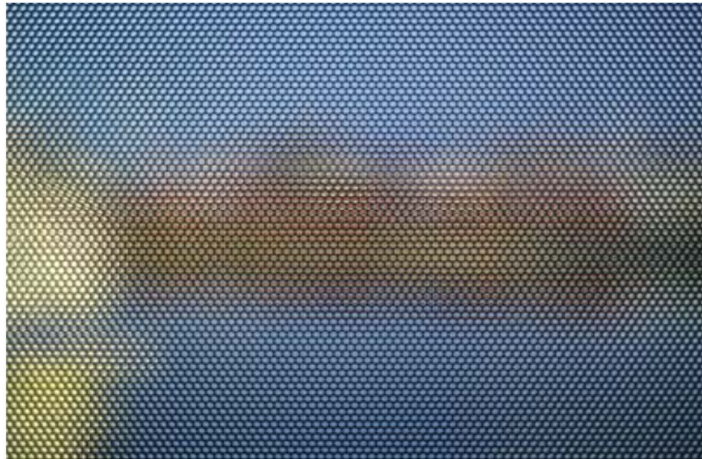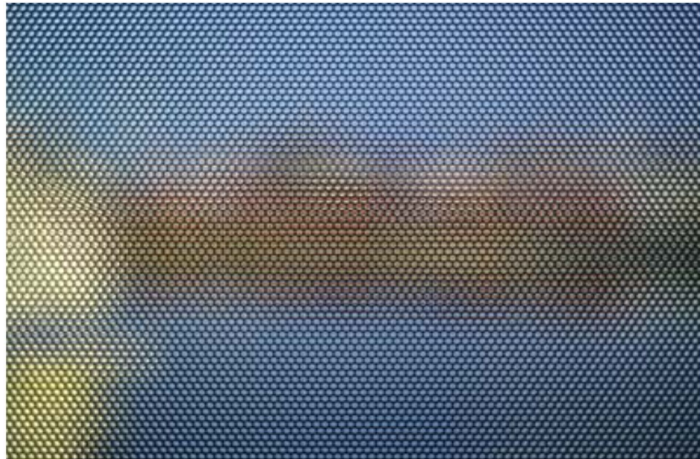# Cost Volume Refinement For Depth Prediction

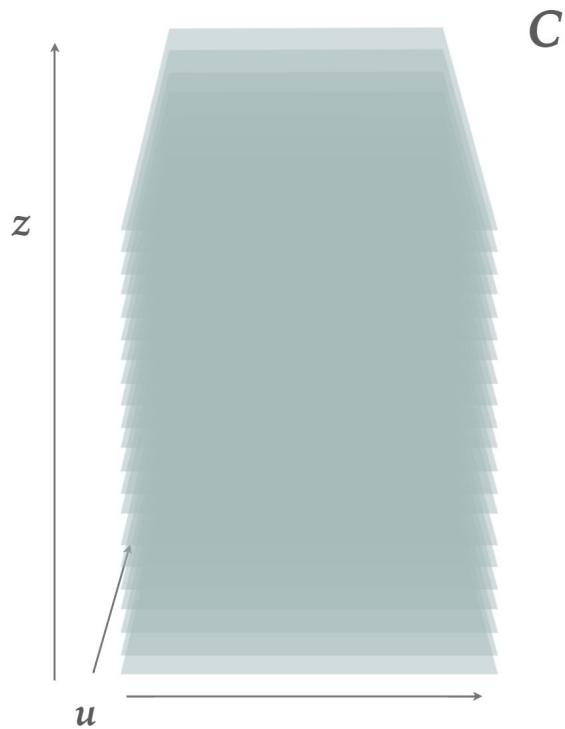Joao Cardoso, Nuno Goncalves, Michael Wimmer

Light Field Images

Light Field Images

Cost Volumes
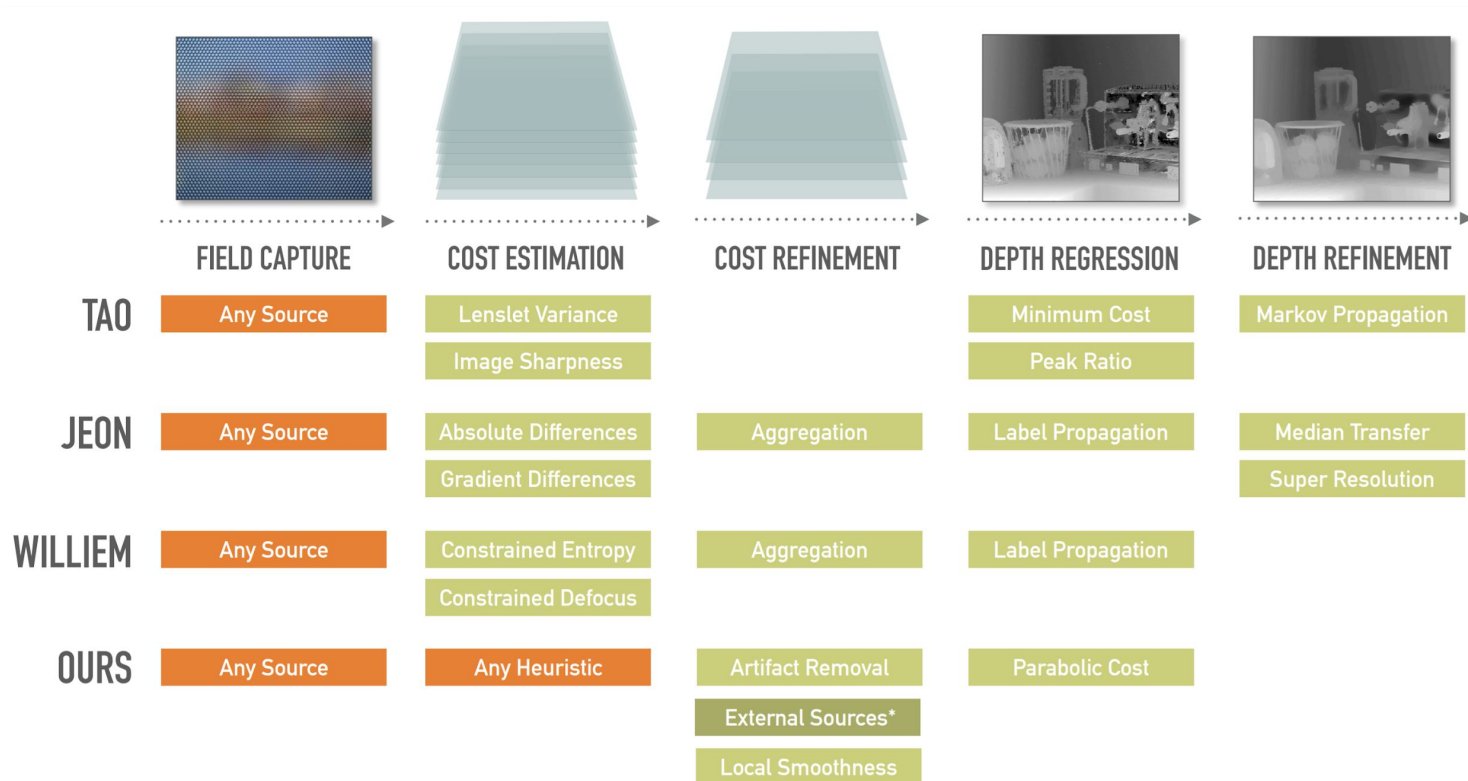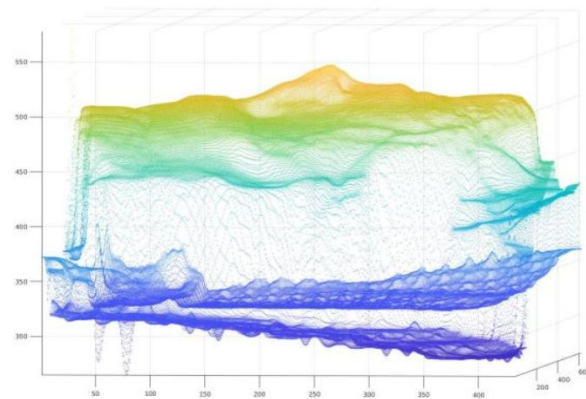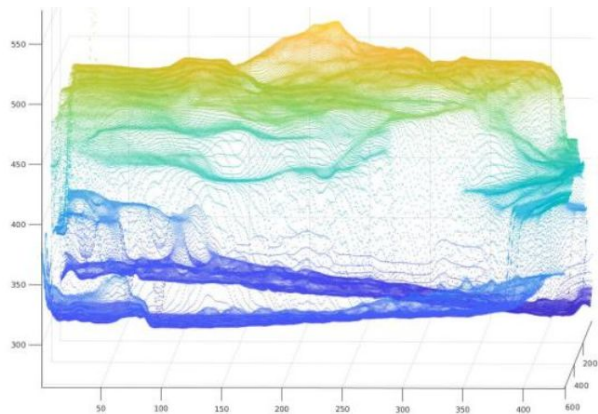
$$D(\mathbf{u}) \simeq D_C(\mathbf{u}) = \underset{z}{\operatorname{argmin}}\, C(\mathbf{u}, z)$$

Typical Pipelines

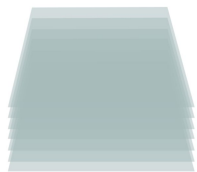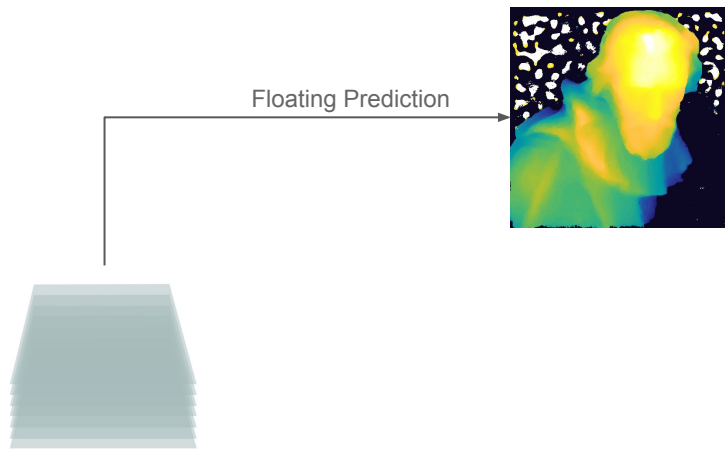|	FIELD CAPTURE	COST ESTIMATION	COST REFINEMENT	DEPTH REGRESSION	DEPTH REFINEMENT
TAO	Any Source	Lenslet Variance		Minimum Cost	Markov Propagation
		Image Sharpness		Peak Ratio	
JEON	Any Source	Absolute Differences	Aggregation	Label Propagation	Median Transfer
		Gradient Differences			Super Resolution
WILLIEM	Any Source	Constrained Entropy	Aggregation	Label Propagation	
		Constrained Defocus			
OURS	Any Source	Any Heuristic	Artifact Removal	Parabolic Cost	
			External Sources*		
			Local Smoothness		

Independent Predictor Combination

$$C_{k+1}(\mathbf{u}, z) = C_k(\mathbf{u}, z) + \lambda_k G(P_\mathbf{u} - z)$$
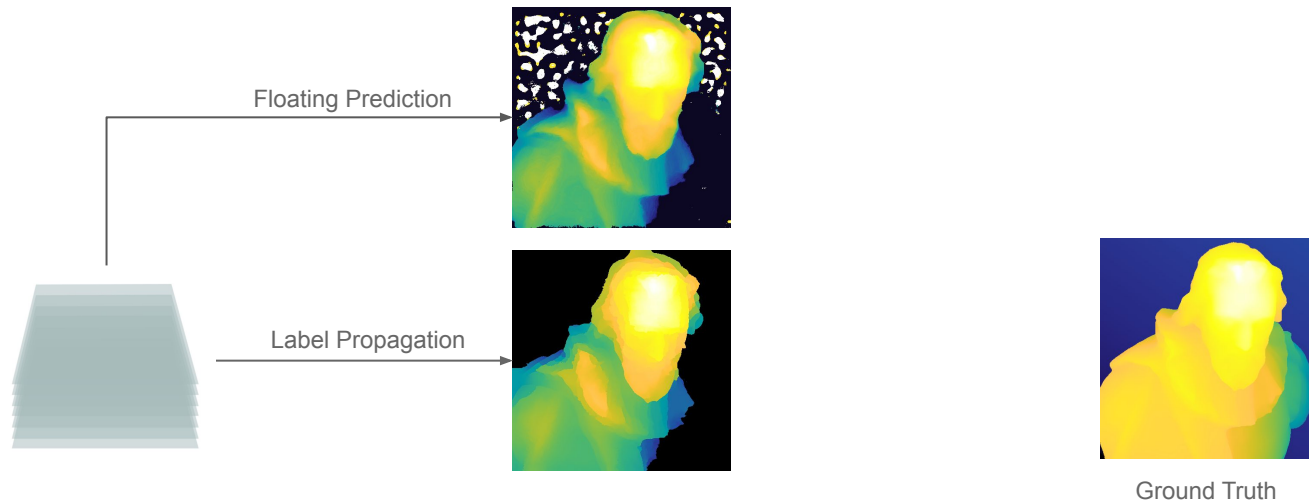
Classification Artifact Removal

Ground Truth

Classification Artifact Removal
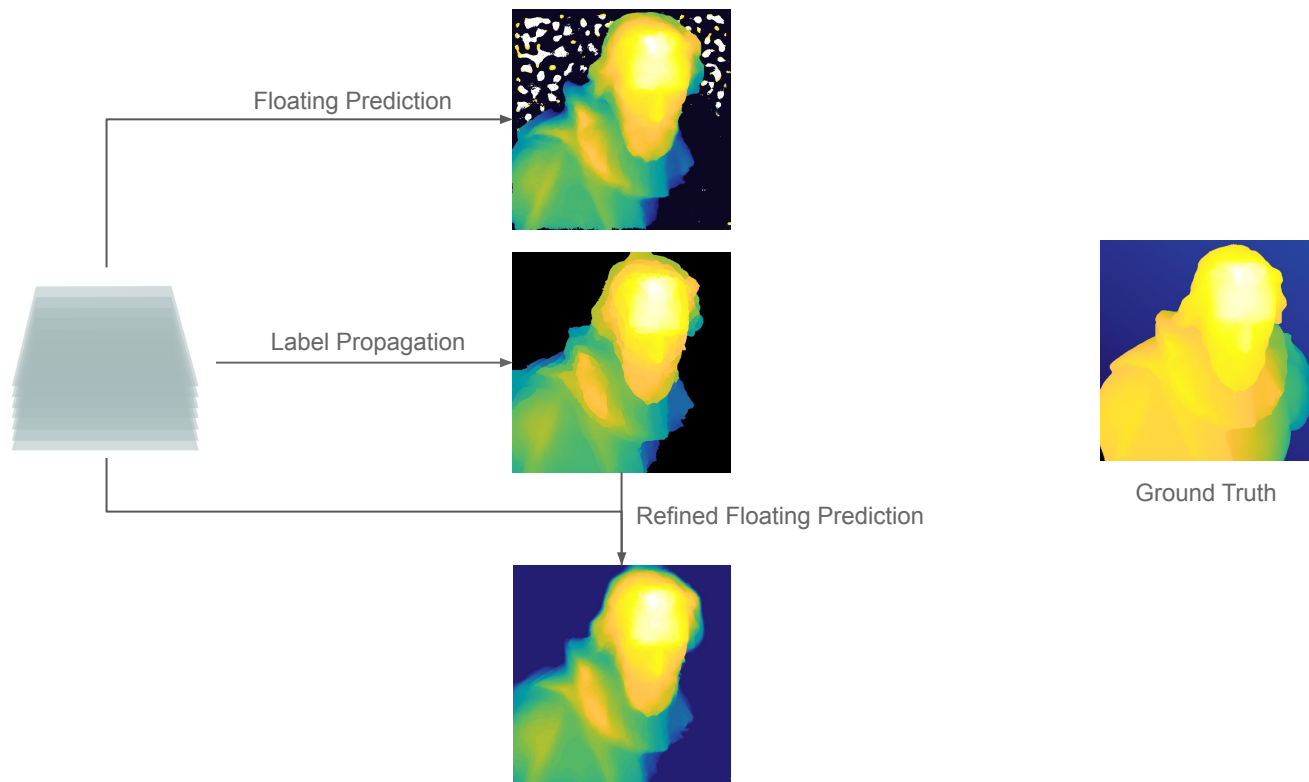

Floating Prediction
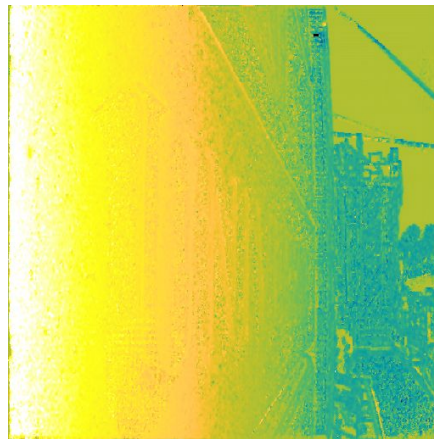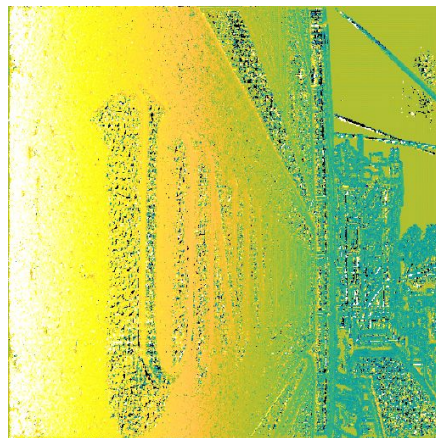
Ground Truth

Classification Artifact Removal

Floating Prediction

Label Propagation

Ground Truth

Classification Artifact Removal

Floating Prediction

Label Propagation

Refined Floating Prediction

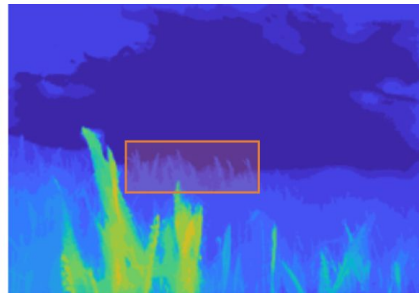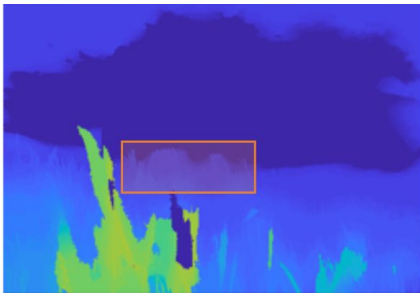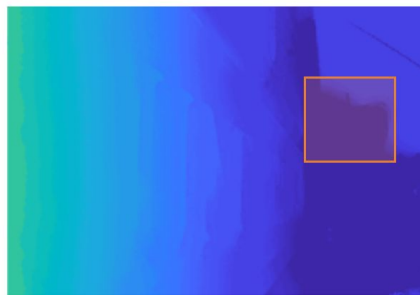Ground Truth

Iterative Local Smoothness

$$\begin{cases} S_0 = C_k \\ S_{j+1}(\mathbf{u}, z) = C_k(\mathbf{u}, z) + \\ \qquad\qquad \lambda_k \sum_{v \in \mathcal{I}_\mathbf{u}} G(\mathcal{D}_{S^j}(v) - z) \cdot W_{S^j}(v) \end{cases}$$
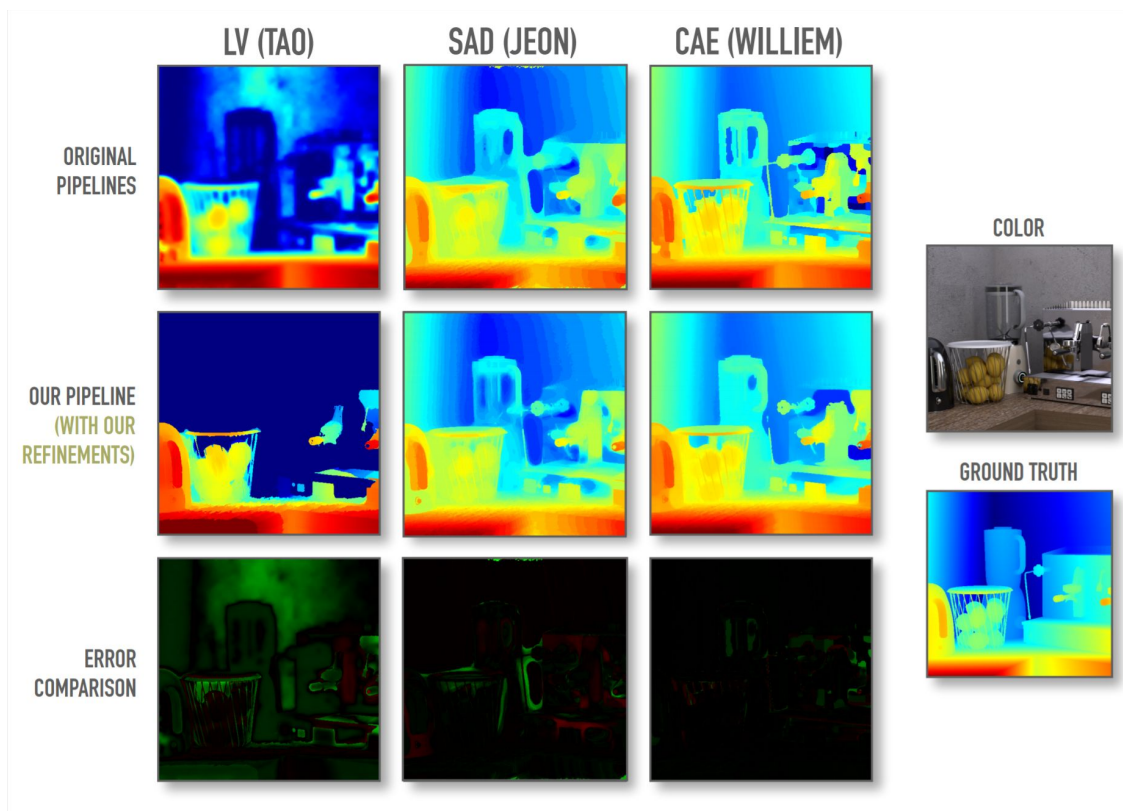
Statistics

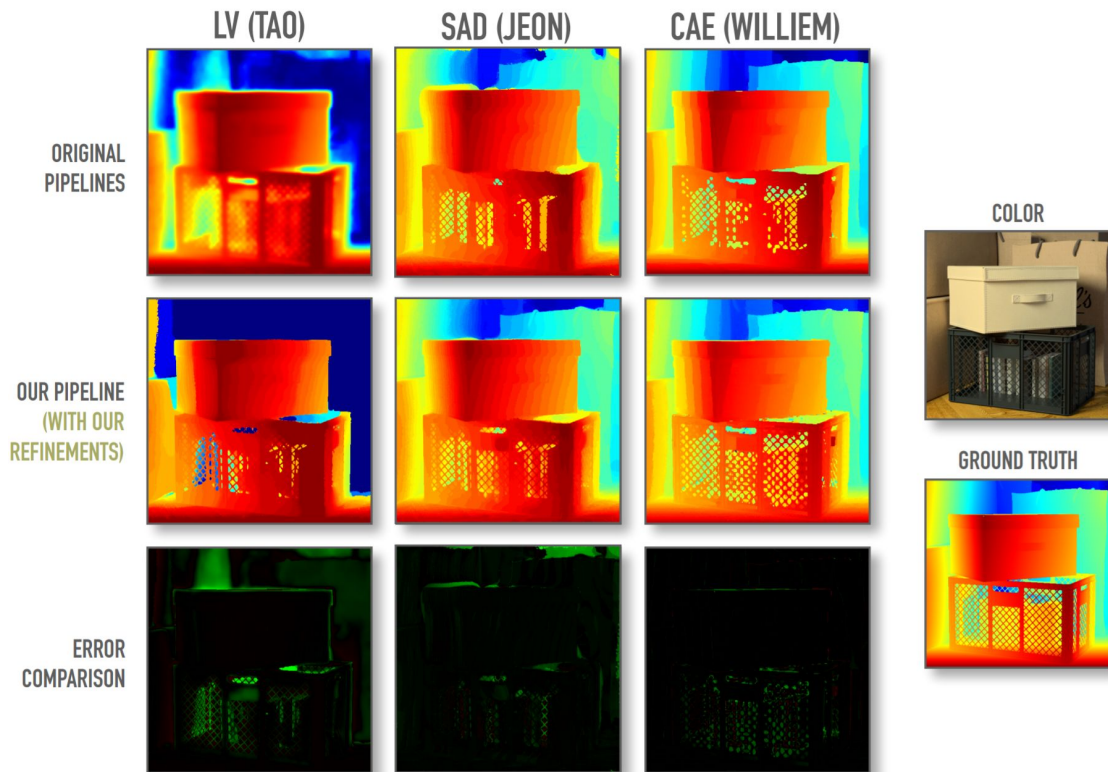| Pipeline	MSE	SSI
LV (Tao *et al.* [11])	2.1672%	9.6871
Refined Lenslet Variance	1.5297%	10.8989
SAD (Jeon *et al.* [1])	1.2829%	11.3914
Refined Sum of Absolute Differences	0.7165%	11.6619
CAE (Williem *et al.* [13])	3.2723%	8.6063
Refined Constrained Angular Entropy	2.1083%	9.9078

Example Results

Example Results

Example Results

Thank you