High-Dynamic-Range Lighting Estimation From Face Portraits
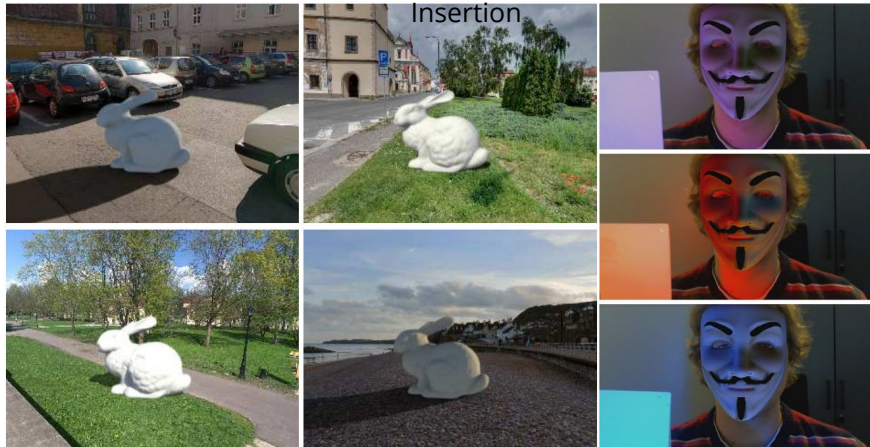
Alejandro Sztrajman[1]   Alexandros Neophytou[2]   Tim Weyrich[1]   Eric Sommerlade[2]

International Conference on 3D Vision, November 2020

[1]University College London   [2]Microsoft
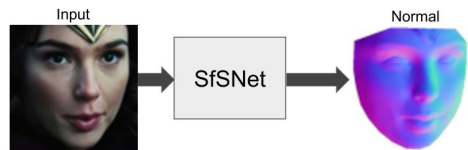
Microsoft

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Introduction

3D Object Insertion

[Y. Hold-Geoffroy et al. 2017] Deep Outdoor Illumination Estimation.

[S. B. Knorr et al. 2014] Real-time illumination estimation from faces for coherent rendering.

Face Relighting

[H. Zhou et al. 2019] Deep single-image portrait relighting

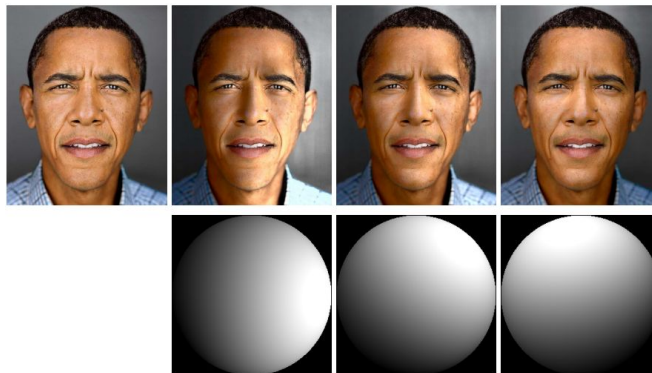### Photometric Stereo

Input

SfSNet

Normal

[S. Sengupta et al. 2018] SfSNet: Learning Shape, Reflectance and Illuminance of Faces in the Wild.

Specular Highlight Removal
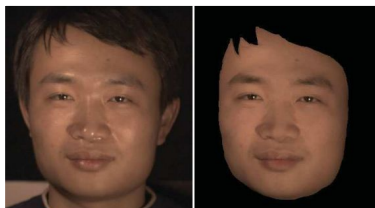
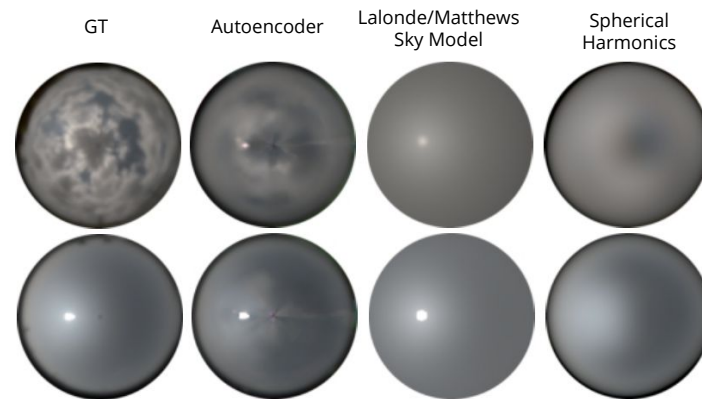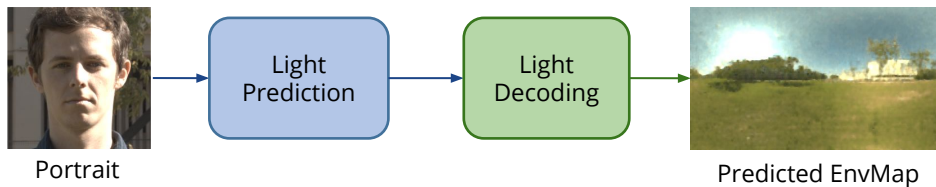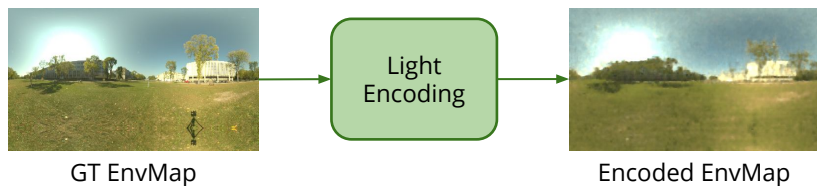[C. Li et al. 2017] Specular Highlight Removal in Facial Images.
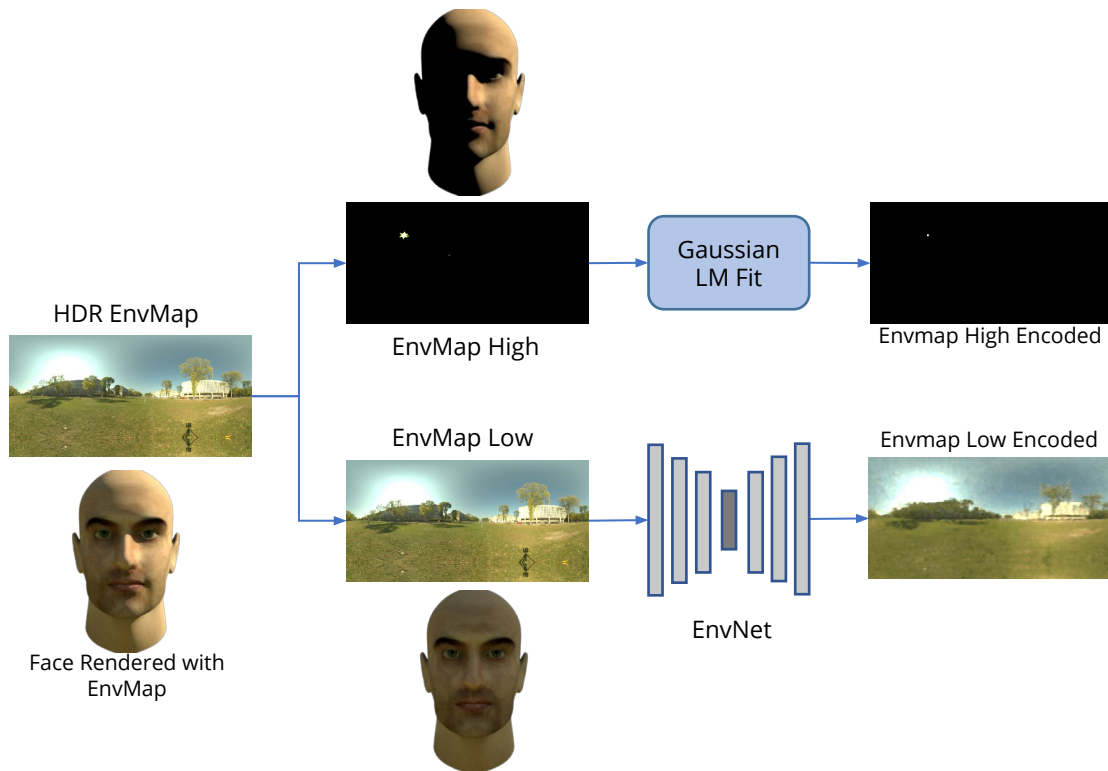
Material Capture and Editing

[G. Liu et al. 2017] Material Editing Using a Physically Based

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Introduction

GT EnvMap → Light Encoding → Encoded EnvMap

Portrait → Light Prediction → Light Decoding → Predicted EnvMap
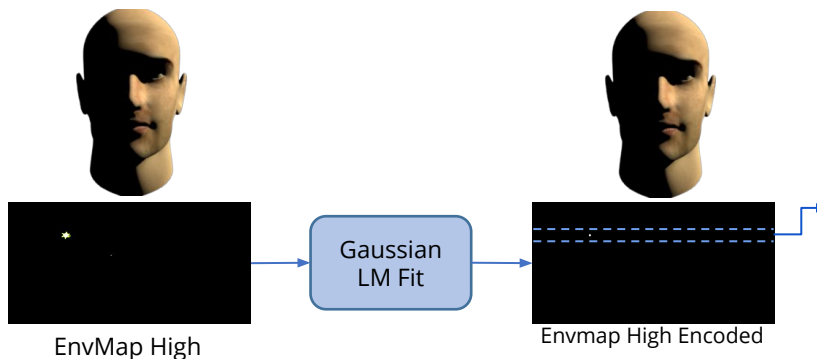

GT   Autoencoder   Lalonde/Matthews Sky Model   Spherical Harmonics
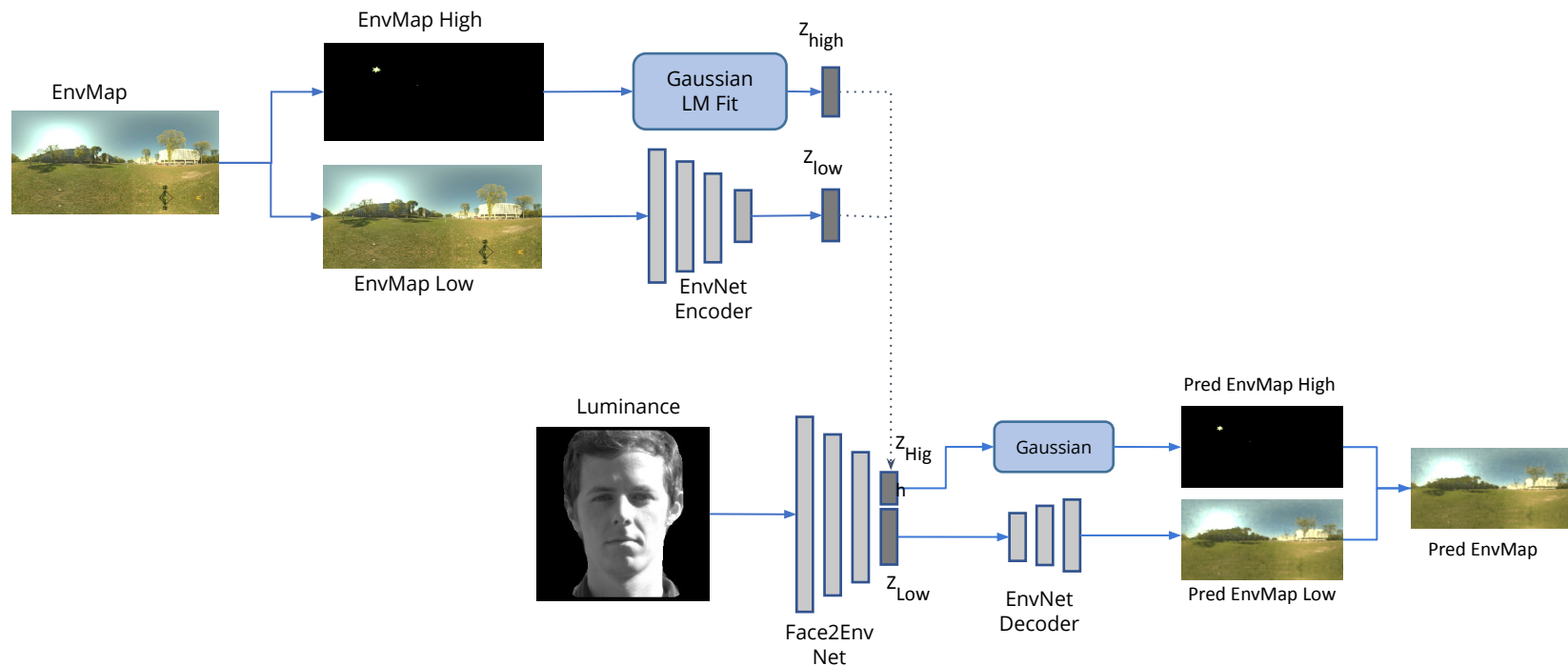
[Calian et al. 2018] From faces to outdoor light probes.

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Light Encoding: EnvNet + Gaussian Fit

HDR EnvMap

Face Rendered with EnvMap

EnvMap High

Gaussian LM Fit

Envmap High Encoded

EnvMap Low

EnvNet

Envmap Low Encoded

Light Encoding: EnvNet + Gaussian Fit

EnvMap High

Gaussian LM Fit

Envmap High Encoded

EnvMap Low

EnvNet

Envmap Low Encoded

The Laval Outdoor HDR Dataset

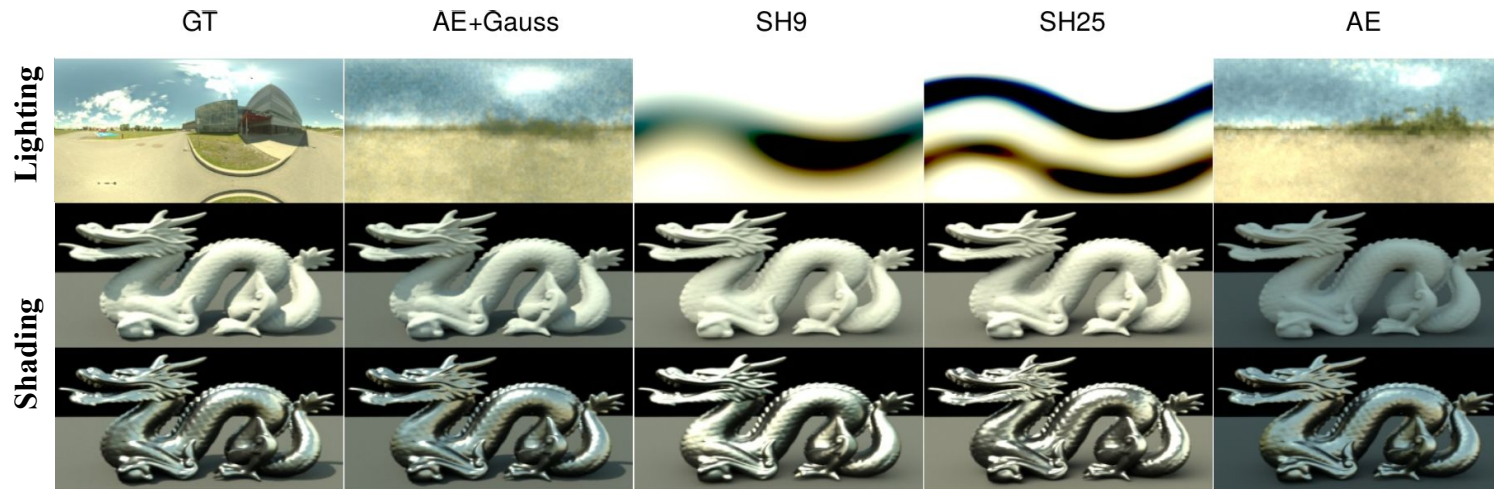UNIVERSITÉ LAVAL

Microsoft

UCL
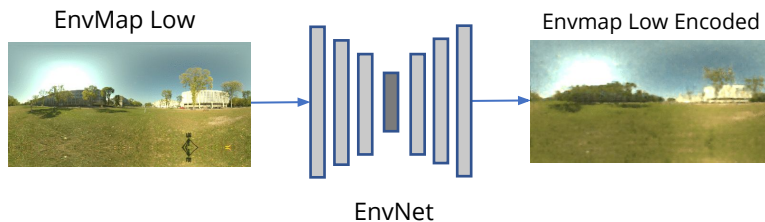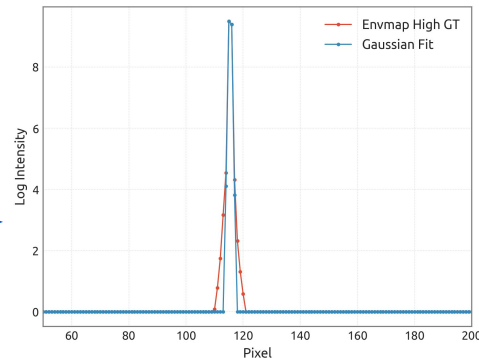
Light Prediction

Light Prediction

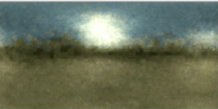Laval Face+Lighting Dataset (Real)

ICT-3DRFE Dataset (Synth)

Luminance

Face2Env Net

z_{High}

z_{Low}

Gaussian

EnvNet Decoder

Pred EnvMap High

Pred EnvMap Low

Pred EnvMap

Microsoft

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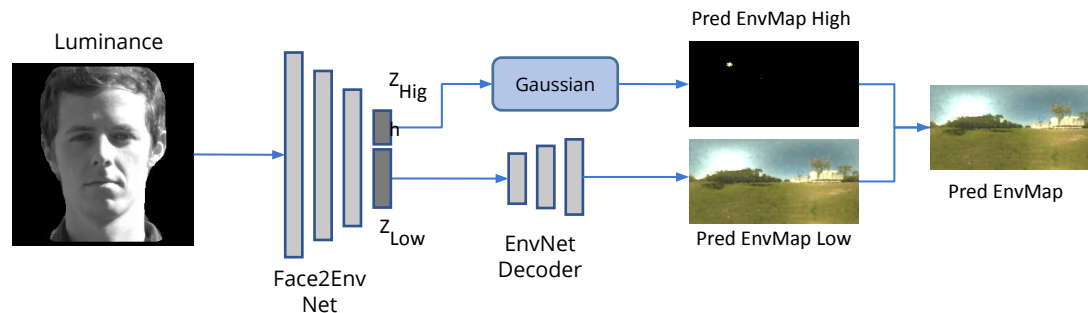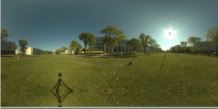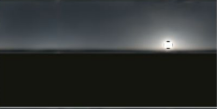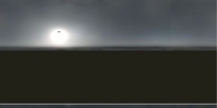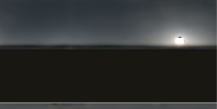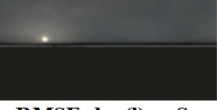
Results: Light Encoding

	Shading		Lighting	
	MAE	RMSE	MAE–dω	RMSE–dω
SH9	0.030 ± 0.024	0.031 ± 0.025	0.20 ± 0.09	0.21 ± 0.09
SH25	0.025 ± 0.024	0.026 ± 0.022	0.21 ± 0.11	0.21 ± 0.11
AE	0.032 ± 0.024	0.033 ± 0.024	0.12 ± 0.04	0.12 ± 0.04
AE+Gauss	$\mathbf{0.022 \pm 0.015}$	$\mathbf{0.023 \pm 0.015}$	$\mathbf{0.08 \pm 0.03}$	$\mathbf{0.08 \pm 0.03}$

Microsoft

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Results: Light Prediction

| | Portrait | GT Envmap | Pred Envmap (Ours) | Pred Envmap (Calian et al.) | GT Render | Pred (Ours) | Pred (Calian et al.) |

	RMSE (s)	SSIM (s)	LPIPS (s)	RMSE-dw (l)	Sun Altitude (l)	Sun Azimuth (l)
Our method	**0.017**	**0.95**	**0.029**	0.15	**0.12**	0.48
Calian et al.	0.031	0.89	0.086	**0.13**	0.41	**0.12**

[D. Calian et al. 2018] From Faces to Outdoor Light Probes.
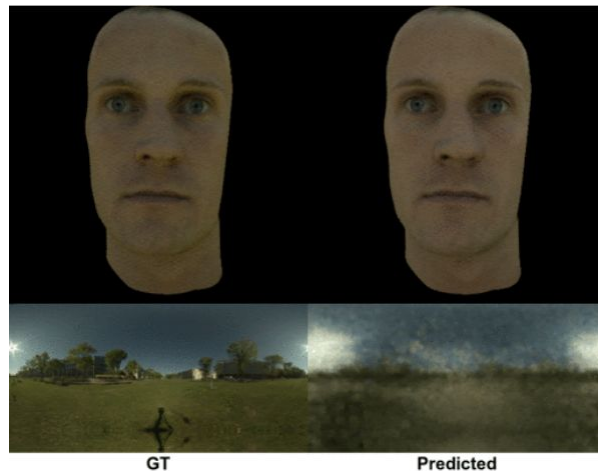
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