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On the comparison of different kernel functionals and neighborhood geometry for nonlocal means filtering

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Abstract The present work proposes a review and comparison of different Kernel functionals and neighborhood geometry for Nonlocal Means (NLM) in the task of digital image filtering. Some different alternatives to change the classical exponential kernel function used in NLM methods are explored. Moreover, some approaches that change the geometry of the neighborhood and use dimensionality reduction of the neighborhood or patches onto principal component analysis (PCA) are also analyzed, and their performance is compared with respect to the classic NLM method. Mainly, six approaches were compared using quantitative and qualitative evaluations, to do this an homogeneous framework has been established using the same simulation platform, the same computer, and same conditions for the initializing parameters. According to the obtained comparison, one can say that the NLM filtering could be improved when changing the kernel, particularly for the case of the Tukey kernel. On the other hand, the excellent performance given by recent hybrid approaches such as NLM SAP, NLM PCA (PH), and the BM3D SAPCA lead to establish that significantly improvements to the classic NLM could be obtained. Particularly, the BM3D SAPCA approach gives the best denoising results, however, the computation times were the longest.

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