Real camera systems have a limited depth of field (DOF) which may cause an image to be degraded due to visible misfocus or too shallow DOF. In this paper, we present a blind deblurring pipeline able to restore such images by slightly extending their DOF and recovering sharpness in regions slightly out of focus. To address this severely ill-posed problem, our algorithm relies first on the estimation of the spatially varying defocus blur. Drawing on local frequency image features, a machine learning approach based on the recently introduced regression tree fields is used to train a model able to regress a coherent defocus blur map of the image, labeling each pixel by the scale of a defocus point spread function. A non-blind spatially varying deblurring algorithm is then used to properly extend the DOF of the image. The good performance of our algorithm is assessed both quantitatively, using realistic ground truth data obtained with a novel approach based on a plenoptic camera, and qualitatively with real images.