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3D Particle Reconstruction of Volumetric Particle Image Velocimetry with Convolutional Neural Network[1] SHAOWU PAN, Department of Aerospace Engineering, University of Michigan, Ann Arbor, USA, QI GAO, School of Aeronautics and Astronautics, Zhejiang University, China, QIJIE LI, HONGPING WANG, RUNJIE WEI, MicroVec. Inc., Beijing, China, JINJUN WANG, Key Laboratory of Fluid Mechanics, Beihang University, China — 3D particle reconstruction of volumetric Particle Image Velocimetry (PIV) is an underdetermined inverse problem of which exact solution is difficult to obtain. Traditionally, approximated solutions can be obtained via optimization, e.g., multiplicative algebraic reconstruction technique (MART). Despite its popularity in recent years, the performance of MART-like algorithms deteriorates when the particle concentration becomes high, e.g., particle per pixel (ppp) ≈ 0.3. In this work, a particle reconstruction method based on convolutional neural network (CNN) is proposed. The method consists of two steps: first, an initial particle field is generated from a plurality of two-dimensional particle images get by camera using multiplied line-of-sight (MLOS) method; second, we use CNN to take the aforementioned initial particle field as input and output the 3D reconstructed particle fields. The data is artificially generated by randomly placing particle in 3D space then projected to four cameras to obtain 2D particle images. Compared to the traditional MART algorithm, the proposed method is not only significantly improving the accuracy of 3D particle reconstruction especially at high particle concentration but also eight times faster than the traditional MART algorithm.

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