A NEW CALIBRATION METHOD FOR MICROSCOPE CAMERA BASED ON CONVOLUTIONAL NEURAL NETWORK

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For sensitive SCMOS or EMCCD microscope cameras, calibration is the first step to get accurate 2D/3D image information when performing demanding live cell experiments and rapid time-lapse recordings with a large field of view. The objective of calibration is to get camera parameters including the focal length and distortion factors precisely. The proposed method uses the convolutional neural network to represent camera projection by having the network specify camera intrinsic, extrinsic parameters and remove the distortion of the captured images and correct spherical aberrations.

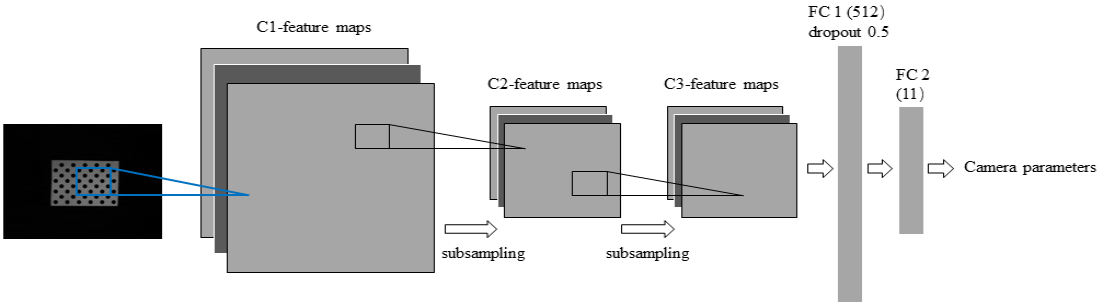

Figure 1: Proposed convolutional neural network architecture

The method finds maximum-likelihood estimates from noisy point correspondences using constraints on focal lengths and resolves ambiguities in estimating the intrinsic and extrinsic parameters as weights. Compared with the traditional calibration [2], our method allows estimation of calibration parameters simultaneously 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 one of the currently cutting-edge approaches to automatic camera calibration.

[1] R.I. Hartley and A. Zisserman. *Multiple View Geometry in Computer Vision.* Cambridge University Press, ISBN: 0521540518, second education, 2004.
[2] Z.Zhang. A flexible new technique for camera calibration(technical report). *IEEE Transactions on Pattern Analysis and Machine Intelligence,*22(11):1330-1334,2002