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CVPR



VANCOUVER, CANADA

THU-PM-031



# 3D Highlighter: Localizing Regions on 3D Shapes via Text Descriptions

Dale Decatur

Itai Lang

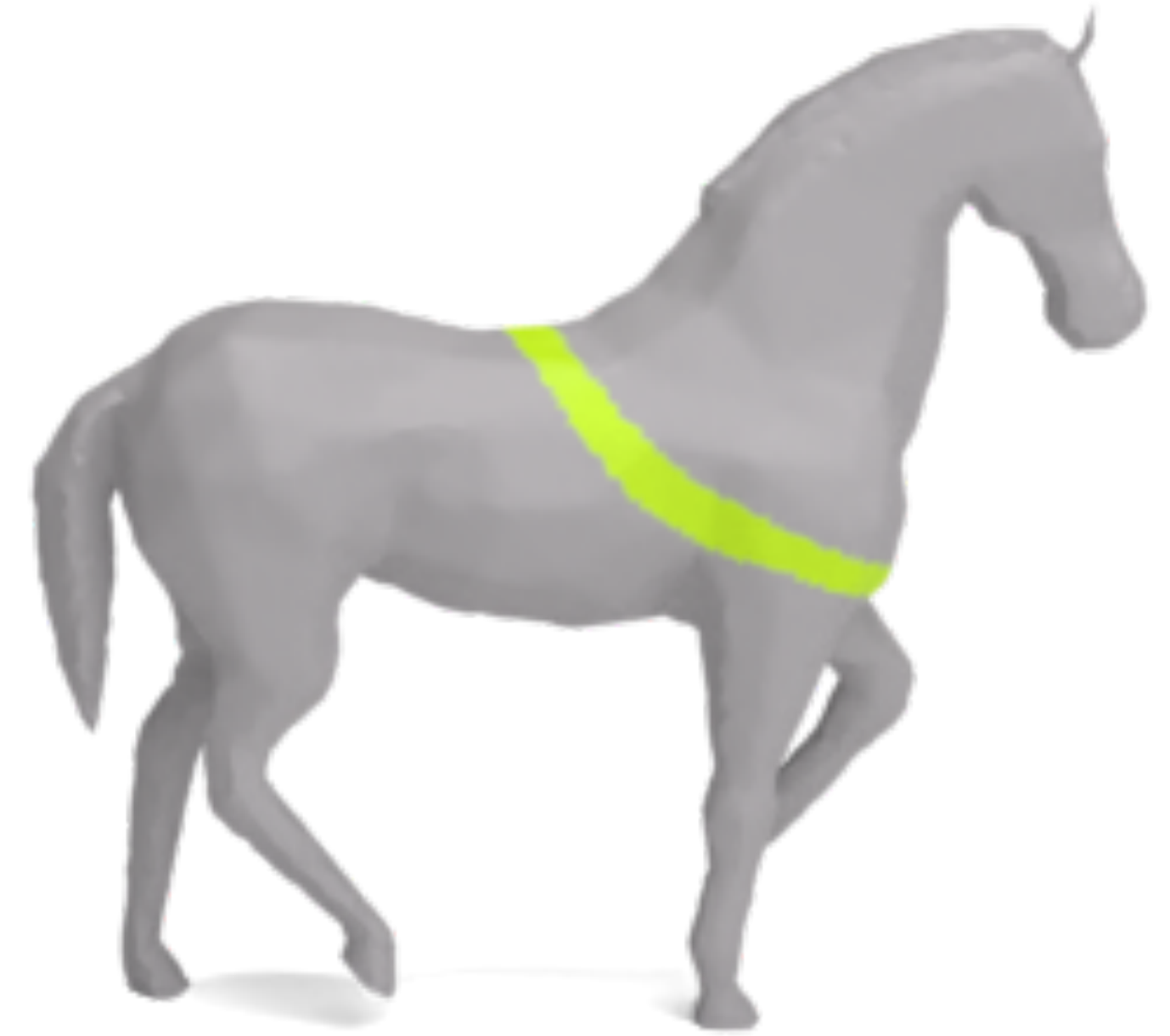
Rana Hanocka

University of Chicago



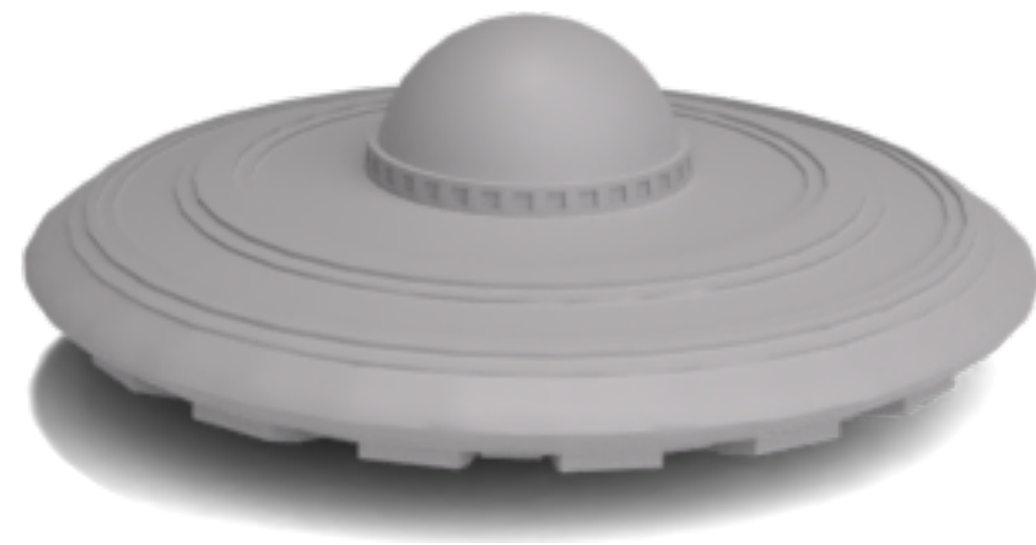


# Where would you put a necklace on a horse?

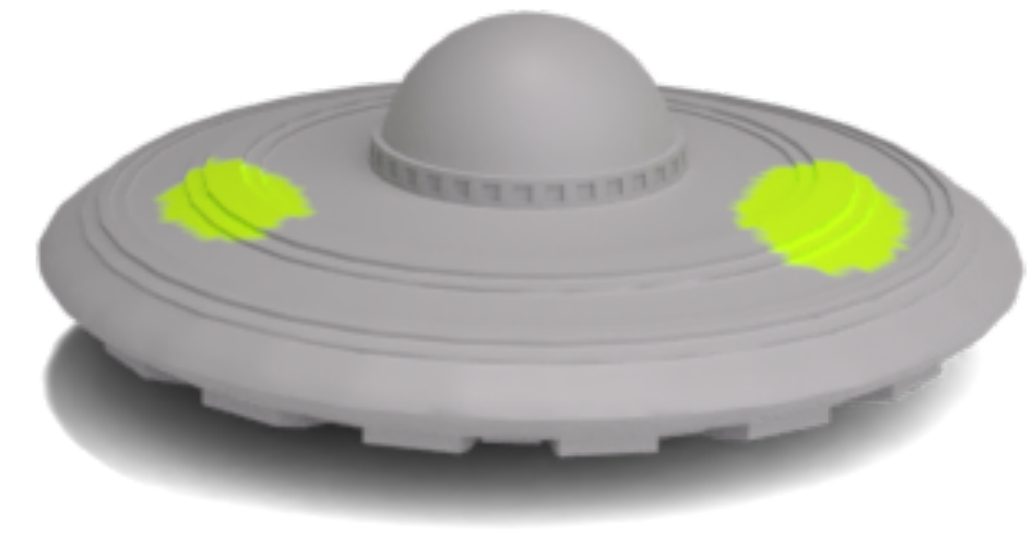




# How about...



*Headlights*



*Shoes*

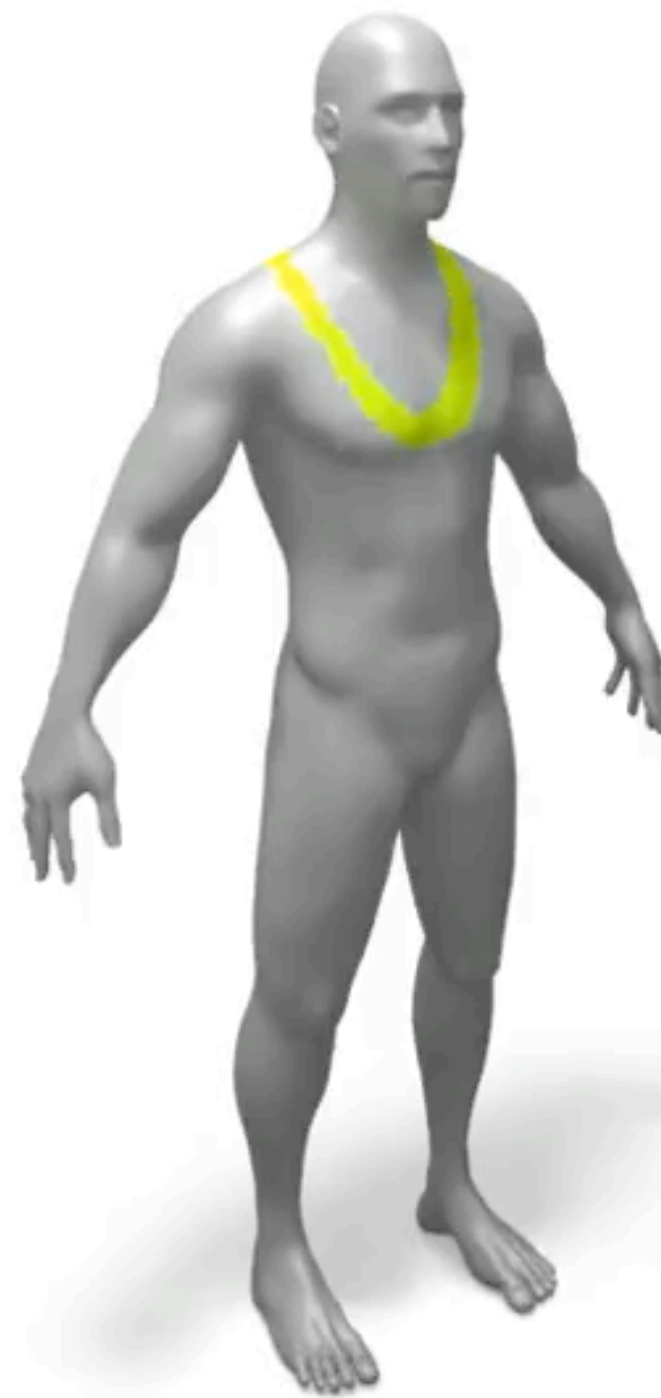




# 3D Highlighter localizes semantic regions on a shape using text as input



Poncho



Necklace



Headphones



<https://threedle.github.io/3DHighlighter>



# 3D Highlighter: Localizing Regions on 3D Shapes via Text Descriptions

CVPR 2023 (Highlight)

Dale Decatur, Itai Lang, Rana Hanocka

University of Chicago

Paper

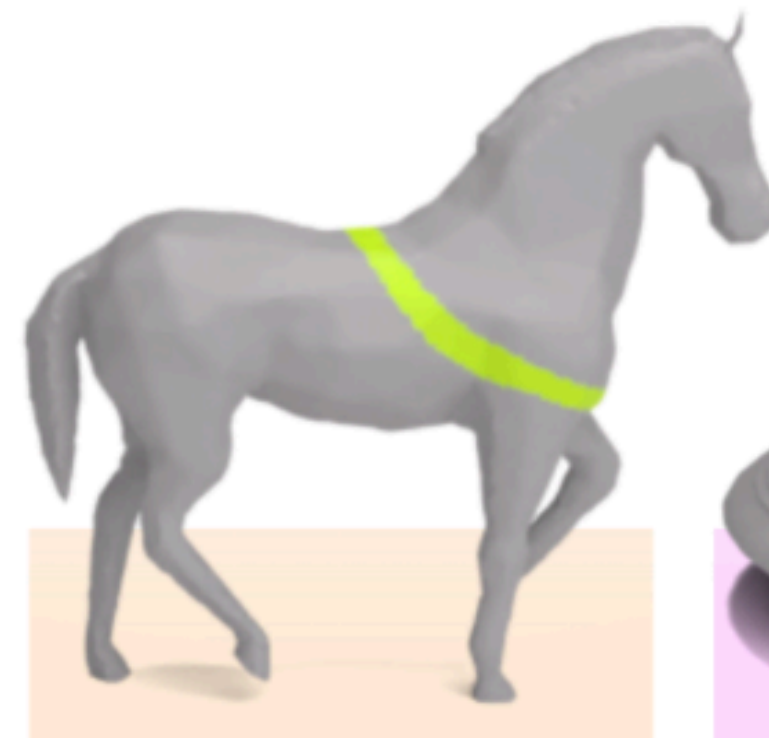
arXiv

Code

Video



Hat



Necklace



Headlights



Shoes



Eyeglasses



# Motivation

## Importance of semantic region localization

- Many tasks in 3D modeling need to be applied locally
- Automate tedious tasks like applying textures locally
- Localizing a semantic region with 3D Highlighter opens up many possibilities for semantically aware processing of 3D shapes

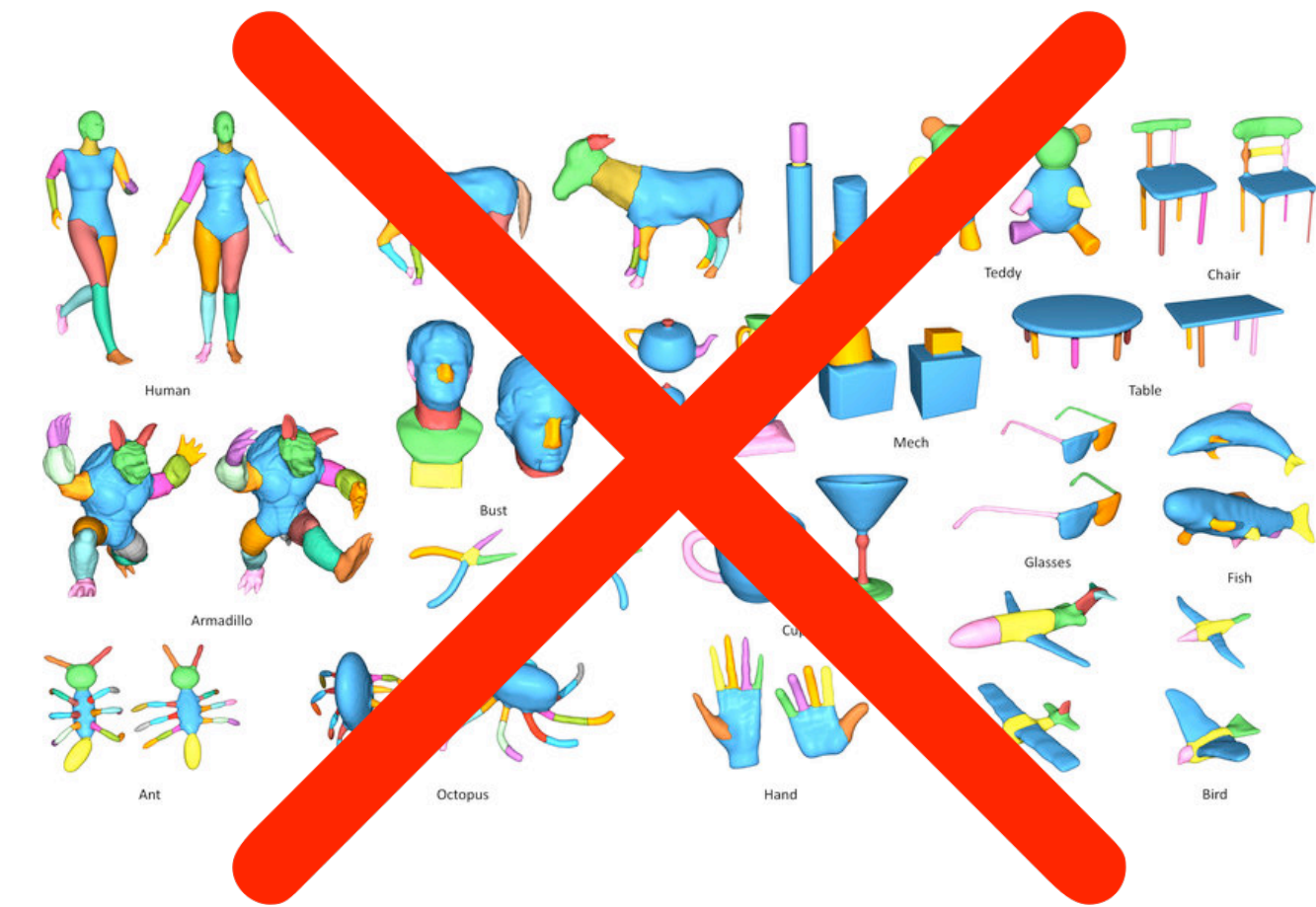




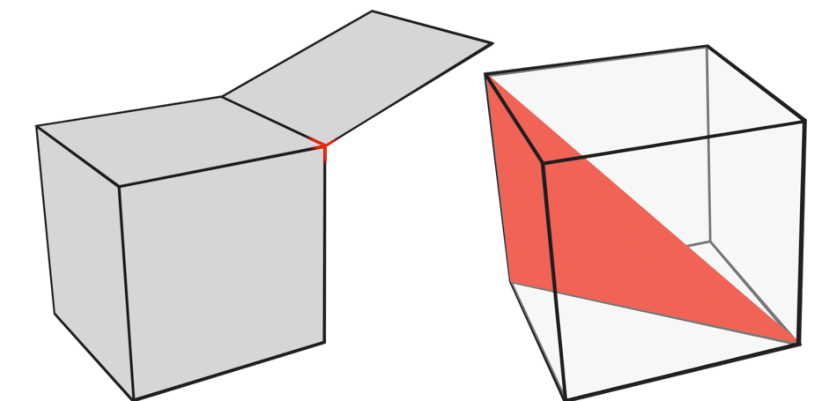
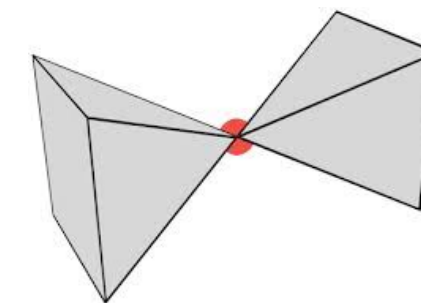
# Challenges of 3D Localization



- No 3D supervision
- Interested in low-quality meshes in the wild (non-manifold, boundaries, self-intersections)
- Ill-defined localizations



Hat





# Key Idea: Analysis via Synthesis

Extracting analytic information implicitly contained in the generative process

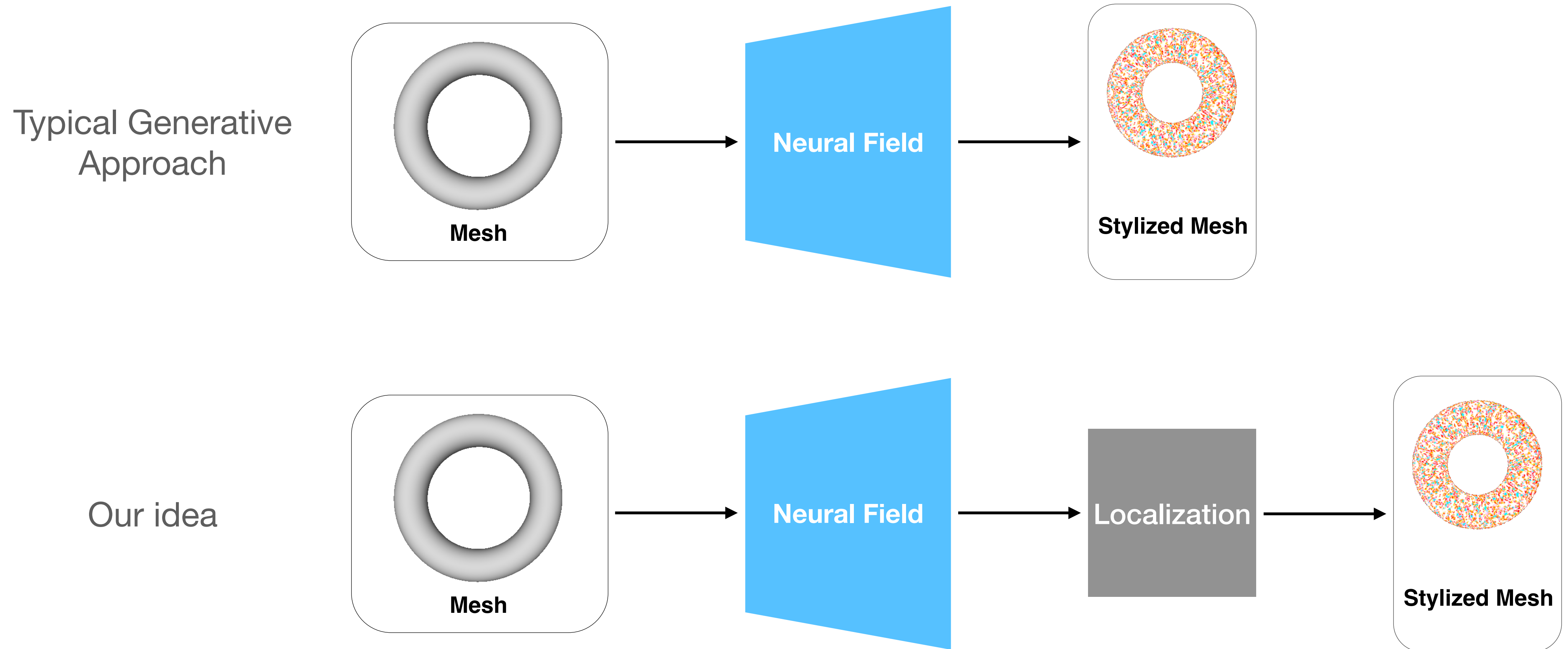
- Generative stylizations demonstrate global semantic understanding
- How can we formulate our problem to explicitly extract semantic properties?





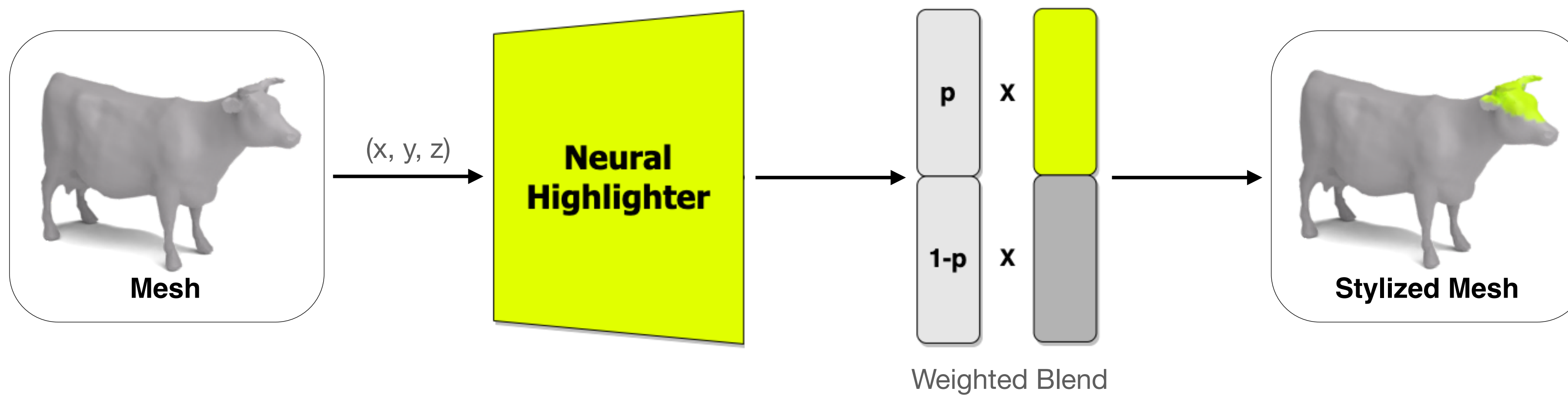


# Directly Perform the Analysis and Use for Synthesis



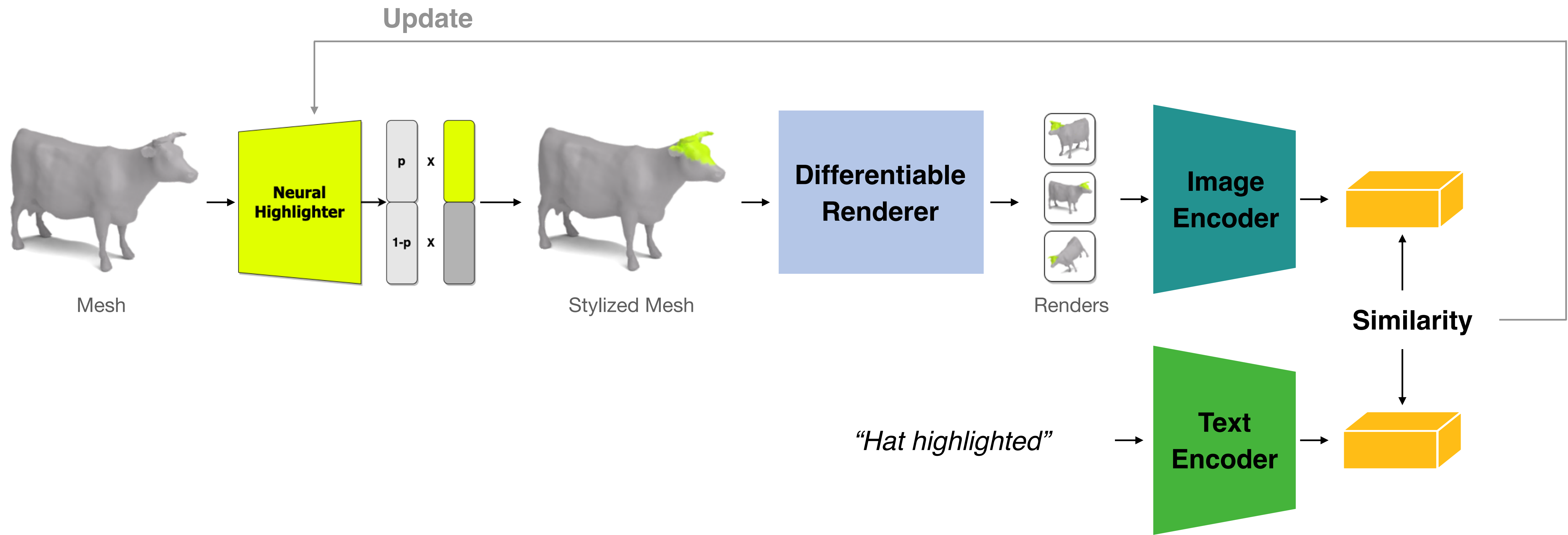


# Our Neural Highlighter



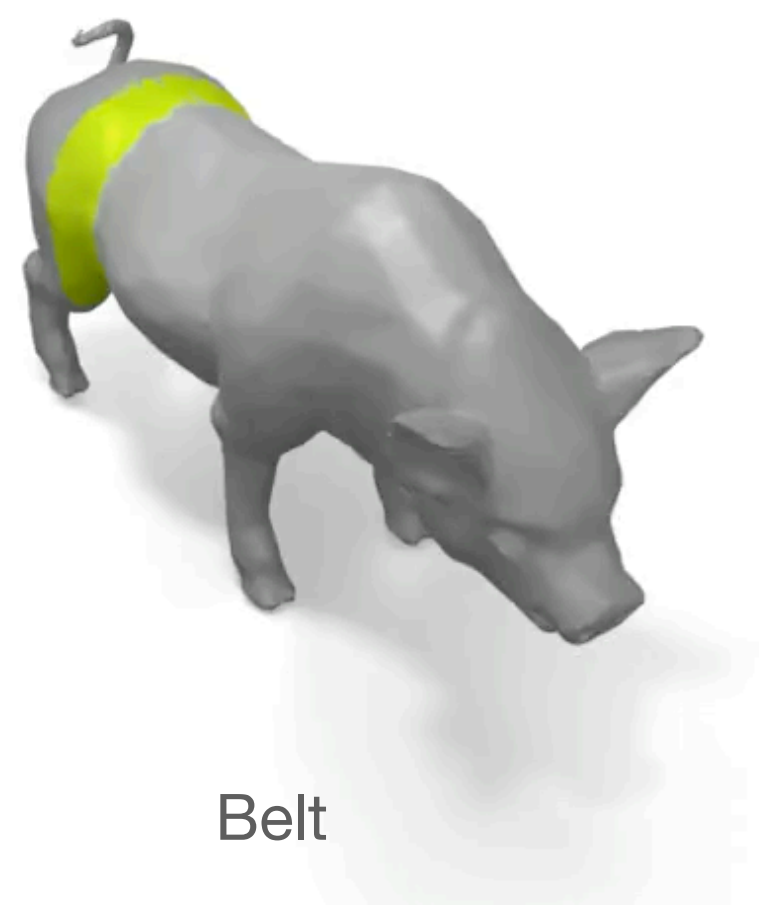
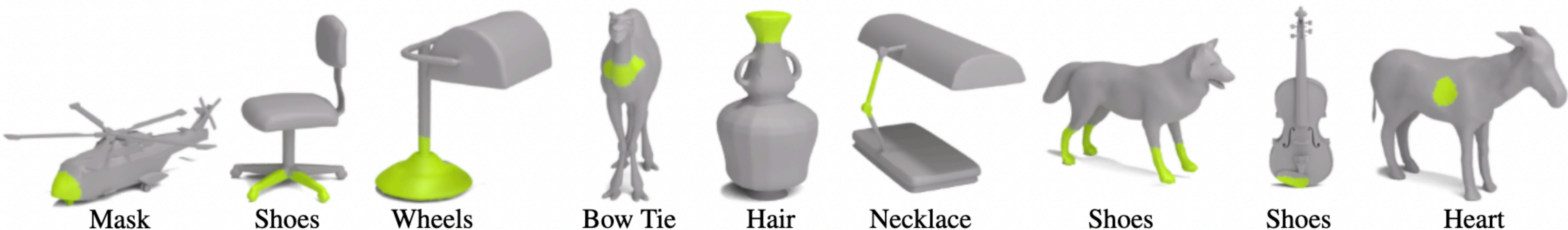


# How We Train the Neural Highlighter



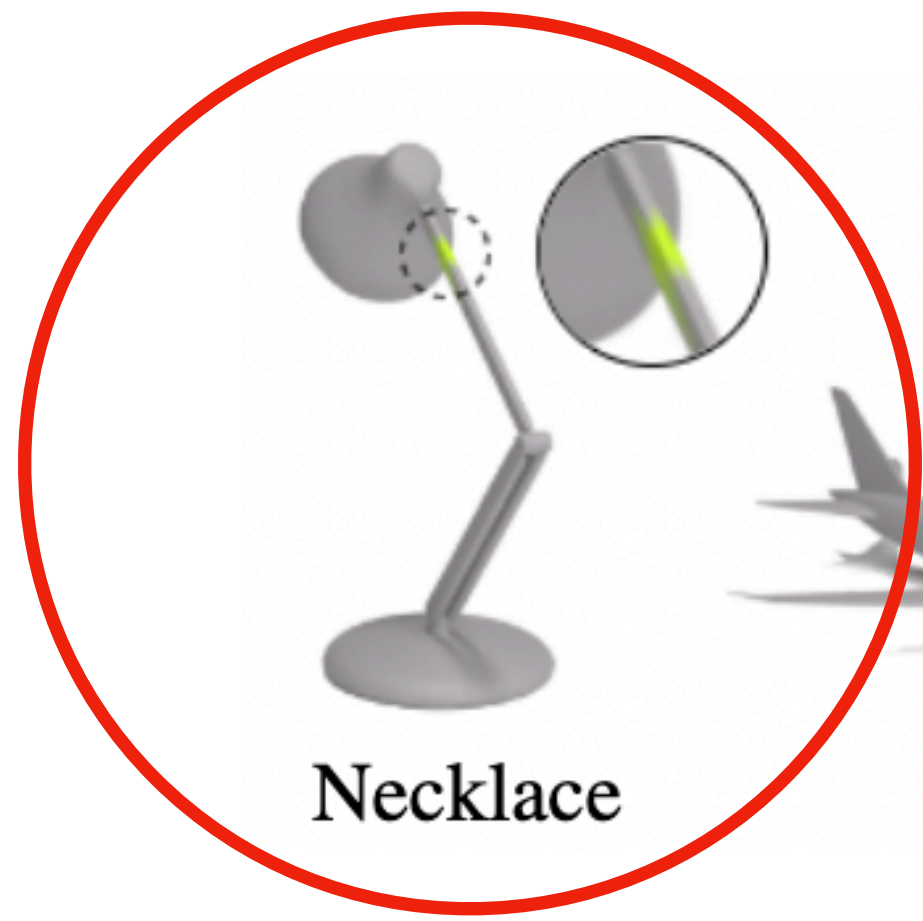


# Results on Diverse Combinations of Meshes and Prompts





# Results on Diverse Combinations of Meshes and Prompts



Necklace



Snout



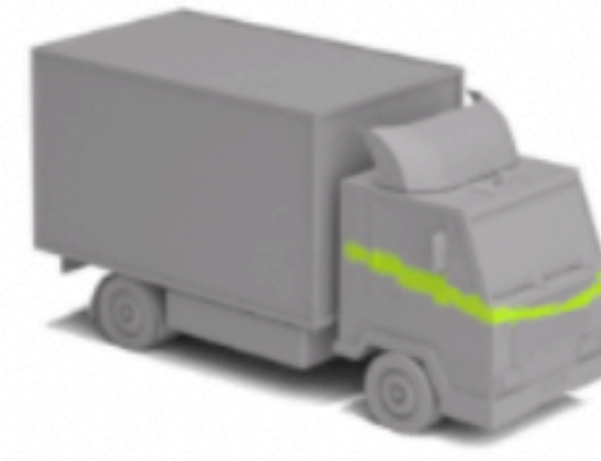
Shoes



Arm



Shoes



Mouth



Floor



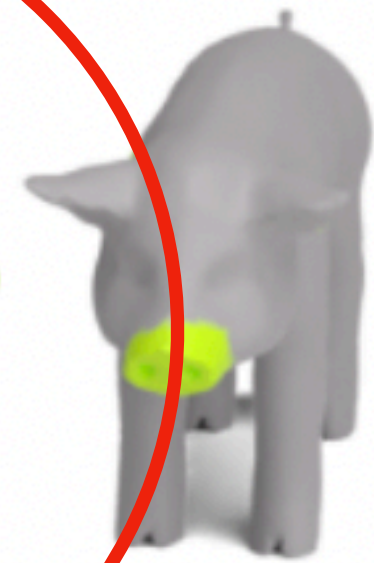
Scarf



Roof



Wings



Car Headlights



Shoes



Glasses



Belt



Collar



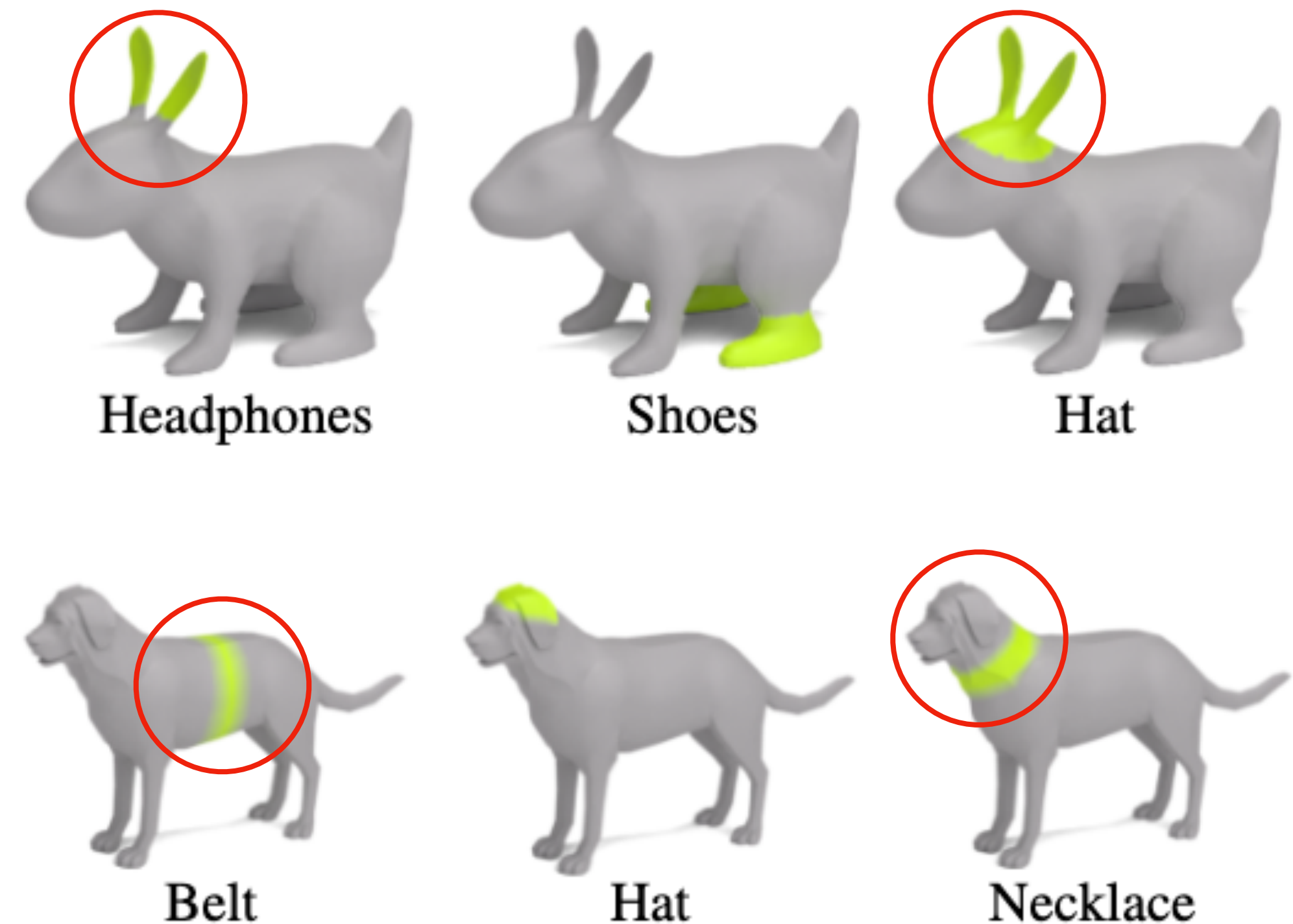
Braids



# Multi-target and Geometric Signal



- 3D Highlighter can localize different regions on the same mesh
- Geometry of waist (belt) and neck (necklace) is nearly identical
- 3D Highlighter places belt and necklace on different regions
- Demonstrates global semantic understanding

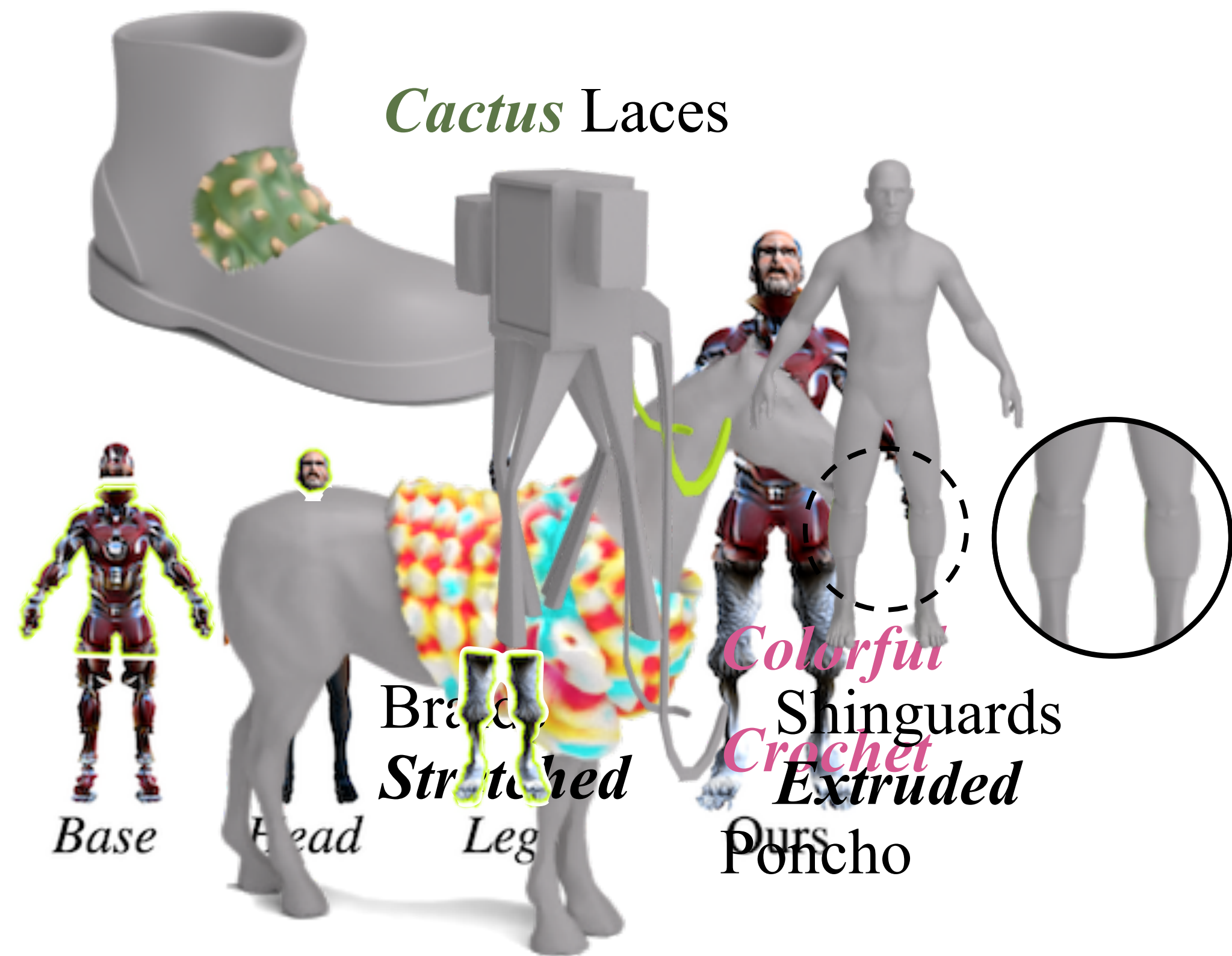




# Applications of 3D Highlighter



- Localized editing
- Local edit composition
- Geometric edits





# Summary



- Mesh localization via pre-trained 2D model  
**No 3D supervision or 3D datasets**
- **Intuitive control** over localization region using text
- Works on **low quality meshes**
- Uses **synthesis** as a means for extracting underlying **analysis**
- Paper and code are publicly available:  
<https://github.com/threedle/3DHighlighter>



*“Něbláče”*



**Thanks for listening!**