Baseline Implementation

- Implemented a basic CNN with two convolution layers and a fully connected layer to do a Regression task.

Model Architecture

Convolutional Layers

The convolutional section is responsible for feature extraction and consists of:

1. **Convolution Layer 1**:
    - Input Channels: 1
    - Output Channels: 32
    - Kernel Size: 3x3
    - Padding: 1
    - Activation: ReLU
2. **MaxPooling Layer 1**: Reduces dimensions by a factor of 2.
3. **Convolution Layer 2**:
    - Input Channels: 32
    - Output Channels: 64
    - Kernel Size: 3x3
    - Padding: 1
    - Activation: ReLU
4. **MaxPooling Layer 2**: Further reduces dimensions by a factor of 2.

Fully Connected Layers

This section processes the extracted features and makes the final prediction:

1. **Flatten Layer**: Converts the feature maps into a 1D vector.
2. **Fully Connected Layer 1**:
    - Input Features: 64 * 10 *42 (derived from the feature map dimensions after convolution and pooling)
    - Output Features: 128
    - Activation: ReLU
3. **Fully Connected Layer 2**:
    - Input Features: 128
    - Output Features: 1 (final prediction)

Forward Pass

The forward pass consists of:

1. Passing the input through the convolutional layers for feature extraction.
2. Feeding the extracted features into the fully connected layers for regression.

Other HyperParameters

- Learning Rate: 0.001
- Optimizer: Adam
- Criterion: MSELoss
- Epochs: 100
- Training/Val Split: 80-20

Results of baseline

- Able to Adapt well to training data, ~0.15 MSE loss and 80% accuracy, however the validation loss is high and Accuracy is low (~12 and 11% respectively) Indicating the following:
    - High Training Accuracy: The model has learned the patterns in the training data very well, including noise or irrelevant features.
    - Low Validation Accuracy: The model struggles to perform well on new data because it hasn't generalized the underlying patterns; instead, it has memorized the specifics of the training set.

Some possible changes / improvements

- Data Augmentation
- Cross-Validation
- Regularization Techniques
- Ensemble Learning