Data Augmentation-free Unsupervised Learning for 3D Point Cloud Understanding

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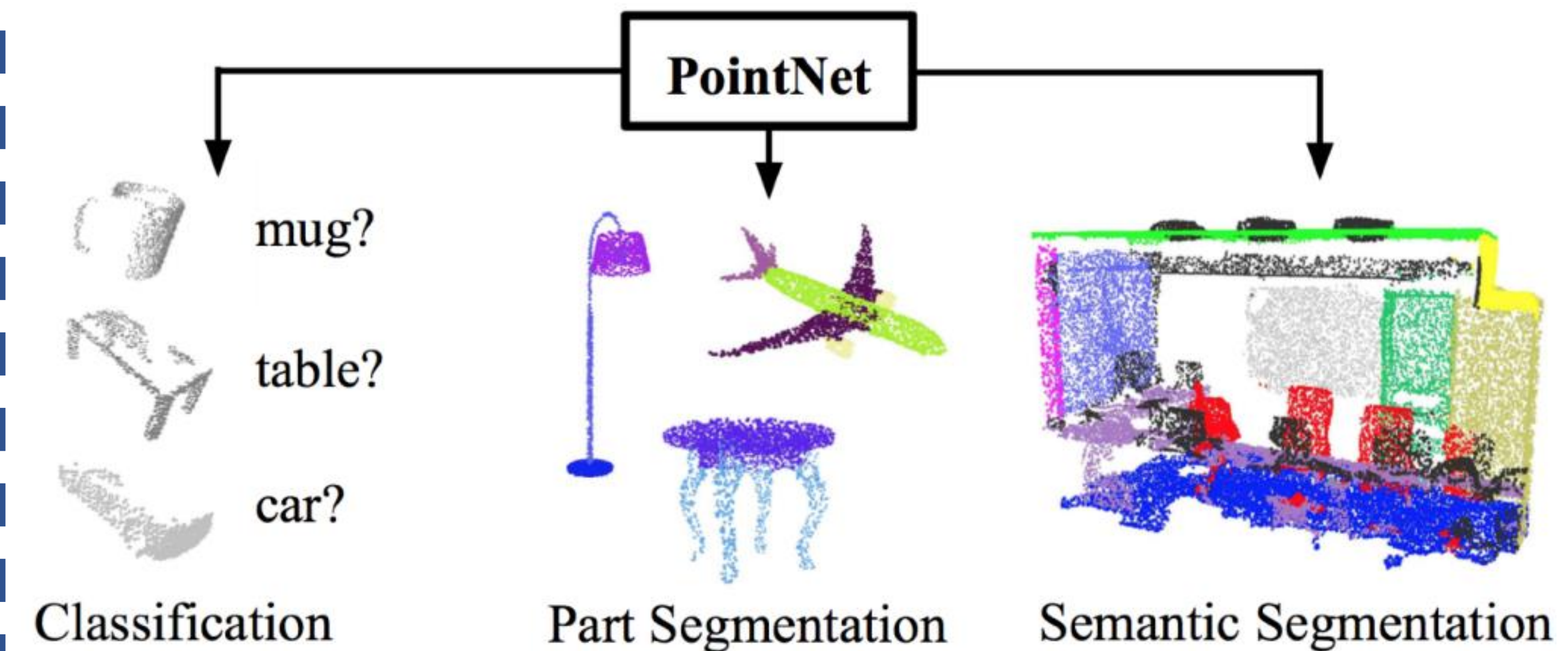[1]University of Technology Sydney, [2]University of Trento, [3]Fondazione Bruno Kessler

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1. Background

❖ **Generative methods** are sensitive to transformations; they typically assume that all 3D objects have the same pose in a given category;

❖ **Contrastive methods** require large batch sizes, memory banks, data augmentation or customized strategies to retrieve informative pairs.
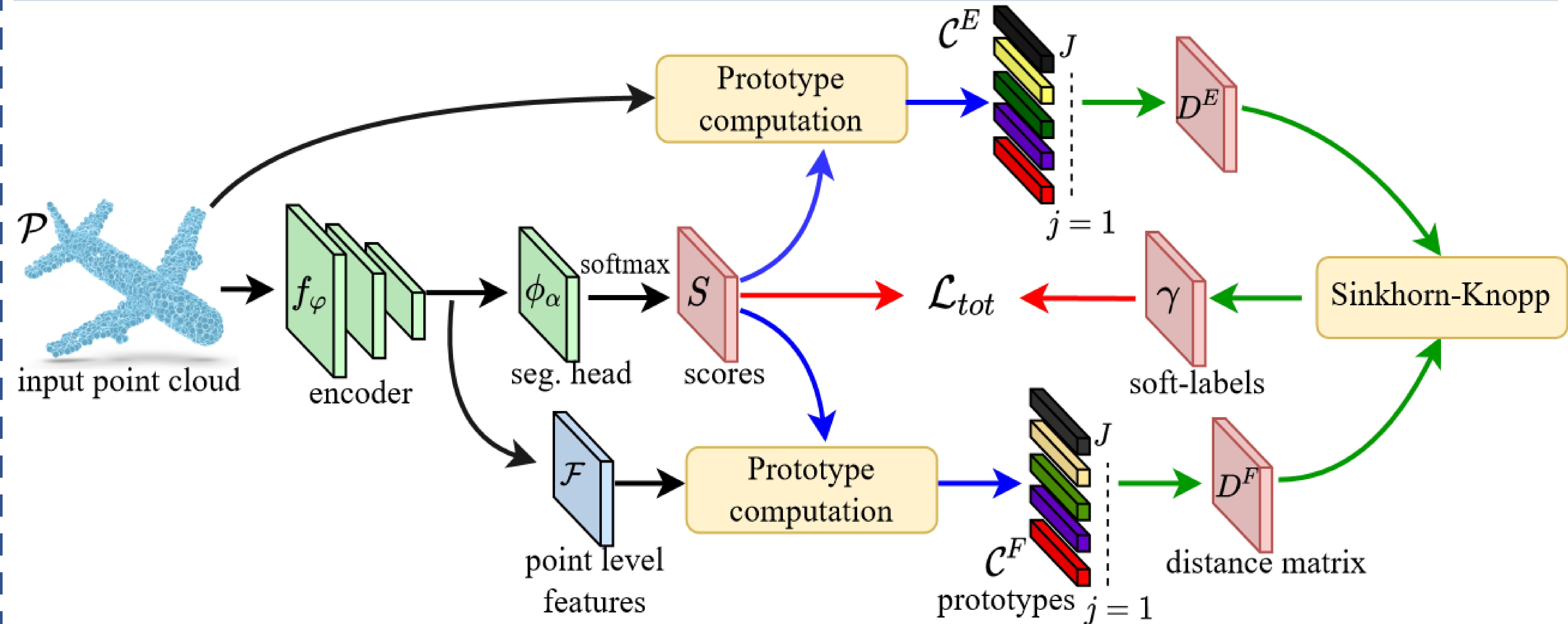

Classification   Part Segmentation   Semantic Segmentation

2. Contributions

❖ We propose a data augmentation-free unsupervised method, which does not rely on data augmentations, negative pair sampling, and large batches, to learn transferable point-level features on a 3D point cloud;

❖ We extend the pseudo-label prediction to an optimal transport problem, which can be efficiently solved by using an efficient variant of the Sinkhorn-Knopp algorithm.

3. Method

❖ Cluster cohesion: If a point p_i belongs to partition j, point p_i and prototype c_j^E should have the shortest distance among the distances of p_i with other prototypes;

❖ Uniform distribution: Each point cloud is assumed to be segmented into equally-sized partitions.

4. Soft-labeled Point Clouds

5. Part Segmentation Results on ShapeNerPart

Source code available at https://github.com/gfmei/softclu