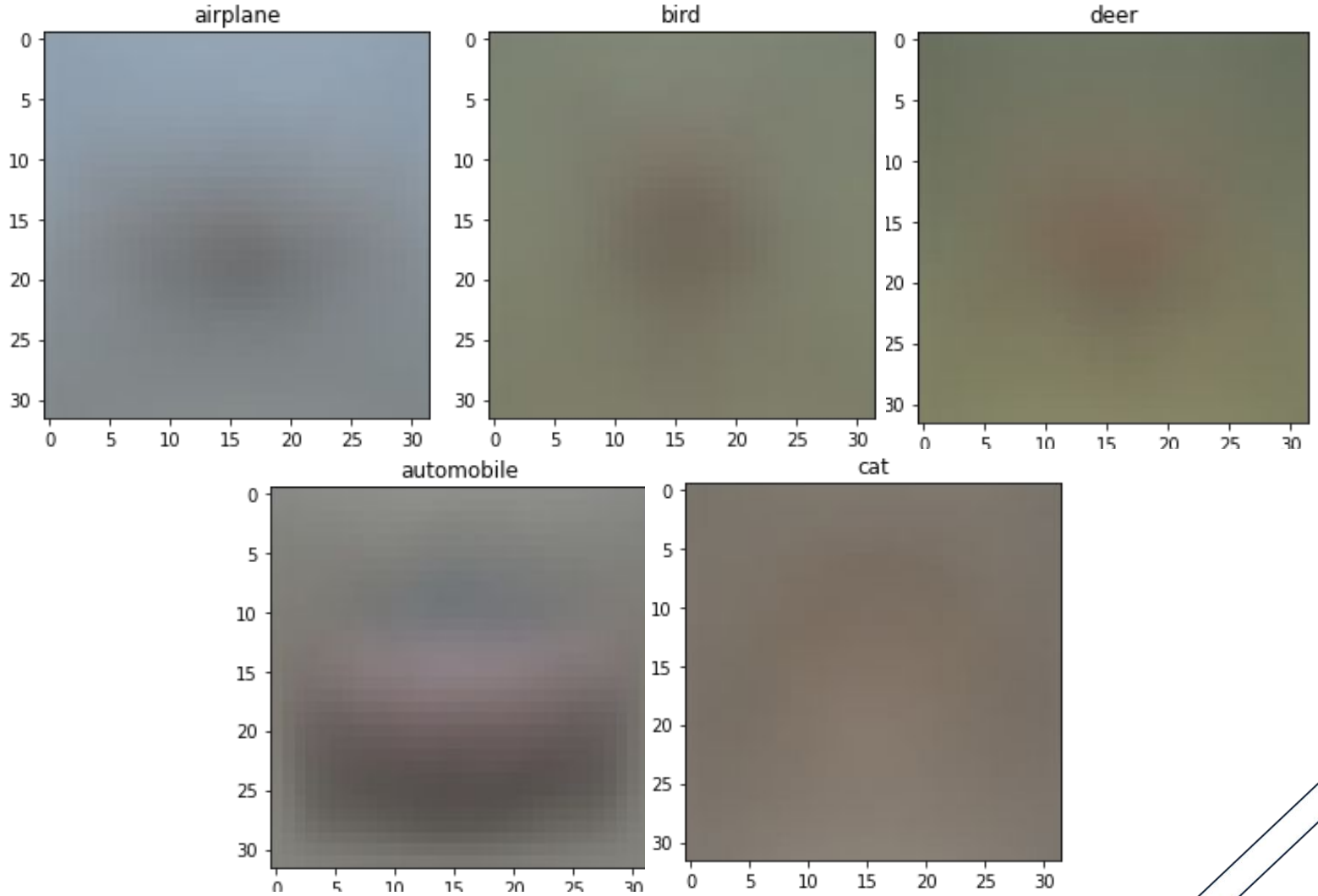
We have 10 categories of images and averaged all images in each class:



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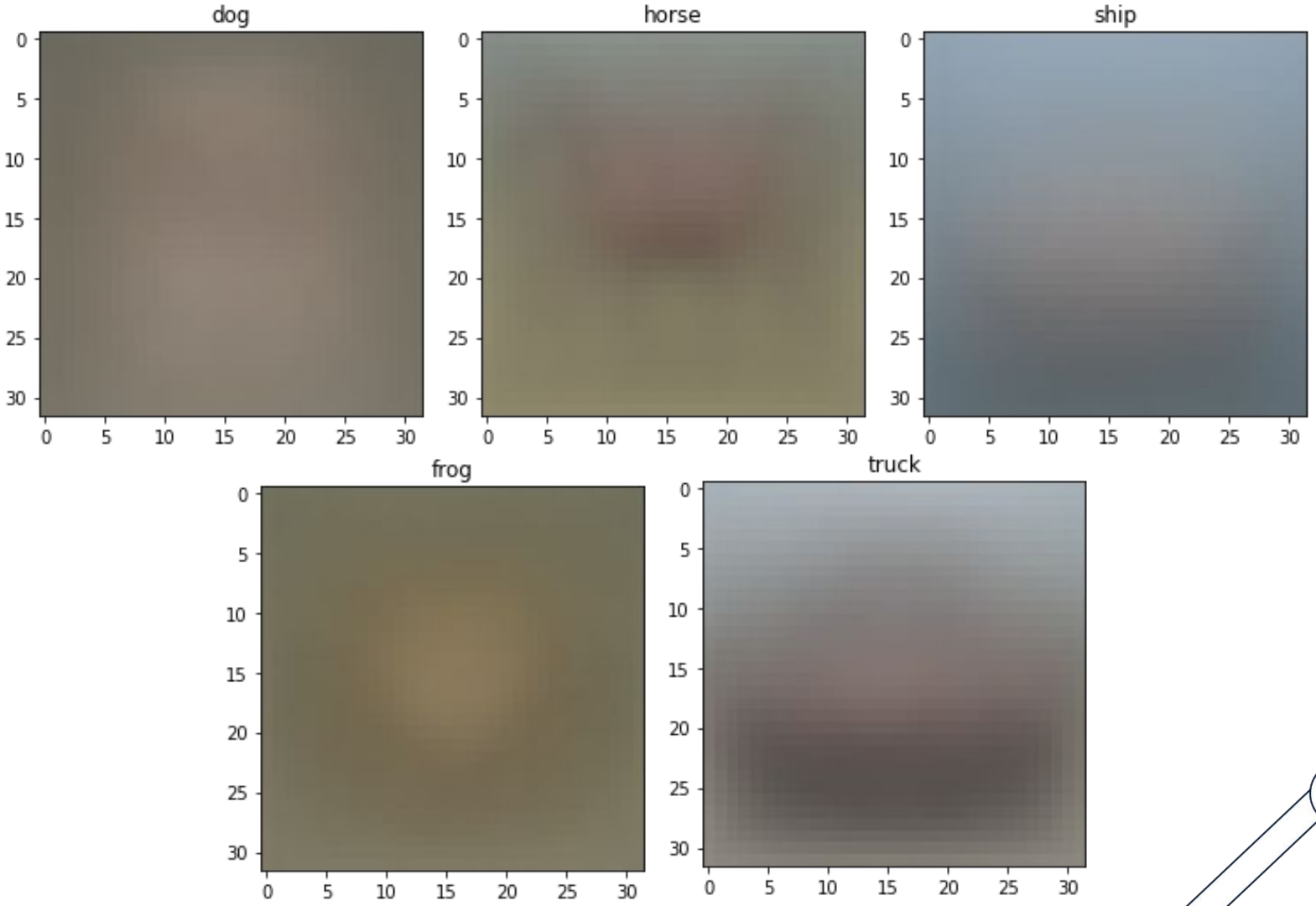

Exploratory Data Analysis

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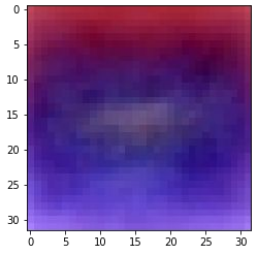
We found the number of images in each class in the training set:

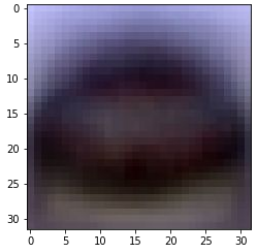
Category	airplane	automobile	bird	cat	deer	dog	frog	horse	ship	truck
Number of Images	4466	4464	4529	4538	4451	4504	4459	4513	4520	4556

Standard Deviation for each class:

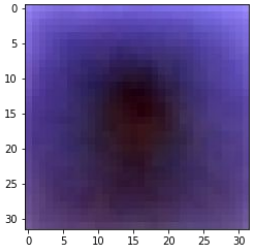
airplane



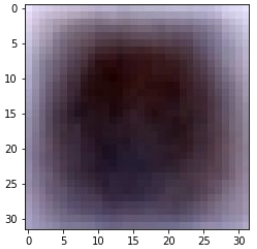
automobile



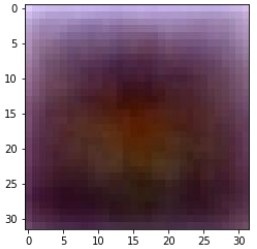
bird



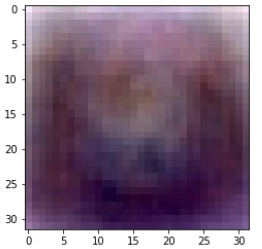
cat



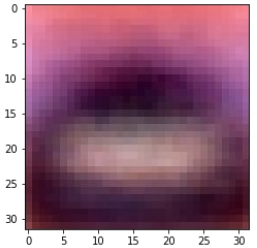
deer



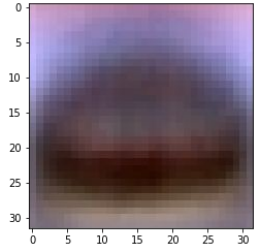
dog



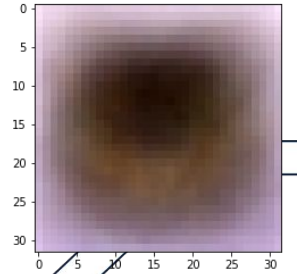
ship



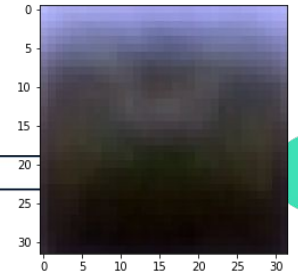
truck



frog



horse



Baseline Model and Results

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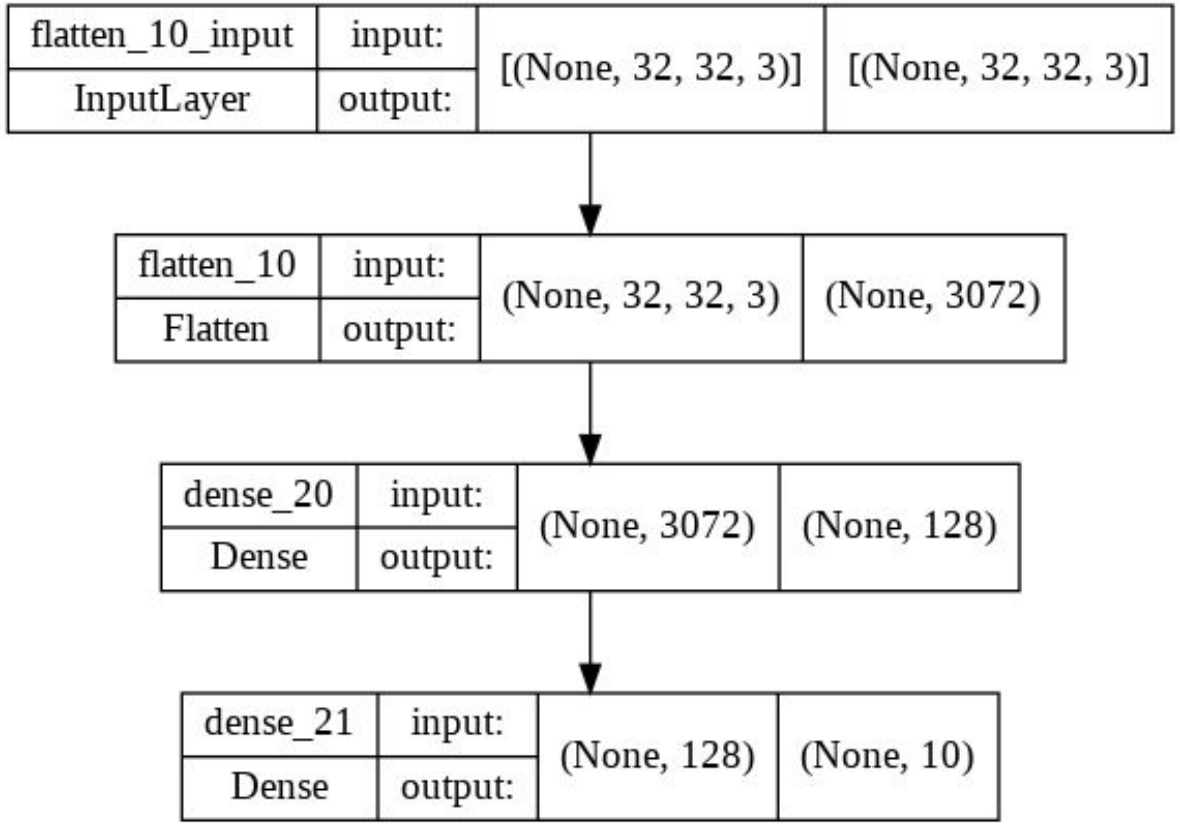
Describe your baseline model:

- What algorithm did you use?
  - Logistic Regression and Multilayer Perceptron (MLP)
- How does it perform on **training / test** prediction/classification?
- they both had a accuracy rates of around 41%

Model Name	Train Accuracy	Test Accuracy
Logistic Regression	0.428	0.402
Multilayer Perceptron (MLP)	0.442	0.429

MLP (Multilayer Perceptron)



Advanced Model and Results

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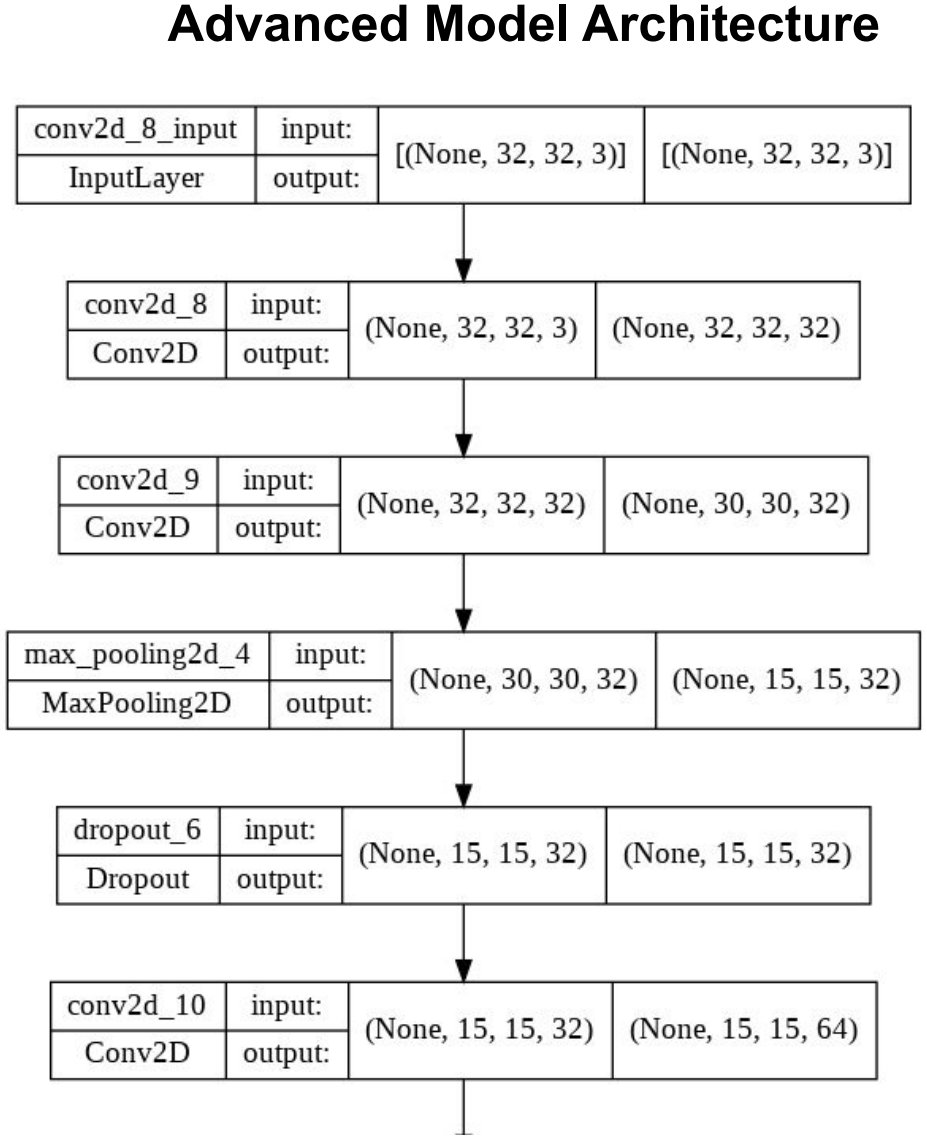
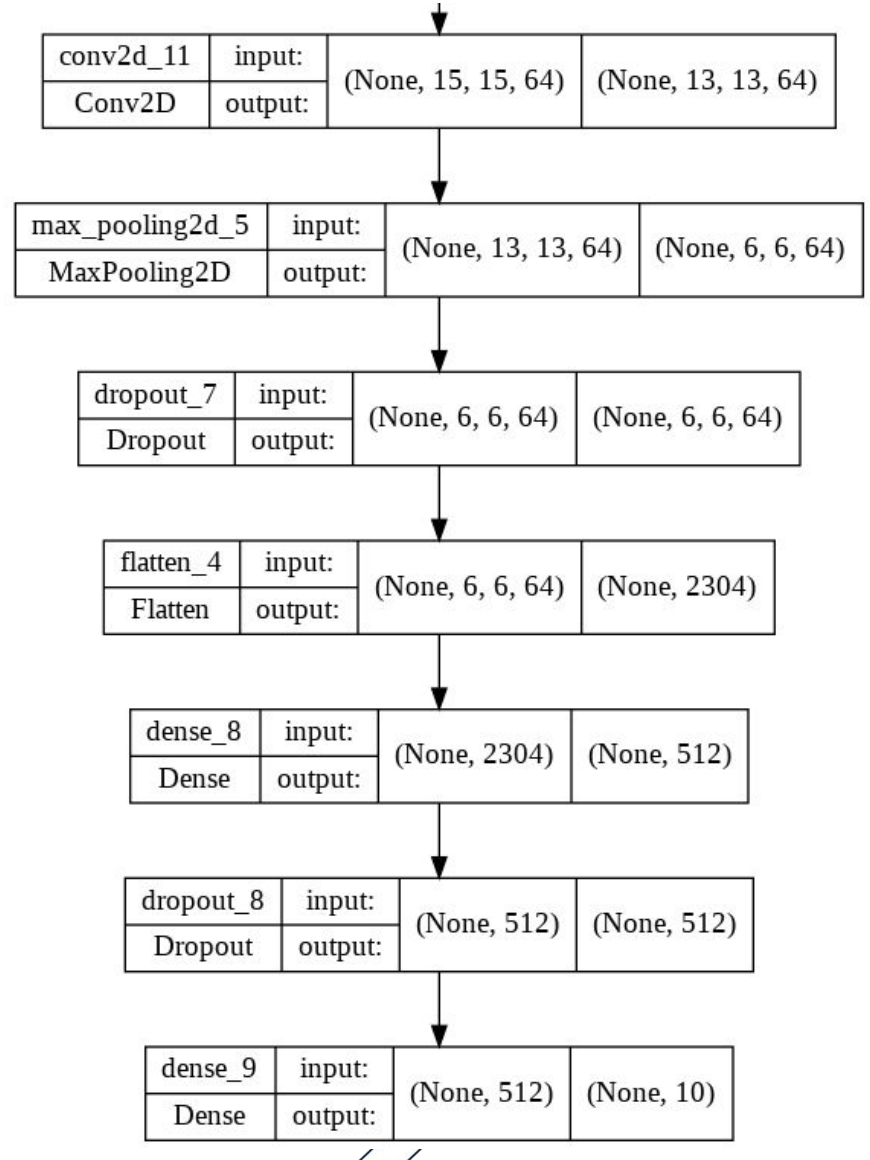
Describe your advanced model:

- How did you think of improving of the baseline model?
  - Convolutional neural network
- How did you change your architecture or strategy?
  - We made the strategy to reduce overfitting to the data, this made the model to have more opportunity to learn instead of memorizing the data.
- What was the outcome? Did it perform better (**training / test** performance)?
  - Yes, accuracy rose from 40% up to 80%, which means it does 3 times less mistakes than before.

Advanced Model Architecture





Project Summary and Future Work

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What was your best model?

- Our best model was a convolutional neural network
  - two convolutional layers with 32 filters
  - two convolutional layers with 64 filters
  - 30% dropout rate of neurons after each maxpool
  - 40% dropout rate of neurons at the end

How accurate was the model?

- **Training accuracy: 89.5% accuracy**
- **Validation accuracy: 79.8% accuracy**
- **Test accuracy: 79% accuracy**

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What did you learn from the model?

- Learned to build a full convolutional neural network and all the steps leading up to it
  - Understanding the situation and our data, doing exploratory data analysis, building a baseline model, building an advanced model
  - How to identify variables in the model that are lowering the test accuracy

If you had more time to improve the model, what would you do?

- Significant difference between training accuracy and testing accuracy, reduce overfitting
  - Epochs, batch size, number of convolutional layers, increasing dropout
- ResNet (gradients are better propagated)

Thank you for listening!

Any questions?