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Millimeter-analysis of super-resolution using deep learning techniques for remote sensing applications

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Statement of the Problem: Satellite image processing plays a crucial role in vegetation detection; land use and land cover changes (LULCC), cloud detection and other atmospheric applications. The level of processing of a remotely sensed (RS) satellite image decides upon the amount of minute information captured from the satellite sensors. In rare cases, RS images may be vulnerable to a lack of interpretability issues in some parts of the image due to the sensor's limits and preprocessing techniques, which attribute to unclear identification of patterns/objects. In these cases, there is a chance of losing minute information. Besides, it is costly and not always feasible in most real applications to build imaging chips and optical components to counterfeit lack of interpretability issues. In such cases, an efficient algorithm can be modeled to improve feature clarity and to resolve the objects to maximum size.

Methodology & Theoretical Orientation: Super-Resolution (SR) based research, exploitation of Deep Learning (DL) components in feature extraction for the enhancement of the minute details and its implications for classification tasks are explored to address the problem statement effectively.

Findings: Feedback Network for image super-resolution (SRFBN) and Enhanced Deep Residual Networks for Single Image Super-resolution (EDSR) algorithms are suitable Deep Learning based SR techniques for pan sharpening and vegetation detection applications and hence, they are used. DenseNet-121 is recommended for agriculture detection, ResNet-50 and Google Net DL pretrained classifiers are recommended for categorical classification applications. This motivated to design two designs for categorical classification of raw panchromatic images a thirteen layer deep CNN network for categorical classification between two spatial signatures a ten layer deep CNN for SR decision making tool. These two designs are compared against DL pretrained/modified versions of these classifiers to validate the efficacy of the proposed works.

Conclusion & Significance: The outcome of this research will emphasize the importance of SR technique in enhancing the minute image's spatial features, thereby overcoming the limitations of imaging sensors' cost and digital airborne imagery in Pan sharpening, improved signature detection, accurate signature classification and precise decision-making tool applications.