

## Appendix 1 Fusion techniques

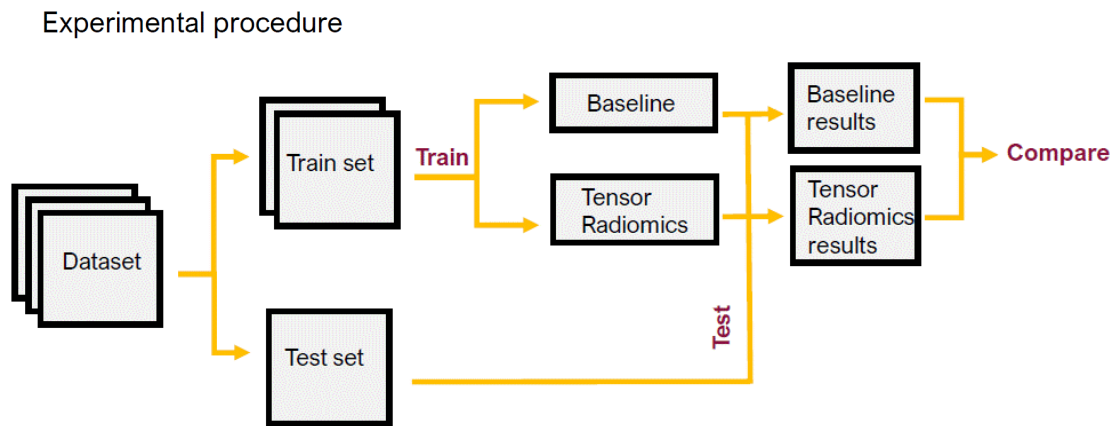
Multi-scale transform (MST) theories are popularly deployed in various image fusion scenarios such as classical MST-based fusion methods including pyramid-based methods like Laplacian pyramid (LP) (40), and ratio of low-pass pyramid (RP) (41), wavelet-based methods like discrete wavelet transform (DWT) (42) and dual-tree complex wavelet transform (DTCWT) (43), and multi-scale geometric analysis (MGA)-based methods like curvelet transform (CVT) (44) and nonsubsampling contourlet transform (NSCT) (45). Generally, MST-based fusion methods consist of three steps (46). First, decompose the source images into a multi-scale transform domain. Then, merge the transformed coefficients with a given fusion rule. Finally, reconstruct the fused image by performing the corresponding inverse transform over the merged coefficients. Sparse representation (SR) addresses the signals' natural sparsity, which is in accord with the physiological characteristics of human visual system (47). In SR-based image processing methods, the sparse coding technique is often performed on local image patches for the sake of algorithm stability and efficiency (48). The sliding window technique is adopted in their method to make the fusion process more robust to noise and misregistration. In (45), the sparse coefficient vector is used as the activity level measurement. NSCT + SR, DTCWT + SR, and CVT + SR are three fusion methods that mixture of MST-based and SR-based methods. In general, the low-pass MST bands are merged with an SR-based fusion approach while the high-pass MST bands are fused using the conventional "max absolute" rule with a local window-based consistency verification scheme (42,49). CBF fuses source images by weighted average using the weights computed from the detail images that are extracted from the source images using CBF. Here, the weights are computed by measuring the strength of details in a detail image obtained by subtracting CBF output from original image (50). Principal component analysis (PCA), Hue, Saturation, and Intensity (HSI), Wavelet and Weighted are other fusion methods that were used in this work (51,52).

## References

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**Table S1** List of fusions techniques explored in section Results of using fusion flavours

Fusion techniques	Sparse representation (SR)	Bilateral Cross Filter (BCF)	Hue, Saturation and Intensity Fusion	Weighted fusion
	Laplacian pyramid (LP)	Principal component analysis (PCA)	Ratio of low-pass pyramid (RP)	
Wavelet-family fusion techniques	Discrete wavelet transform (DWT)	Curvelet transform (CVT)	Dual-tree complex wavelet transform (DTCWT)	Nonsubsampled contourlet transform (NSCT)
	NSCT + SR	DTCWT + SR	CVT + SR	Wavelet fusion



**Figure S1** The framework for TR analysis with bin size flavours.