LAB Seminar

2.5D representation Depth & Normal

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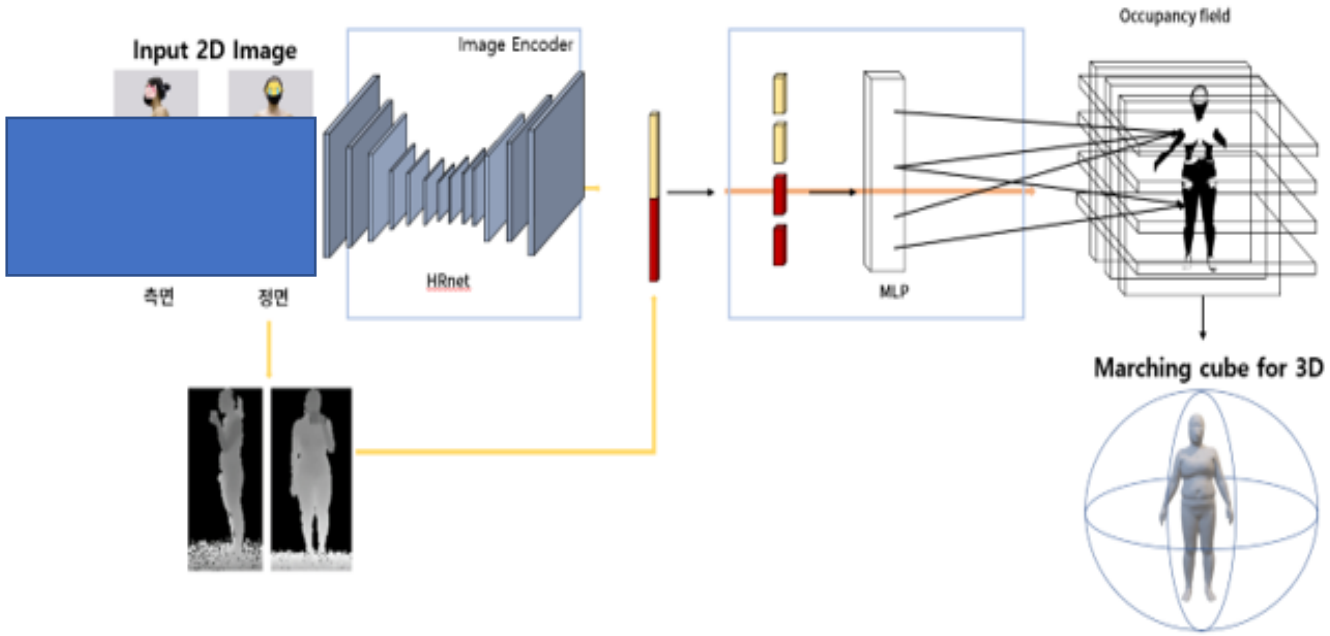
Key concept



Leverage input data outside the network

Use depth and occupancy prob

Key concept

Problem : depth is fragile

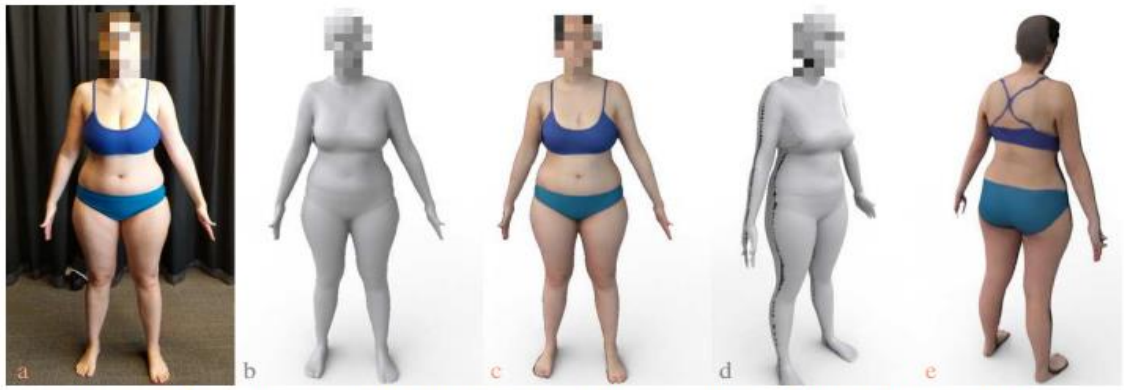
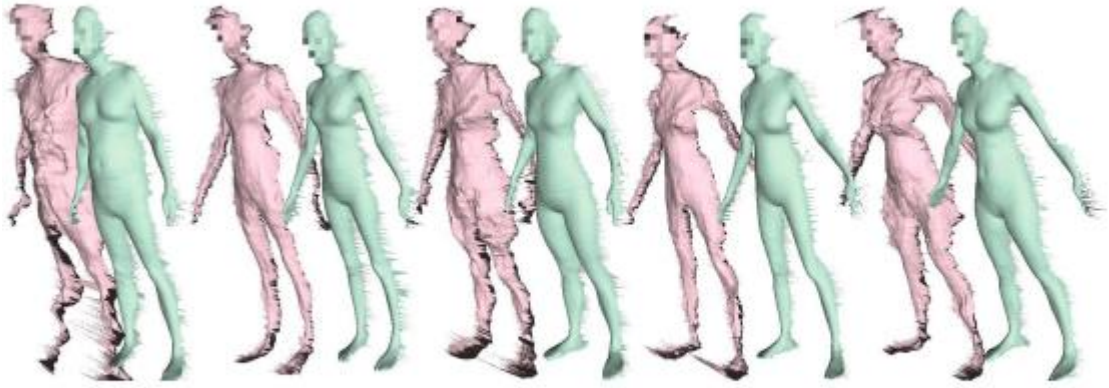


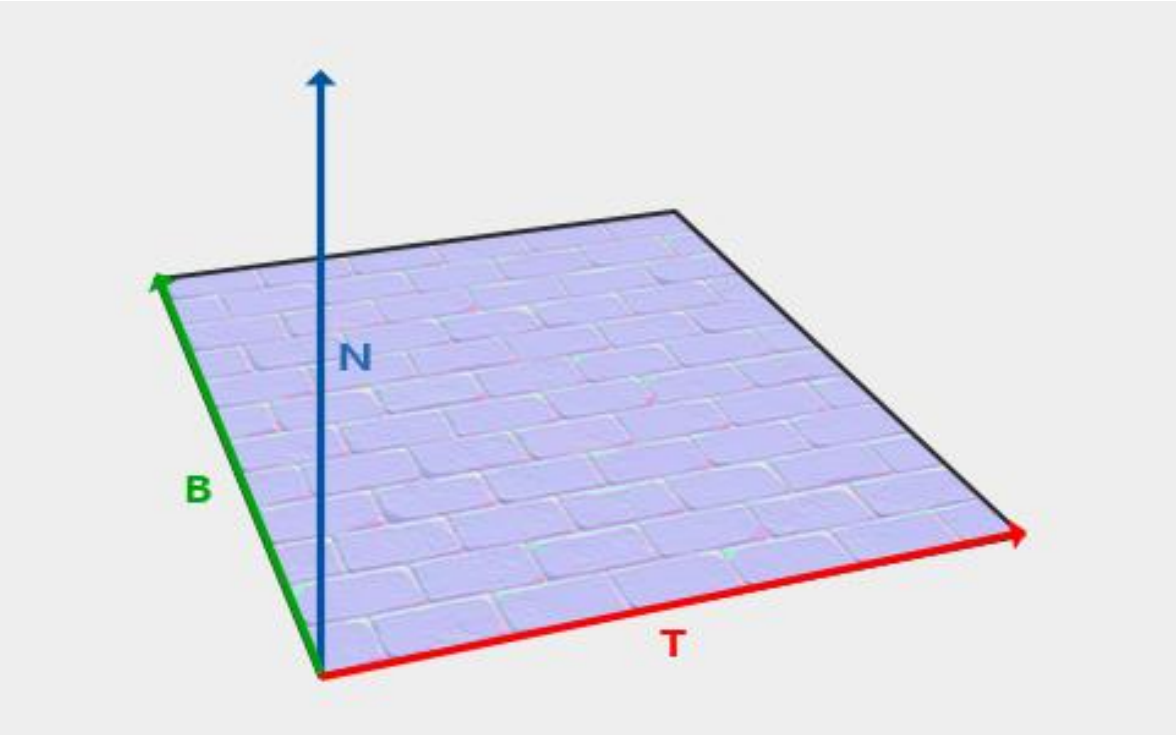
Figure 1: FAX converts a single RGB image (a) into a scan (b, d) with albedo texture (c, e)



ing (**pink**) an $L1$ loss on depth and (**green**) an $L1$ loss on normals.

The effect of the normal map on the output *Loss* was greater than that of the depth (Pix2PixHD)

What is the normal?



한국어로 직역하면 법선

2.5D representation

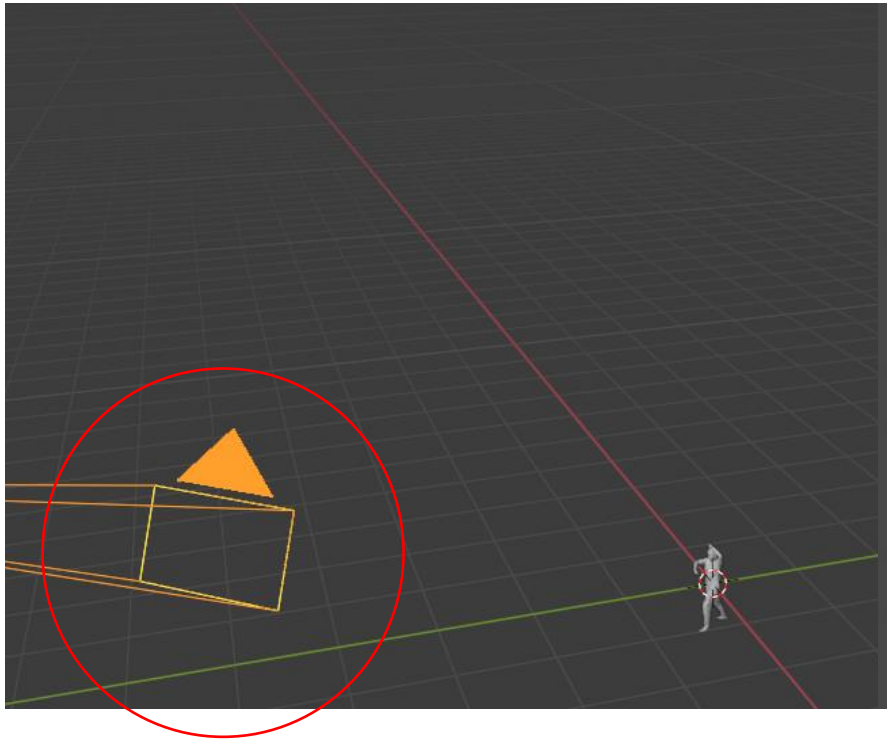
Estimation or image2image translation

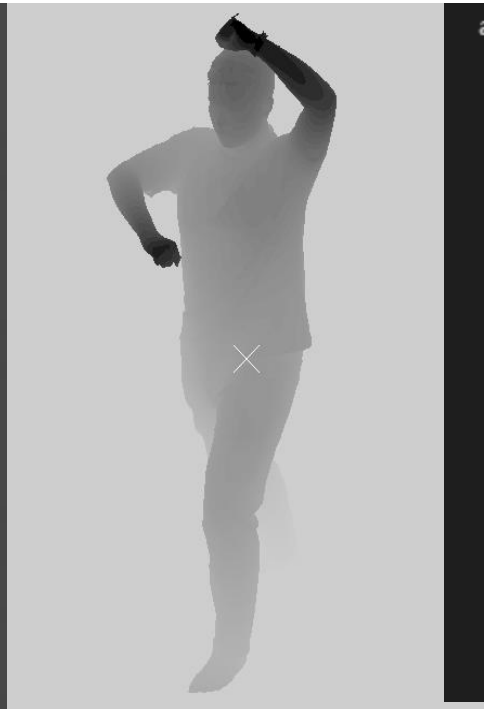
Gradient from mesh or Depth??

How to get Ground Truth??

Camera location

(X, Y, Z, θ, Φ)





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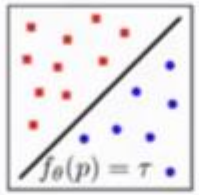
        [1. , 0.5, 0.5],
        [1. , 0.5, 0.5]],

       [[1. , 0.5, 0.5],
        [1. , 0.5, 0.5],
        [1. , 0.5, 0.5],
        ...,
        [1. , 0.5, 0.5],
        [1. , 0.5, 0.5],
        [1. , 0.5, 0.5]],
```

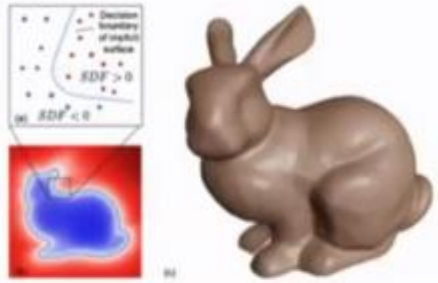
Implicit neural representation

Neural networks as a continuous shape representation

Occupancy Networks
(Mescheder et al. 2019)
$(x, y, z) \rightarrow$ occupancy

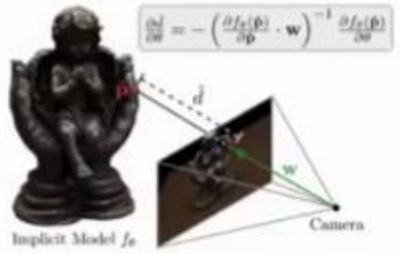


DeepSDF
(Park et al. 2019)
$(x, y, z) \rightarrow$ distance



Scene Representation Networks
(Sitzmann et al. 2019)
$(x, y, z) \rightarrow$ latent vec. (color, dist.)

Differentiable Volumetric Rendering
(Niemeyer et al. 2020)
$(x, y, z) \rightarrow$ color, occ.



13

Matthew Tancik: Neural Radiance Fields for View Synthesis (https://youtu.be/dPWLybp4LL0)

Reference

Implicit representation

- TetraTSDF: 3D human reconstruction from a single image with a tetrahedral outer shell
- Deep Local Shapes: Learning Local SDF Priors for Detailed 3D Reconstruction
- PIX2SCENE: LEARNING IMPLICIT 3D REPRESENTATIONS FROM A SINGLE IMAGE
- DeepSDF: Learning Continuous Signed Distance Functions for Shape Representation
- DeepMesh: Differentiable Iso-Surface Extraction
- NeRF: Representing Scenes as Neural Radiance Fields for View Synthesis
- Neural Geometric Level of Detail: Real-time Rendering with Implicit 3D Shapes

normal

- FACSIMILE: Fast and Accurate Scans From an Image in Less Than a Second
- Leveraging Spatial and Photometric Context for Calibrated Non-Lambertian Photometric Stereo
- Material Image Classification using Normal Map Generation
- Adaptive Surface Normal Constraint for Depth Estimation
- A Confidence-based Iterative Solver of Depths and Surface Normals for Deep Multi-view Stereo
- Estimating and Exploiting the Aleatoric Uncertainty in Surface Normal Estimation

Face

- i3DMM: Deep Implicit 3D Morphable Model of Human Heads
- Learning to Aggregate and Personalize 3D Face from In-the-Wild Photo Collection fine detail
- Cross-modal Deep Face Normals with Deactivable Skip Connections

Loss

- Self-Calibrating Neural Radiance Fields