

Machine Learning, Spring 2020

Deep Learning for Image Registration

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Python tutorial: <http://learnpython.org/>

TensorFlow tutorial: <https://www.tensorflow.org/tutorials/>

PyTorch tutorial: <https://pytorch.org/tutorials/>

Acknowledge: The slides are partially referred to the online materials by Taegyun Joen, <https://www.slideshare.net/TaegyunJeon1/pr12-you-only-look-once-yolo-unified-realtime-object-detection> and online YOLO paper and other materials (from ECS289g by Prof. Lee)

What is image registration

Image registration: is the process of transforming different sets of data into one coordinate system. Data may be multiple photographs, data from different sensors, times, depths, or viewpoints.[1] It is used in computer vision, medical imaging,[2] military automatic target recognition, and compiling and analyzing images and data from satellites. Registration is necessary in order to be able to compare or integrate the data obtained from these different measurements. (Wikipedia)

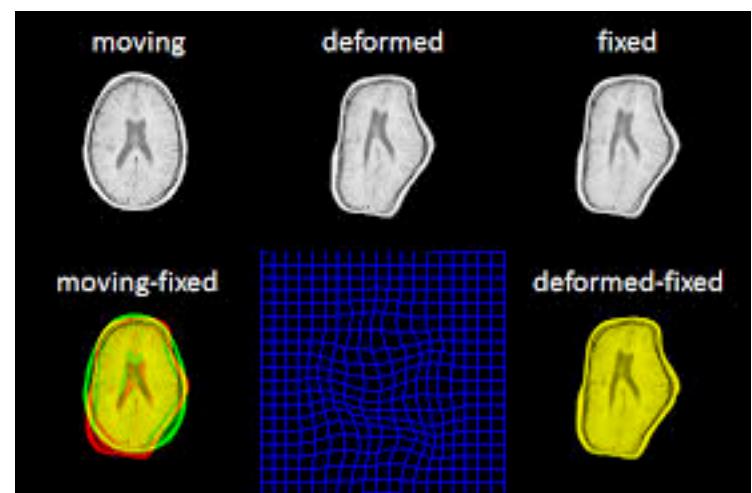
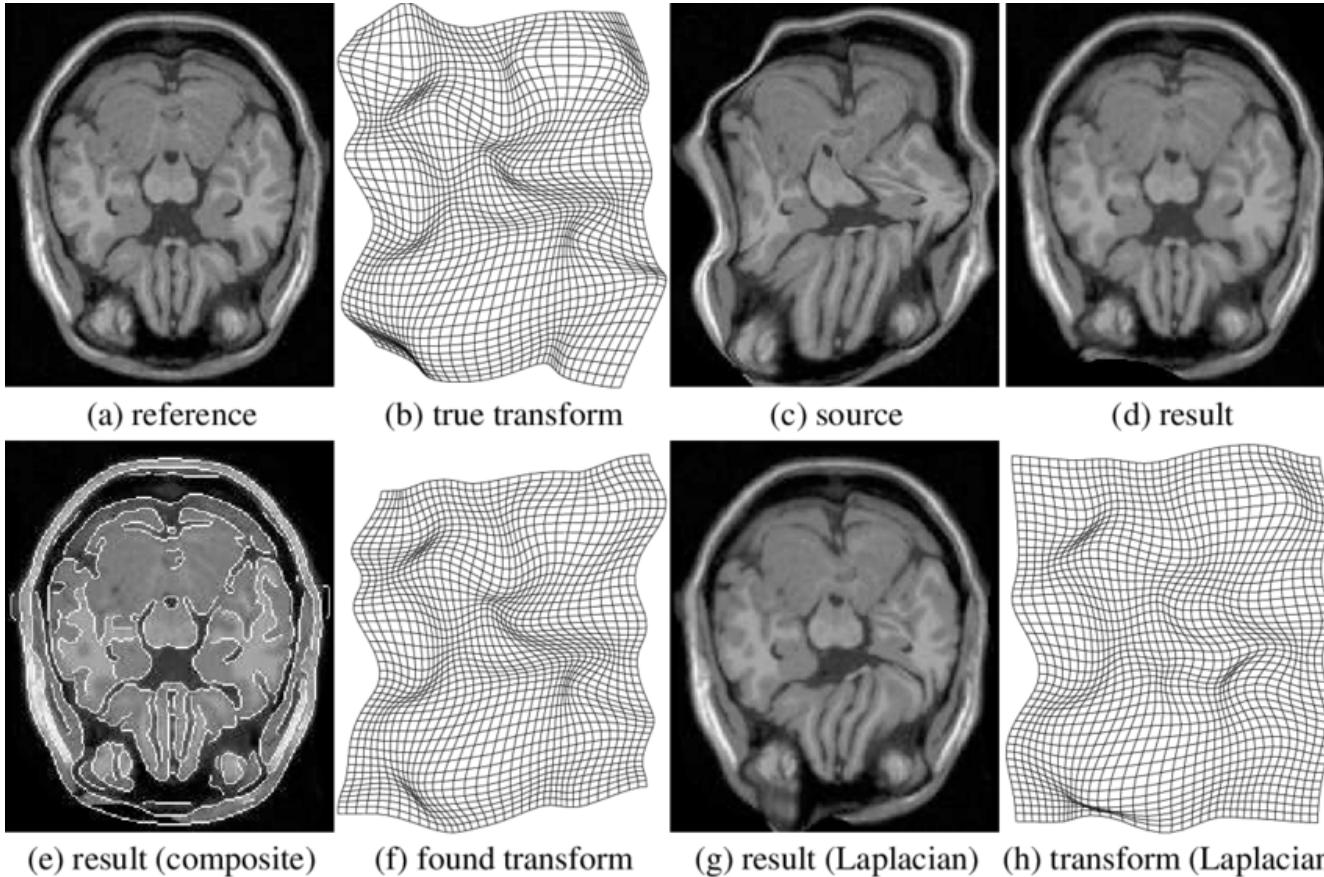


Image Source: Mathworks & Matlab Central

Non-rigid Image Registration



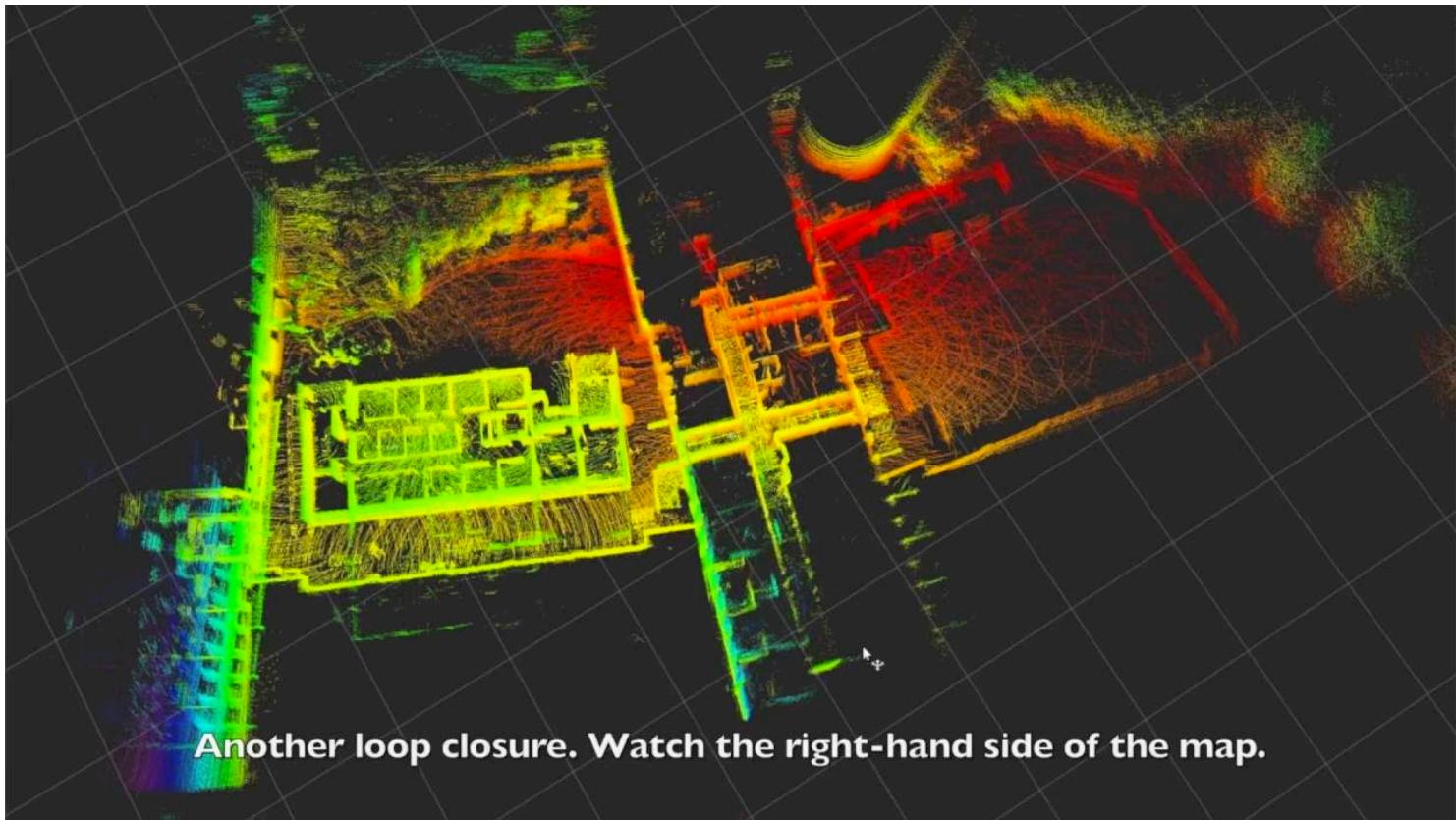
[Credit: Andriy etc, 1009](#)

3D Image Group Registration

Finding correspondences between two or more 3D shapes and/or recovering the underlying transformation that maps one shape to others.

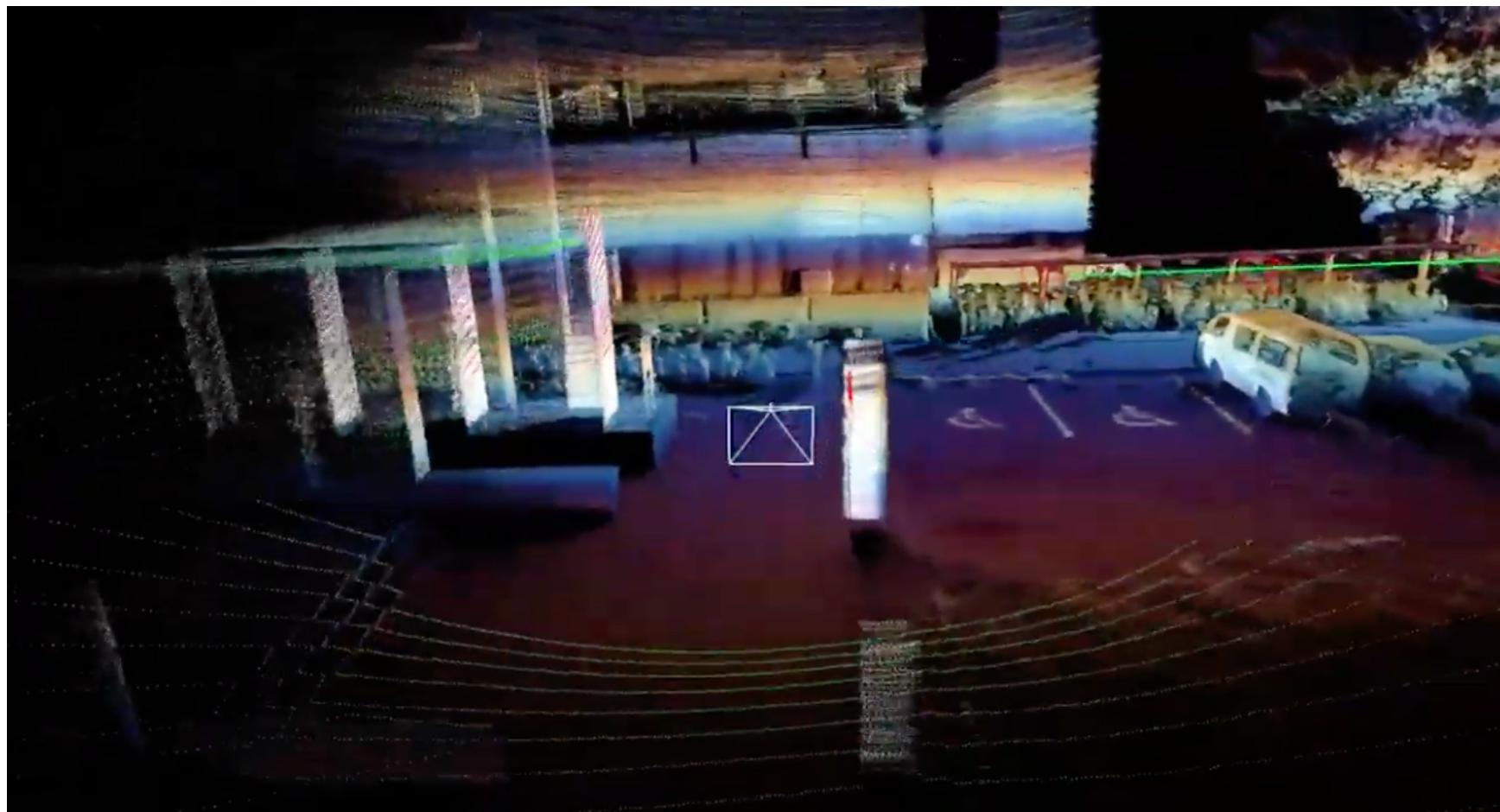


3D Simultaneous localization and mapping (SLAM)

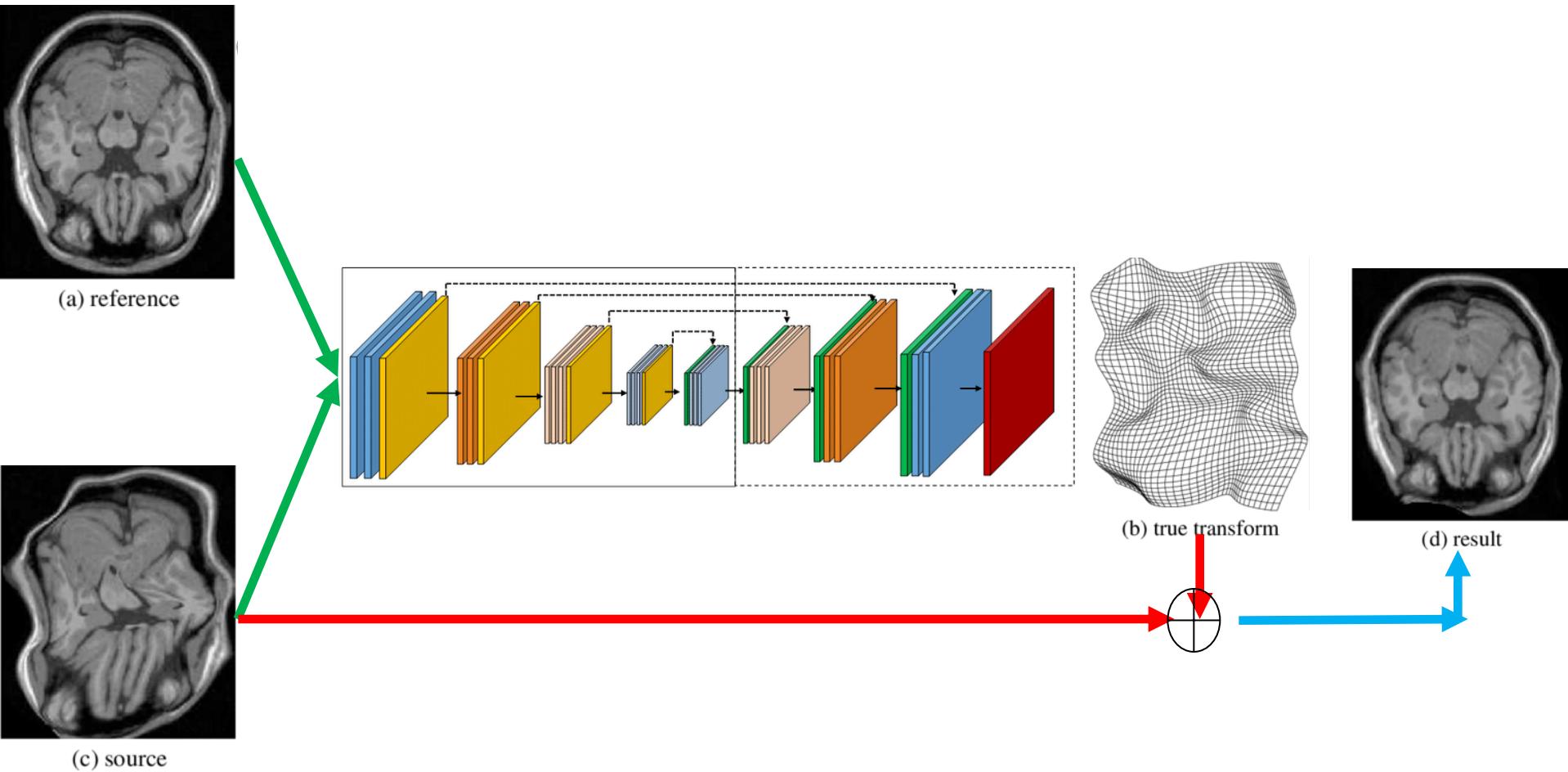


Video Source: <https://www.youtube.com/watch?v=08GTGfNneCI>

3D SLAM 2



CNN for Image Registration



CNN for Image Registration

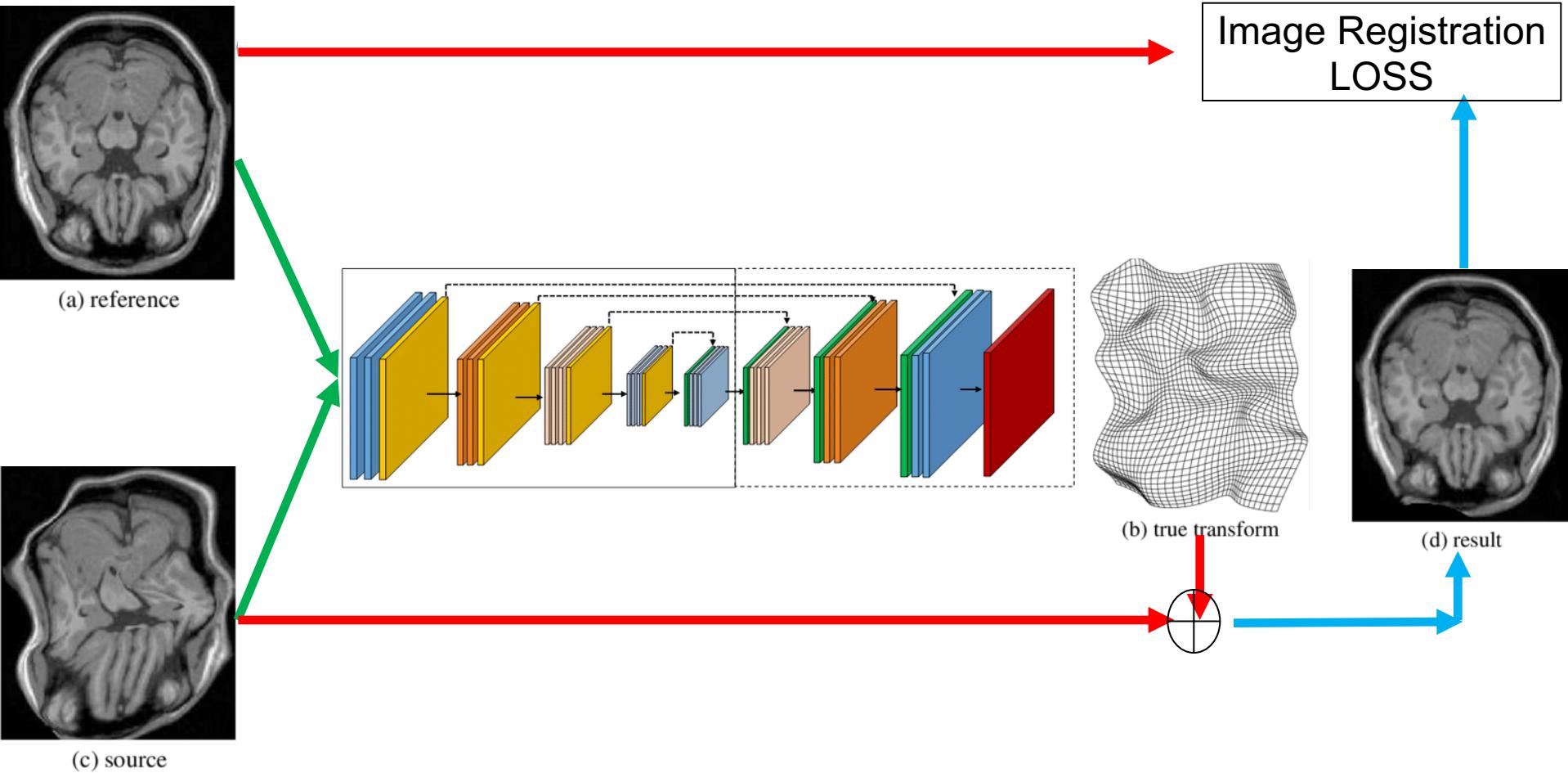


Image Displacement Field

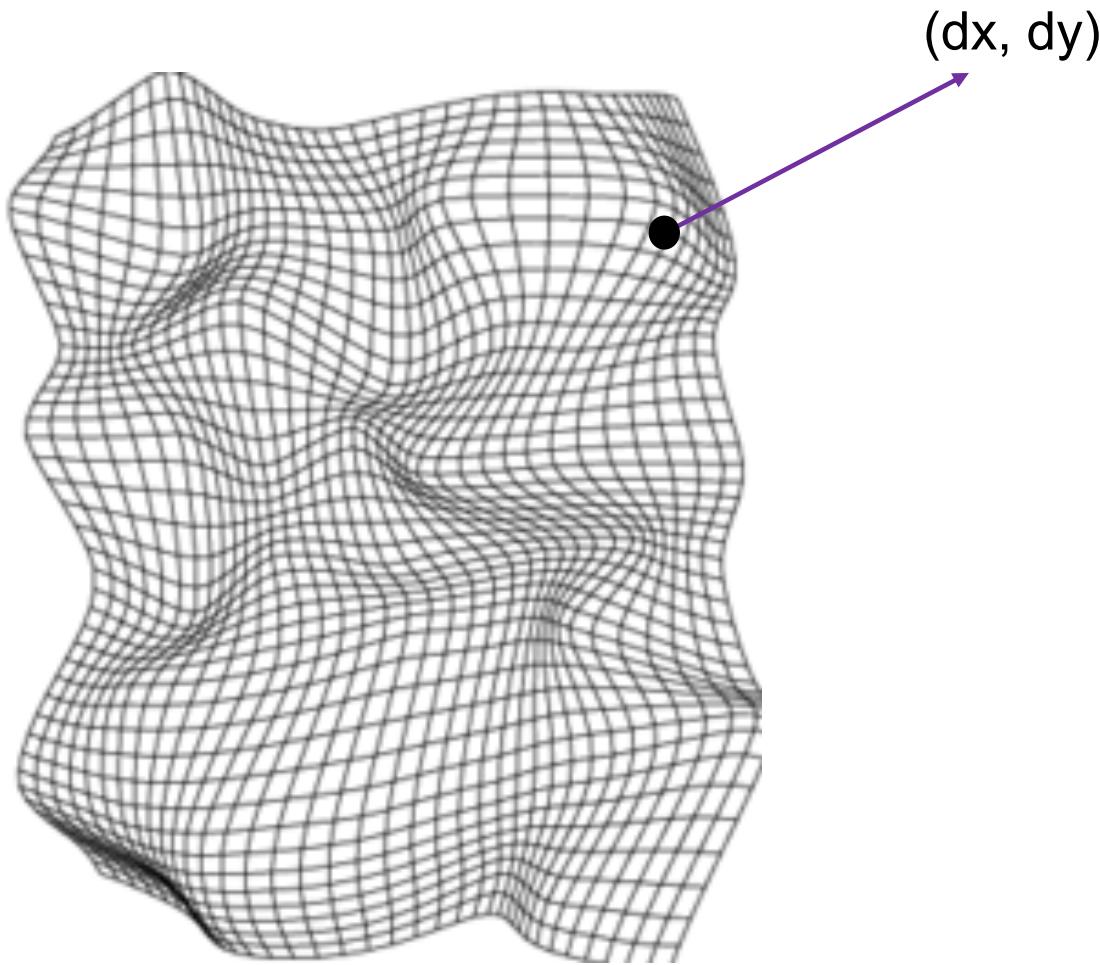


Image Warp Process

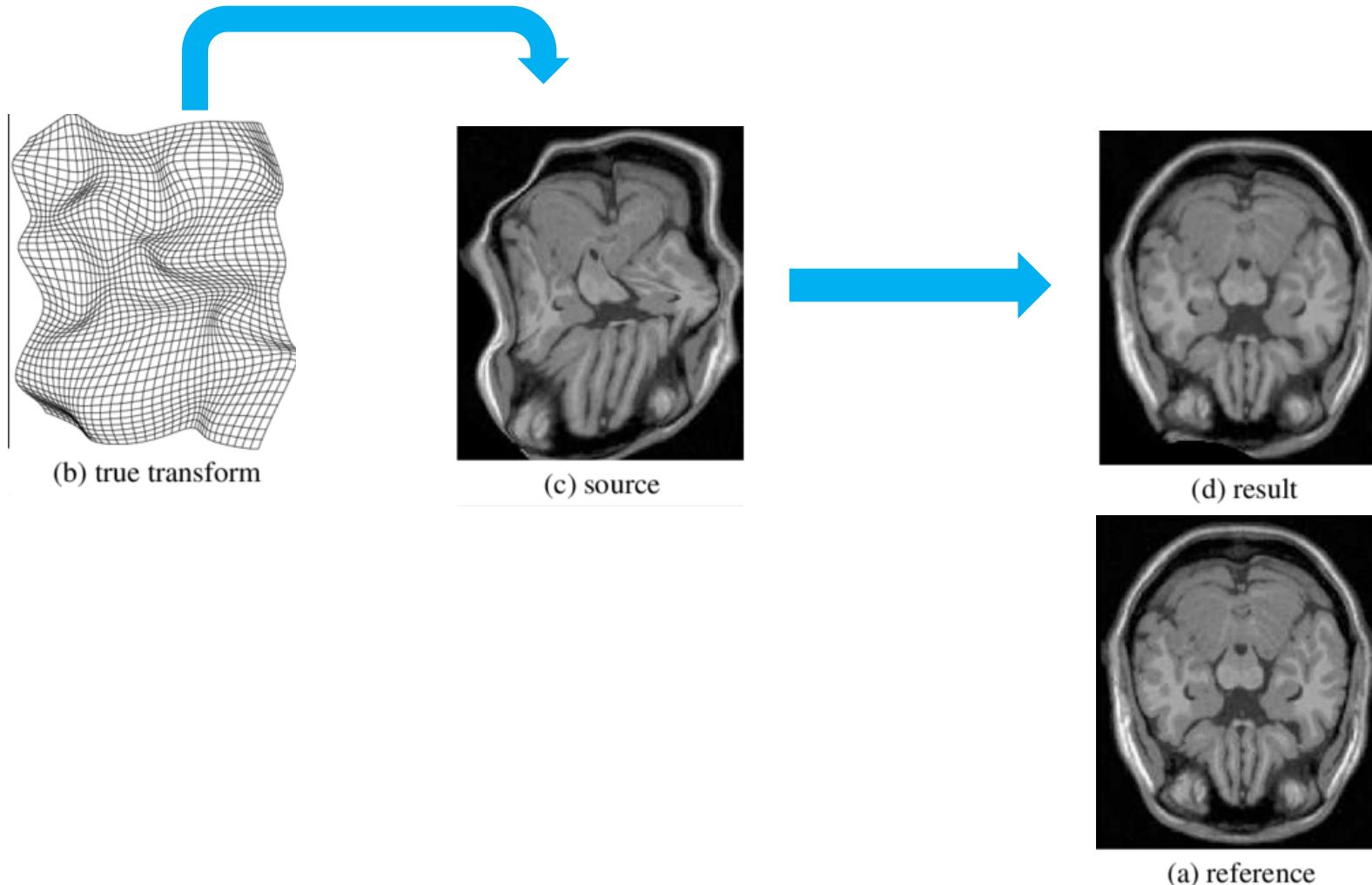


Image Registration Loss



Image Registration Loss

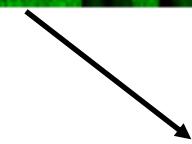
Before Registration



After Registration



Image Difference



CNN for Image Registration

