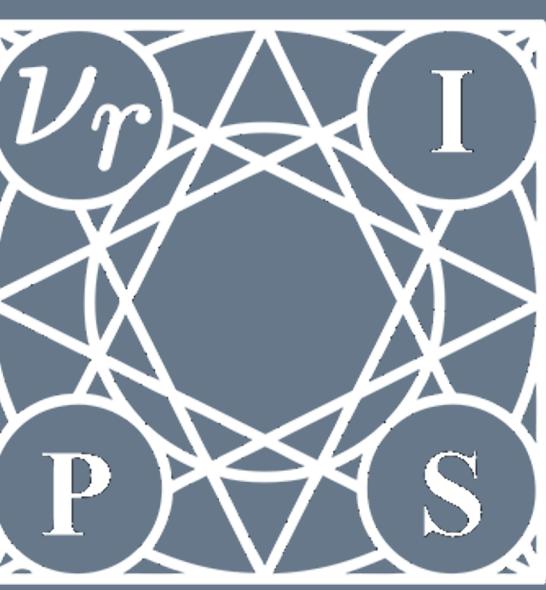


# Canonical 3D Deformer Maps

## Unifying parametric and Non-parametric Methods for Dense Weakly-supervised Category Reconstruction

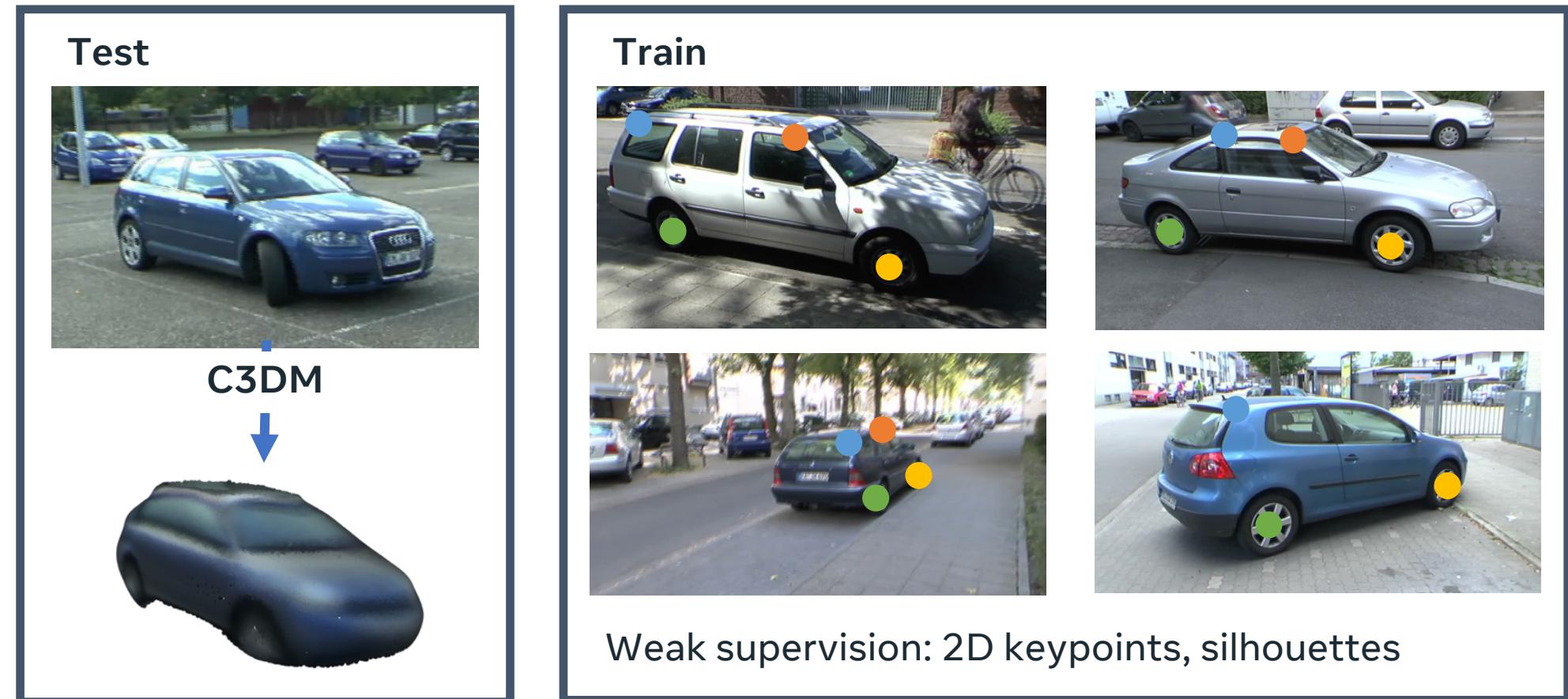
David Novotny\*  
Roman Shapovalov\*  
Andrea Vedaldi

<http://www.robots.ox.ac.uk/~david/c3dm/>



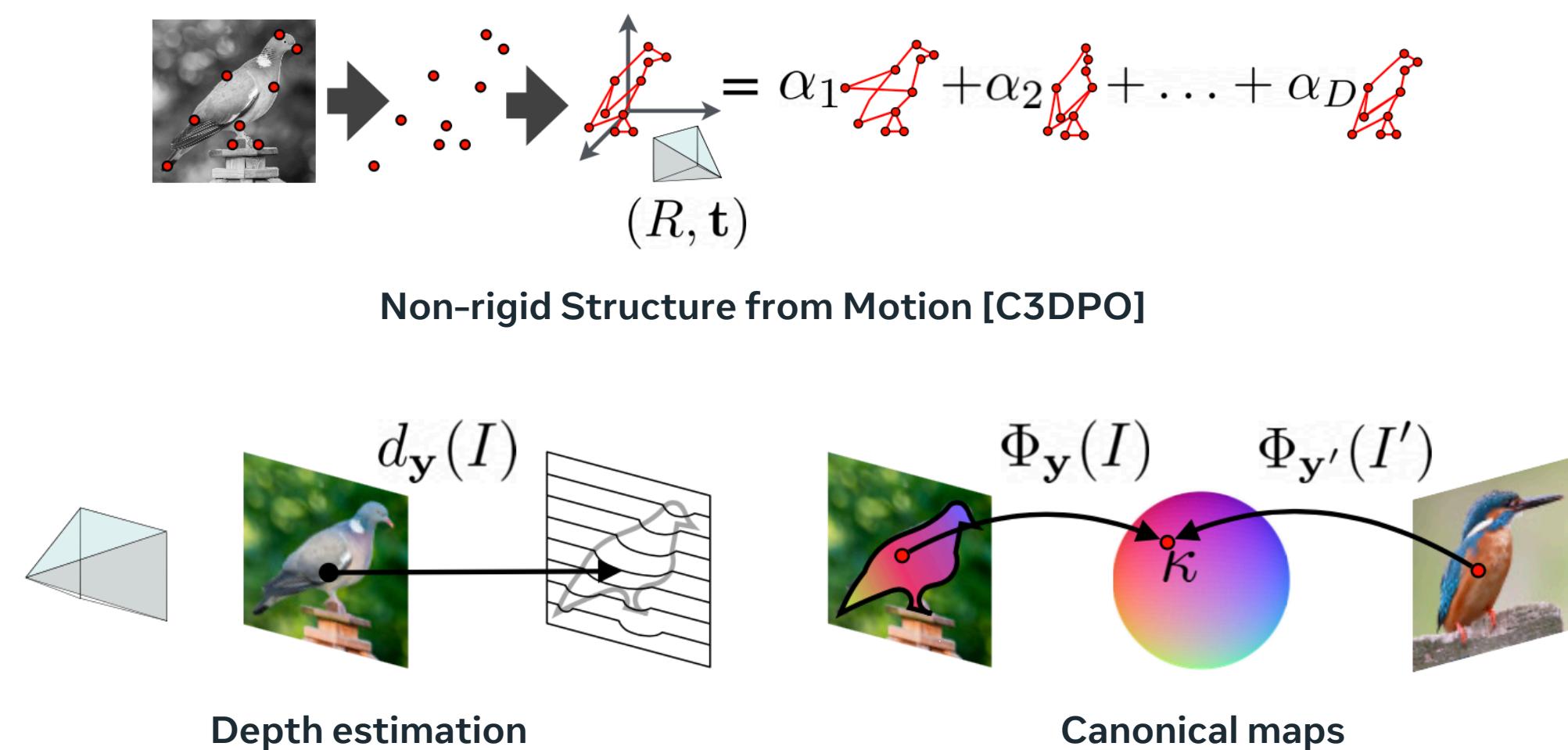
### The task

Monocular category-centric 3D reconstruction.



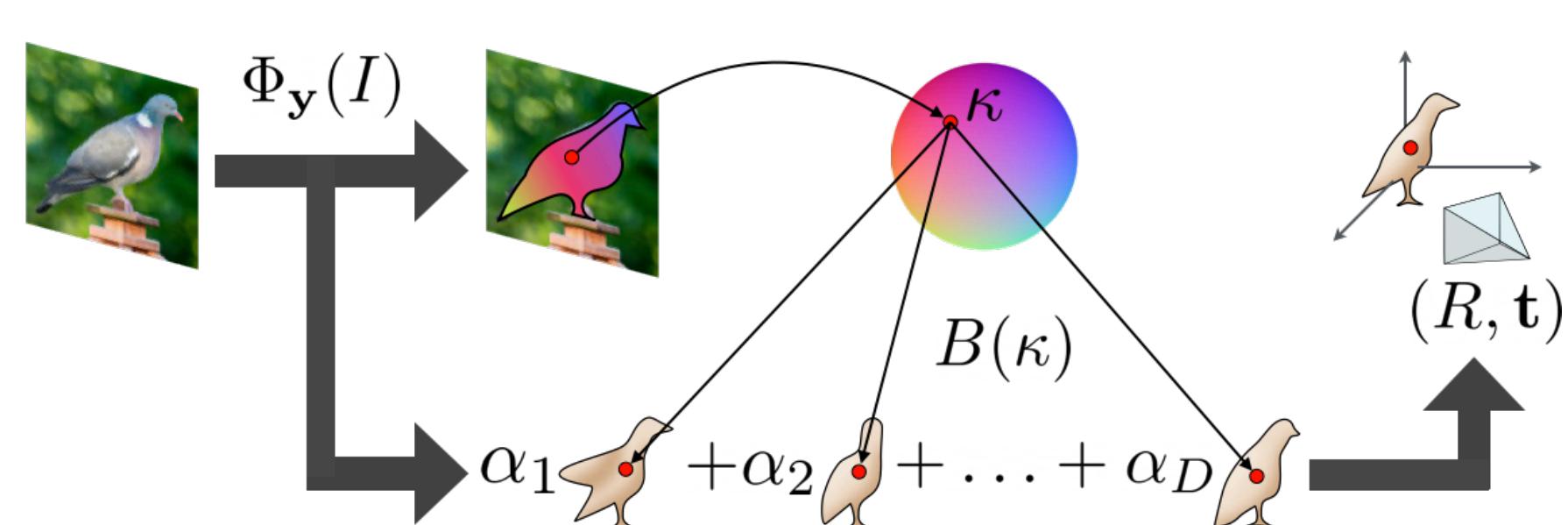
### C3DM: The best of three worlds

We draw inspiration from three research directions:



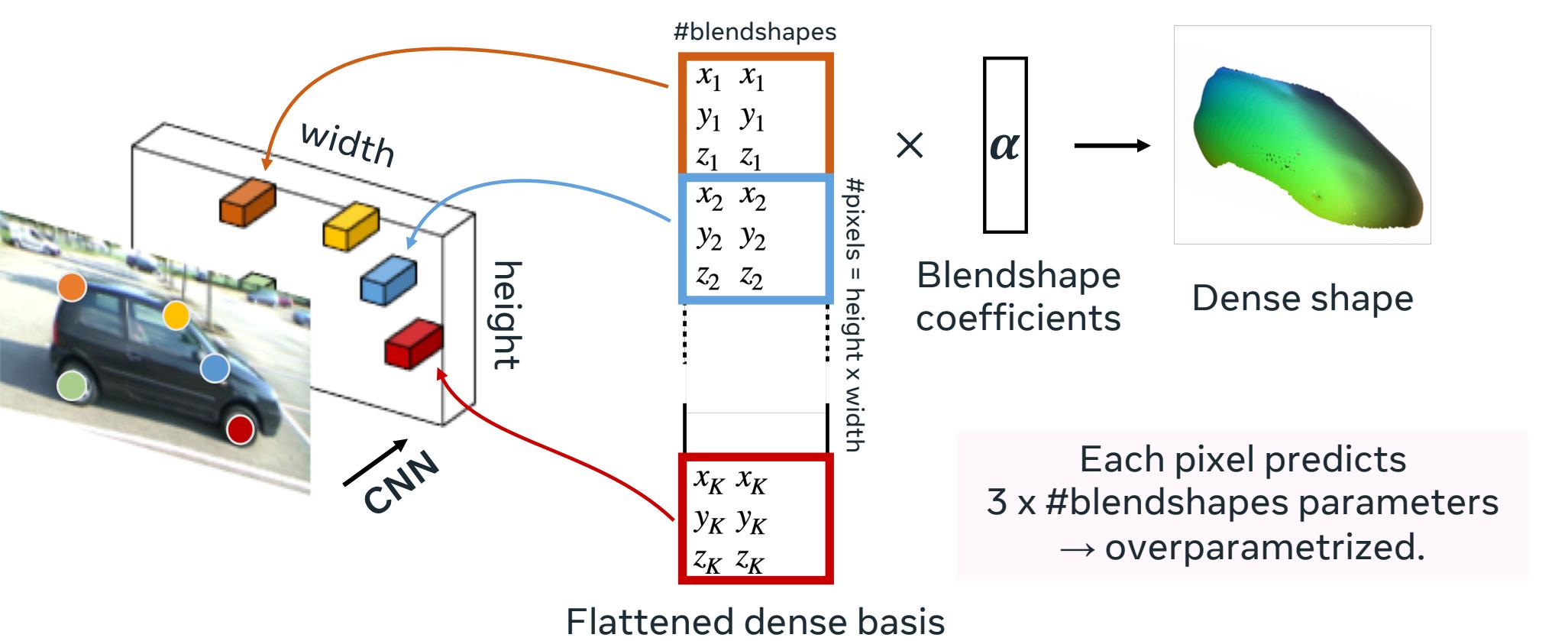
### C3DM overview

1. For each pixel, a spherical embedding  $\kappa$  is produced with a CNN  $\Phi$ .
2. Embedding  $\kappa$  is mapped by an MLP  $B(\kappa)$  to points on  $D$  blendshapes.
3. Linear combination of blendshapes produces the point in world coords.



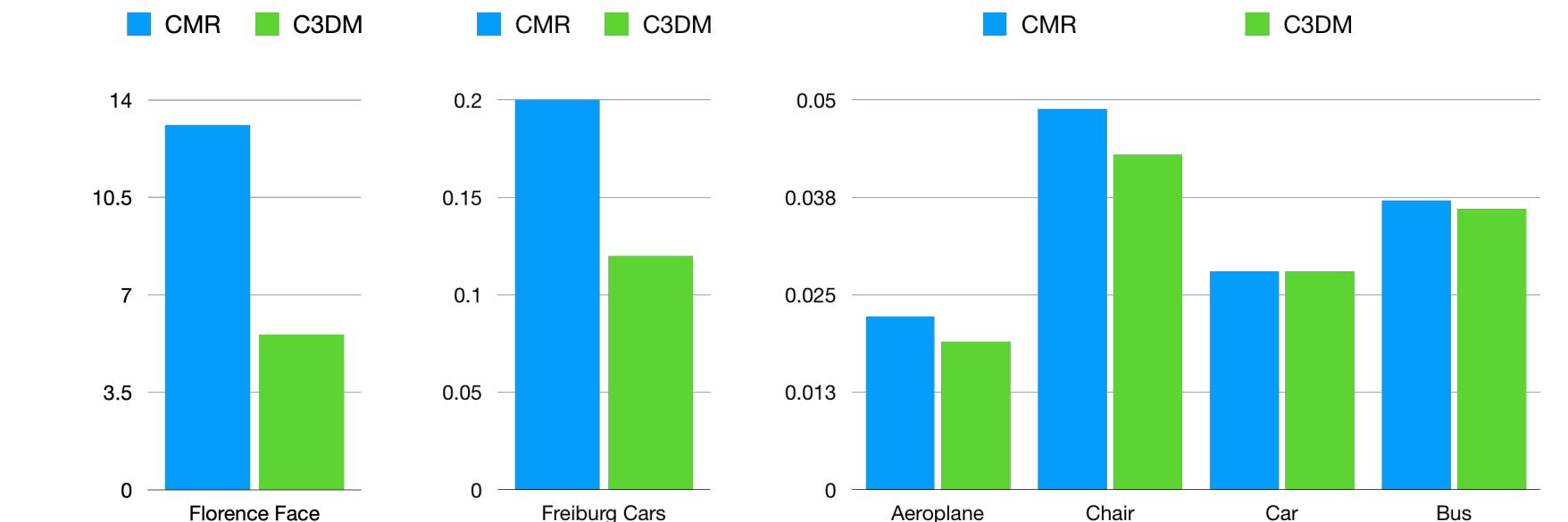
### Dense basis

Extends linear Non-Rigid SfM basis formulation to dense predictions.



### Experiments

Chamfer distance after rigid alignment.

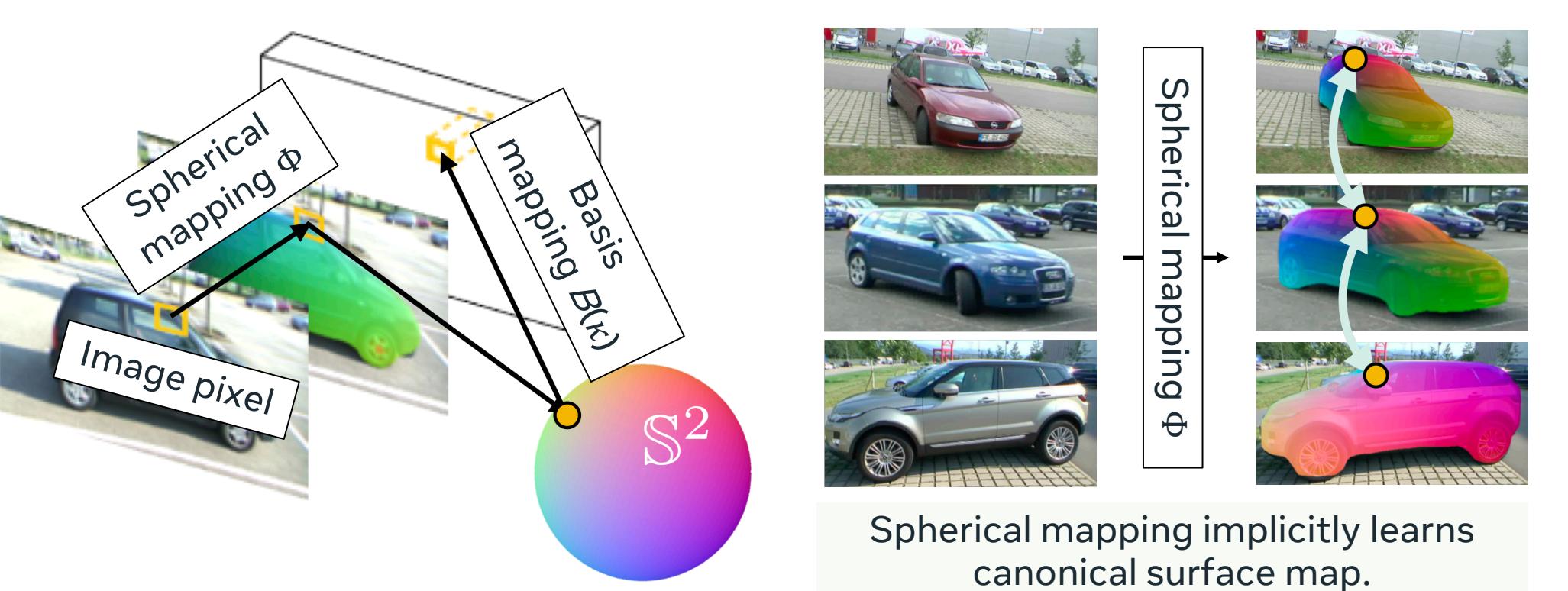


### Qualitative results



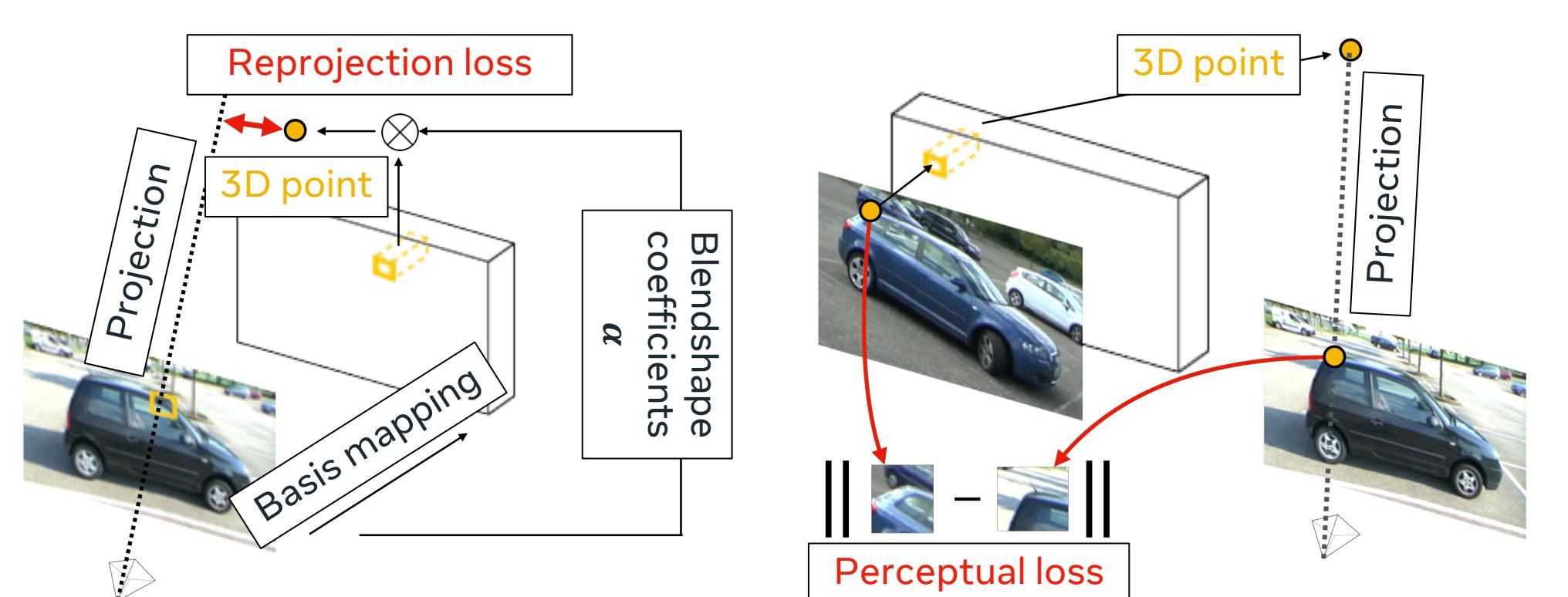
### Spherical canonical map

Basis vectors predicted through a spherical bottleneck to make a compact canonical surface map.



### Perceptual & reprojection losses

**Reprojection loss** forces 3D points to lie on their projection rays.  
**Perceptual loss** warps patches between views and enforces photometric consistency in VGG feature space.



### References

- [C3DPO] David Novotny, Nikhila Ravi, Benjamin Graham, Natalia Neverova, and Andrea Vedaldi. C3DPO: Canonical 3d pose networks for non-rigid structure from motion. In Proc. ICCV, 2019.
- [CMR] Angjoo Kanazawa, Shubham Tulsiani, Alexei A. Efros, and Jitendra Malik. Learning category-specific mesh reconstruction from image collections. In Proc. ECCV, 2018.