Netcalibration: A New Convolutional Neural Network for Lens Calibration of Scientific Camera for Microscopy

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In 3D reconstruction as well as measurement from various viewing positions from a camera, it is important that calibration parameters can be obtained automatically. This includes the camera intrinsic, extrinsic parameters as well as radial and tangential distortions based on the value of the parameters estimated by an algorithm. The calibration has a similar process setting as neural network when it comes to optimization to find the parameters by performing operations on software. Inspired by this idea, we explore the application of a deep convolution neural network, trained on target board images obtained from experiment, to represent camera projection by having the network weighting on matrixes specify camera intrinsic, extrinsic parameters.

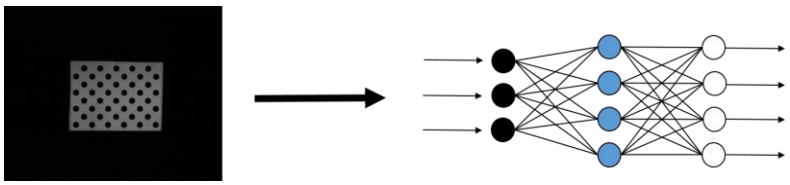

Figure 1: The camera parameters was estimated from target board using proposed convolutional neural network architecture

Compared with traditional calibration method [1], our method allows simultaneous estimation of calibration parameters and decreases the cost function at each iteration. This provides accurate parameters estimation, 3D reconstruction accuracy, and robustness to noise and poor initialization. The experiment result shows that the proposed method has accuracy, stability and robustness as expected. It is an optimal approach for automatic camera calibration [2].

[1] Z.Zhang. A flexible new technique for camera calibration (technical report). *IEEE Transactions on Pattern Analysis and Machine Intelligence,*22(11):1330-1334,2002

[2] Y. Hold-Geoffroy, K. Sunkavalli, J. Eisenmann, M. Fisher, E. Gambaretto, S. Hadap, and J.-F. Lalonde. A perceptual measure for deep single image camera calibration. *CVPR*, 2018.