

Point Spread Function Filtering for Radially Variant Blur Restoration

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In this paper, we present a point spread function (PSF) filtering technique for solving the radially variant blur restoration problem. Radially variant blur is generated by a spherical single-element lens imaging system (SSLIS) that is embedded in an experimental camera module. The restoration of this category of blur is carried out in a polar coordinate system using polar PSFs at different fields of view (FOVs). However, restoration using large PSFs tends to introduce severe ringing artifacts in the restored image owing to the nonsparse nature of these PSFs. We show in this paper that the PSF filtering technique can effectively minimize ringing artifacts by filtering out some PSF pixels with an intensity lower than the threshold intensity. As a result, a nonsparse PSF becomes a sparse PSF, which is for good restoration results. The effectiveness of the PSF filtering technique was validated by visual comparison using three test images captured by the SSLIS camera module. In addition, a systematic way to determine the optimal filtering coefficient for a PSF at any FOV within the FOV range is also introduced.

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