

# **BLIND DECONVOLUTION ALGORITHMS FOR ROTATIONAL MOTION BLURRED IMAGES**

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This thesis addresses an image deconvolution problem. By using a single blurred image, a sharp image is reconstructed from the image degraded by either linear motion blur or rotational motion blur. Since the cause of degradation existing either as the line spread function (LSF) or point spread function (PSF) is assumed unknown, motion blur estimation is performed prior to the image deconvolution phase. In the motion blur estimation phase, the cepstral analysis is used to estimate the motion length for both kinds of motion blur. For the linear motion blur case, the PSF is characterized by the motion length and the motion direction. The motion direction is estimated by using the modified Radon transform. For the rotational motion blur case, the center of rotation characterizing the degradation is estimated before the restoration phase. In the accelerated motion case, where the coefficients of convolution mask are not the same, an online estimation algorithm is used to estimate the coefficients providing the motion length has been known. A number of experiments have been performed to demonstrate the feasibility of the presented algorithms. Firstly, a blurred image model for each motion blur case is presented. Based on analysis of each type of motion blur, the blur estimation problem is solved based on the derived blurred image model. Then, the image deconvolution method is employed to obtain a sharp image. In the linear motion blurred image case, a noiseless Kalman filter is derived and proposed to restore the blurred image. In the rotational motion blurred image, its space variance is firstly reduced by a space variant decomposition algorithm, i.e. by employing a circle generating algorithm. The circle generating algorithm is used to obtain the space invariant motion path. Therefore, the 2-D space variant deconvolution problem falls into a 1-D space invariant deconvolution problem. Here, the blurred image is restored for each concentric circle by using the Lagrange multiplier method. The full sharp image can be obtained by unifying the deconvolution results from all concentric circles. The remaining unrestored pixels are solved by using the median filter.