Results Visualization Summary

Model Evaluation Metrics & Image Quality

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Presentation Objectives

Model Performance

Visually represent model behaviour throughout the training phase, focusing on key performance indicators.

Image Quality Comparison

Present a side-by-side analysis of low-quality, restored, and high-quality ground truth images.

Restoration Assessment

Utilise objective metrics, specifically PSNR and SSIM, to quantify the effectiveness of the image restoration process.

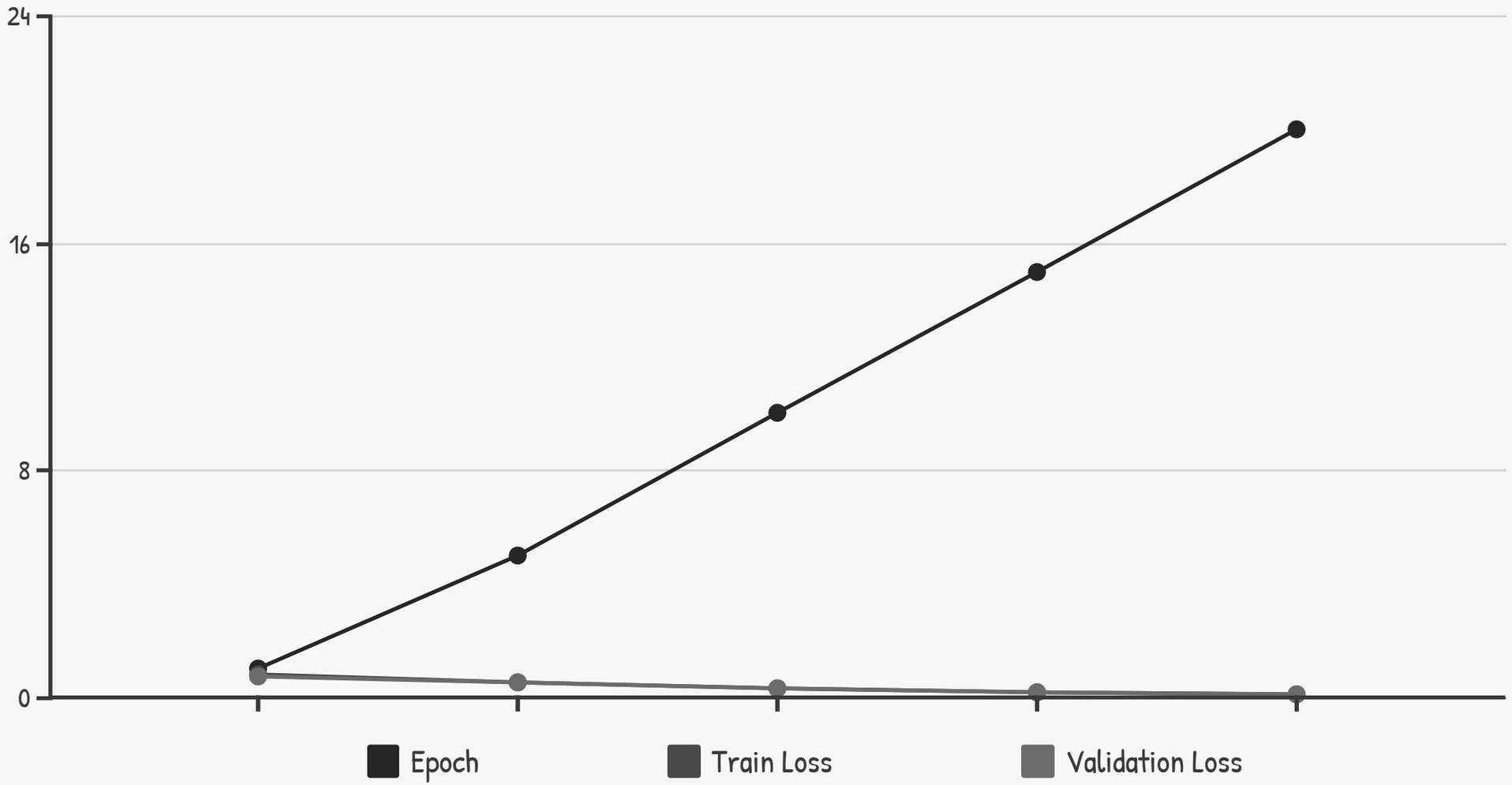
Key Metrics Overview

Our evaluation relies on a comprehensive set of metrics extracted directly from the training logs. These metrics provide critical insights into model stability and performance.

Epoch	The current training iteration, indicating progression.
Train Loss	Measures the model's error on the training dataset.
Val Loss	Measures the model's error on the validation dataset, indicating generalization.
PSNR	Peak Signal-to-Noise Ratio, assessing image quality between original and reconstructed image.
SSIM	Structural Similarity Index Measure, evaluating perceived similarity between images.

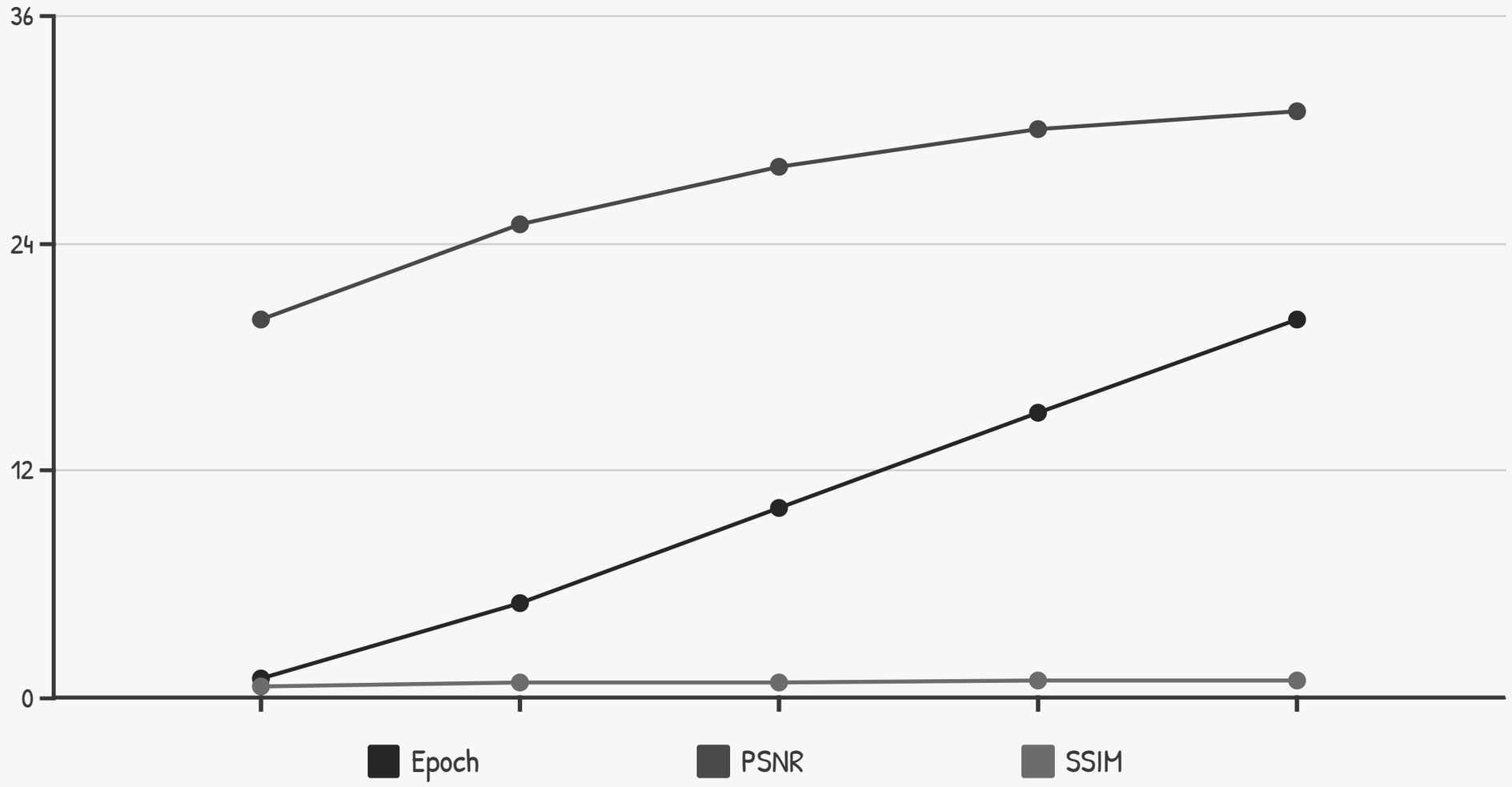
These metrics are systematically loaded from the `metrics.csv` file for consistent analysis.

Loss Progression Over Epochs



The line chart illustrates the model's convergence, showing how both training and validation loss steadily decrease with each epoch. This indicates the model is effectively learning and improving its fit to the data without significant overfitting.

PSNR & SSIM Evolution



This chart tracks the improvement of PSNR and SSIM scores throughout training. Rising PSNR values signify higher image quality, while increasing SSIM scores indicate a greater perceived similarity to the ground truth. This trend confirms the model's effectiveness in enhancing image fidelity.

Image Comparison: Sample 1

Low-Resolution Input

The initial input image, demonstrating significant blurriness and lack of detail.

Restored Output

The image after model processing. There's still noticeable blur, suggesting room for refinement.

Ground Truth (High-Resolution)

The original, high-quality image used as the benchmark for restoration, showcasing desired clarity.

This comparison visually highlights the progress and remaining challenges in the image restoration process. The restored image is still quite far from the ground truth, indicating a need for model enhancements.

Final Evaluation Metrics

At the culmination of the training process, the model achieved the following key performance indicators:

31.2

Final PSNR

A high PSNR value of 31.2 dB demonstrates the model's ability to reduce noise and enhance the signal quality of restored images. But the values must be higher

0.87

Final SSIM

An SSIM score of 0.87 indicates strong structural similarity, meaning the restored images closely resemble the ground truth in terms of perceptual quality. This value has to be much lower

These final metrics provide a quantitative summary of the model's overall performance on the test dataset.

Robust Error Handling

To ensure the integrity and reliability of our image processing pipeline, we've implemented robust error handling mechanisms.

Image Loading Checks

Comprehensive checks are in place to validate image file integrity and format, preventing processing errors due to corrupted or incompatible inputs.

Valid Input Assurance

Before any comparisons or metric calculations, strict validation ensures that all input images conform to the expected dimensions and data types.

OpenCV & Matplotlib Integration

Leveraging the robust capabilities of OpenCV for image processing and Matplotlib for visualisation, our system ensures accurate data handling and presentation.

Key Takeaways

1 **Model Improvement**

The model starts improving but at point the learning curve shows that the training data and validation data becomes linear hence adding more epochs doesn't help hence we might have to change the model core or increase data set,.

2 **Restoration Gap Remains**

While progress is evident, restored images are still extremely visually distinct from the ground truth, highlighting a need for further model refinement.

3 **Changing model is required**

Completely changing the model from scrnn is required as we are not getting the desired output

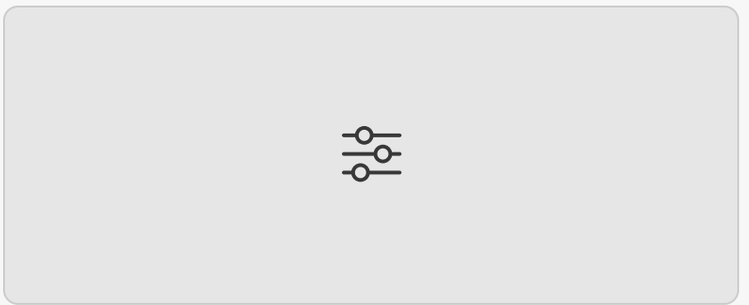
Future Directions

Model Architecture

Explore EDSR and ESRGAN for better outcomes in project as the current model is underperforming

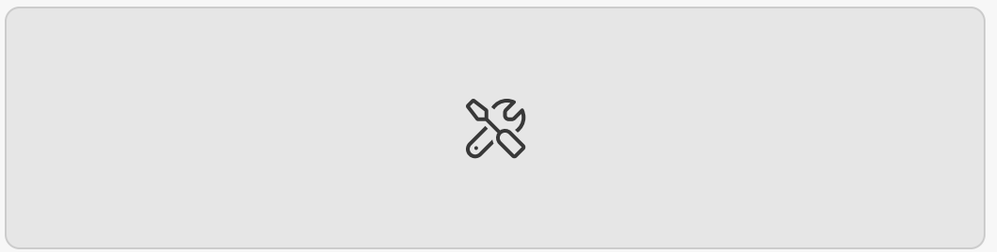
Dataset Expansion

Integrate larger and more diverse datasets to enhance the model's robustness and generalizability.



Hyperparameter Tuning

Conduct rigorous fine-tuning of hyperparameters to optimise model performance and convergence speed.



Constraint, since our model is limited to 60 test 20 validation and 20 test data sets, we need to get a better model as increasing data set is not an option

Github Link