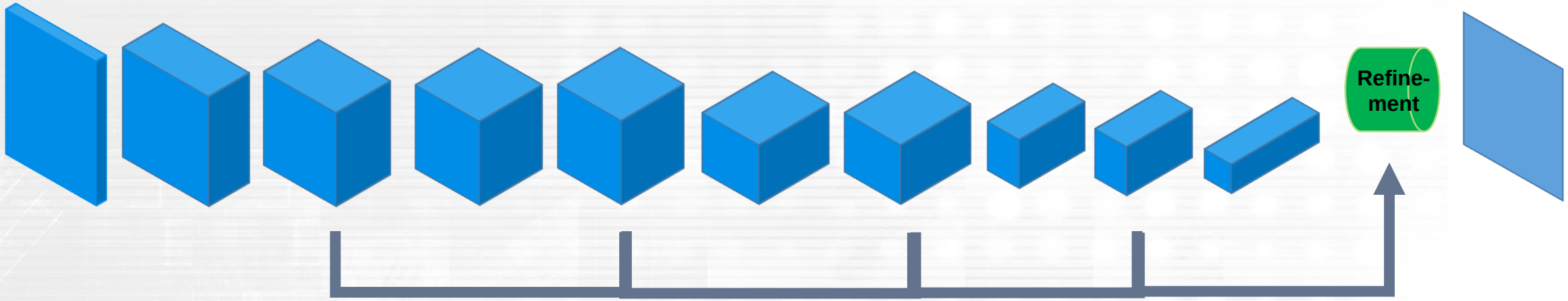
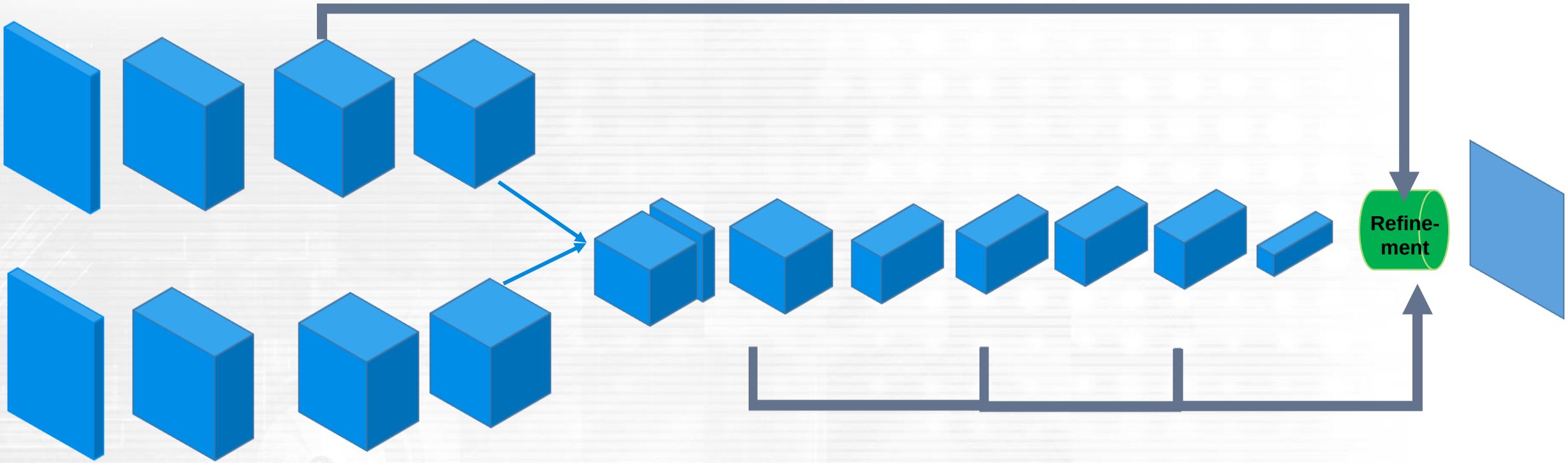
Optical Flow

FlowNet



출처 FlowNet: Learning Optical Flow with Convolutional Networks, ICCV 2015

FlowNet



출처 FlowNet: Learning Optical Flow with Convolutional Networks, ICCV 2015

Data Augmentation

CNN for Registration

출처 Nonrigid Image Registration Using Multi-scale 3D Convolutional Neural Networks, MICCAI 2017
Quicksilver: Fast Predictive Image Registration - a Deep Learning Approach, arXiv 2017

CNN for Registration

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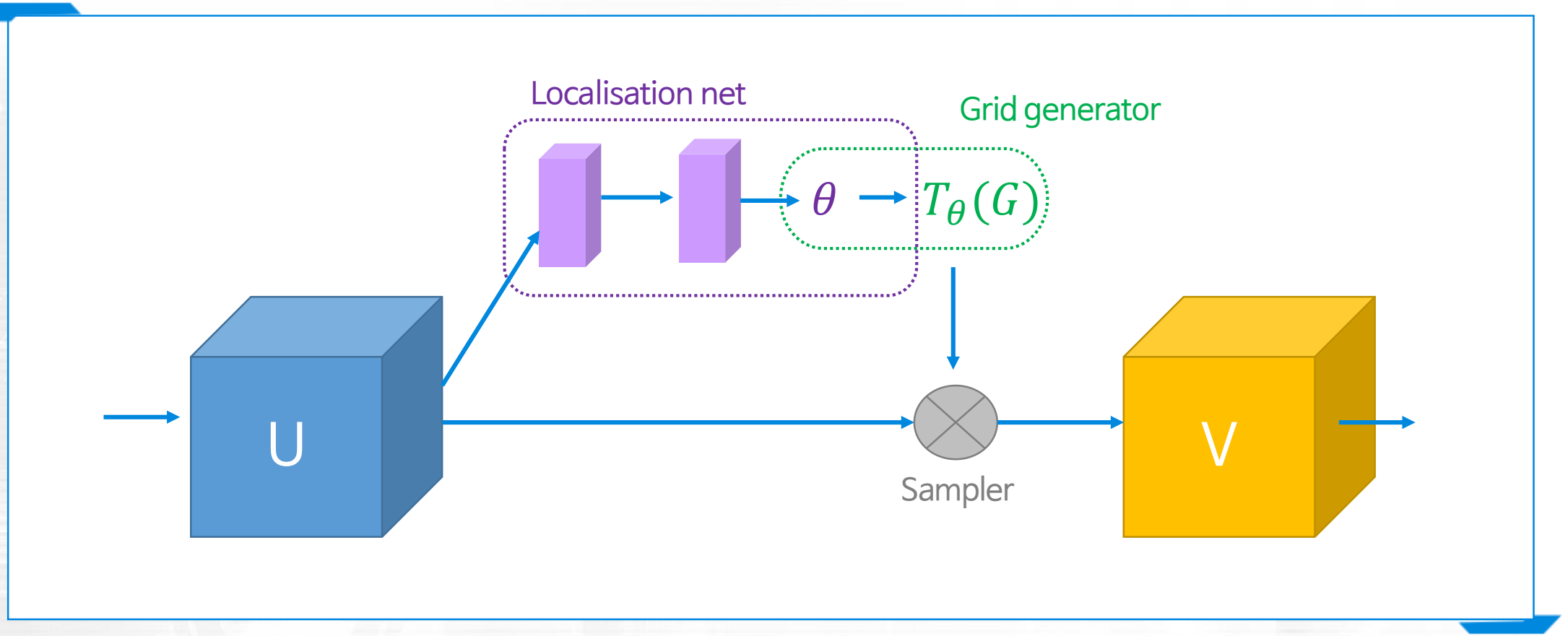
Spatial Transformer Network

Spatial Transformer Network



출처 Spatial Transformer Networks, NIPS 2015

Spatial Transformer Network

$$V_i^c = \sum_n^H \sum_m^W U_{nm}^c \delta(\lfloor x_i^s + 0.5 \rfloor - m) \delta(\lfloor y_i^s + 0.5 \rfloor - n)$$

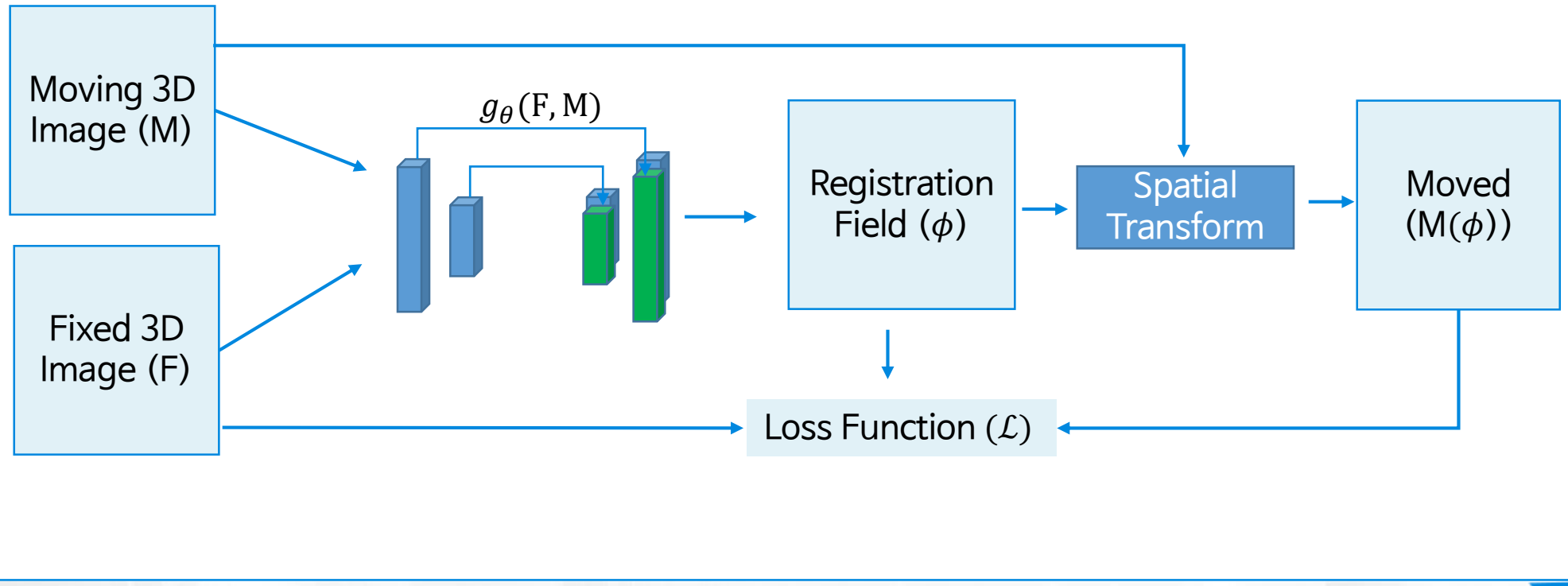
$$V_i^c = \sum_n^H \sum_m^W U_{nm}^c \max(0, 1 - |x_i^s - m|) \max(0, 1 - |y_i^s - n|)$$

$$\frac{\partial V_i^c}{\partial U_{nm}^c} = \sum_n^H \sum_m^W \max(0, 1 - |x_i^s - m|) \max(0, 1 - |y_i^s - n|)$$

$$\frac{\partial V_i^c}{\partial x_i^s} = \sum_n^H \sum_m^W U_{nm}^c \max(0, 1 - |y_i^s - n|) \begin{cases} 0 & if\ |m - x_i^s| \geq 1 \\ 1 & if\ m \geq x_i^s \\ -1 & if\ m < x_i^s \end{cases}$$

출처 Spatial Transformer Networks, NIPS 2015

Registration via Unsupervised Learning



출처 An Unsupervised Learning Model for Deformable Medical Image Registration, CVPR 2018

Registration via Unsupervised Learning

출처 An Unsupervised Learning Model for Deformable Medical Image Registration, CVPR 2018

Registration Metric

- Endpoint error (EPE)
- Landmark based validation
- Segmentation based validation

Registration Metric

- Inverse consistency error
- Intensity variance