

# Neural Volumetric Object Selection (NVOS)

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<https://jason718.github.io/nvos>

# Task: object selection in neural volumes

Selecting objects in **3D neural volumes** based on **2D user input**

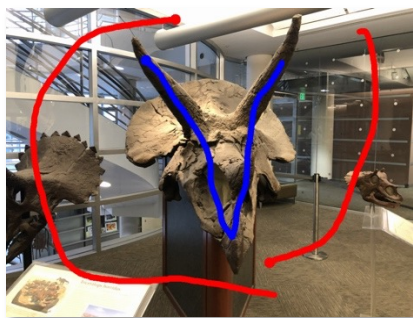
- **3D neural volumes:** MPVs [Szeliski and Golland 1998] or NeRFs [Mildenhall et al. 2020]
- **2D user input:** 2D scribbles in one view



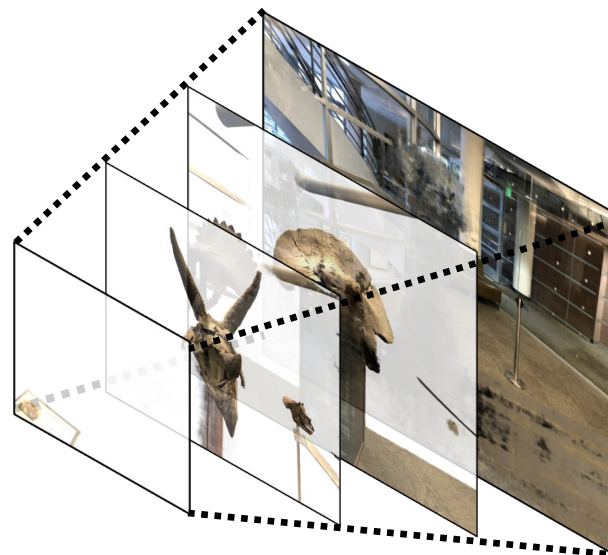
# Approach: Overview



Input: multi-view images

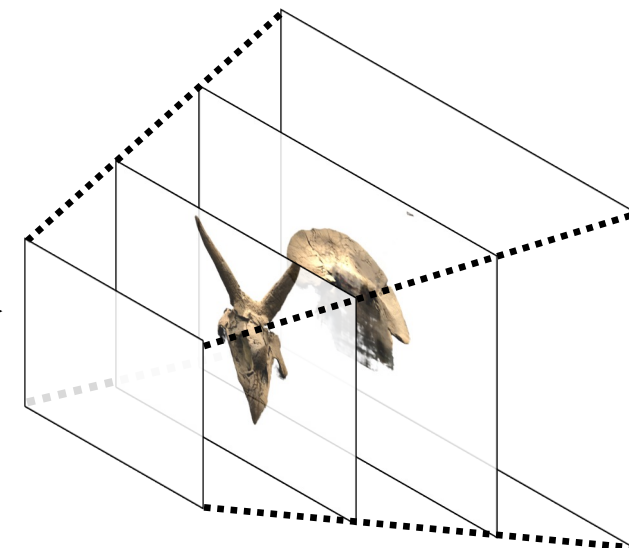


Input: 2D scribbles



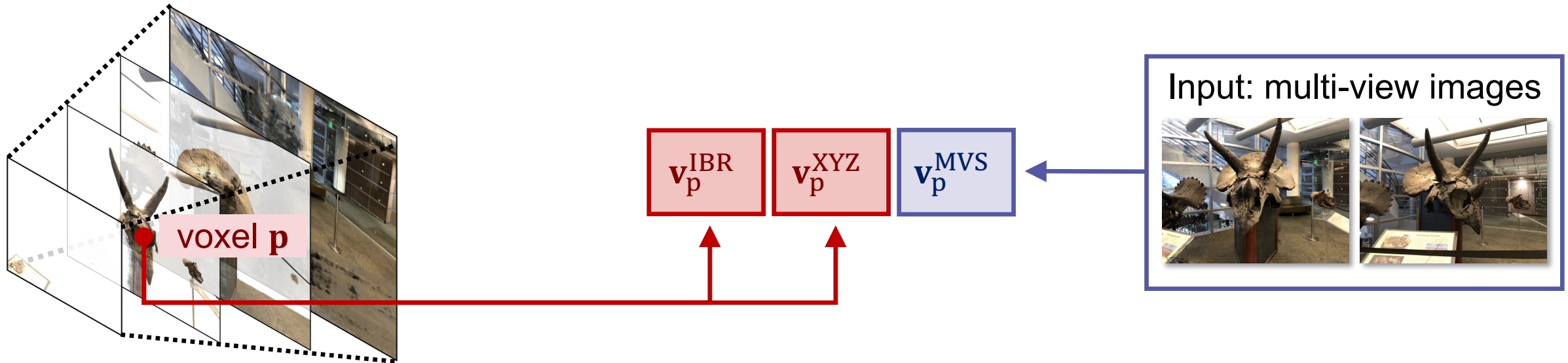
Input: learned volumetric representation

NVOS



Goal: 3D foreground segmentation

# Voxel feature



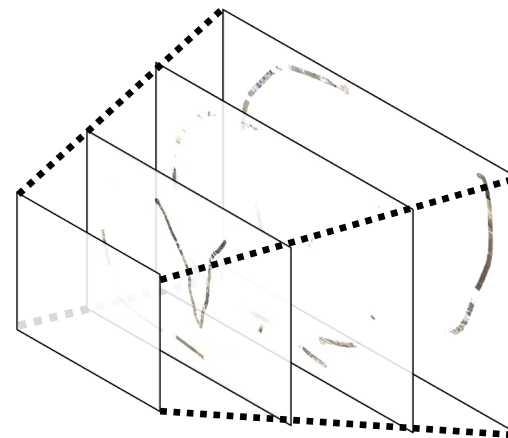
**Voxel feature embedding**  $\mathbf{v}_p = [\mathbf{v}_p^{\text{IBR}}; \mathbf{v}_p^{\text{IBR}}; \mathbf{v}_p^{\text{IBR}}]$

- $\mathbf{v}_p^{\text{IBR}}$ : discretized neural feature
  - MPI: NeX [Wizadwongsa et al. 2021] / NeRF: PlenOctree [Yu et al. 2021]
- $\mathbf{v}_p^{\text{XYZ}}$ : 3D positional encoding feature
- $\mathbf{v}_p^{\text{MVS}}$ : multi-view image feature embedding, following MVSNet [Yao et al. 2018]

# Training



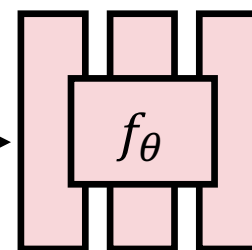
Lift 2D  
scribbles to 3D



3D-lifted scribbles

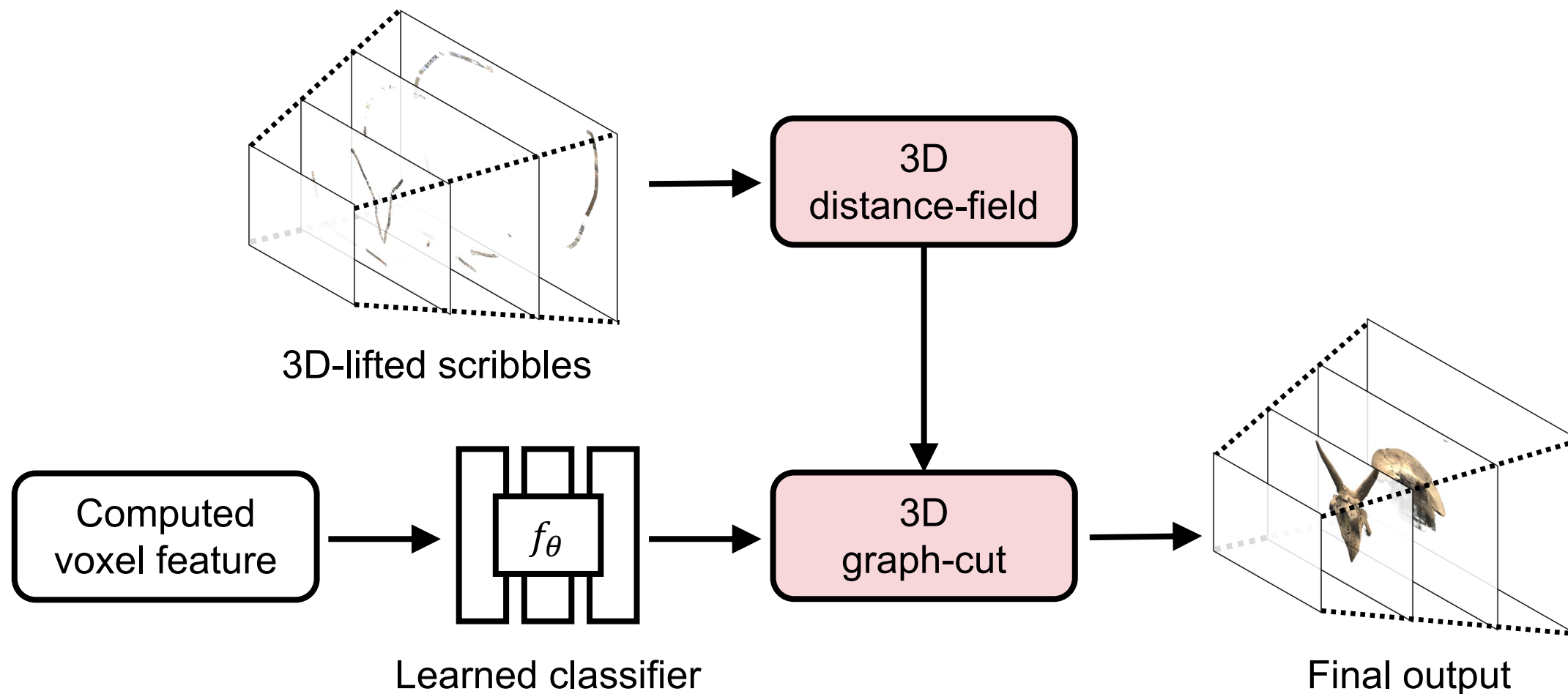
Computed  
voxel feature

Fg/bg  
training



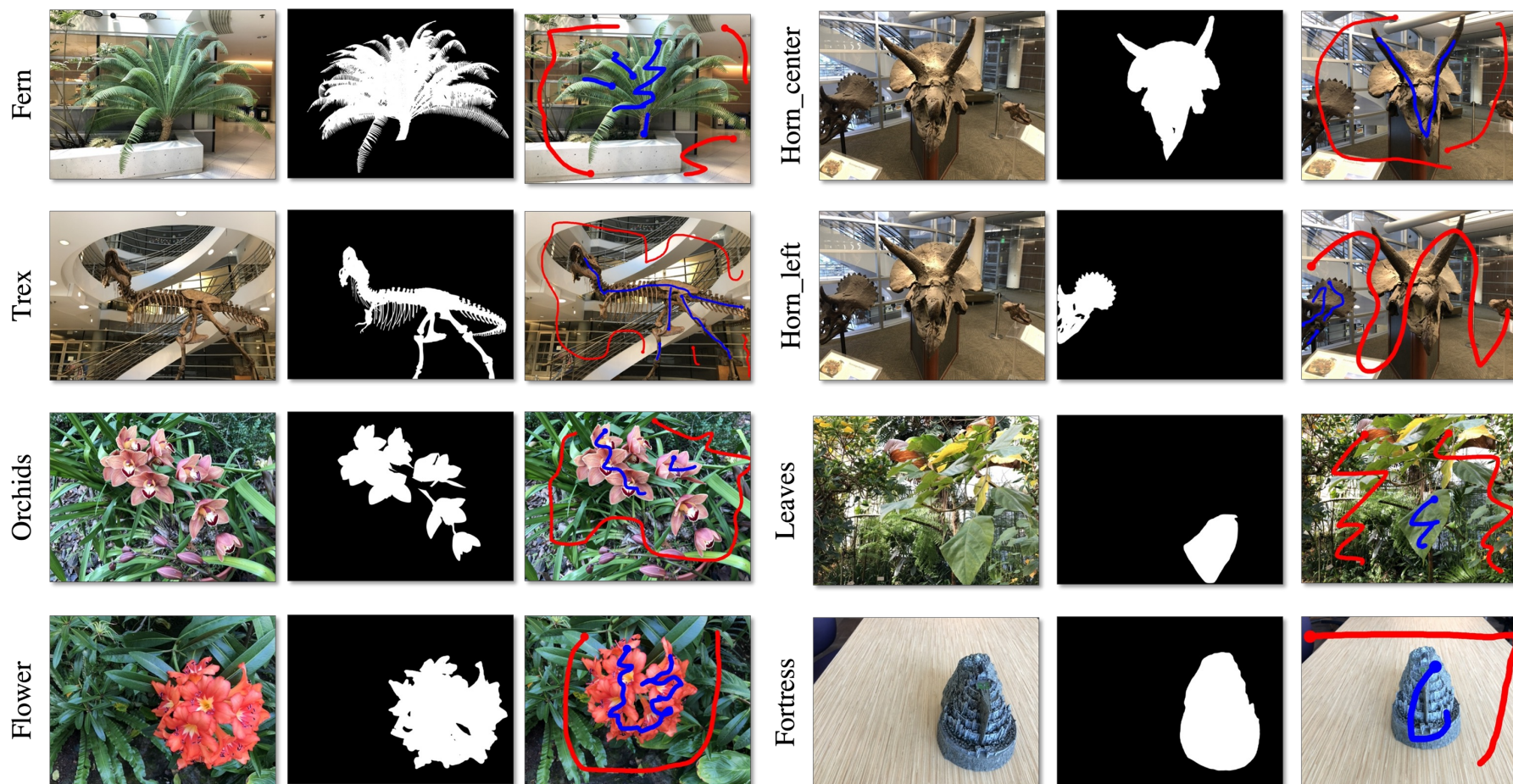
Output classifier

# Post-processing



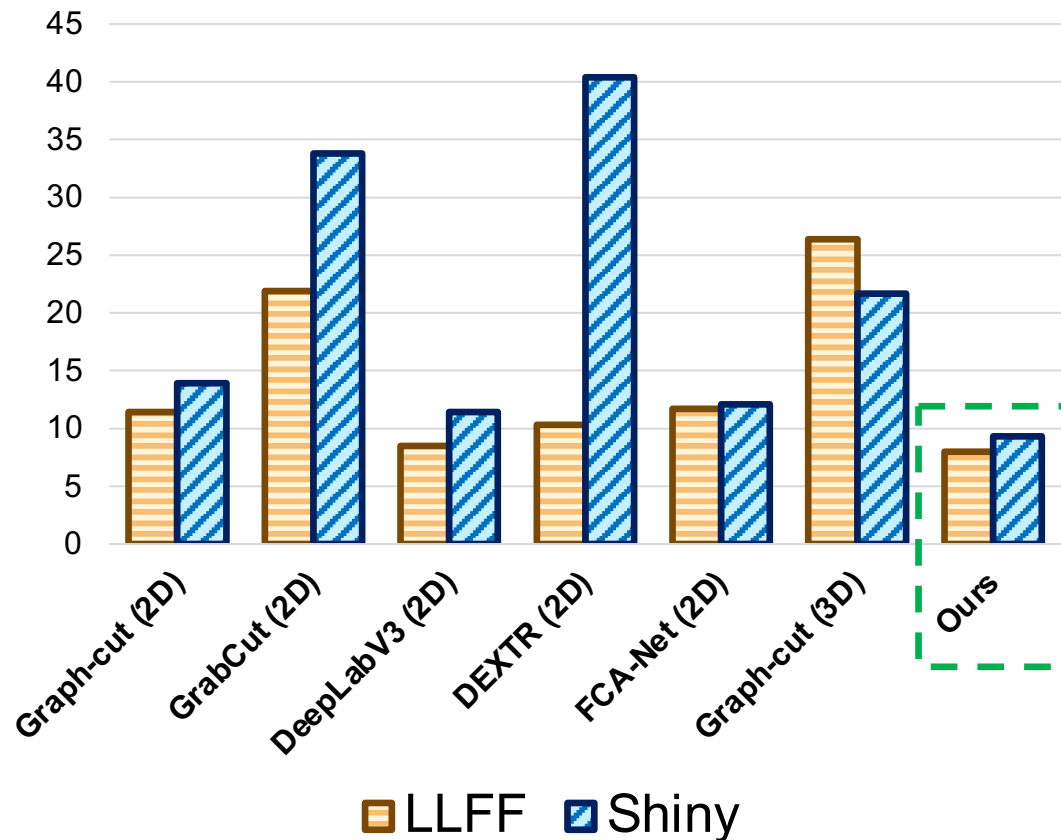
# Dataset

We annotate LLFF [Mildenhall et al. 2019] / Shiny [Wizadwongsa et al. 2021] with masks & scribbles

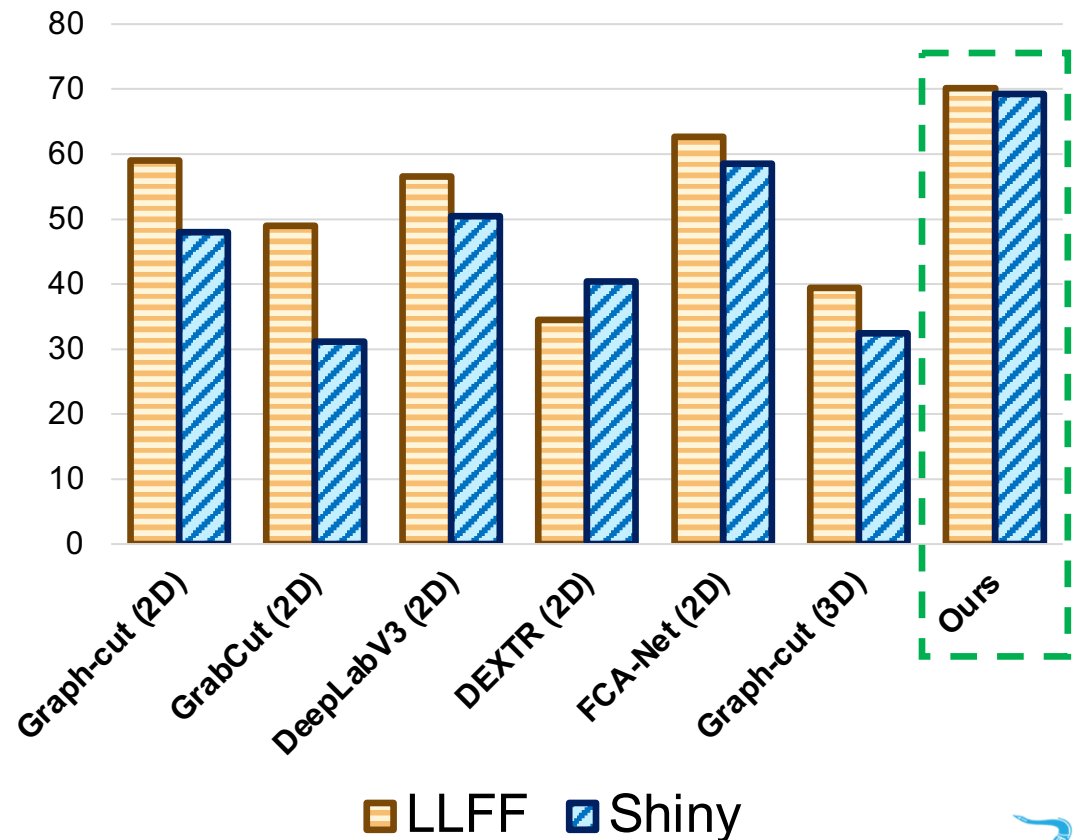


# Results: 2D mask evaluation

Error (lower is better)



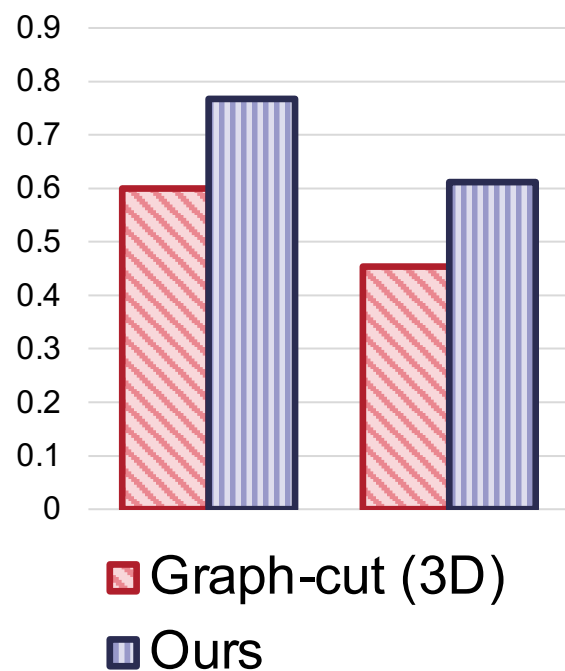
IoU (higher is better)



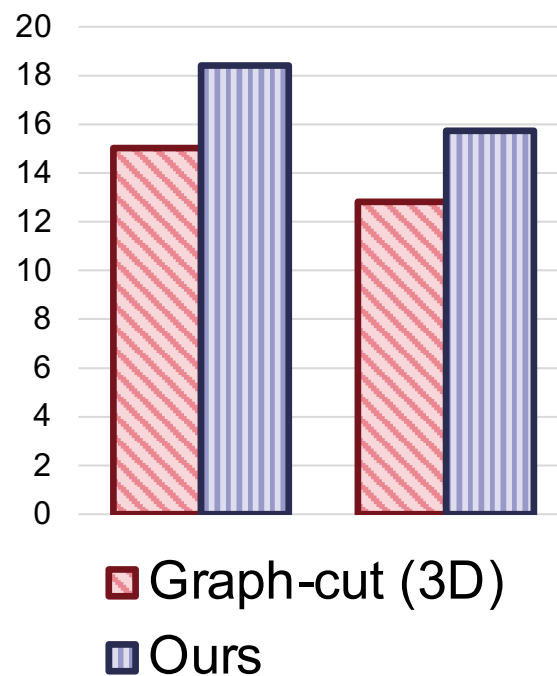


# Results: novel-view object rendering

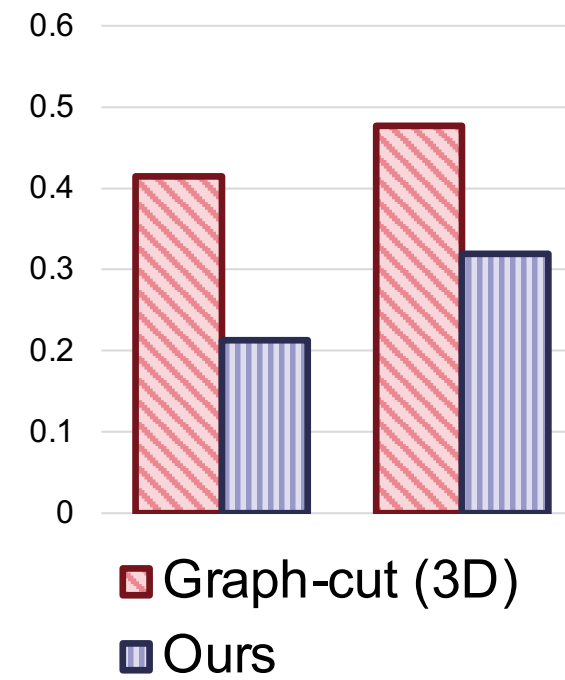
SSIM  
(higher the better)



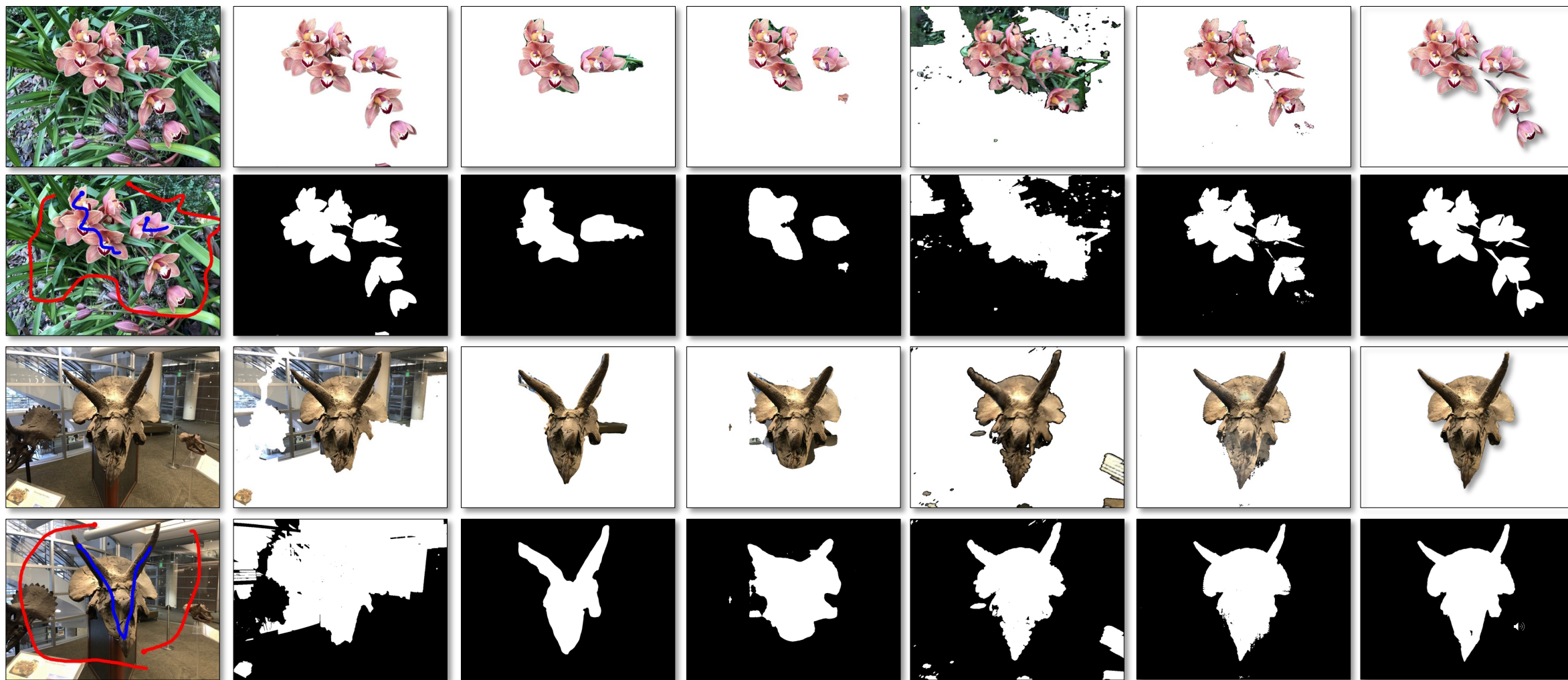
PSNR  
(higher the better)



LPIPS  
(lower the better)



# Results



RGB

GrabCut (2D)

FCA-Net (2D)

DeepLabV3 (2D)

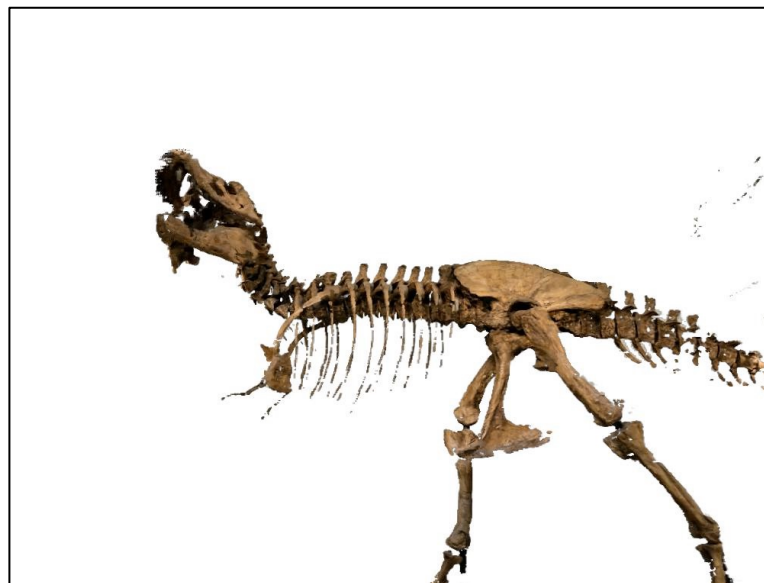
Graph-cut (3D)

Ours (3D)

Ground-truth

# Thanks!

Please visit the [poster session 2.1 at 10am-12:30pm on June 22!](https://jason718.github.io/nvos)



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