## Investigating Overfitting in Convolutional Neural Networks

### 1. Introduction

Neural networks are a form of machine learning models, roughly inspired from how the human brain processes information. They have become increasingly prevalent in our developing world, providing powerful and unique solutions to a wide variety of problems. However, with power also comes risk, as training a neural network too much can cause overfitting. Overfitting occurs when a model learns the training data too well and performs poorly on unseen data. In this study, we investigate whether increasing the number of parameters in a convolutional neural network leads to greater overfitting, as measured by the difference between training and test accuracy.

### 2. Statistical Question

Does increasing the number of parameters in a fixed CNN architecture cause a greater difference between training and testing accuracy?

**Hypotheses**

$H_0 : \beta = 0$

$H_a : \beta \geq 0$

Where $\beta$ is the true slope of the population least-squares regression line that relates number of parameters of the model to the difference in accuracy of the model on the train dataset and the test dataset.

### 3. Data Collection

We trained $\mathbf{x}$ convolutional models on a randomly selected small subset of

size 100 images from the CIFAR-10 dataset, each with the same architecture (*see figure 1*). Each model had a different number of parameters, uniformly ranging from approximately 1 million to 50 million.

**Model Architecture**

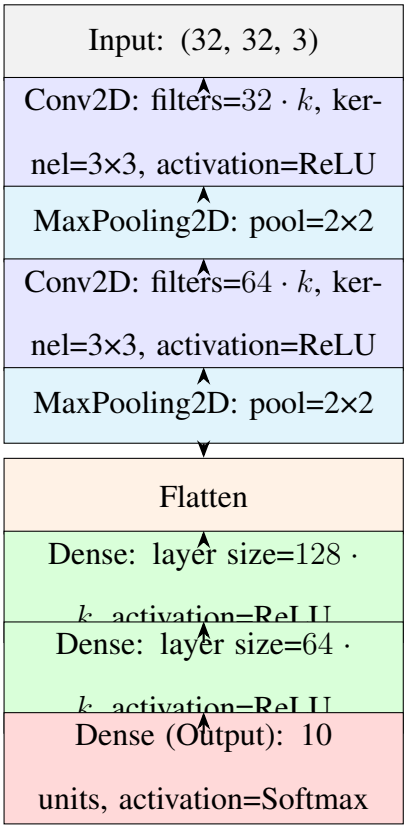


*Figure 1: Architecture of CNN Model*

**Data Display**

**Data Analysis**

**Conclusion**

**Reflection**