# Evaluation of the ShNeRF Render results

This Notebook is seperated from the actual Pipeline and has the purpose to measure the exact performance of the imodel

**Prequesits to run this notebook**

In this Notebook, the two "best" checkpoints `2024-07-28_174845_l1_pure_hook` and `2024-07-28_164939_l1_oSig_hook` were used. Therefore, these are required, as well as the binarized dataset

## Step 1: Render images from the Model Checkpoint using dataset camera positions

```
ns-render dataset --load-config outputs\hook-big-training\alex-silhouette-model\2024-07-28_164939_l1_oSig_hook\config.yml --rendered-output-names bw --split val --data data\working\binarized_images_lowres\hook --output-path \evals-for-doc\2024-07-28_164939_l1_oSig_hook --colormap-options.colormap gray
```

```
ns-render dataset --load-config outputs\hook-big-training\alex-silhouette-model\2024-07-28_174845_l1_pure_hook\config.yml --rendered-output-names bw --split val --data data\working\binarized_images_lowres\hook --output-path \evals-for-doc\2024-07-28_174845_l1_pure_hook --colormap-options.colormap gray
```

## Step 2: Create IoU's

In [34]:
```
# Replace these paths with your local paths
images_gt_path = 'C:/dev/TU/htcv-project/nerf-shape-from-silhouette/data/working/bi

images_pred_path_l1_pure = 'C:/dev/TU/htcv-project/evals-for-doc/2024-07-28_174845_
images_pred_path_l1_oSig = 'C:/dev/TU/htcv-project/evals-for-doc/2024-07-28_164939_

# For the IoU visualization
output_folder_pure = 'C:/dev/TU/htcv-project/evals-for-doc/2024-07-28_174845_l1_pur
output_folder_oSig = 'C:/dev/TU/htcv-project/evals-for-doc/2024-07-28_164939_l1_oSi
```

In [40]:
```
import os
import cv2
from sklearn.metrics import jaccard_score
import numpy as np

def compute_iou(image1, image2):
    # Flatten the images and compute the IoU
```

```
    image1_flat = image1.flatten()
    image2_flat = image2.flatten()
    iou = jaccard_score(image1_flat, image2_flat, average='macro')
    return iou

def binarize_image(image, threshold=50):
    _, binary_image = cv2.threshold(image, threshold, 255, cv2.THRESH_BINARY)
    return binary_image

def create_overlay(image1, image2):
    # Create an RGB image for visualization
    overlay = np.zeros((image1.shape[0], image1.shape[1], 3), dtype=np.uint8)

    # Intersection in green
    intersection = np.logical_and(image1, image2)
    overlay[intersection == 1] = [255, 255, 255]

    # Differences in red and blue
    only_image1 = np.logical_and(image1, np.logical_not(image2))
    only_image2 = np.logical_and(image2, np.logical_not(image1))

    overlay[only_image1 == 1] = [0, 0, 255]  # The predicted image
    overlay[only_image2 == 1] = [255, 0, 0]  # The ground truth image

    return overlay

def compare_folders(folder1, folder2, output_folder):
    if not os.path.exists(output_folder):
        os.makedirs(output_folder)

    folder1_images = sorted(os.listdir(folder1))
    folder2_images = sorted(os.listdir(folder2))

    if len(folder1_images) != len(folder2_images):
        raise ValueError("The number of images in the two folders should be the sam

    total_iou = 0
    n_images = len(folder1_images)

    all_ious = []

    for img_name1, img_name2 in zip(folder1_images, folder2_images):
        img1_path = os.path.join(folder1, img_name1)
        img2_path = os.path.join(folder2, img_name2)

        img1 = cv2.imread(img1_path, cv2.IMREAD_GRAYSCALE)
        img2 = cv2.imread(img2_path, cv2.IMREAD_GRAYSCALE)

        if img1.shape != img2.shape:
            raise ValueError(f"Image sizes do not match: {img_name1} and {img_name2

        img1_binary = binarize_image(img1)
        img2_binary = binarize_image(img2)

        iou = compute_iou(img1_binary, img2_binary)
        total_iou += iou
```

```
        overlay = create_overlay(img1_binary, img2_binary)
        overlay_path = os.path.join(output_folder, f"{img_name1}_overlay.png")
        cv2.imwrite(overlay_path, overlay)

        all_ious.append(iou)

    print("saved all IoU Images to " + output_folder)
    average_iou = total_iou / n_images

    with open(os.path.join(output_folder, 'average_iou.txt'), 'w') as f:
        f.write(f"Average IoU for all images: {average_iou:.4f}")

    print(f"Average IoU for all images: {average_iou:.4f}")

    return all_ious
```

In [42]:
```
# RUN
print("L1 pure: ")
ious_l1_pure = compare_folders(images_gt_path, images_pred_path_l1_pure, output_fol
print("-")
print("L1 oSig: ")
ious_l1_osig = compare_folders(images_gt_path, images_pred_path_l1_oSig, output_fol
```

```
L1 pure:
saved all IoU Images to C:/dev/TU/htcv-project/evals-for-doc/2024-07-28_174845_l1_pu
re_hook/val/iou
Average IoU for all images: 0.8284
-
L1 oSig:
saved all IoU Images to C:/dev/TU/htcv-project/evals-for-doc/2024-07-28_164939_l1_oS
ig_hook/val/iou
Average IoU for all images: 0.8410
```

## Result Evaluation / Visualization

In [141…
```
import matplotlib.pyplot as plt

def plot_overlays(output_folder, title):
    # Get the list of overlay images in the output folder
    overlay_images = sorted([img for img in os.listdir(output_folder) if img.endswi

    # Ensure there are at least 6 images to plot
    if len(overlay_images) < 6:
        raise ValueError('Not enough overlay images to plot. At least 6 required.')

    # Create a figure with 2 rows and 3 columns
    fig, axes = plt.subplots(2, 3, figsize=(10, 8))
    fig.suptitle(title, fontsize=15)

    for i, ax in enumerate(axes.flat):
        # Read the image
        img_path = os.path.join(output_folder, overlay_images[i])
        img = cv2.imread(img_path)
        img_rgb = cv2.cvtColor(img, cv2.COLOR_BGR2RGB)  # Convert from BGR to RGB
```

```
        # Display the image
        ax.imshow(img_rgb)
        ax.set_title(overlay_images[i])
        ax.axis('off')

    plt.tight_layout()
    plt.show()


def scatter_both_models(pure_ious, osig_ious):
    # Create a box plot
    plt.figure(figsize=(6, 5))

    data = [pure_ious, osig_ious]

    plt.boxplot(data,
                labels=['L1 Pure', 'L1 oSig'],
                patch_artist=True,
                boxprops=dict(facecolor='orange',
                    color='black',
                    alpha=0.5),
                whiskerprops=dict(color='black', alpha=1.0),
                medianprops=dict(color='black', alpha=0.0)) # dont show

    mean_pure = np.mean(pure_ious)
    mean_osig = np.mean(osig_ious)

    # Overlay individual data points
    for i, dataset in enumerate(data):
        plt.scatter([i + 1] * len(dataset), dataset, color='black', label='All IoUs

    #and mean
    plt.scatter([1], [mean_pure], color='green', edgecolor='black', s=100, zorder=5
    plt.scatter([2], [mean_osig], color='purple', edgecolor='black', s=100, zorder=

    plt.xlim(0.5, 2.5)

    plt.title('IoU Values of L1 Pure and L1 oSig')
    plt.xlabel('Class')
    plt.ylabel('Value')
    handles, labels = plt.gca().get_legend_handles_labels()
    plt.legend(handles=handles, labels=labels, loc='best')


    # Render the plot
    plt.show()
```

In [142…

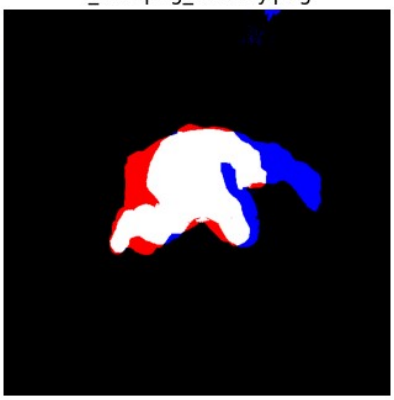
```
# Show IoU Images
plot_overlays(output_folder_pure, 'IoU Images of L1 Pure')
plot_overlays(output_folder_oSig, 'IoU Images of L1 oSig')

# Show a Scatter Plot of all individual IoU values for oSig and Pure
scatter_both_models(ious_l1_pure, ious_l1_osig)
```

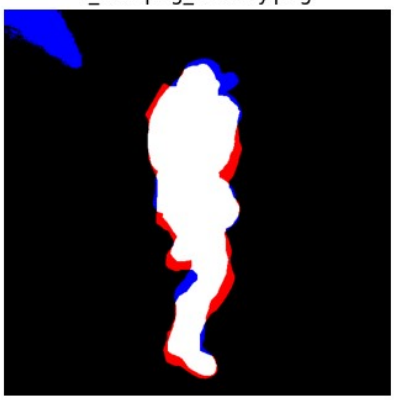
IoU Images of L1 Pure

r_000.png_overlay.png

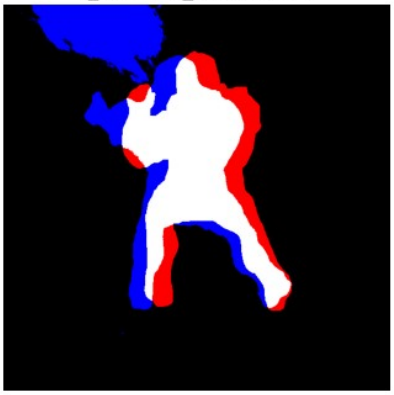
r_001.png_overlay.png



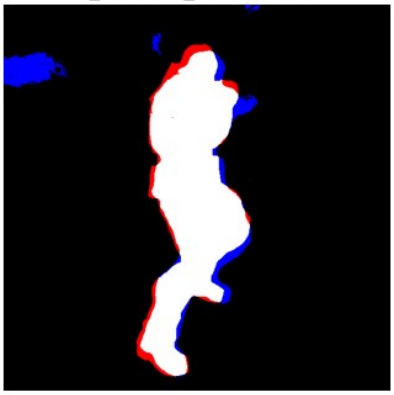
r_002.png_overlay.png



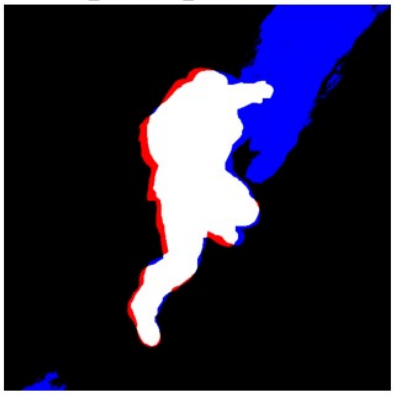
r_003.png_overlay.png



r_004.png_overlay.png

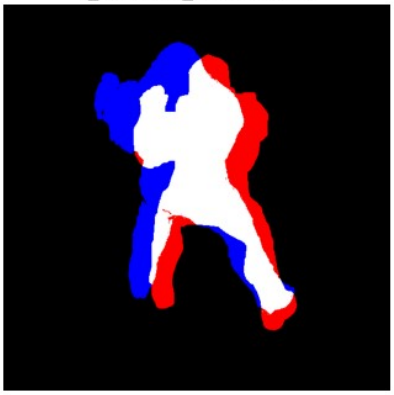


r_005.png_overlay.png



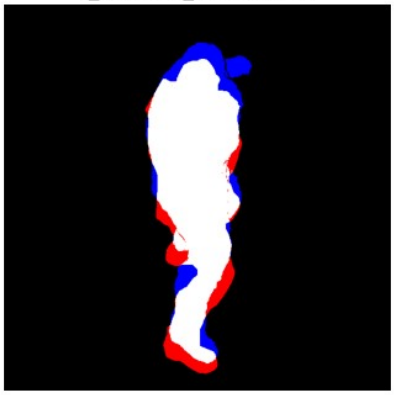
IoU Images of L1 oSig

r_000.png_overlay.png

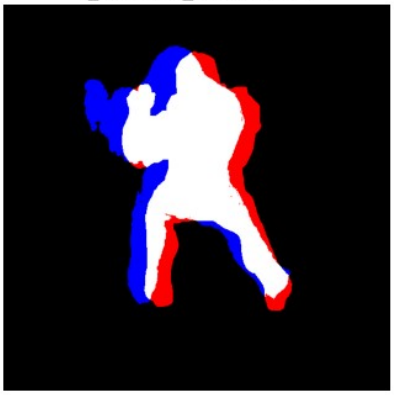


r_001.png_overlay.png

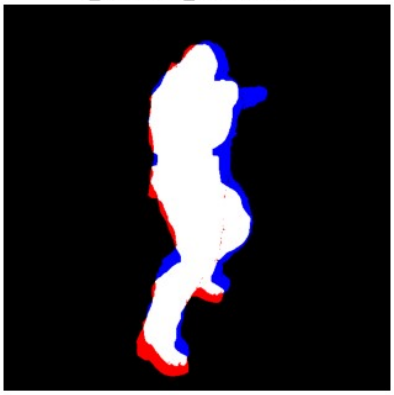
r_002.png_overlay.png



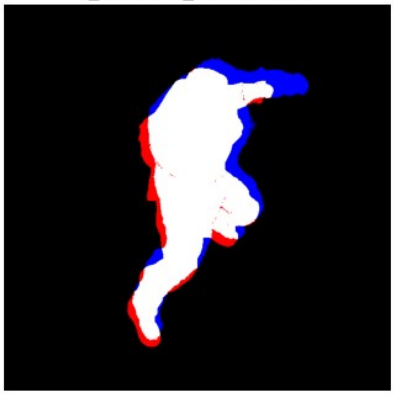
r_003.png_overlay.png

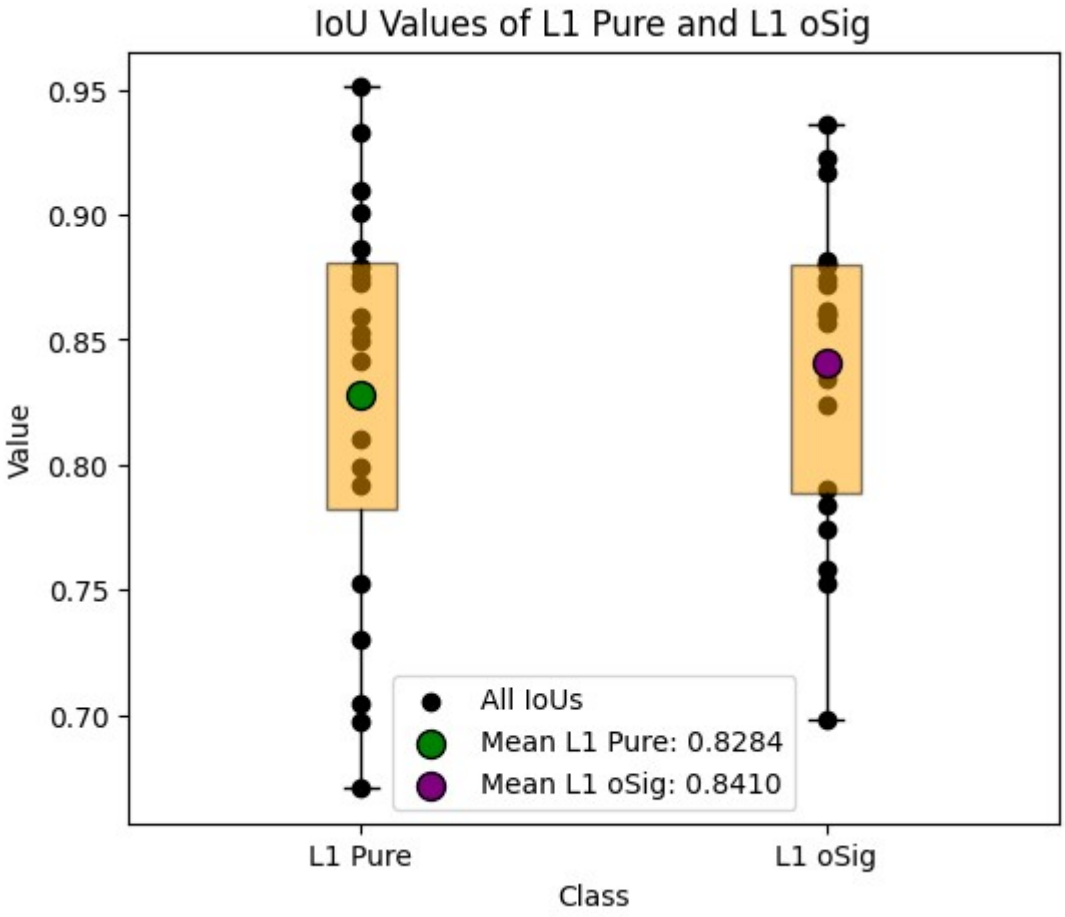


r_004.png_overlay.png



r_005.png_overlay.png




IoU Values of L1 Pure and L1 oSig
0.95
0.90
0.85
0.80
0.75
0.70
Value
All IoUs
Mean L1 Pure: 0.8284
Mean L1 oSig: 0.8410
L1 Pure
L1 oSig
Class