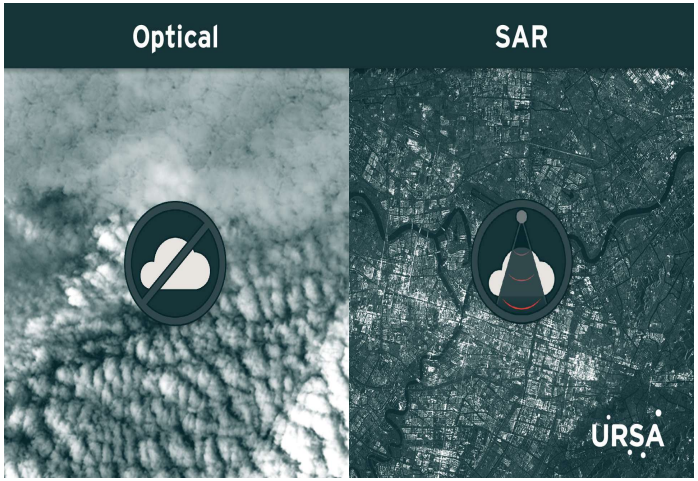
[SAR IMAGE]

[CSIT, Affiliations]

Abstract

Synthetic Aperture Radar (SAR) images offer valuable insights into Earth's surface, but their monochromatic nature limits visual clarity. This research presents a deep learning model for colorizing SAR images, improving their interpretability while retaining crucial structural details. By leveraging Convolutional Neural Networks and generative approaches, our model transforms grayscale SAR images into realistic colorized versions, aiding in applications like land cover classification, disaster monitoring, and environmental assessment. Experimental results using datasets from ISRO demonstrate the model's ability to generate high-quality colorized SAR images with minimal information loss.

Background



Materials and Methods

- **Dataset**:
  - SAR images from [Kaggle/ISRO/other sources].
  - Includes multiple radar polarizations (VV, VH).
  - Preprocessed by resizing to [x × y] and applying noise reduction.
- **Model Architecture**:
  - Based on [CNN/GAN].
  - **Encoder**: Extracts features using convolutional layers.
  - **Decoder**: Reconstructs colorized image with transposed convolutions.
  - **Loss Function**: Pixel-wise loss + perceptual loss.
- **Training Details**:
  - **Dataset Split**: 80% training, 10% validation, 10% testing.
  - **Batch Size**: [32/64].
  - **Optimizer**: Adam, learning rate [value].
  - **Epochs**: [number] epochs with early stopping.
- **Evaluation Metrics**:
  - **PSNR**: Measures image quality.
  - **SSIM**: Measures perceptual similarity.
- **Hardware & Software**:
  - **Hardware**: [GPU details].
  - **Software**: Python, TensorFlow/Keras/PyTorch, OpenCV, Matplotlib.

Results

- **Improved visual quality** with colorized SAR images.
- **Better interpretation** of land features and topography.
- **Enhanced classification** accuracy for machine learning.
- **Noise reduction** in raw SAR data.
- **Faster object recognition** and detection.
- **Quicker data processing** for experts.

Conclusion

- The SAR image colorization model enhances image clarity, boosts classification accuracy, reduces noise, and speeds up object detection, making SAR data more efficient for analysis and decision

Future Direction

- **AI/ML Integration** for better accuracy.
- **Real-time Processing** for immediate use.
- **Cross-domain Applications** in agriculture, urban planning, etc.
- **Data Fusion** with other satellite data.
- **Improved Algorithms** for large datasets.
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