Bonus Report

1. First Convolutional Layer (conv1):

- **Purpose**: The first layer detects basic, low-level features such as edges, corners, and textures.
- **Observations**:
    - The feature maps at this stage highlight sharp changes in pixel intensity, focusing on areas with strong contrasts (object boundaries).
    - Each filter emphasizes different orientations or patterns, such as vertical or horizontal edges.
- These features are fundamental for understanding the structure of the image.

2. Second Convolutional Layer (conv2):

- **Purpose**: The second layer captures more complex patterns and combines the low-level features from conv1.
- **Observations**:
    - Feature maps are less interpretable than the first layer but focus on more abstract patterns, such as textures and specific shapes within the image.
    - These maps highlight parts of the object while suppressing irrelevant background information.
- **Significance**: This layer builds hierarchical representations, making the model more selective toward meaningful features for classification.

General Insights

- **Feature Evolution**: As the data flows deeper into the network, the feature maps transition from capturing generic patterns (edges and textures) to more specific and abstract features (shapes, parts of objects).
- **Hierarchical Learning**: The progressive abstraction ensures the model learns patterns relevant for distinguishing between classes in the CIFAR-10 dataset.
- **Effect of Batch Normalization**:
    - Batch normalization stabilizes the feature maps by normalizing their distribution. This enhances training stability and improves feature discrimination in deeper layers.

Relation to Visualization

The visualizations from conv1 and conv2 show this pattern:

1. **conv1**: Bright, sharp regions indicating basic structural patterns like edges and boundaries.
2. **conv2**: Softer and more focused regions, representing abstract combinations of features relevant for specific objects or classes.

This interpretation aligns with the architecture's goal: progressively refining raw pixel data into meaningful representations for classification.