

Comparison of Windowing Techniques on Urban8k Dataset

Classification Accuracy

The performance of different windowing techniques was evaluated using a classifier, with the following accuracy results:

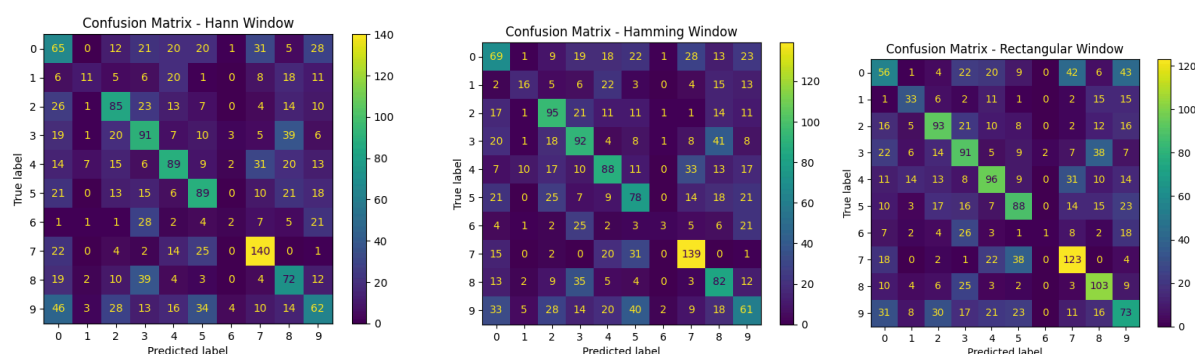
- **Hann Window:** 40%
- **Hamming Window:** 41%
- **Rectangular Window:** 43%

While all three windows exhibit similar performance, the Rectangular window achieves the highest accuracy among them.

Confusion Matrix Analysis

The confusion matrices provide insights into the classification performance for each windowing technique:

- **Hann Window:** The confusion matrix shows higher misclassification across multiple classes, suggesting increased spectral leakage or lower feature discrimination.
- **Hamming Window:** A slight improvement in accuracy over Hann suggests better class separation, but misclassifications remain significant.
- **Rectangular Window:** This window yields the best accuracy, indicating that it preserves more relevant features for classification.

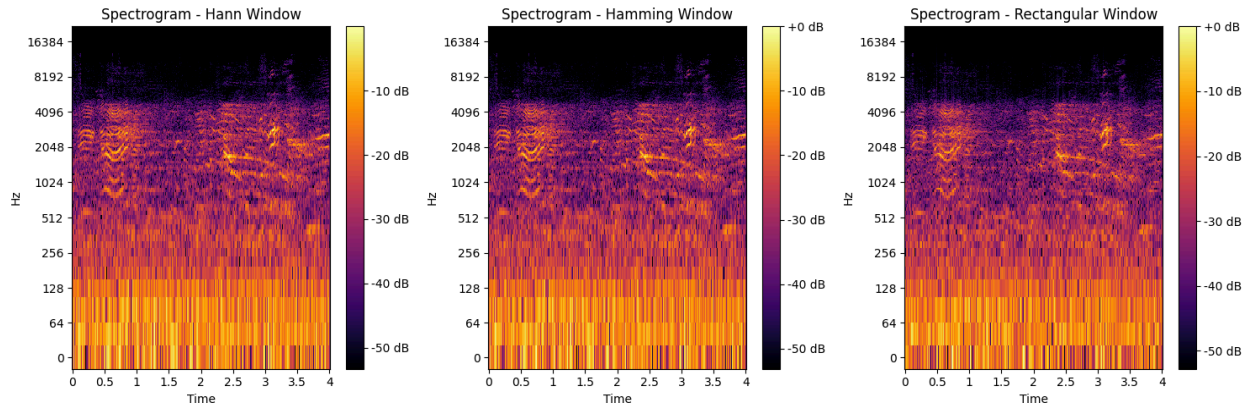


Spectrogram Analysis

Spectrograms reveal how different windows affect the time-frequency representation of signals:

- **Hann Window:** Produces a smooth transition but may introduce spectral leakage.

- **Hamming Window:** Provides a balance between leakage and frequency resolution, improving clarity.
- **Rectangular Window:** Retains all data but may introduce abrupt transitions, potentially enhancing classification accuracy.



Conclusion

The Rectangular window achieves the highest classification accuracy, likely due to its ability to retain more signal information. However, the choice of the optimal window depends on the trade-off between spectral leakage and feature preservation. Future work could explore additional window functions and their impact on classification performance.