

Super-Resolution Model for Image Enhancement

1. Introduction

This report presents a super-resolution model that enhances low-resolution images using deep learning. The project is based on the SRCNN model, a convolutional neural network designed to upscale images while preserving details. The goal is to generate high-quality images from low-resolution inputs efficiently.

2. Literature Review

Super-resolution techniques have been widely studied in image processing. Traditional methods like interpolation (bilinear, bicubic) often produce blurry results. Deep learning models, especially convolutional neural networks (CNNs), have significantly improved image upscaling. SRCNN, FSRCNN, and GAN-based models have demonstrated high performance in enhancing image quality.

3. Dataset and Preprocessing

The dataset used for training is the DIV2K dataset, which contains high-resolution images. To create training pairs, we downsampled the images to generate low-resolution versions. These pairs were then used to train the model to reconstruct high-resolution images from low-resolution inputs.

4. Model Architecture

The model is based on the Super-Resolution Convolutional Neural Network (SRCNN). It consists of three convolutional layers:

- The first layer extracts image features using a 9x9 kernel.
- The second layer refines these features using a 1x1 kernel.
- The final layer reconstructs the high-resolution image using a 5x5 kernel.

The model is trained using Mean Squared Error (MSE) loss and Adam optimizer.

5. Training and Results

The model was trained on the DIV2K dataset for 20 epochs with a batch size of 16. The results were evaluated using Peak Signal-to-Noise Ratio (PSNR) and Structural Similarity Index (SSIM). The

model successfully improved image quality compared to traditional interpolation methods.

6. Visualizations

Below are sample results comparing low-resolution images, original high-resolution images, and the super-resolution outputs generated by our model. The improvements in image sharpness and details demonstrate the effectiveness of the approach.

7. Conclusion and Future Work

This project successfully implemented a super-resolution model that enhances low-resolution images. The results show significant improvement in image quality. Future work could involve using GAN-based models for even better enhancements and real-time applications.