

Generic Document Image Dewarping by Probabilistic Discretization of Vanishing Points

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1. Letter strokes as well as pictures and page boundaries provide a lot of lines, some of which are "vertical" (in 3D), others "horizontal". These can be used to detect the zenith, then the horizon line and the focal length of the document





Under a generalized cylinder shape assumption, perspective and page curl can be dewarped simultaneously by discretizing vanishing points along the horizon line Probability distribution that a chord of circle C meets a line L at position x by chance

3. The 3D directions of the vanishing points are computed and their angles with the camera x-axis are smoothed according to a median filter



4. The filtered bottom curve then the full document are reconstructed in 3D. The image is back-projected onto the 3D model which finally only has to be unfolded to get the dewarped image





An example of result obtained with our method as it stands on an image of a building, demonstrating the genericity of our approach. Left: Acquired image with graphic layers showing the intermediate results of the algorithm. Right: Dewarped building.

2. Vanishing points are detected along the horizon line by performing a binary-tree descent search. A probabilistic criterion is used to decide when to stop cutting: a vanishing point is said *meaningful* if it cannot be obtained (at least once) by chance





Some examples of results obtained on the IUPR dataset. First row: Original images with information on the progress of our algorithm. Second row: dewarped images. Last row: Number of recognized words for the GT scan / Distorted / Unwarped documents.



Influence of the camera tilt on focal computation and word detection. Relative error on the focal length and number of recognized words