**Panoptic Neural Fields**: A Semantic Object-Aware Neural Scene Representation

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**Problem Statement:** Given an image sequence, create a semantic object-aware neural 3D scene representation.

**Key Points:**
- Separate small instance-specific MLPs for each object instance (things) in the scene and a large MLP for static stuff background.
- Creates a panoptic-radiance field that can be queried at any 3D point over time for the semantic label, instance label, color, and density.
- Single unified model for multiple tasks like semantic segmentation, panoptic segmentations, view synthesis, scene editing.
- Handles dynamic 3D scenes with multiple moving (rigid) objects.

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**Initialization schemes**
- Random initialization
- Baseline initialization
- Learned initialization

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**Experiments on KITTI**

- Rendered semantic segmentation
- Rendered (expected) depth

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**Initialization schemes**
- Meta Learned Initialization with Federated Averaging

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**Method**
- Appearance PSNR

<table>
<thead>
<tr>
<th>Method</th>
<th>Appearance PSNR</th>
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<tbody>
<tr>
<td>NeRF</td>
<td>21.18</td>
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<tr>
<td>FVS</td>
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<td>PBNR</td>
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<tr>
<td>Mip-NeRF</td>
<td>21.54</td>
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<tr>
<td>Ours</td>
<td>21.91</td>
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</tbody>
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**Scene Editing**
- Rendered views without scene editing
- Rendered views with scene editing