Abstract

In this supplementary material, we show quantitative and qualitative results of our method on several synthetic scenes. To demonstrate the large variety of data our method works on, we evaluate on real world Lytro light fields, the HCI benchmark [3], the light field benchmark [1], datasets from the Stanford archive [2], and our own synthetic datasets created for this submission. We present results for both seen and unseen light fields. Since ground truth is only available for our synthetic scenes and [1], we show quantitative evaluations only for those data sets.

For the diffuse and specular component, we compute local mean-squared error (LMSE), global mean squared error (GMSE) and structural similarity index (SSIM). For LMSE and GMSE, smaller values are better, while for SSIM, a larger value is better. Accuracy of depth maps is assessed with (MSE). For better visualization and consistency with the main paper, all metrics are multiplied by 100.

For visual evaluation, we show center views of diffuse and specular components, estimated disparity, and center view of reconstructed light field. On the last two pages, we also link video files to demonstrate angular consistency. Since we use a crosshair-shaped subset of 17 views, the video shows only 17 frames corresponding to the vertical and horizontal directions in the video files.

Note: text appearing in red is a link and can be used to navigate the document. Text appearing in blue is a link to a video file.

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Light field \textit{First training example}

\textbf{Type}: Synthetic data set generated with Blender using Cycles rendering engine

\textbf{Size}: $9 \times 9$ views

\textbf{Resolution}: $512 \times 512$ pixels

\textbf{Disparity range}: $[-2.55 \ 1.44]$  

\textbf{Scene description}: The data set contains a glossy object with complicated geometry, and a mixture of planar and curved surfaces. The foreground object has almost no structure. This light field was used for training the network.

\textbf{Light field preview}
Our results compared with ground truth

- GT diffuse
- Our diffuse
- GT specular
- Our specular
- GT disparity
- Our disparity
- GT center view
- Our center view
Numerical evaluation

- **Diffuse**
  - LMSE = 0.2
  - GMSE = 0.24
  - SSIM = 67.58

- **Specular**
  - LMSE = 0.05
  - GMSE = 0.08
  - SSIM = 84.26

- **Disparity**
  - MSE = 3.92
Light field Second training example

**Type:** Synthetic data set generated with Blender using Cycles rendering engine

**Size:** 9 × 9 views

**Resolution:** 512 × 512 pixels

**Disparity range:** [−2.04 2.1]

**Scene description:** The data set has an object with soft reflection. The background contains some texture with clear pattern. This data set is used for training the network.

Light field preview
Our results compared with ground truth

Light field Second training example
Numerical evaluation

Light field Second training example

- **Diffuse**
  - LMSE = 0.11
  - GMSE = 0.14
  - SSIM = 56.16

- **Specular**
  - LMSE = 0.12
  - GMSE = 0.17
  - SSIM = 83.23

- **Disparity**
  - MSE = 3.45
Overview

Light field *First test example*

**Type:** Synthetic data set generated with Blender using Cycles rendering engine

**Size:** $9 \times 9$ views

**Resolution:** $512 \times 512$ pixels

**Disparity range:** $[-2.04, 2.86]$

**Scene description:** This data is used in the main paper. With non-trivial illumination, the scene exhibit lots of specularity. The data set has never been shown to the network, and is used for testing.

Light field preview

![Light field preview](image-url)
Our results compared with ground truth
• **Diffuse**
  
  LMSE = 0.11  
  GMSE = 0.13  
  SSIM = 84.25  

• **Specular**
  
  LMSE = 0.14  
  GMSE = 0.15  
  SSIM = 77.85  

• **Disparity**
  
  MSE = 18.42
Light field *Second test example*

**Type:** Synthetic data set generated with Blender using Cycles rendering engine

**Size:** $9 \times 9$ views

**Resolution:** $512 \times 512$ pixels

**Disparity range:** $[-2.04, 1.76]$

**Scene description:** This data set has two objects and is also used in the main paper for the comparisons with other methods, and reproduced here for better image resolution. This is an unseen light field that is used for testing.

**Light field preview**
Our results compared with ground truth
• **Diffuse**
  \[
  \text{LMSE} = 0.1 \\
  \text{GMSE} = 0.26 \\
  \text{SSIM} = 75.03
  \]

• **Specular**
  \[
  \text{LMSE} = 0.13 \\
  \text{GMSE} = 0.28 \\
  \text{SSIM} = 82.9
  \]

• **Disparity**
  \[
  \text{MSE} = 5.87
  \]
Light field *Third test example*

**Type:** Synthetic data set generated with Blender using Cycles rendering engine

**Size:** 9 × 9 views

**Resolution:** 512 × 512 pixels

**Disparity range:** \([-2.04, 1.99]\]

**Scene description:** This data set has many glossy objects with similar shapes, which is challenging for the disparity estimation. This is an unseen light field that is used for testing.

**Light field preview**

![Light field preview](image)
Our results compared with ground truth

GT diffuse

GT specular

GT disparity

GT center view

Our diffuse

Our specular

Our disparity

Our center view
• **Diffuse**
  
  - LMSE = 0.05
  - GMSE = 0.06
  - SSIM = 82.02

• **Specular**

  - LMSE = 0.04
  - GMSE = 0.05
  - SSIM = 75.64

• **Disparity**

  - MSE = 11.26
Light field Fourth test example

Type: Synthetic data set generated with Blender using Cycles rendering engine

Size: $9 \times 9$ views

Resolution: $512 \times 512$ pixels

Disparity range: $[-2.04, 1.95]$

Scene description: This data set shows an object with fine details and curved surfaces. This is an unseen light field that is used for testing.

Light field preview
Our results compared with ground truth

Light field Fourth test example

GT diffuse

Our diffuse

GT specular

Our specular

GT disparity

Our disparity

GT center view

Our center view
Numerical evaluation

• **Diffuse**
  LMSE = 0.19  
  GMSE = 0.29  
  SSIM = 68.57

• **Specular**
  LMSE = 0.3  
  GMSE = 0.37  
  SSIM = 51.52

• **Disparity**
  MSE = 5.82
Light field *Fifth test example*

**Type:** Synthetic data set generated with Blender using Cycles rendering engine

**Size:** 9 × 9 views

**Resolution:** 512 × 512 pixels

**Disparity range:** \([-2.04, 1.84]\)

**Scene description:** This data set contains an object with almost diffuse reflection and very soft specularity. This is an unseen light field that is used for testing.

**Light field preview**
Our results compared with ground truth

GT diffuse

GT specular

GT disparity

GT center view

Our diffuse

Our specular

Our disparity

Our center view
• **Diffuse**
  
  LMSE = 0.11  
  GMSE = 0.25  
  SSIM = 77.28

• **Specular**
  
  LMSE = 0.18  
  GMSE = 0.37  
  SSIM = 84.5

• **Disparity**
  
  MSE = 3.54
Light field Flowers

**Type:** Real world light field obtained with Lytro Illum plenoptic camera

**Size:** 9 × 9 views

**Resolution:** 434 × 625 pixels

**Disparity range:** [−1.43, 1.42]

**Scene description:** This is a real-world example captured in sunlight. This dataset is used in unsupervised training of the autoencoder.
Our results

Light field Flowers

GT center view

Our center view

Our diffuse

Our specular

Our disparity
Light field *Koala with saxophone*

**Type:** Real world light field obtained with Lytro Illum plenoptic camera

**Size:** 9 × 9 views

**Resolution:** 434 × 625 pixels

**Disparity range:** [−1.52 0.93]

**Scene description:** This is a real-world example captured in approximately white light. It contains an almost Lambertian koala toy and a highly specular saxophone. The data set is also used during unsupervised training.

Light field preview
Our results

Light field Koala with saxophone

GT center view

Our center view

Our diffuse

Our specular

Our disparity
Light field *Origami*

**Type:** Real world light field obtained with Lytro Illum plenoptic camera

**Size:** $9 \times 9$ views

**Resolution:** $434 \times 625$ pixels

**Disparity range:** $[-1.76, 0.67]$

**Scene description:** This is a real-world example that is also used in the main paper. The light field shows two objects with different material, one is made of paper and another one is from wood with glossy coating.

**Light field preview**
Our results

Light field Origami

GT center view

Our center view

Our diffuse

Our specular

Our disparity
Light field *Hedgehog*

**Type:** Real world light field obtained with Lytro Illum plenoptic camera

**Size:** $9 \times 9$ views

**Resolution:** $434 \times 625$ pixels

**Disparity range:** $[-1.82 \ 0.84]$ 

**Scene description:** Another example with a highly specular object that is used for unsupervised training of the network.

**Light field preview**
Our results
Light field *Saxophone and Koala*

**Type:** Real world light field obtained with Lytro Illum plenoptic camera

**Size:** 9 × 9 views

**Resolution:** 434 × 625 pixels

**Disparity range:** [−2.25 0.63]

**Scene description:** This data set is used in the main paper, here we show larger images compared to the main manuscript. This data set was never presented to the network and is used for testing.
Our results

Light field Saxophone and Koala

GT center view

Our center view

Our diffuse

Our specular

Our disparity
Light field Maria

**Type:** Real world light field from HCI benchmark [3]

**Size:** $9 \times 9$ views

**Resolution:** $926 \times 926$ pixels

**Disparity range:** $[-1.04 \ 0.37]$

**Scene description:** A wooden statue with textured background. For more details about this data set we refer to the benchmark [3]

**Light field preview**
Our results

Light field Maria

GT center view

Our center view

Our diffuse

Our specular

Our disparity
Light field Cube

**Type:** A real-world light field from the HCI benchmark [3]

**Size:** 9 × 9 views

**Resolution:** 898 × 898 pixels

**Disparity range:** [−1.59, 0.93]

**Scene description:** Data set from HCI benchmark [3] that is used in the main paper. Here we present larger images and reconstructed center view of the light field.

**Light field preview**

![Light field preview image]
Our results

Light field Cube

GT center view

Our center view

Our diffuse

Our specular

Our disparity
Light field Bicycle benchmark

**Type:** Synthetic test scene from light field benchmark [1]

**Size:** $9 \times 9$ views

**Resolution:** $512 \times 512$ pixels

**Disparity range:** $[-1.7, 1.7]$

**Scene description:** A scene with complicated geometries and shapes which is difficult for both reflection separation and disparity estimation.

Light field preview
Our results

Light field Bicycle benchmark

GT center view

Our center view

Our diffuse

Our specular

Our disparity
Light field *Cotton benchmark*

**Type:** Synthetic test scene from light field benchmark [1]

**Size:** $9 \times 9$ views

**Resolution:** $512 \times 512$ pixels

**Disparity range:** $[-1.46, 1.32]$  

**Scene description:** A synthetic scene with a single object made of concrete.
Our results

Light field \textit{Cotton benchmark}

GT center view

Our center view

GT diffuse

Our diffuse

GT disparity

Our disparity

MSE = 1.38
Overview

Light field Antinous benchmark

Type: Synthetic test scene from light field benchmark [1]

Size: 9 × 9 views

Resolution: 512 × 512 pixels

Disparity range: [−2.83, 2.58]

Scene description: An additional scene from the light field benchmark, similar to the previous data set, but with different illumination.

Light field preview
Our results

Light field Antinous benchmark

GT center view

Our center view

GT diffuse

Our diffuse

GT disparity

Our disparity

MSE = 9.25
Light field Vinyl benchmark

**Type:** Synthetic test scene from light field benchmark [1]

**Size:** $9 \times 9$ views

**Resolution:** $512 \times 512$ pixels

**Disparity range:** $[-1.49 \ 0.94]$ 

**Scene description:** The foreground object has metal parts that are specular. This is a synthetic data set from the additional scenes presented in the benchmark [1].
Our results

Light field Vinyl benchmark

GT center view

Our center view

GT disparity

Our disparity

MSE = 4.4
Light field *Amethyst*

**Type:** Real world Stanford data set [2]

**Size:** $9 \times 9$ views

**Resolution:** $512 \times 384$ pixels

**Disparity range:** $[-2.46, 1.4]$

**Scene description:** A real-world scene with lots of specularity and complex geometry.

**Light field preview**
Our results

GT center view

Our center view

Our diffuse

Our specular

Our disparity
Light field *LegoTruck*

**Type:** Real world Stanford data set [2]

**Size:** 9 × 9 views

**Resolution:** 480 × 640 pixels

**Disparity range:** [−2.03 1.18]

**Scene description:** A real-world scene with object made from Lego.

**Light field preview**

![Light field preview](image)
Our results

Light field LegoTruck

GT center view

Our center view

Our diffuse

Our specular

Our disparity
Video from data set: *Amethyst*

- Input light filed
- Our results
- Diffuse
- Specular
- Reconstructed

Video from data set: *Flowers*

- Input light filed
- Our results
- Diffuse
- Specular
- Reconstructed

Video from data set: *First test example*

- Input light filed
- Our results
- Diffuse
- Specular
- Reconstructed

Video from data set: *Third test example*

- Input light filed
- Our results
- Diffuse
- Specular
- Reconstructed

Video from data set: *Hedgehog*

- Input light filed
• Our results

• Diffuse

• Specular

• Reconstructed