

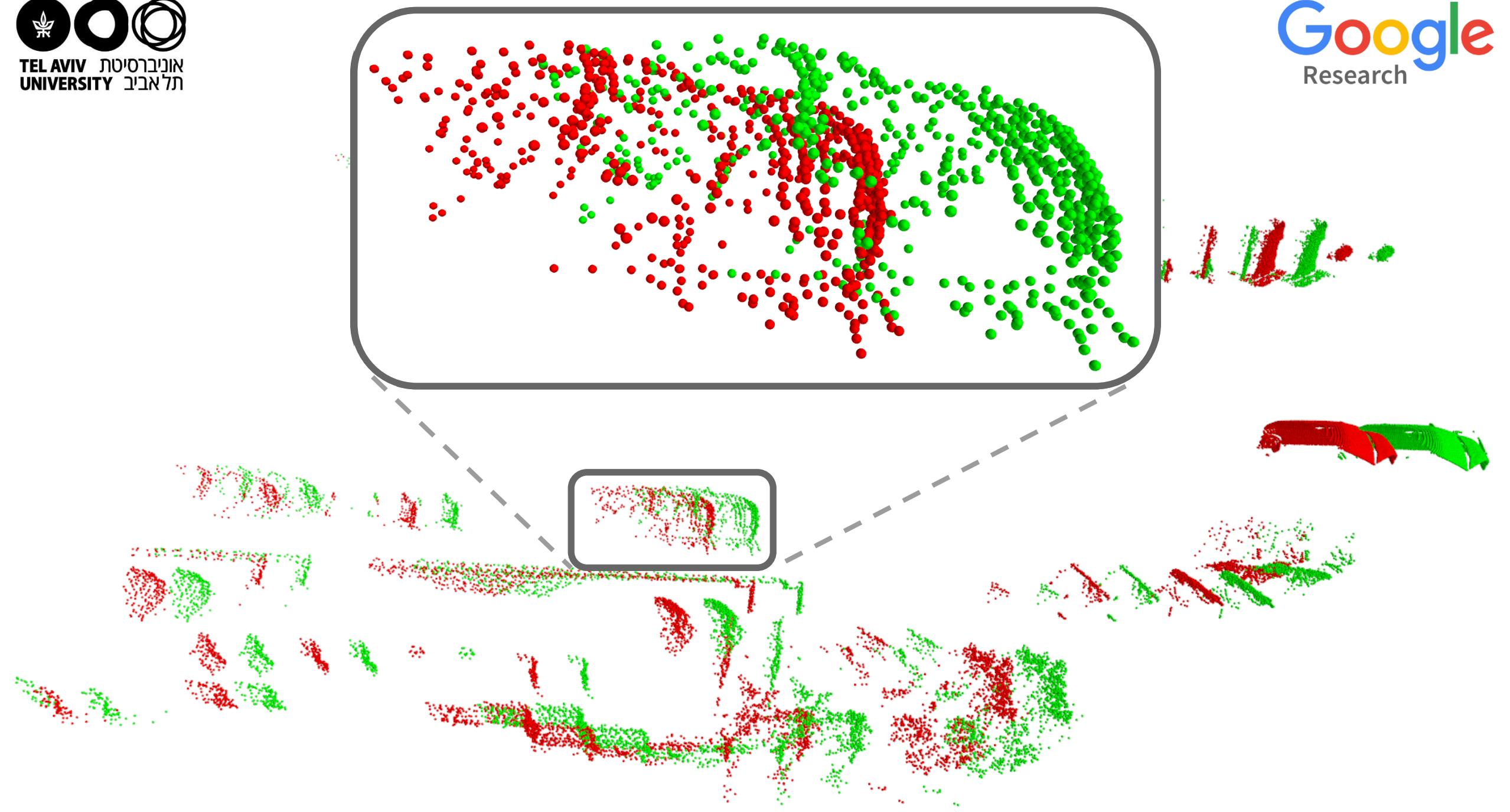
SCOOP: Self-Supervised Correspondence and Optimization-Based Scene Flow

Itai Lang^{1,2}, Dror Aiger², Forrester Cole², Shai Avidan¹, Michael Rubinstein²

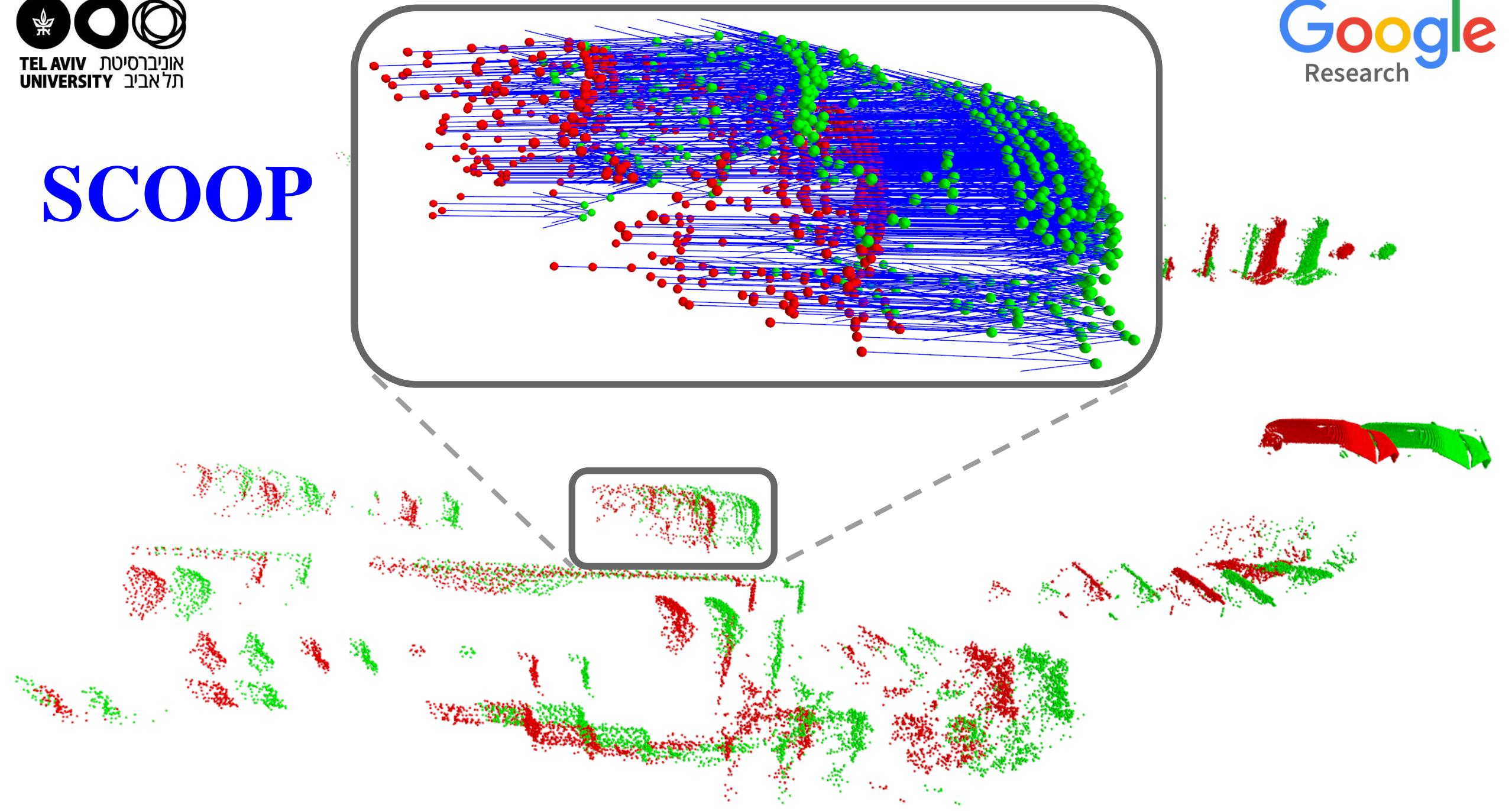
¹Tel Aviv University

²Google Research

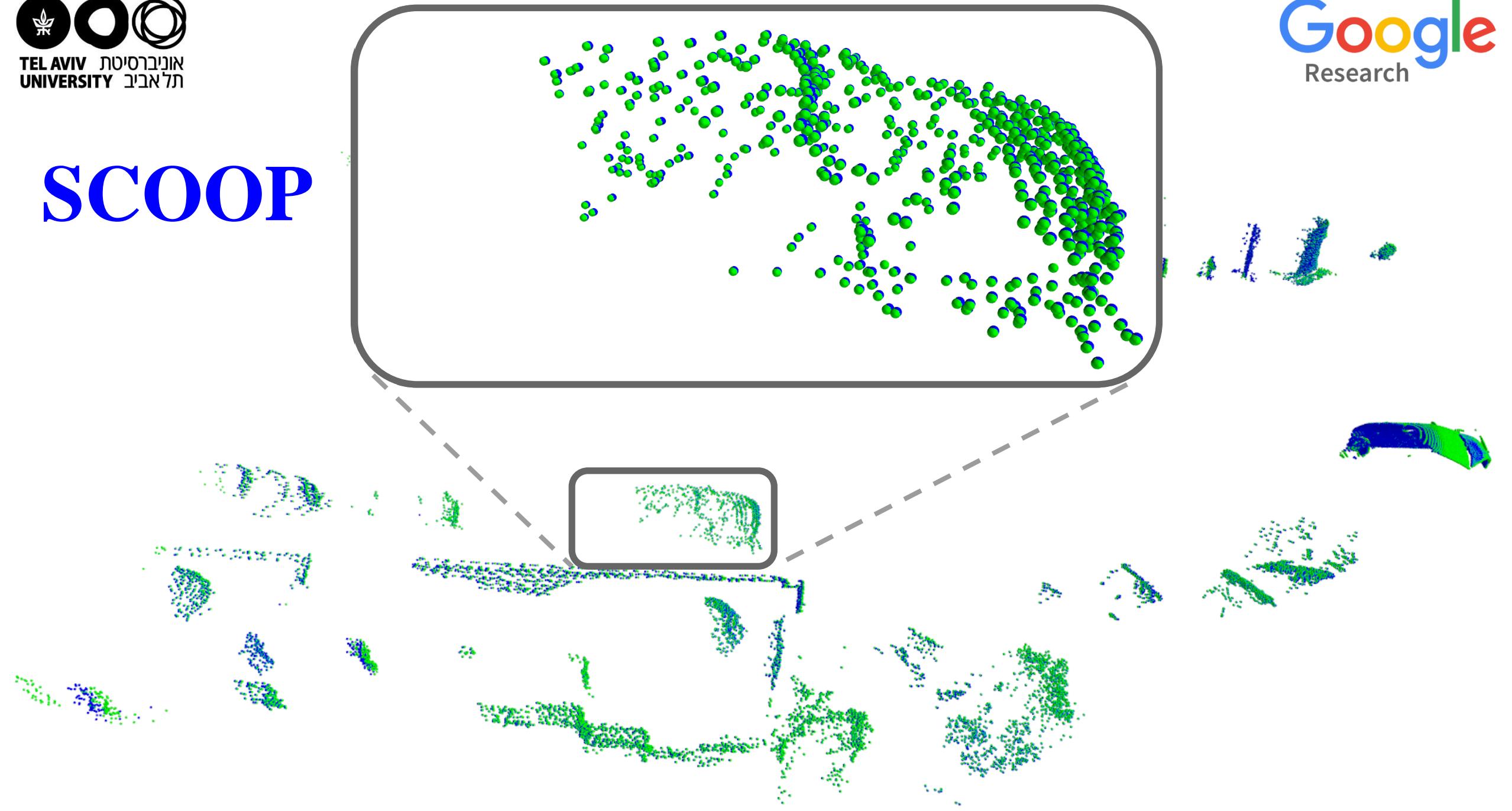




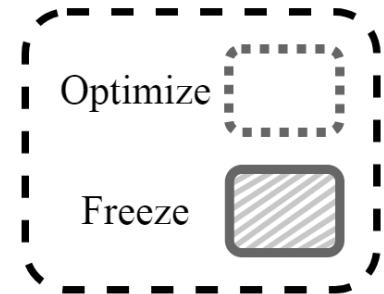
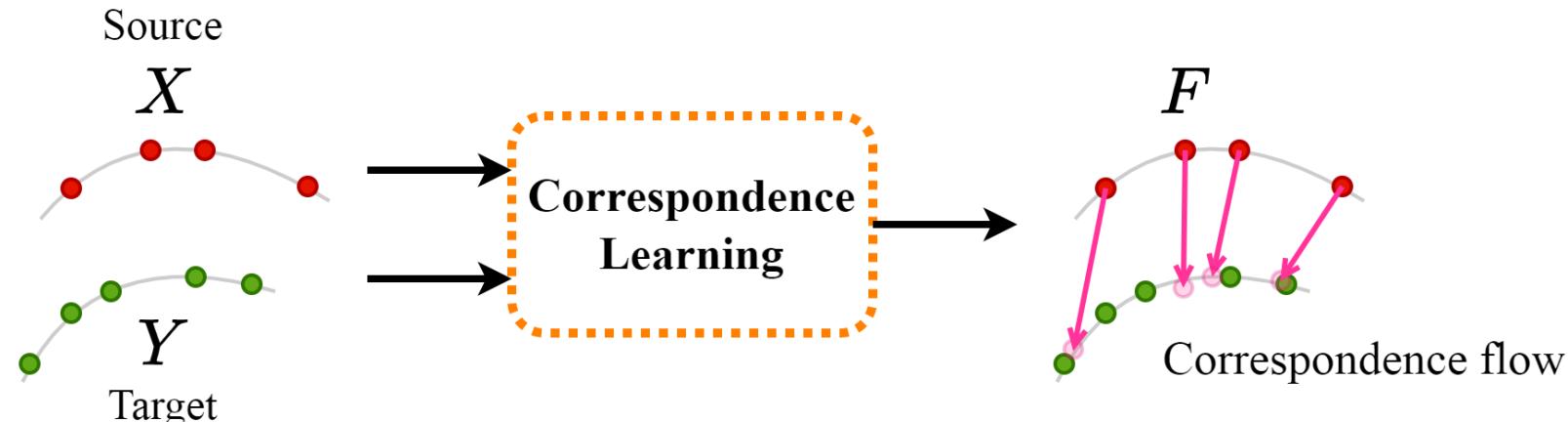
SCOOP



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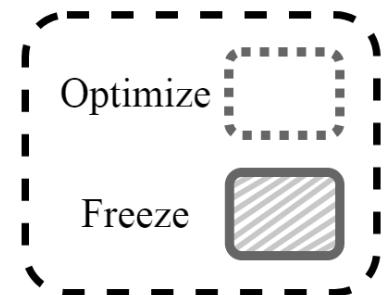
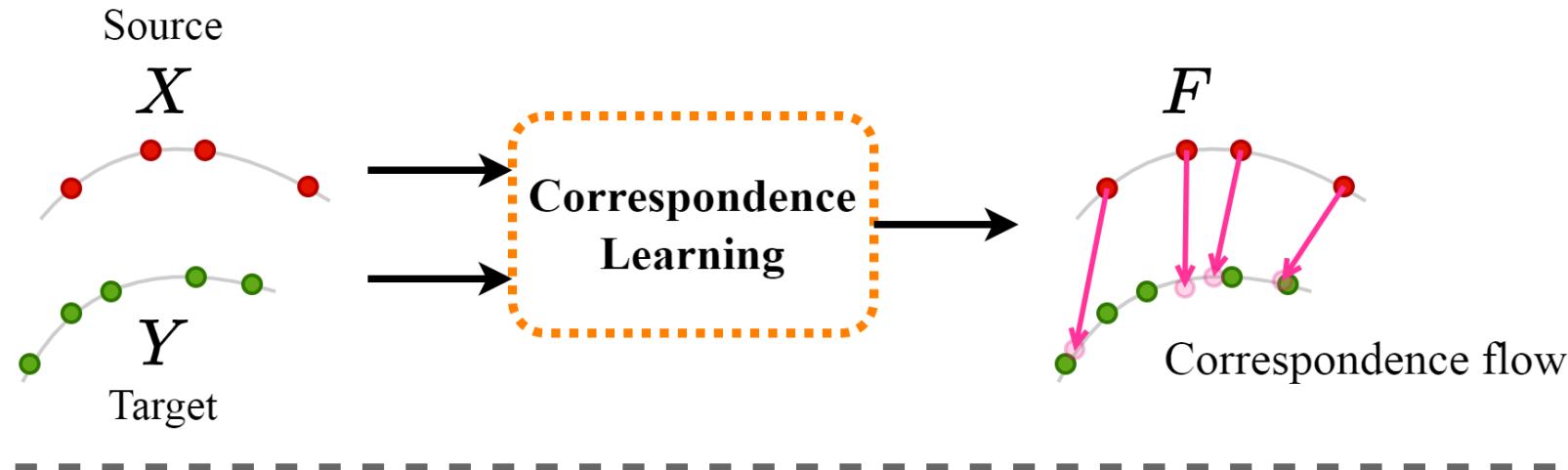


Our Method

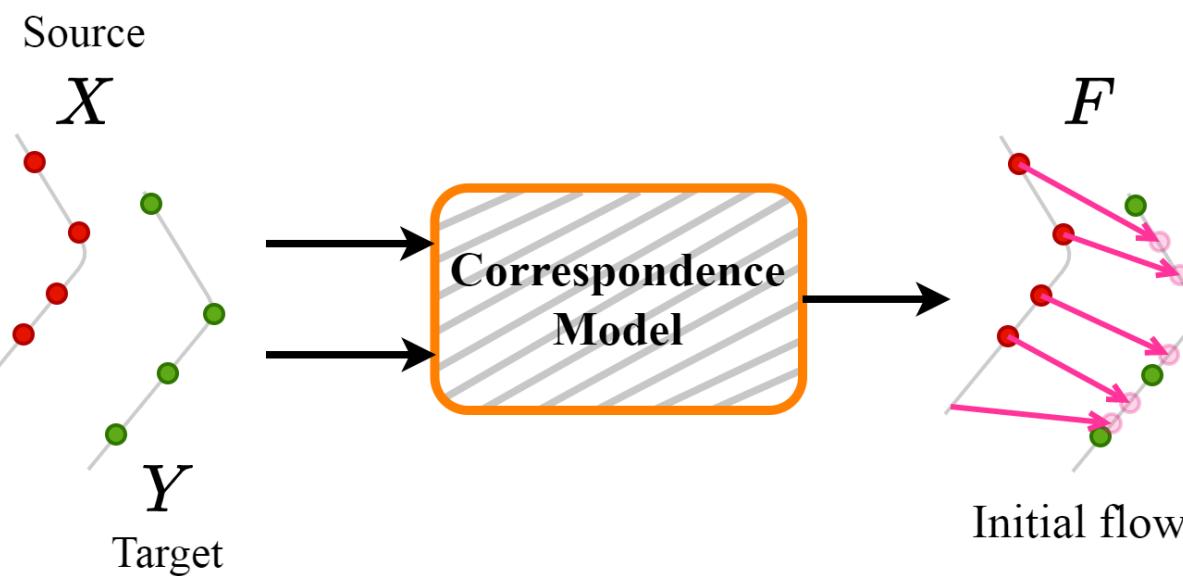


Train
Test

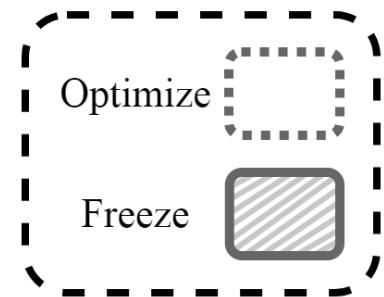
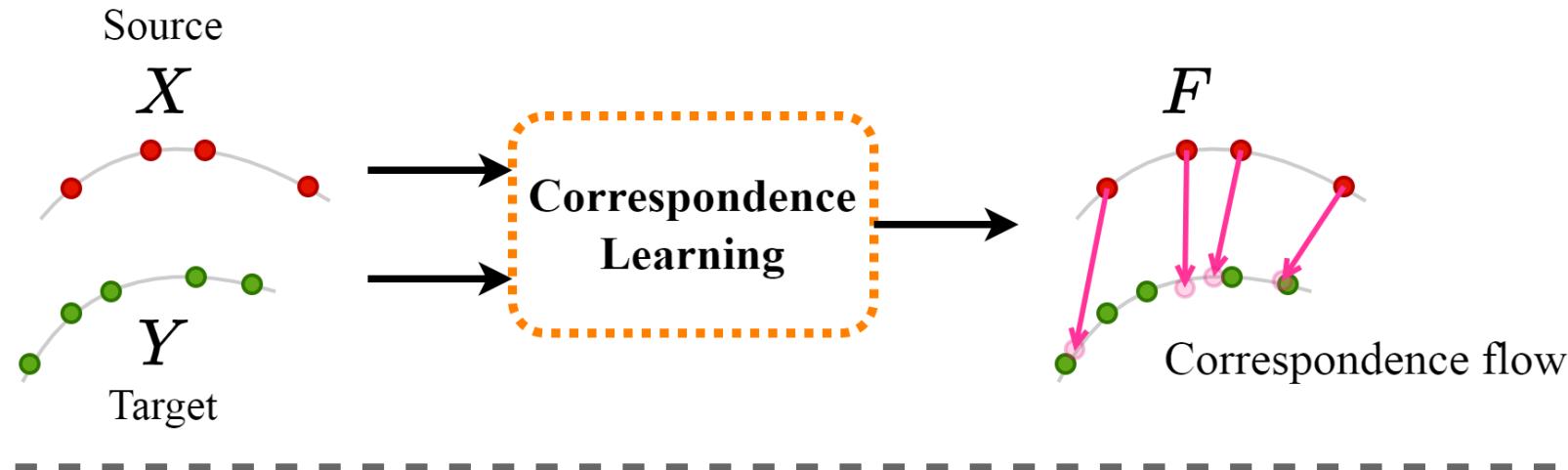
Our Method



Train
Test

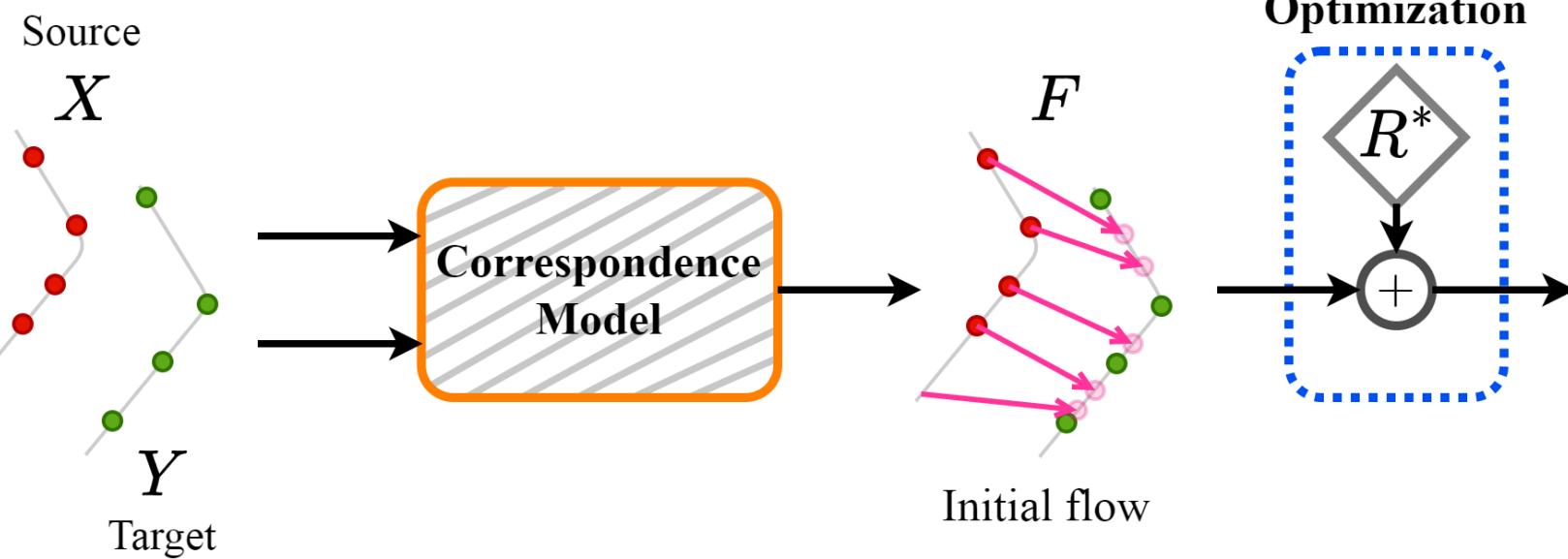


Our Method

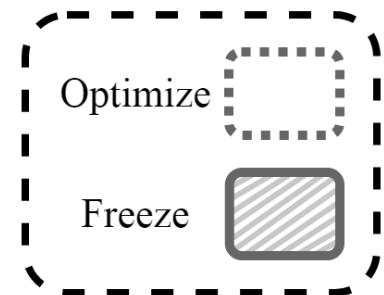
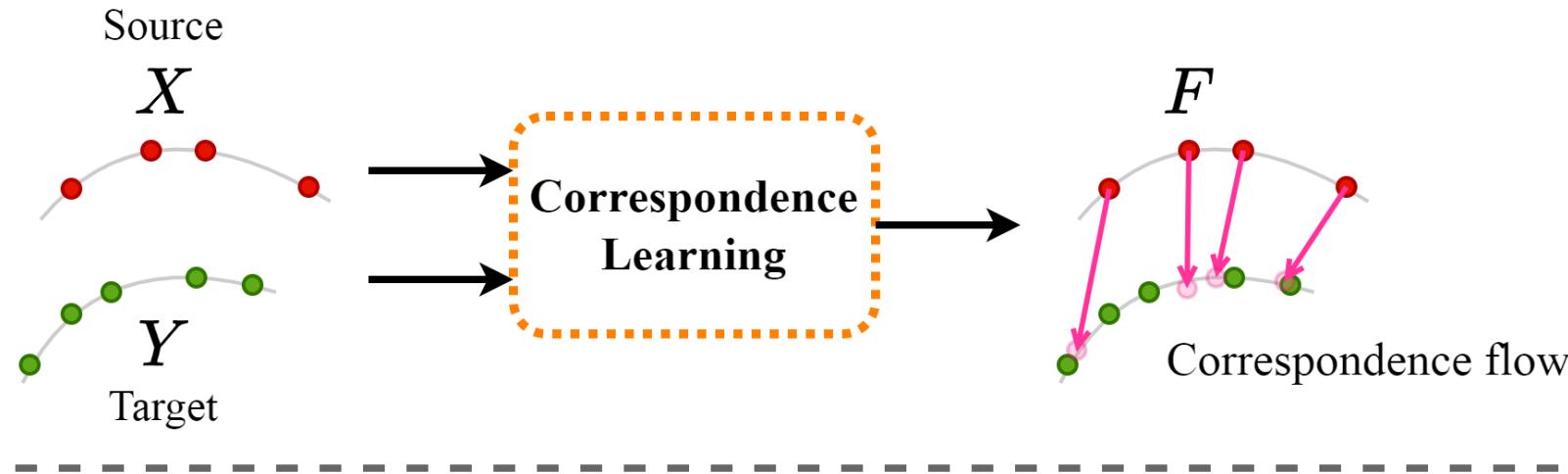


Train

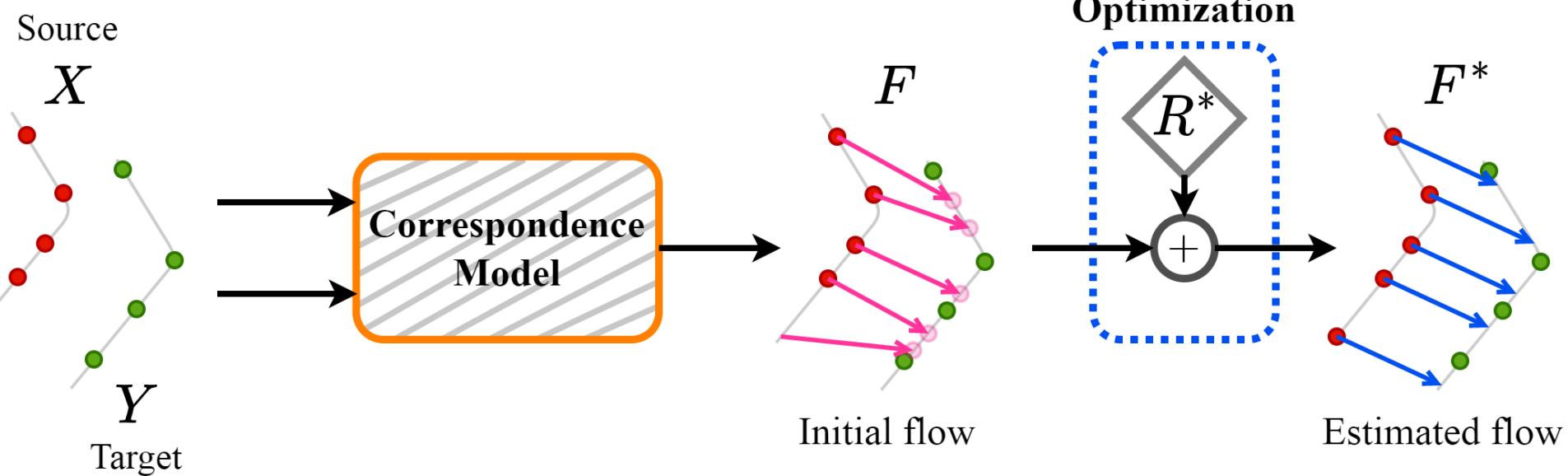
Test



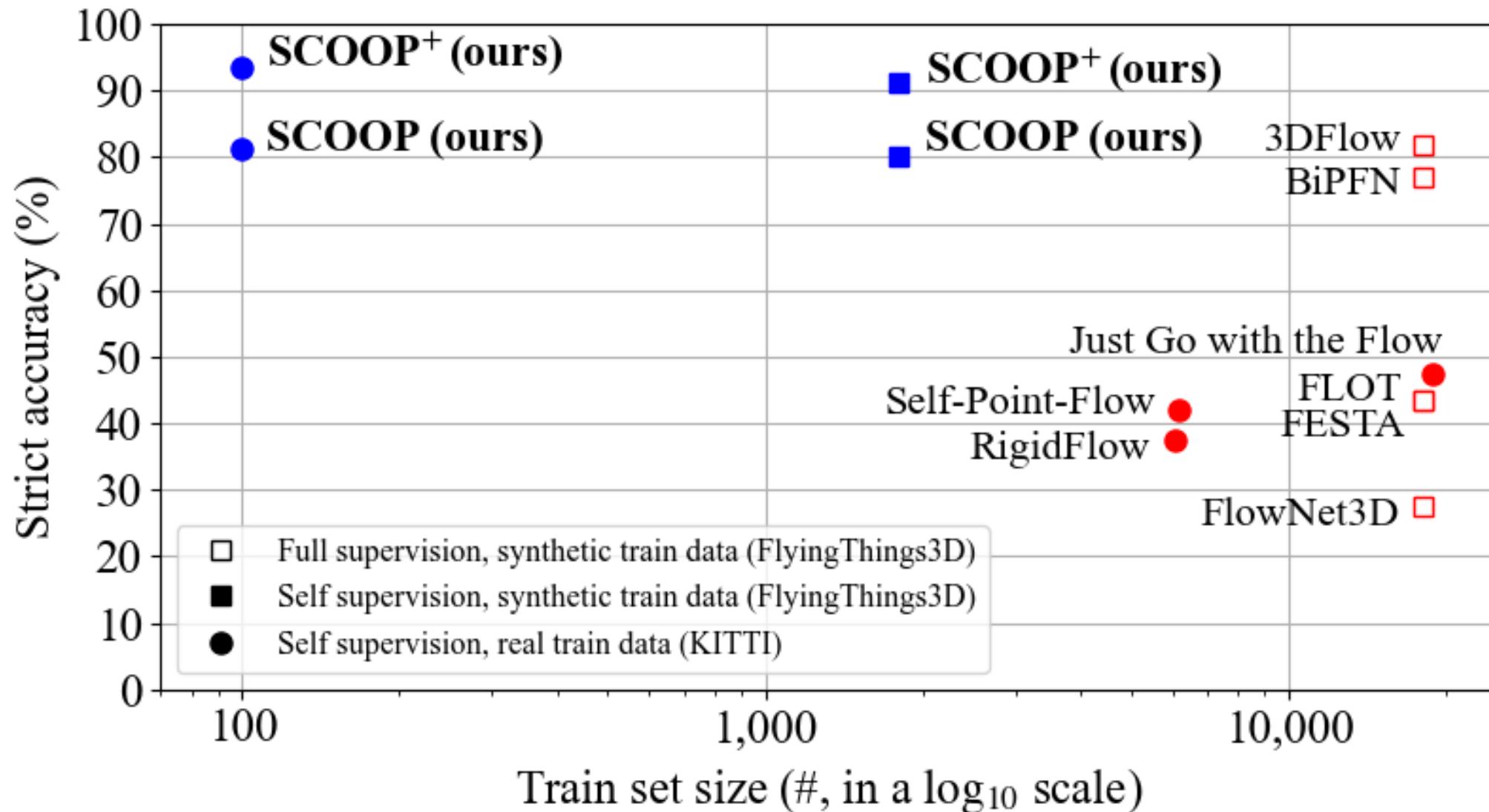
Our Method



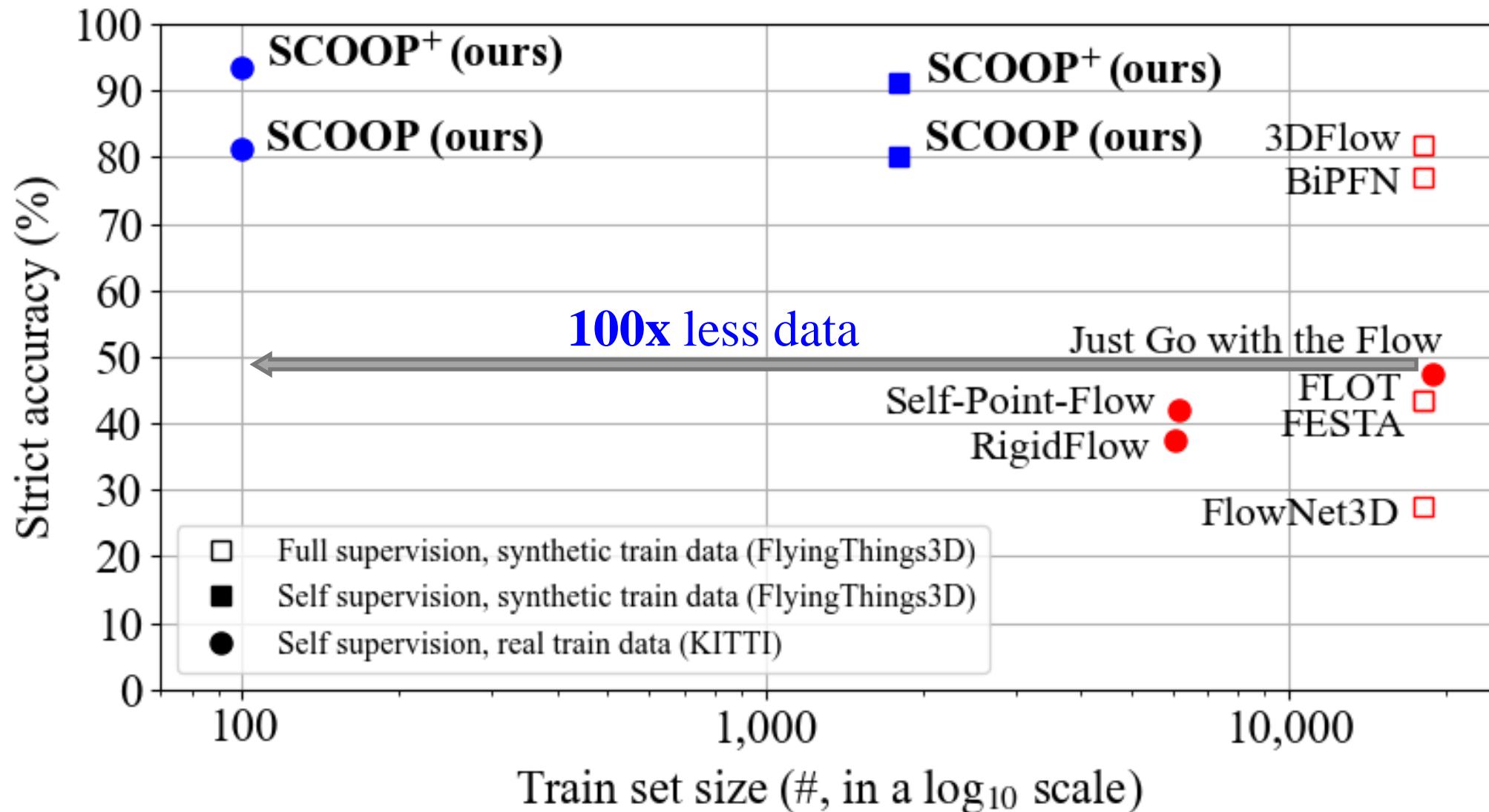
Train



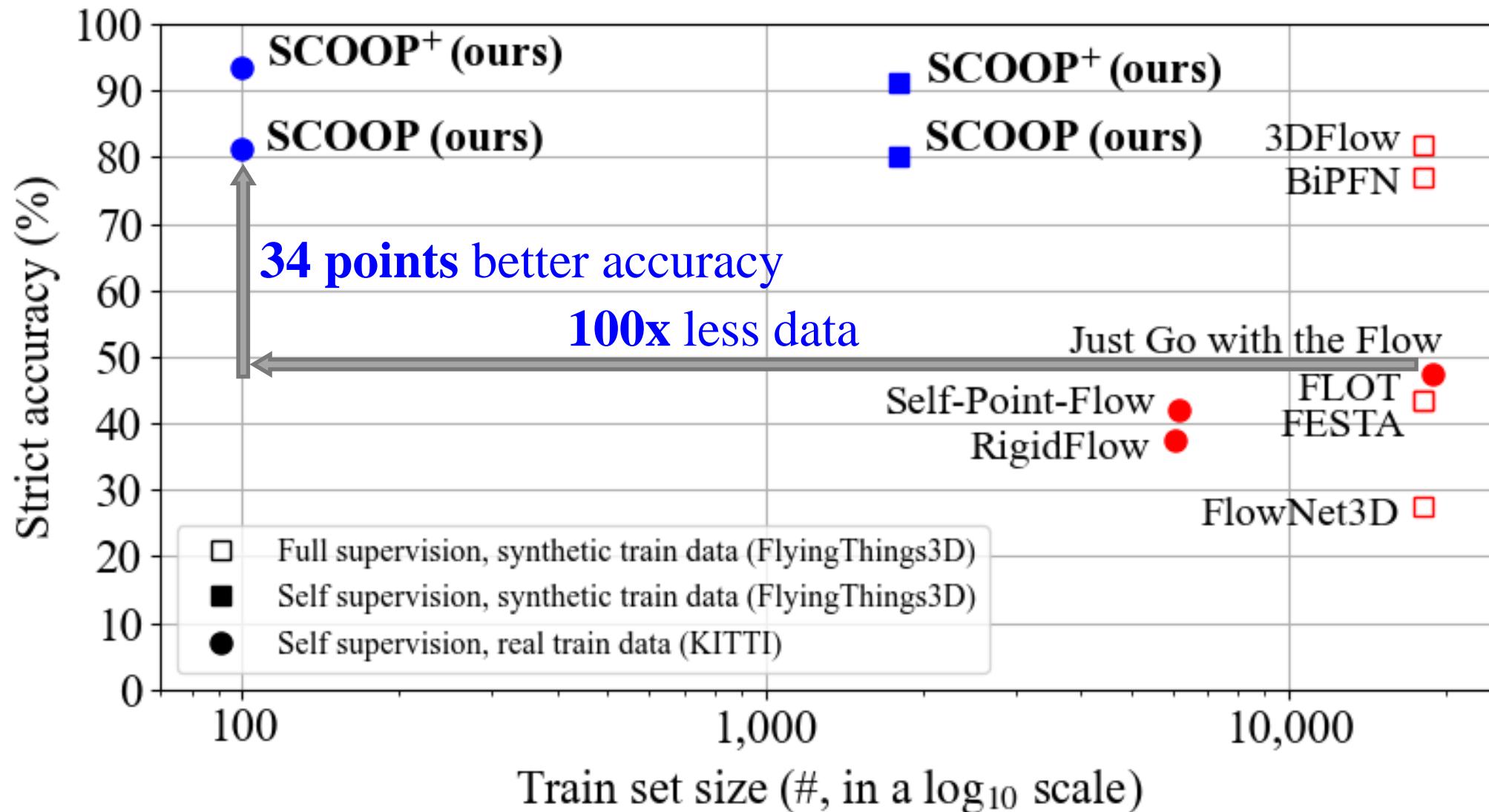
Flow Accuracy vs. Train Set Size



Flow Accuracy vs. Train Set Size



Flow Accuracy vs. Train Set Size





SCOOP: Self-Supervised Correspondence and Optimization-Based Scene Flow

CVPR 2023



Itai Lang^{1,2*}



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Forrester Cole²



Shai Avidan¹



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*The work was done during an internship at Google Research.

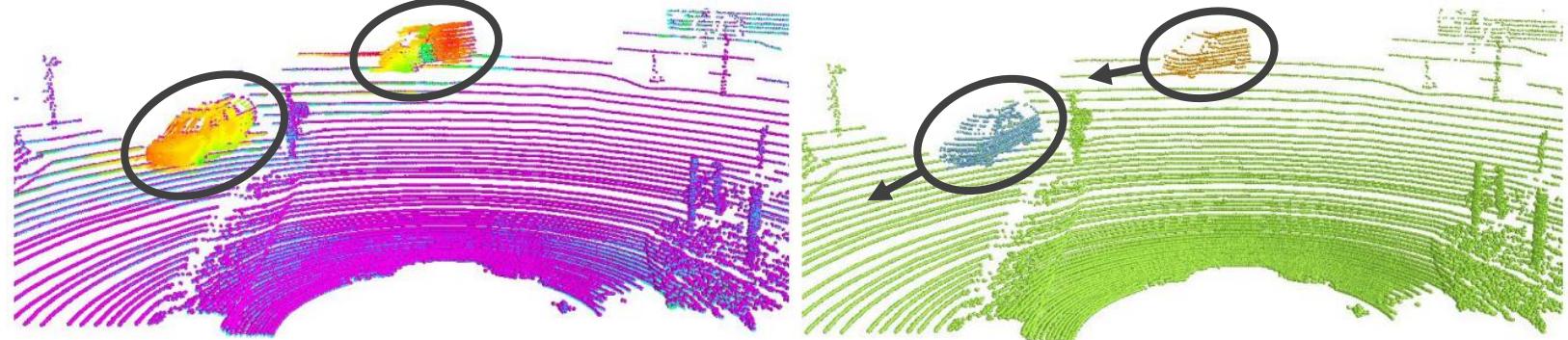
Paper

arXiv

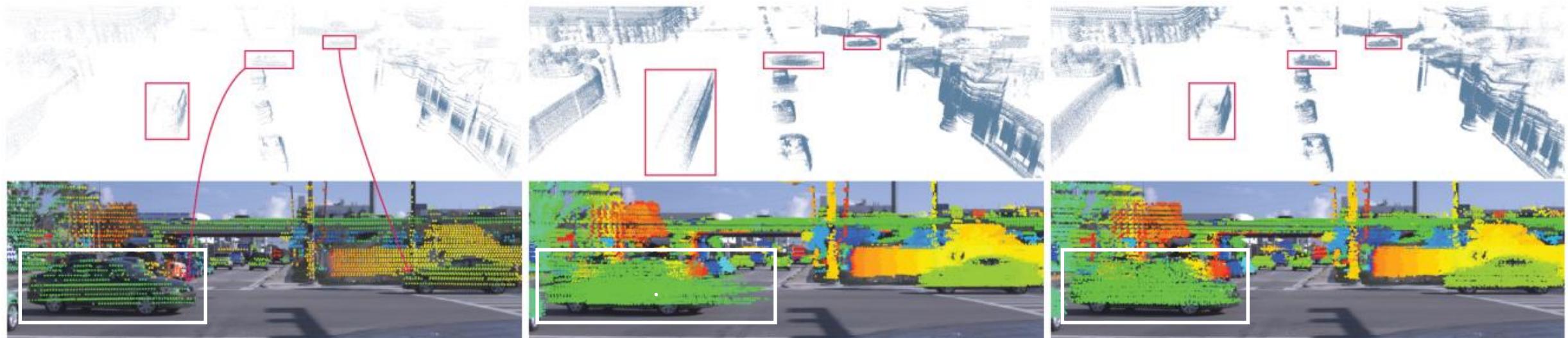
Video

Code

Motivation for Scene Flow

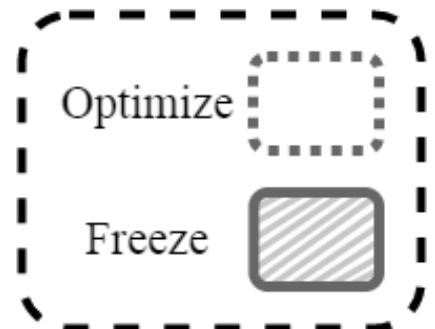
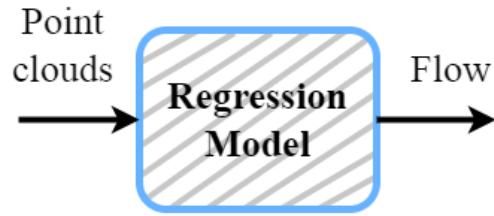
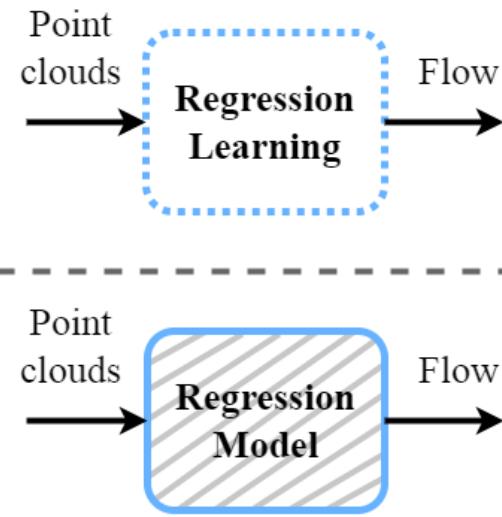


FlowNet3D, Liu *et al.*, 2019

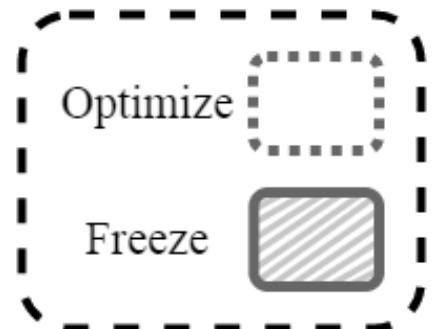
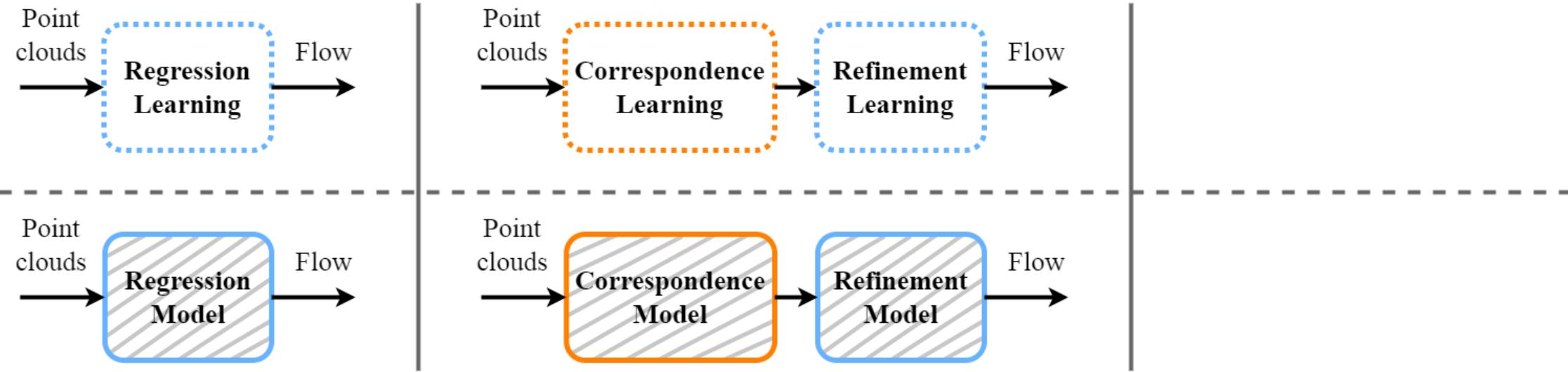


Graph Prior, Pontes *et al.*, 2020

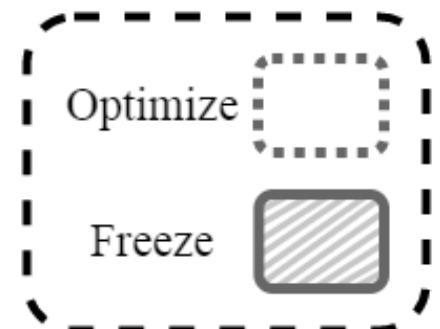
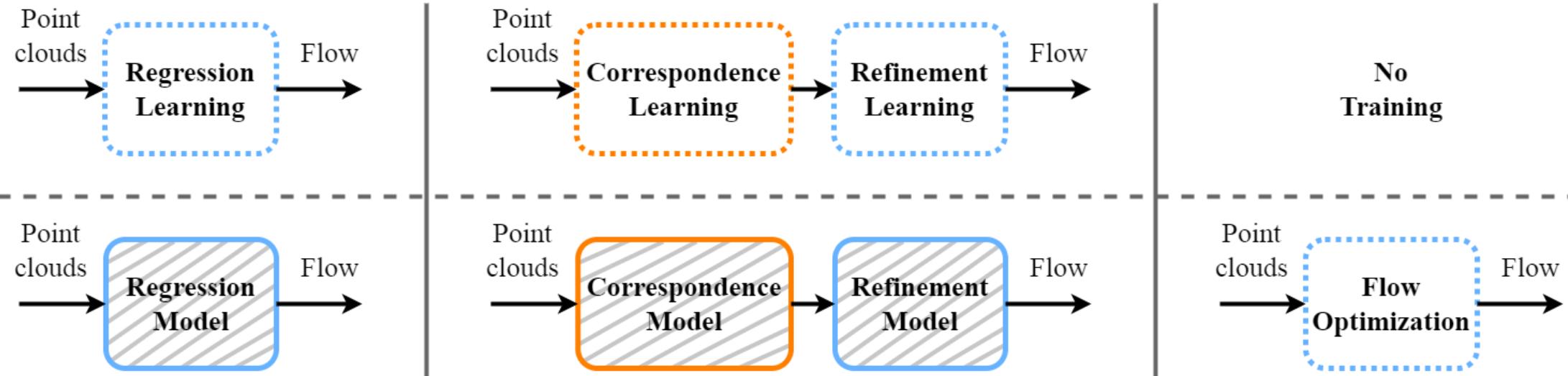
Previous Approaches *vs.* Ours



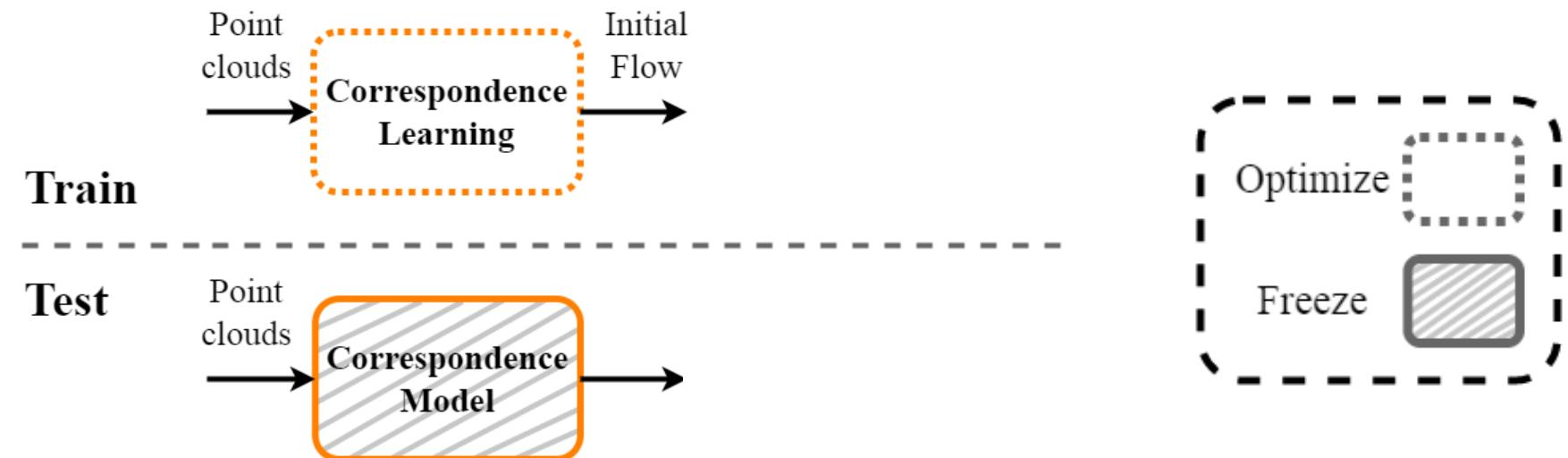
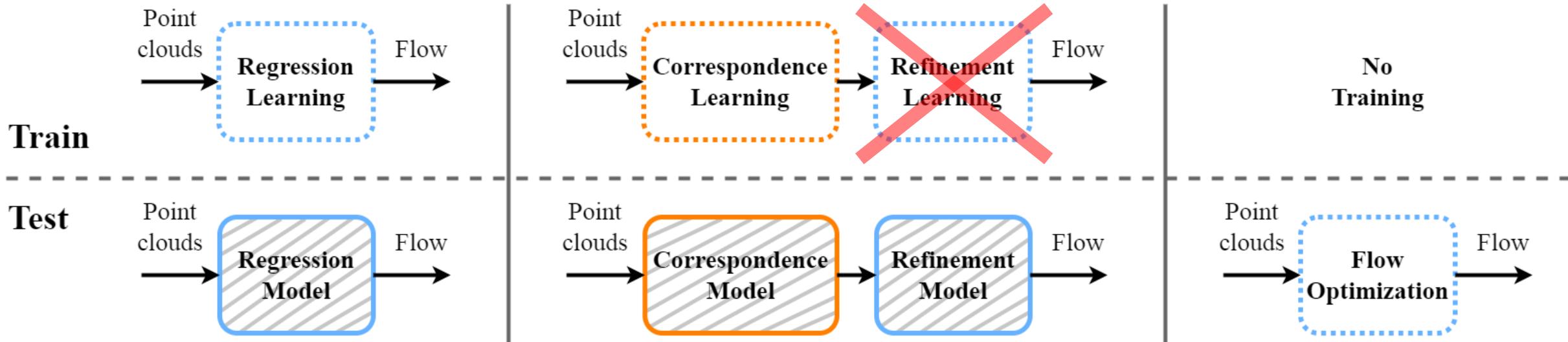
Previous Approaches *vs.* Ours



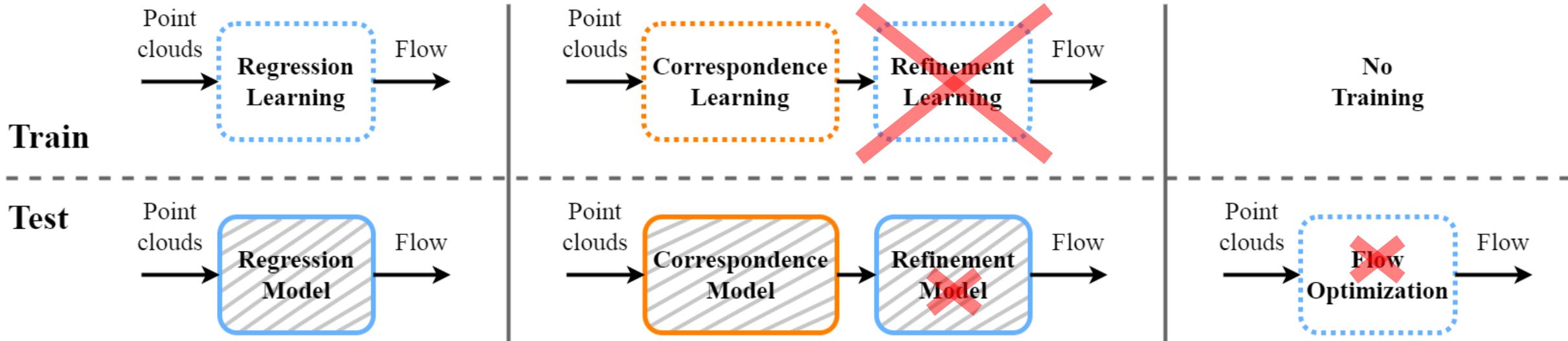
Previous Approaches *vs.* Ours



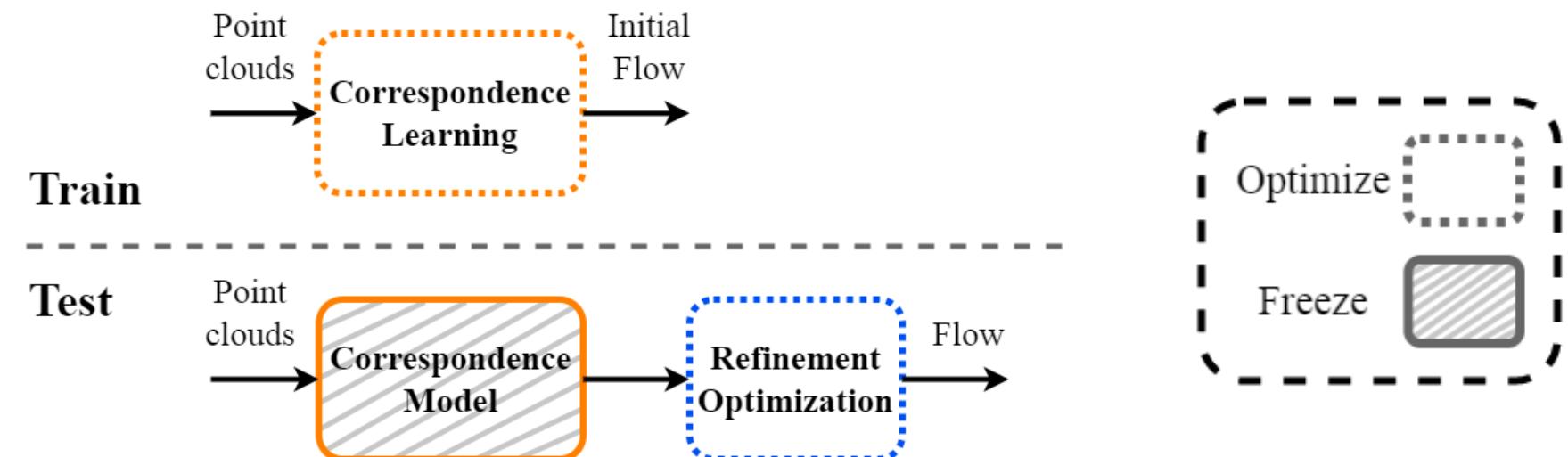
Previous Approaches *vs.* Ours



Previous Approaches *vs.* Ours

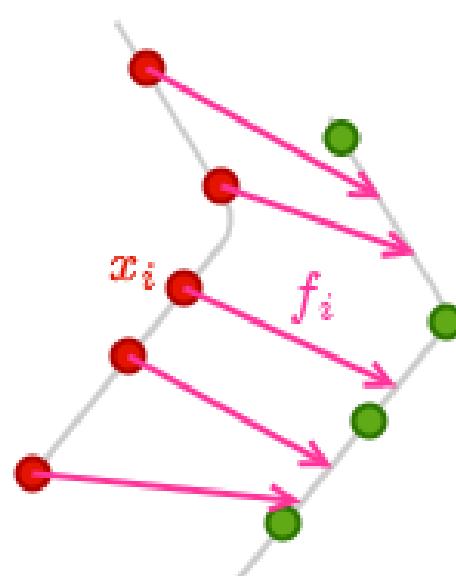


Hybrid!



Self-Supervised Losses

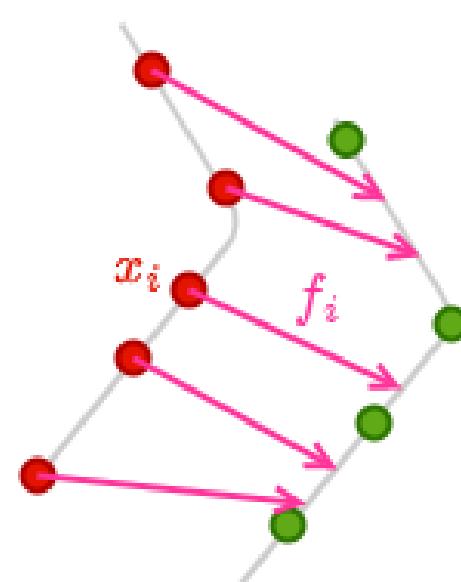
● Source ● Target



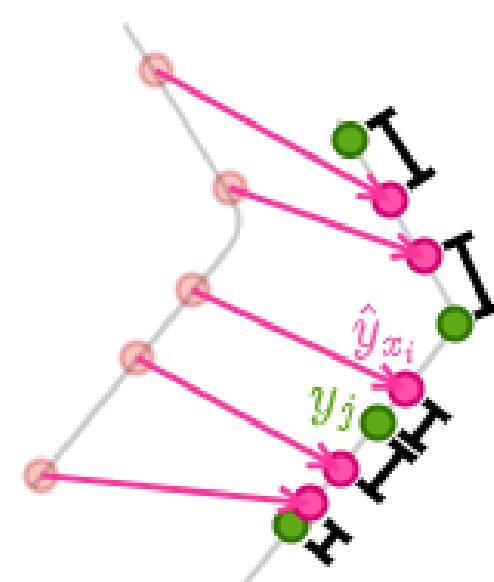
Flow before refinement

Self-Supervised Losses

● Source ● Target ● Soft correspondence



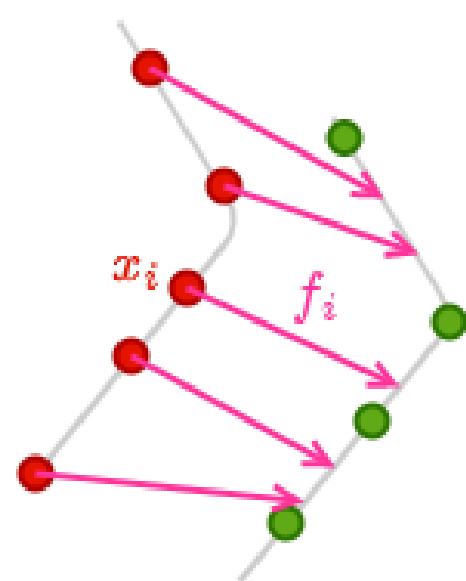
Flow before refinement



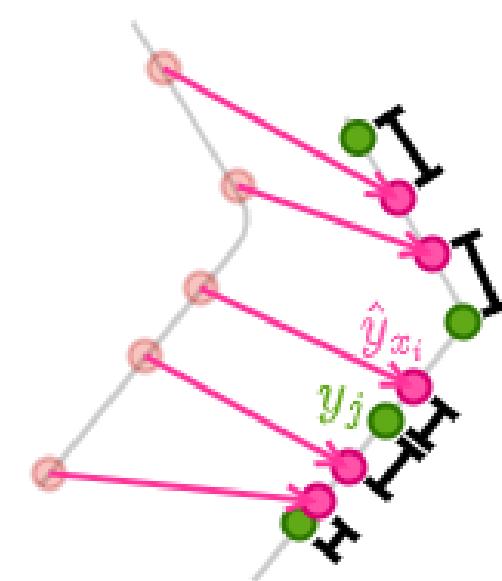
Distance loss

Self-Supervised Losses

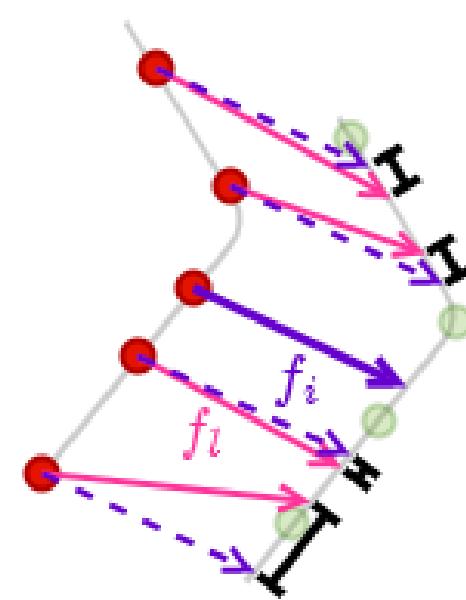
● Source ● Target ● Soft correspondence



Flow before refinement



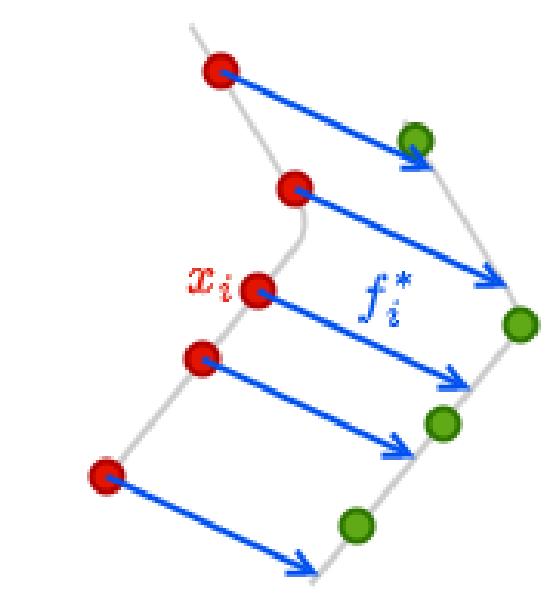
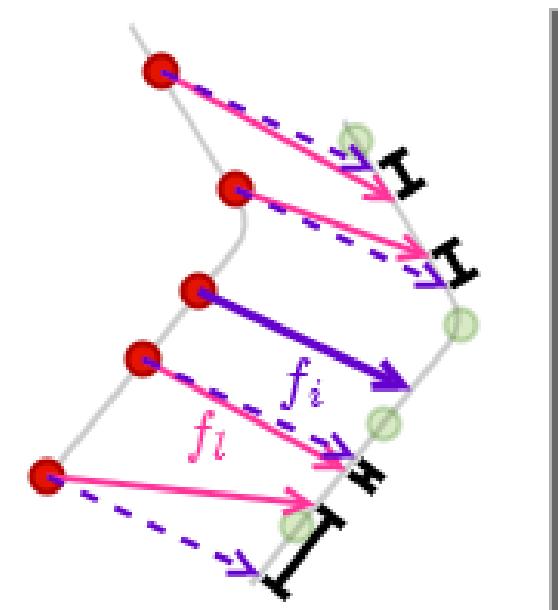
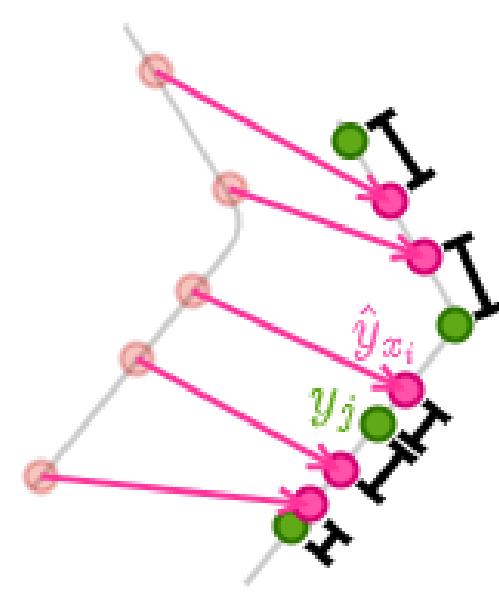
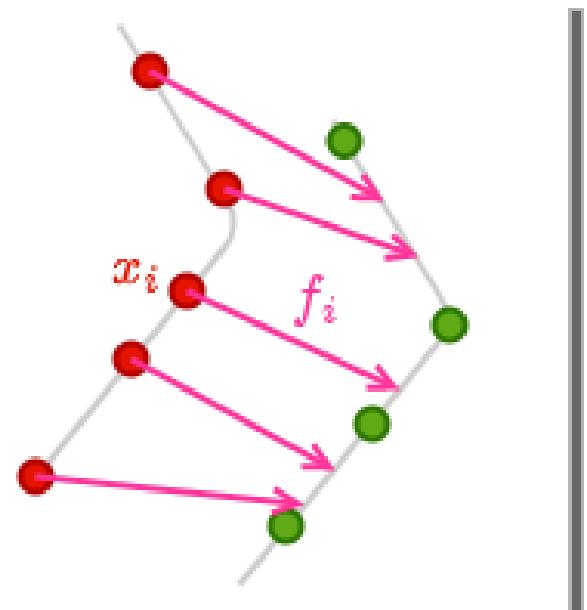
Distance loss



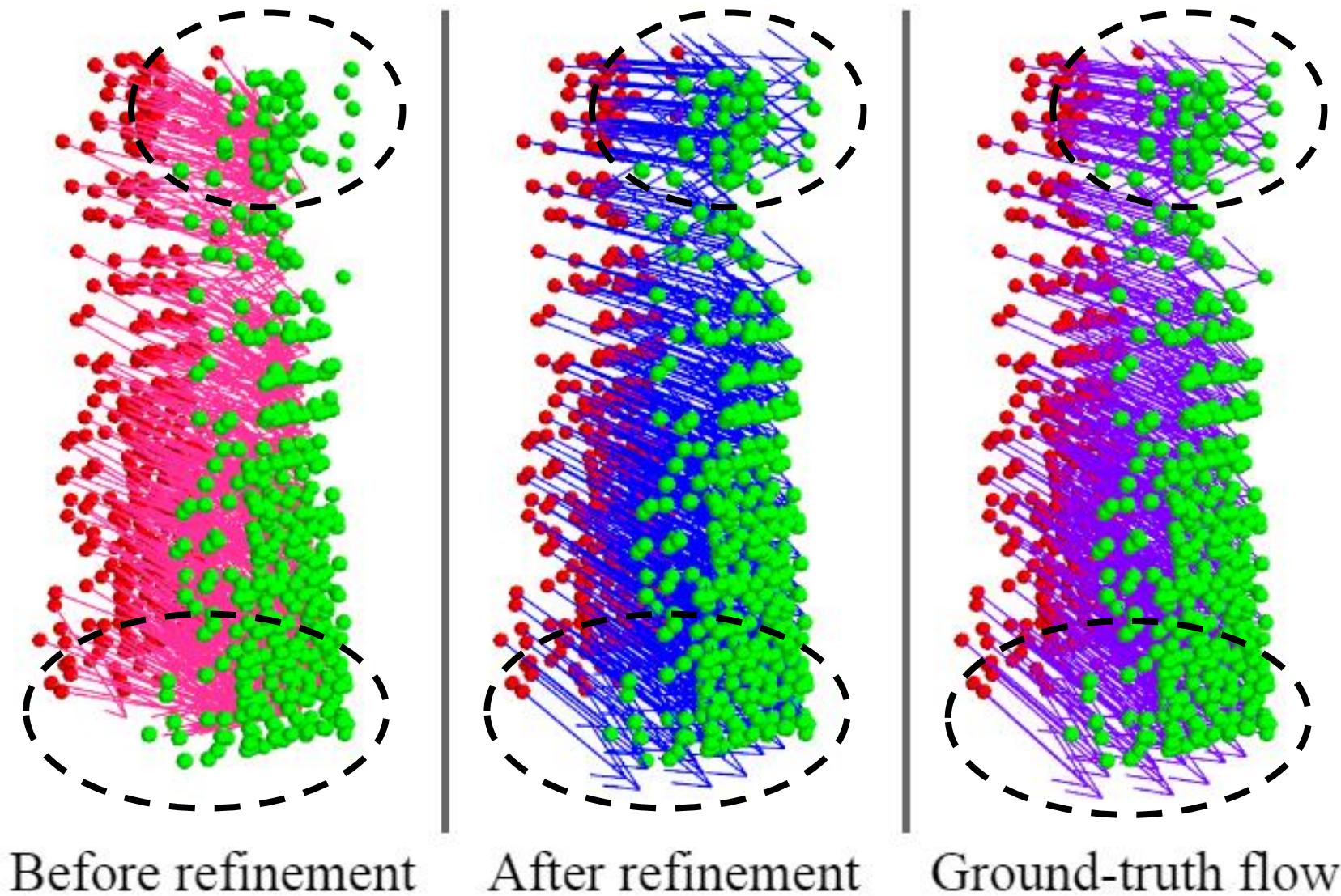
Smoothness loss

Self-Supervised Losses

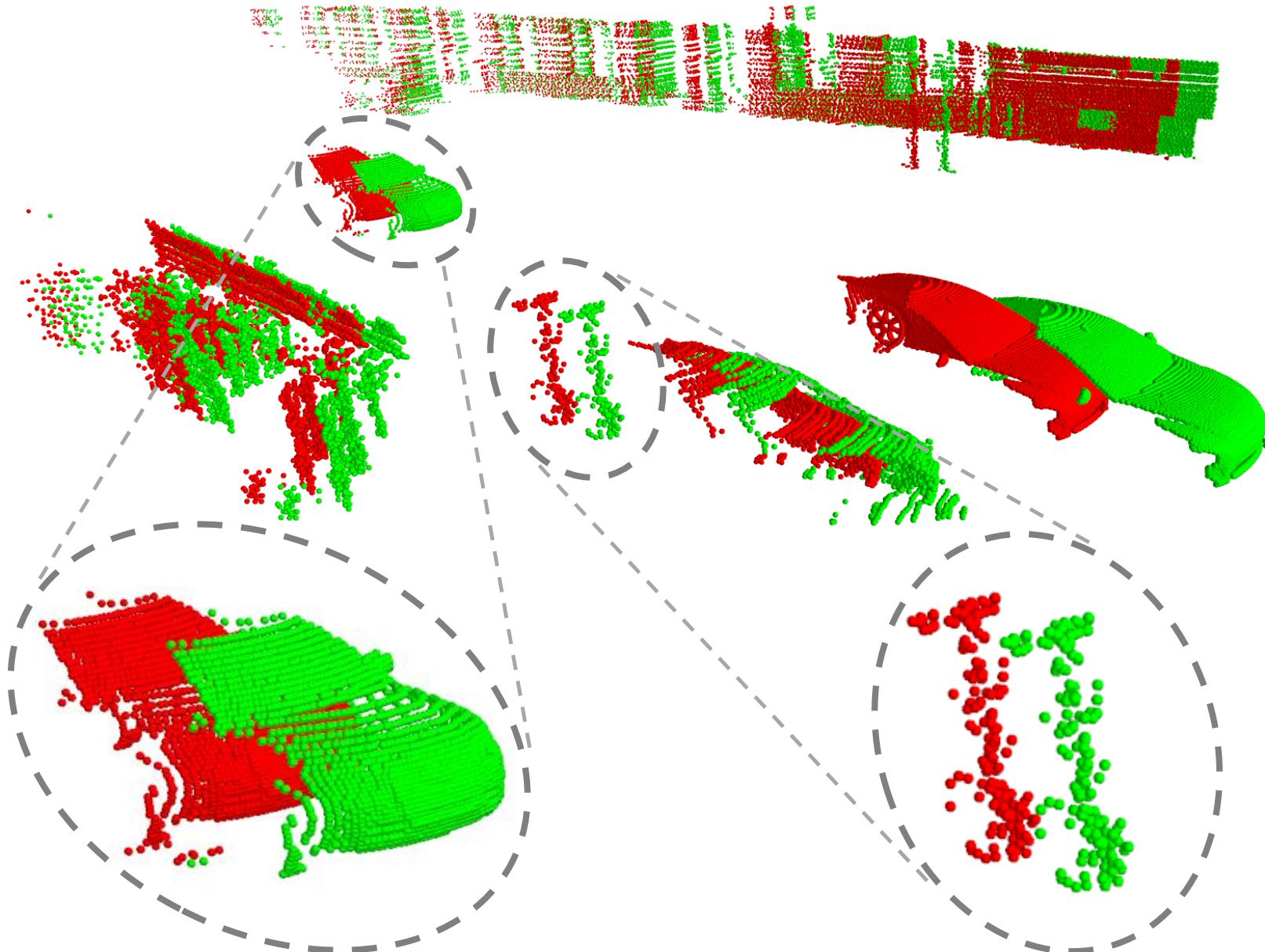
● Source ● Target ● Soft correspondence



The Flow Refinement Effect

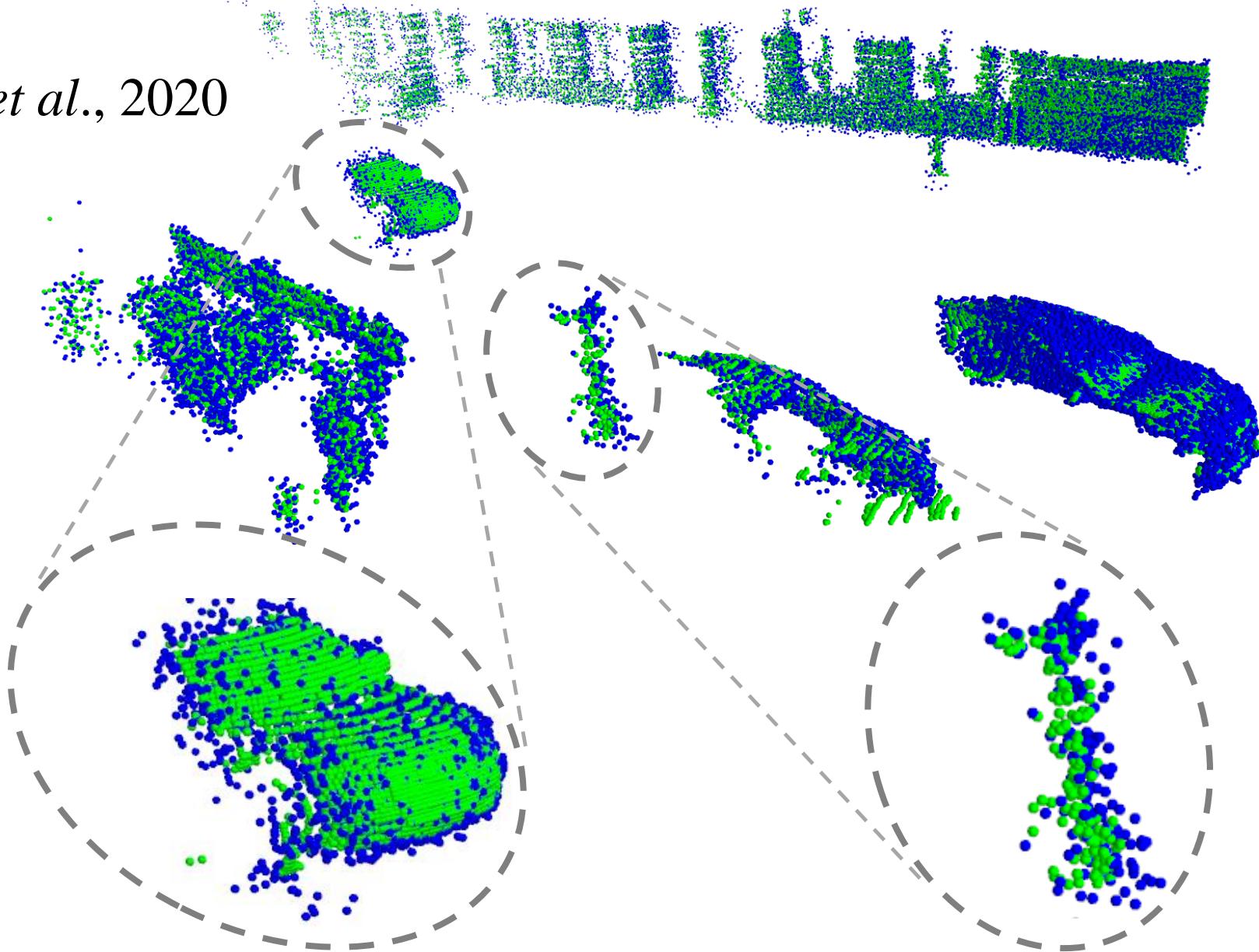


Visual Comparison



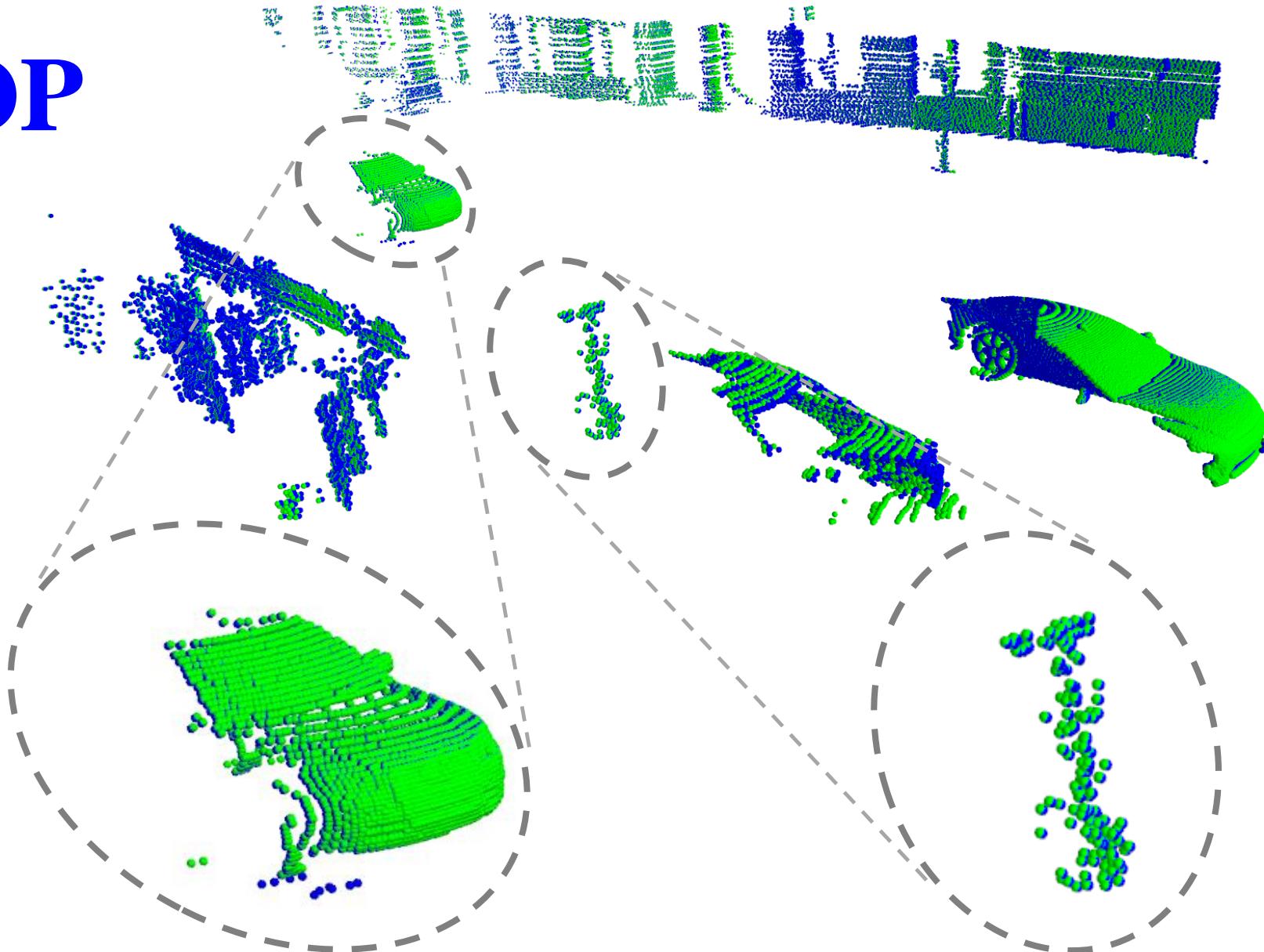
Visual Comparison

FLOT, Puy *et al.*, 2020

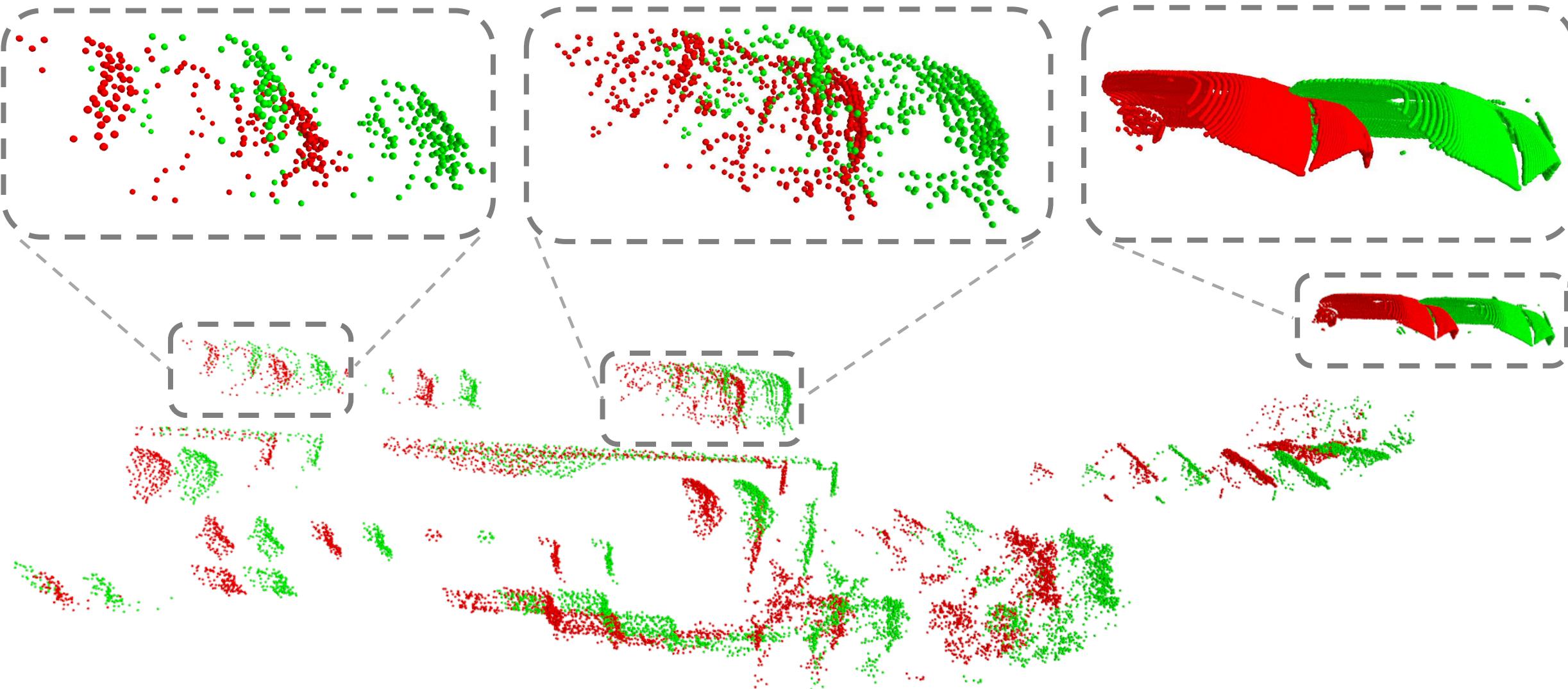


SCOOP

Visual Comparison

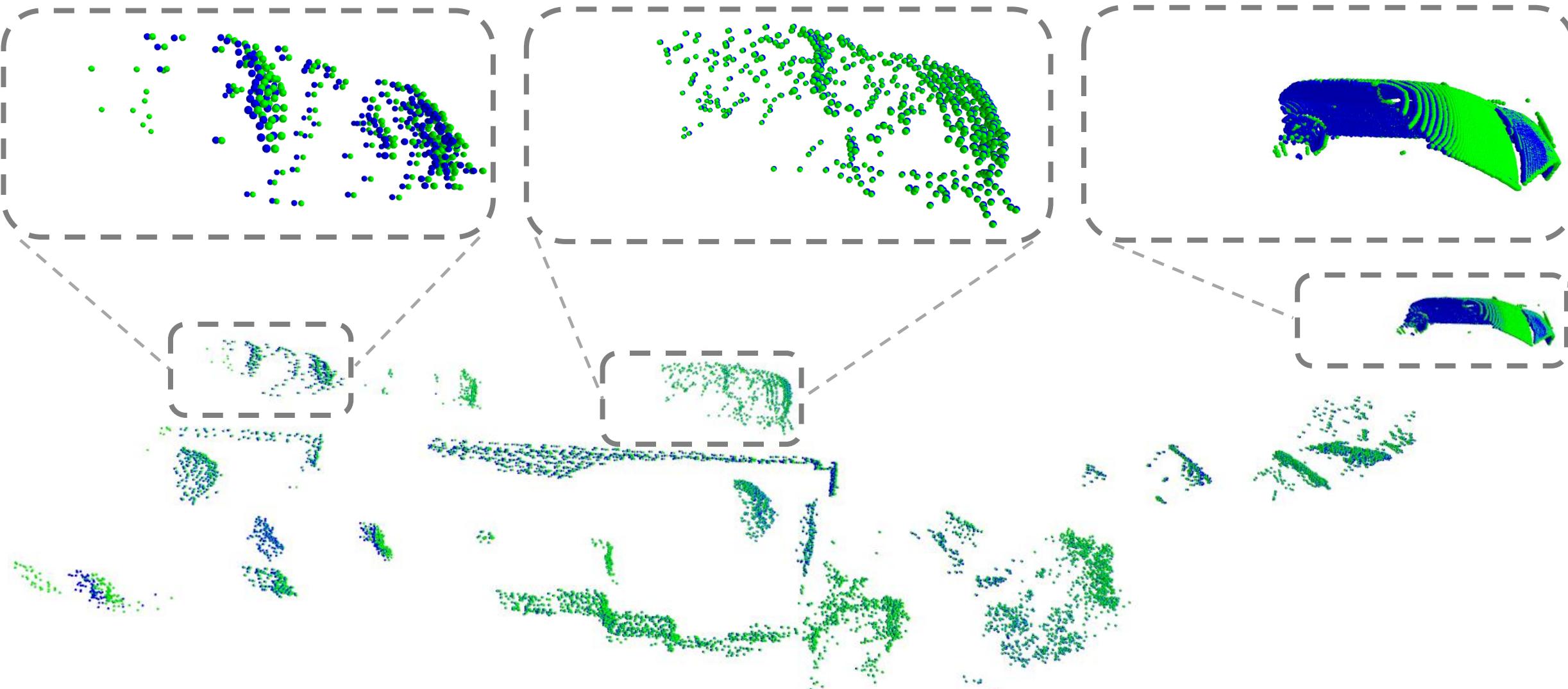


Varying Point Density



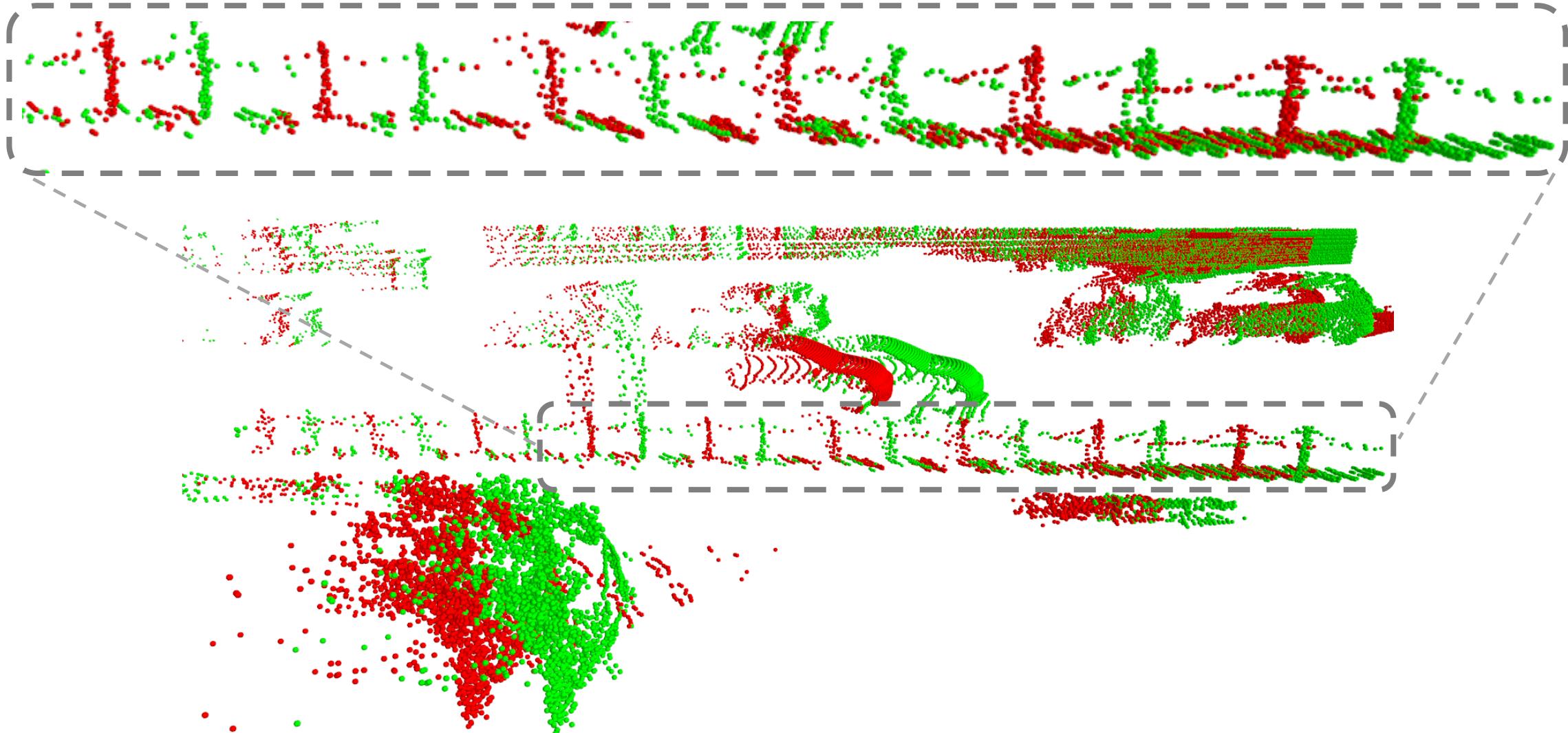
Input **source** and **target** point clouds

Varying Point Density



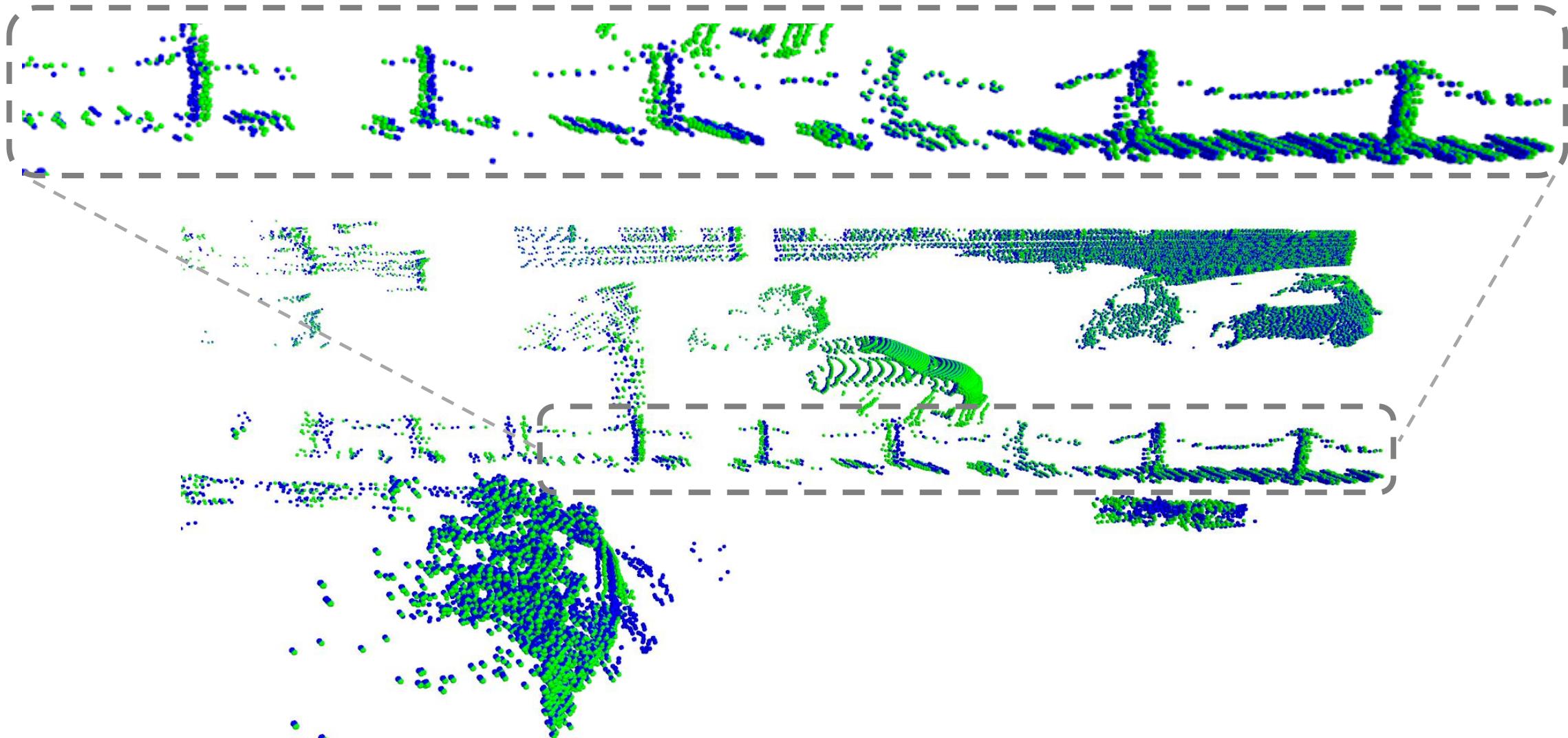
SCOOP's result

Repetitive Structures



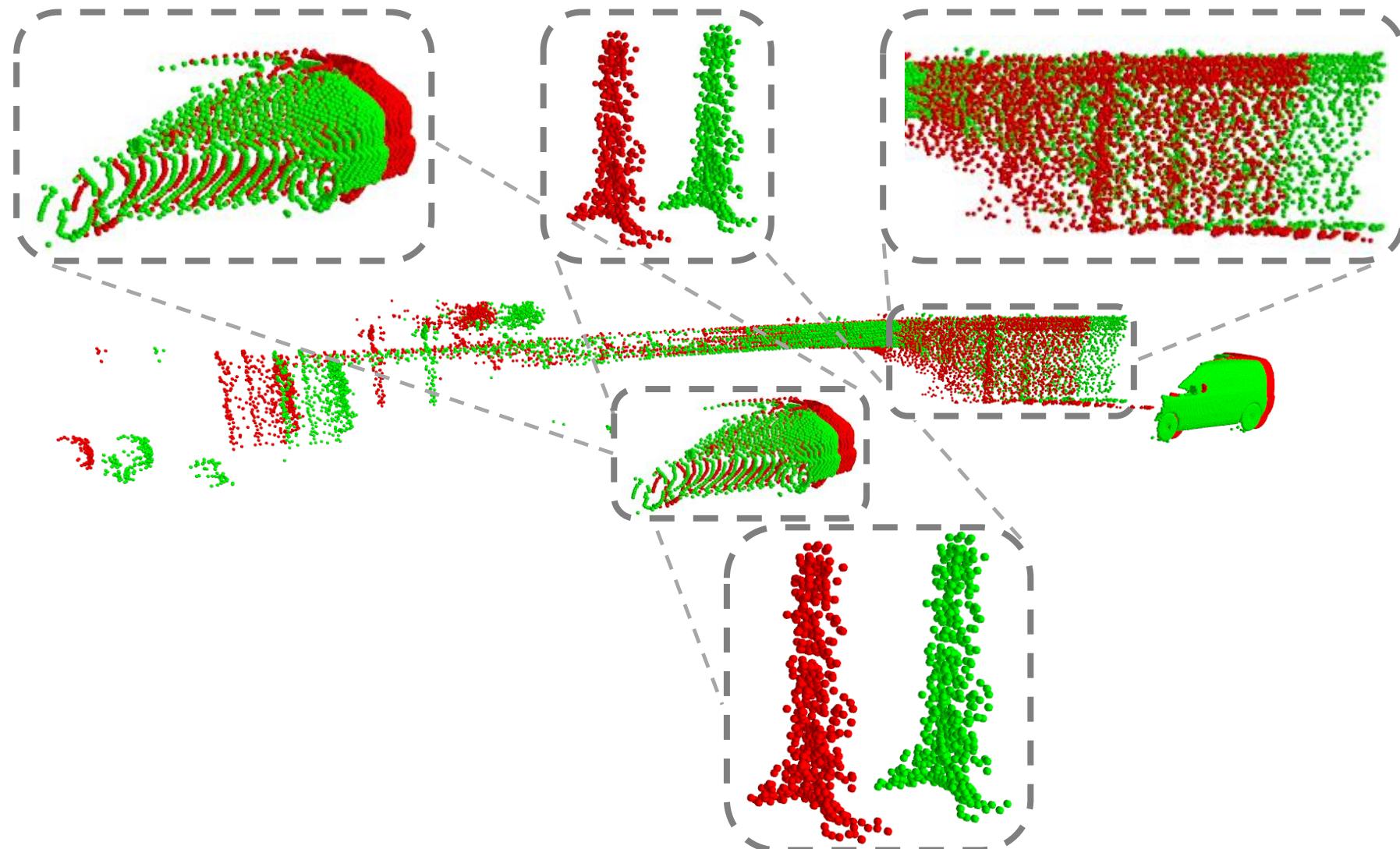
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Repetitive Structures



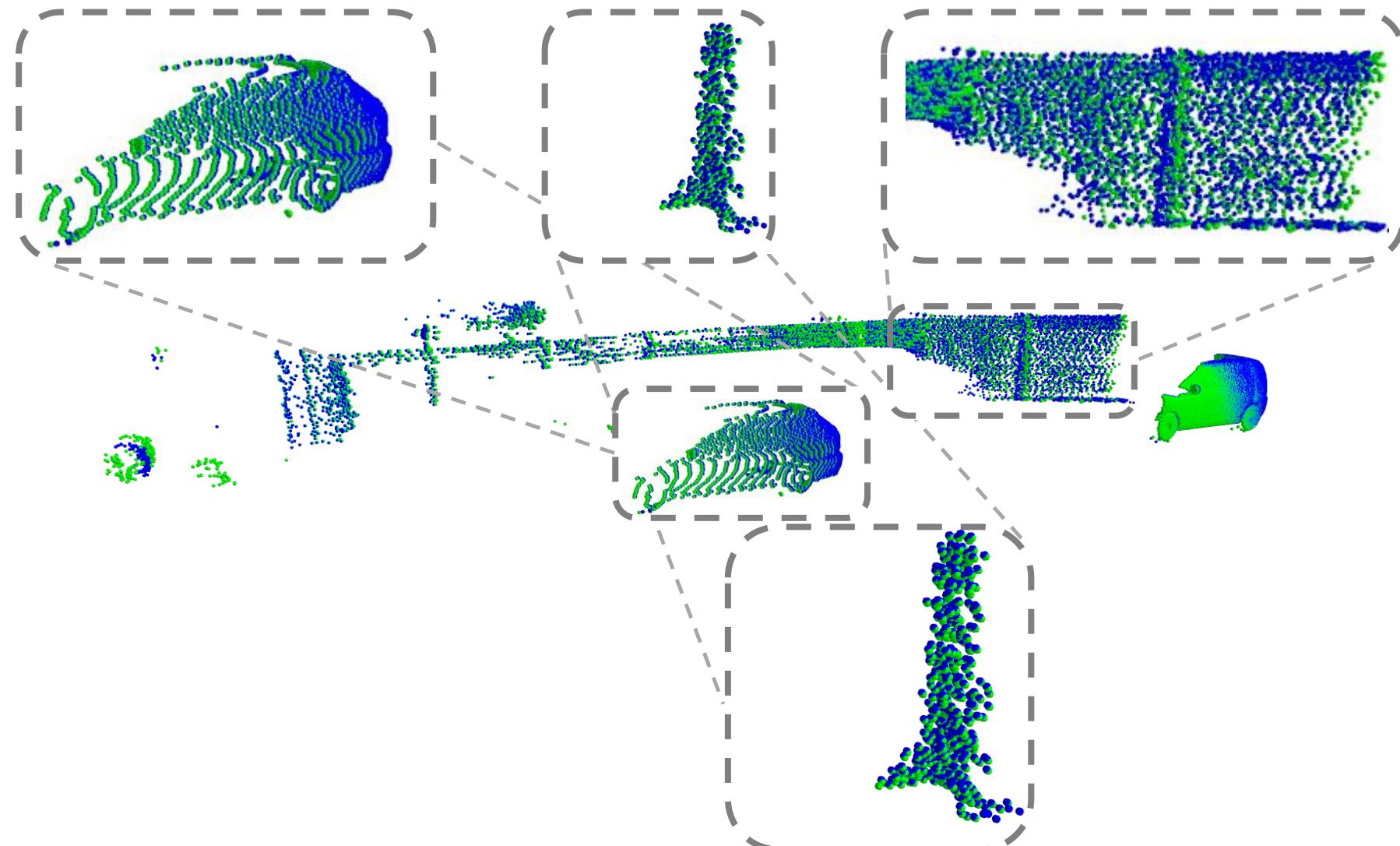
SCOOP's result

Different motion and Geometry



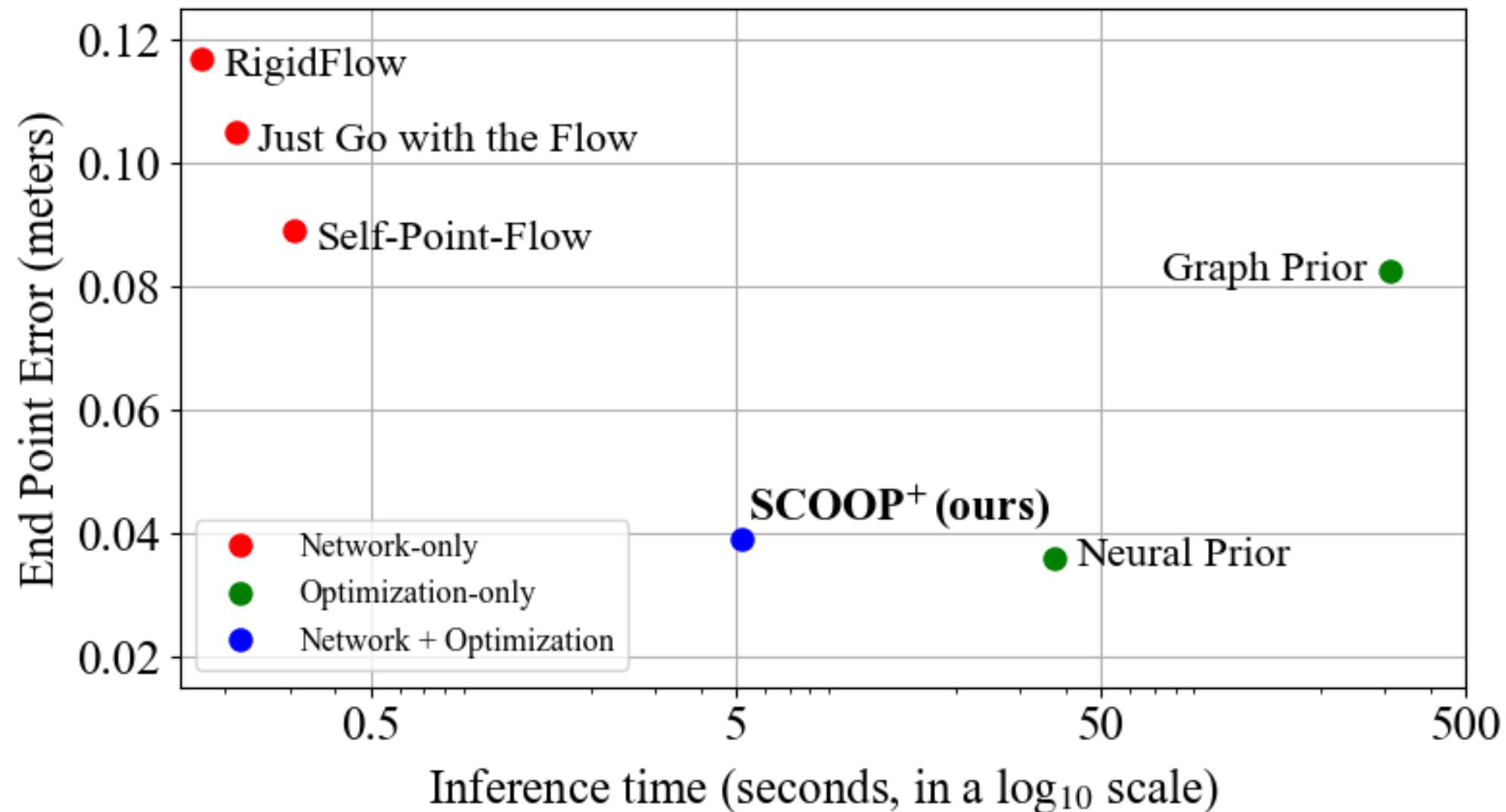
Input **source** and **target** point clouds

Different motion and Geometry

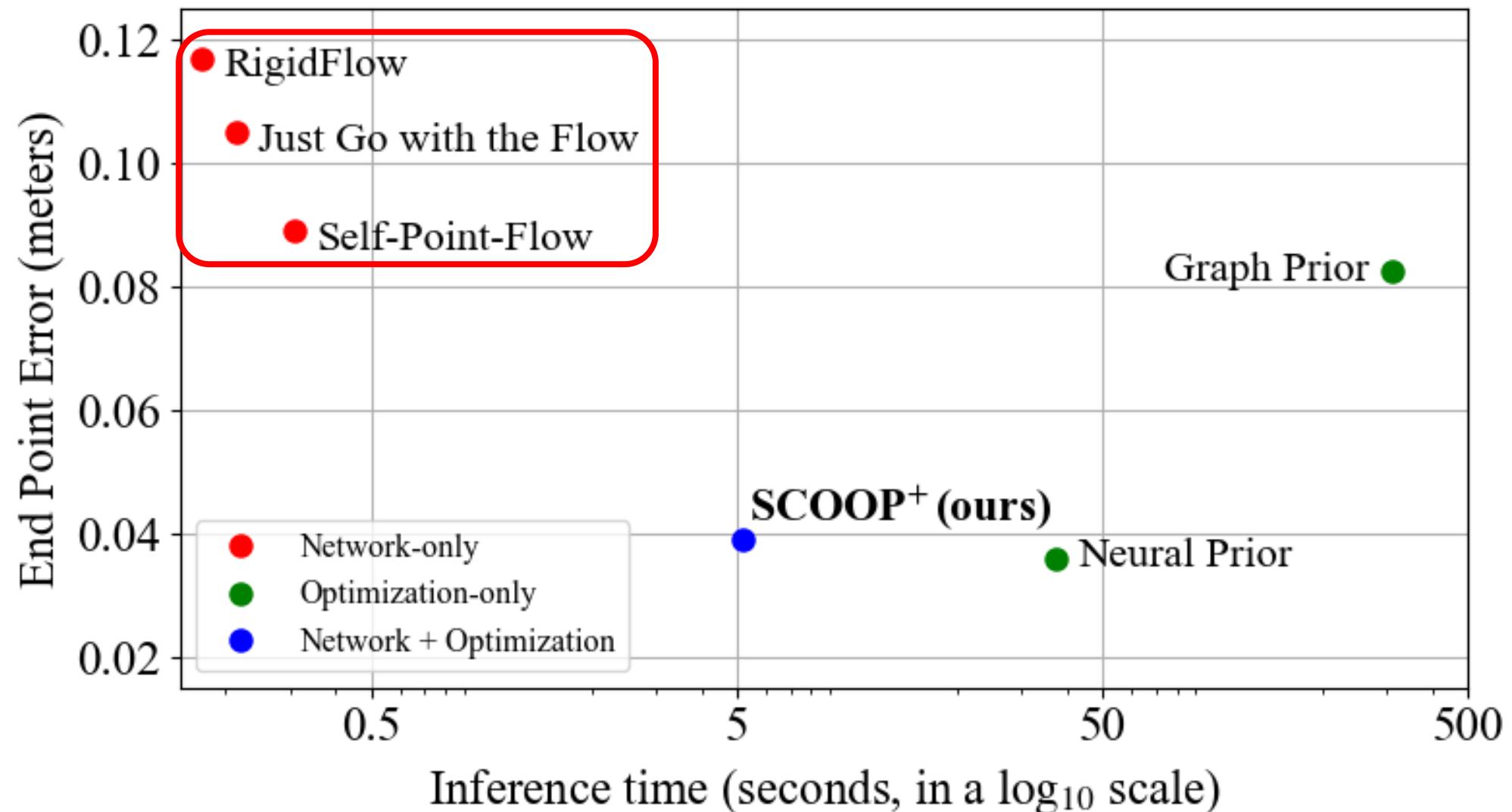


SCOOP's result

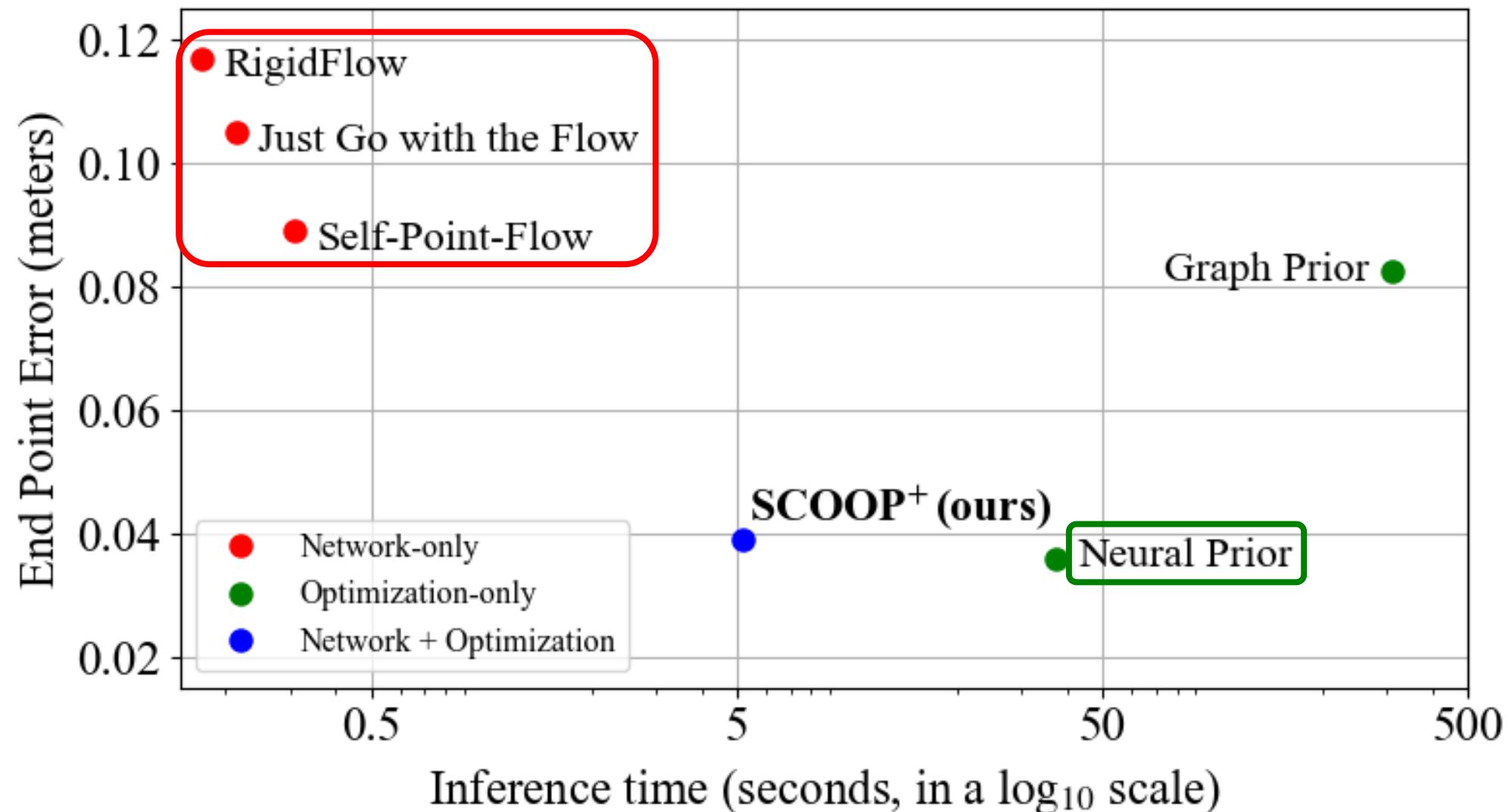
Flow Error *vs.* Inference Time



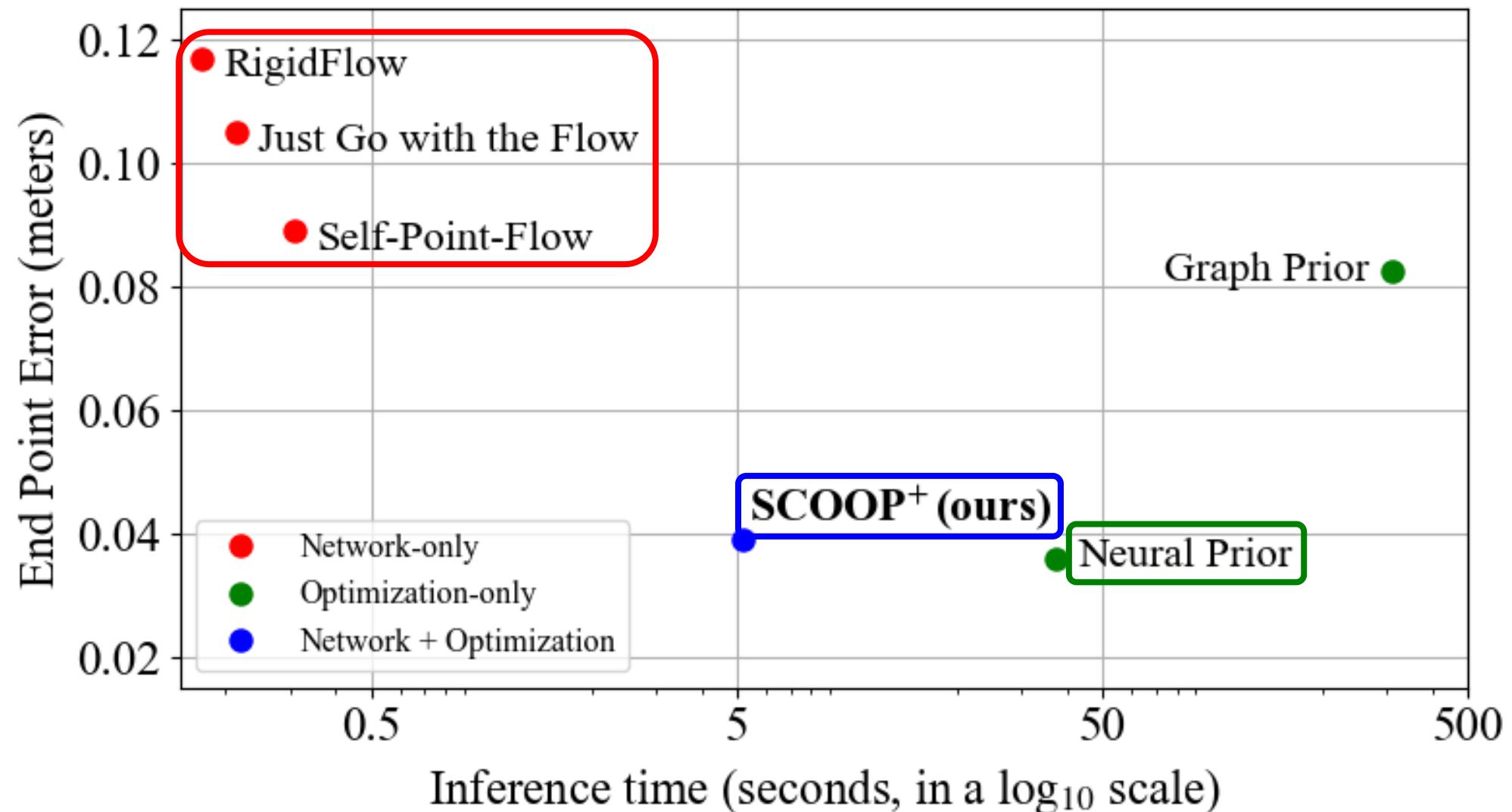
Flow Error *vs.* Inference Time



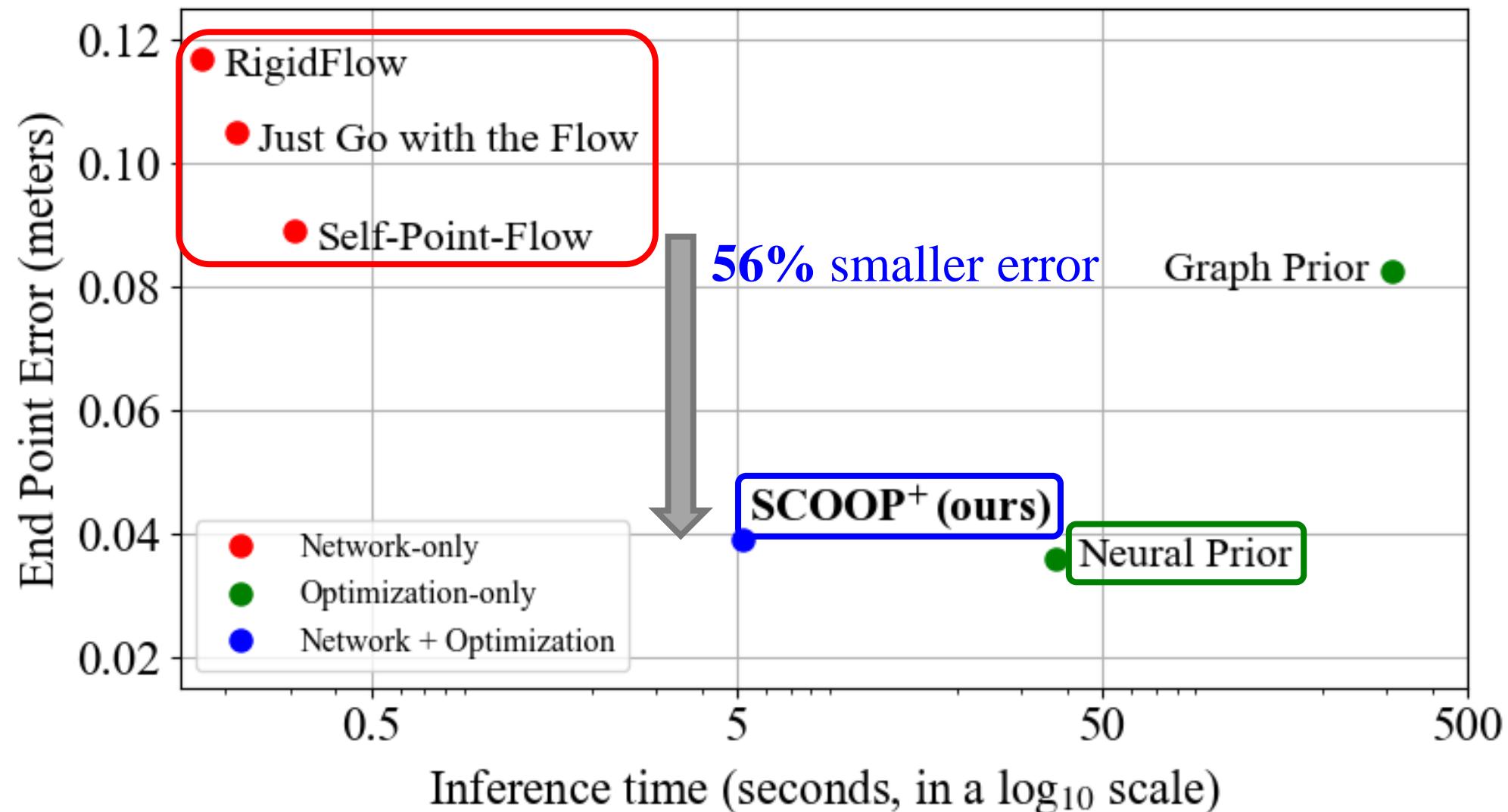
Flow Error *vs.* Inference Time



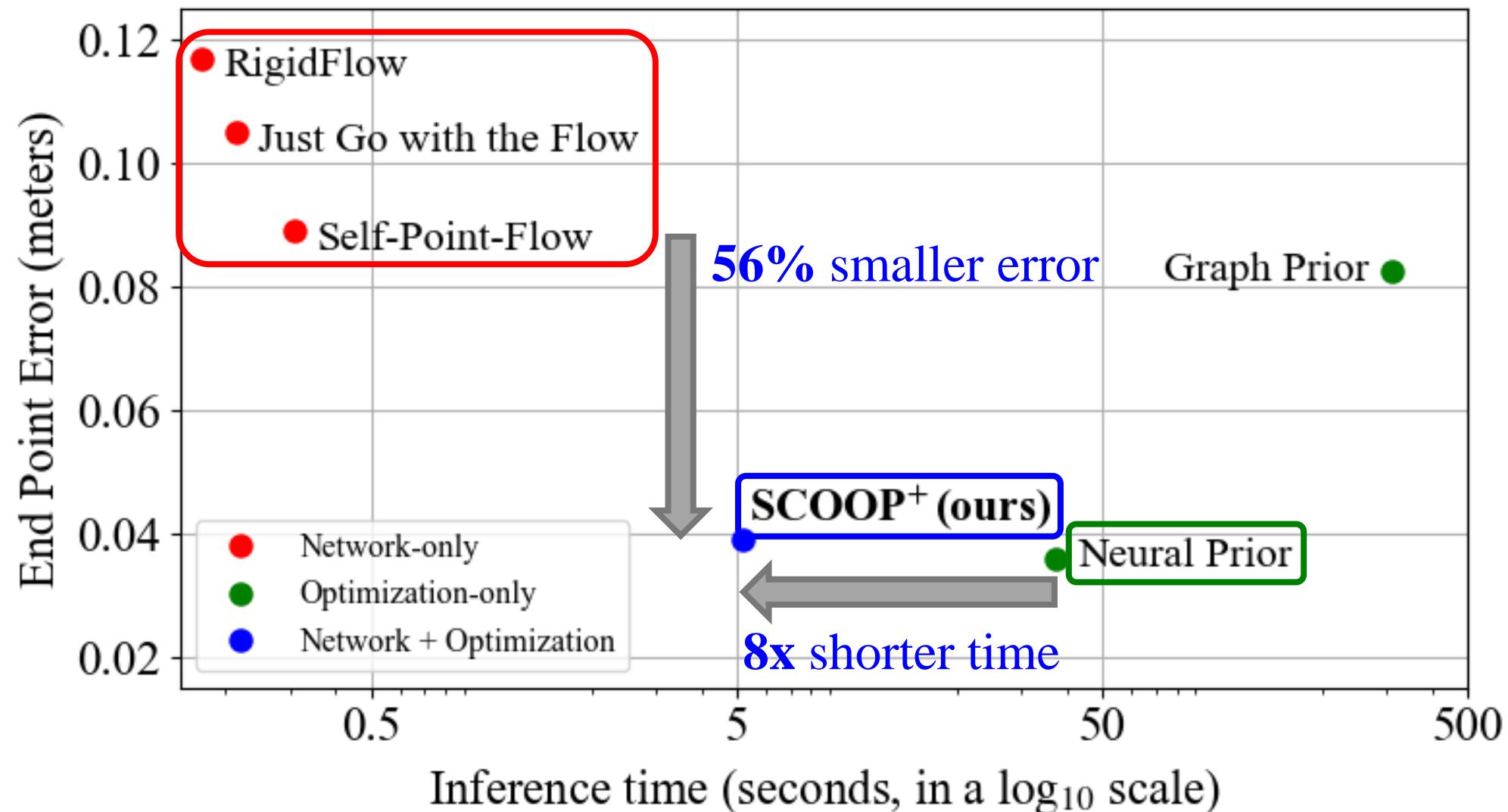
Flow Error *vs.* Inference Time



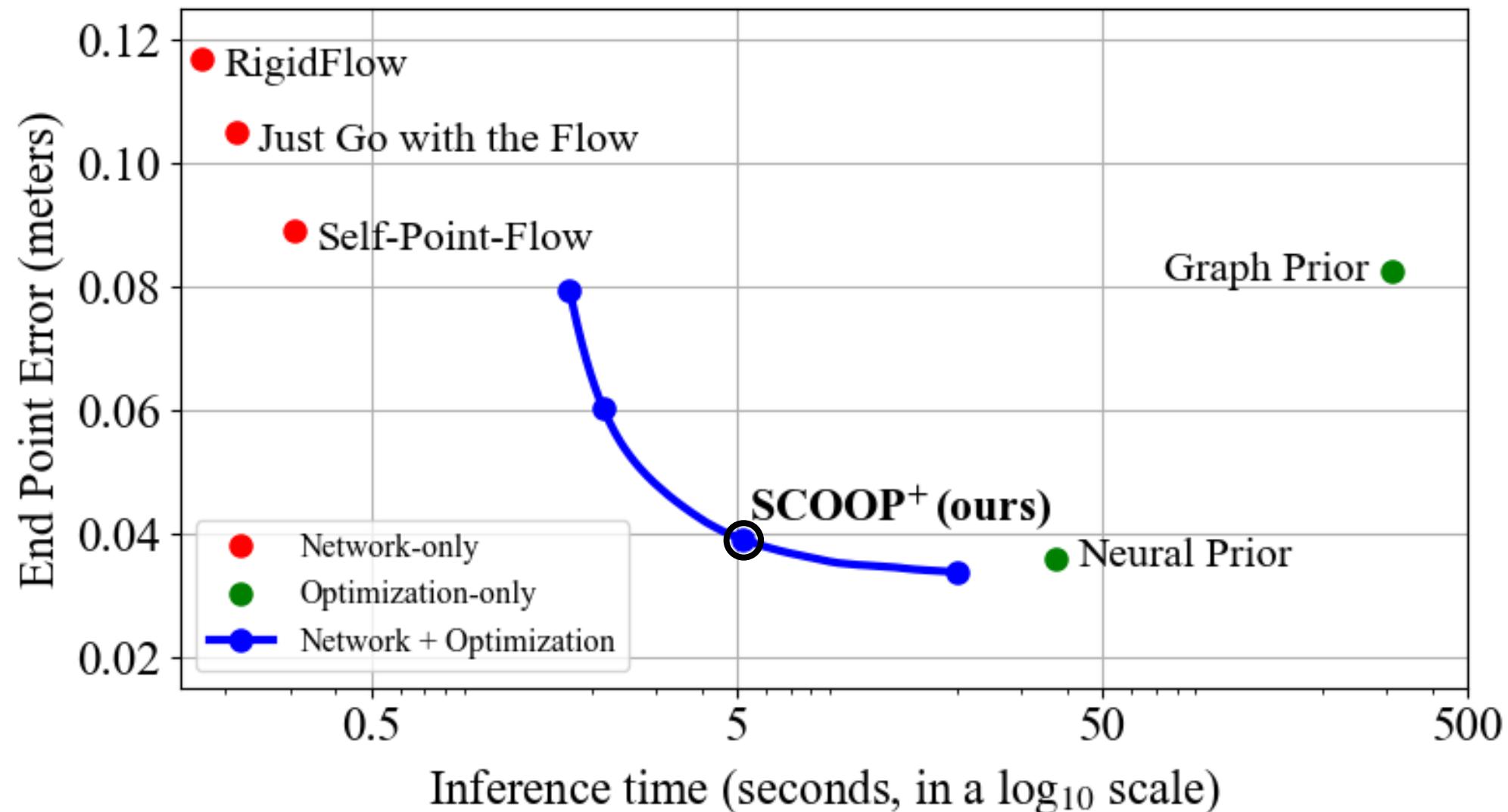
Flow Error *vs.* Inference Time



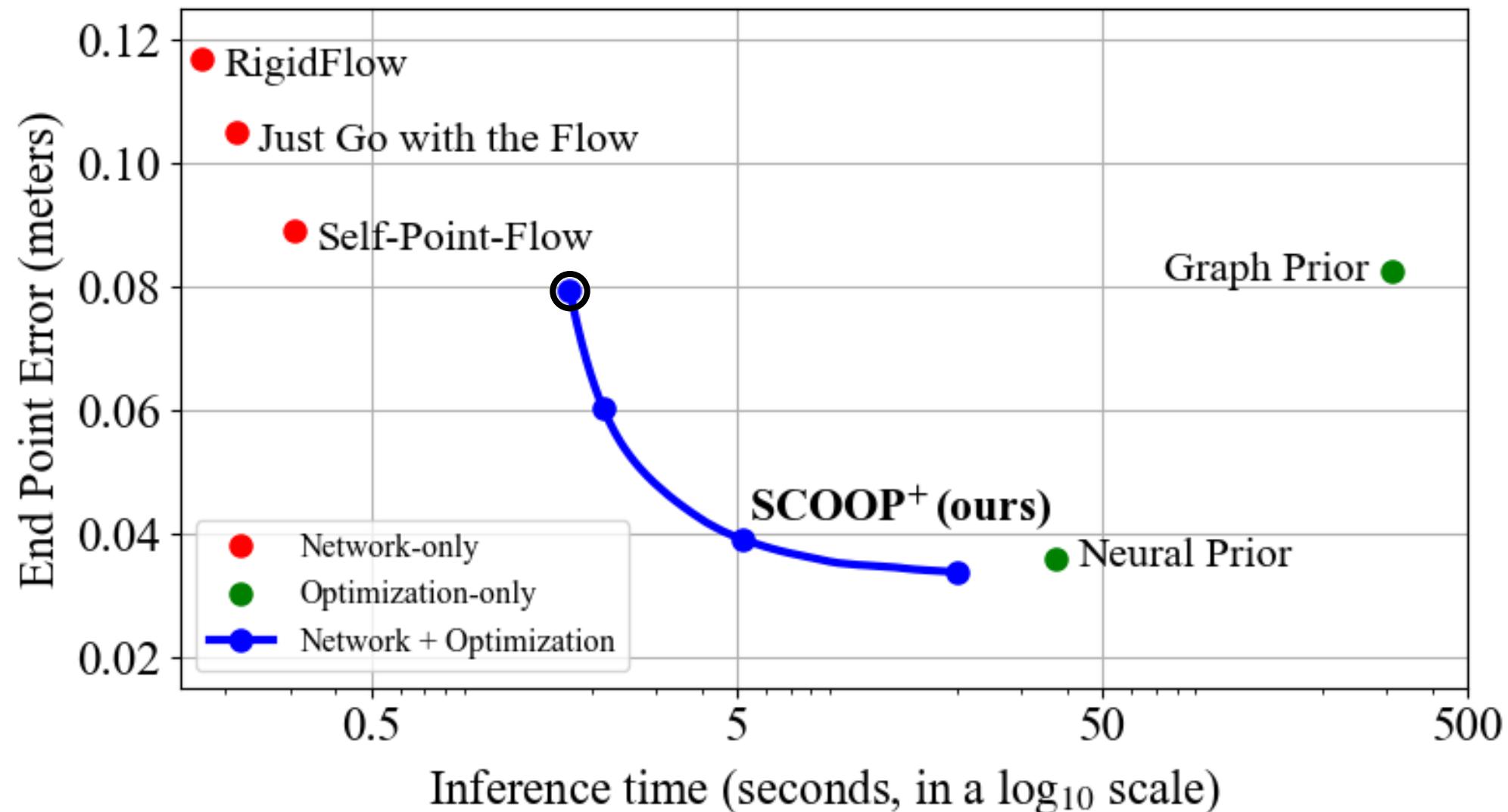
Flow Error *vs.* Inference Time



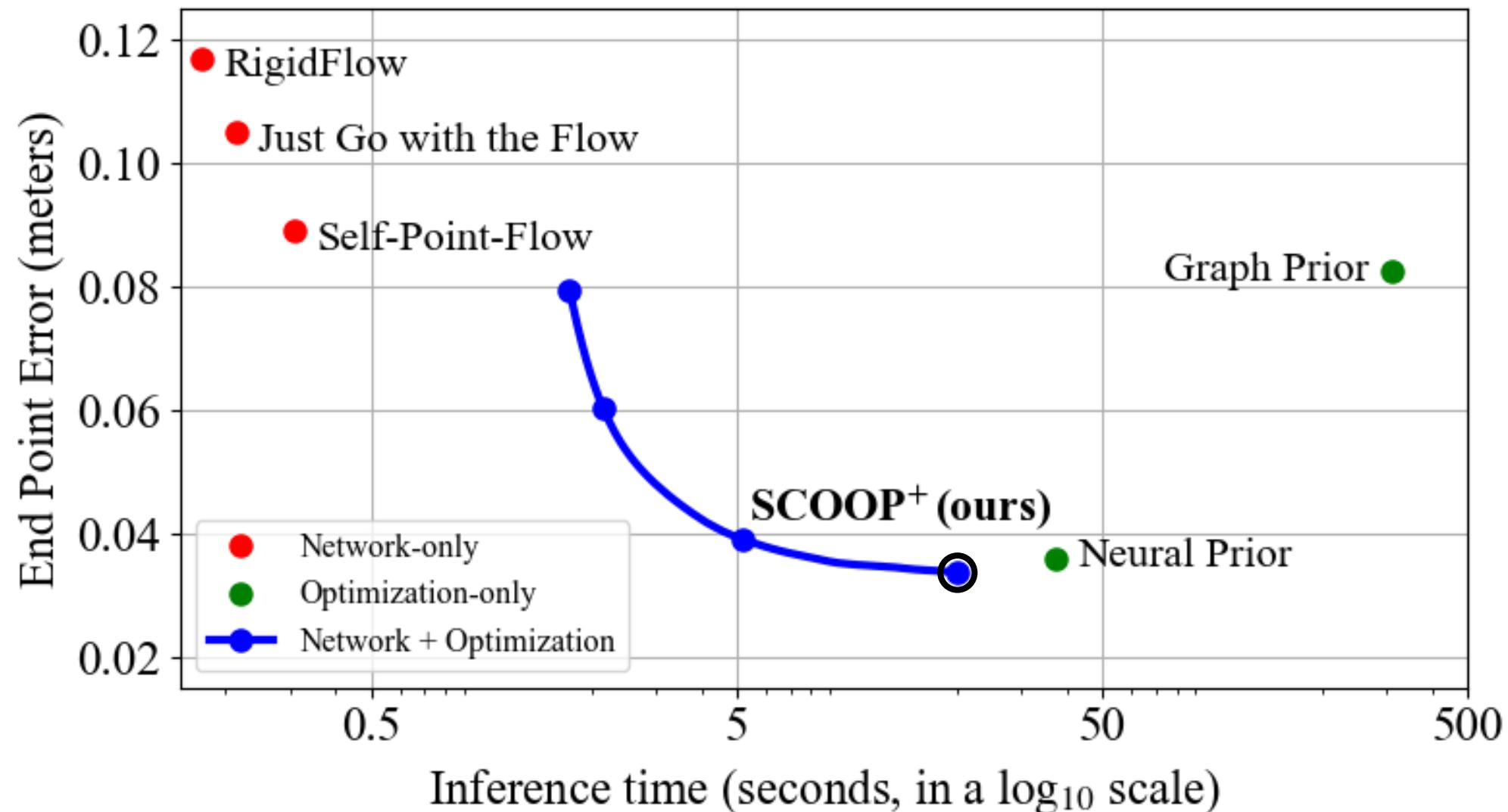
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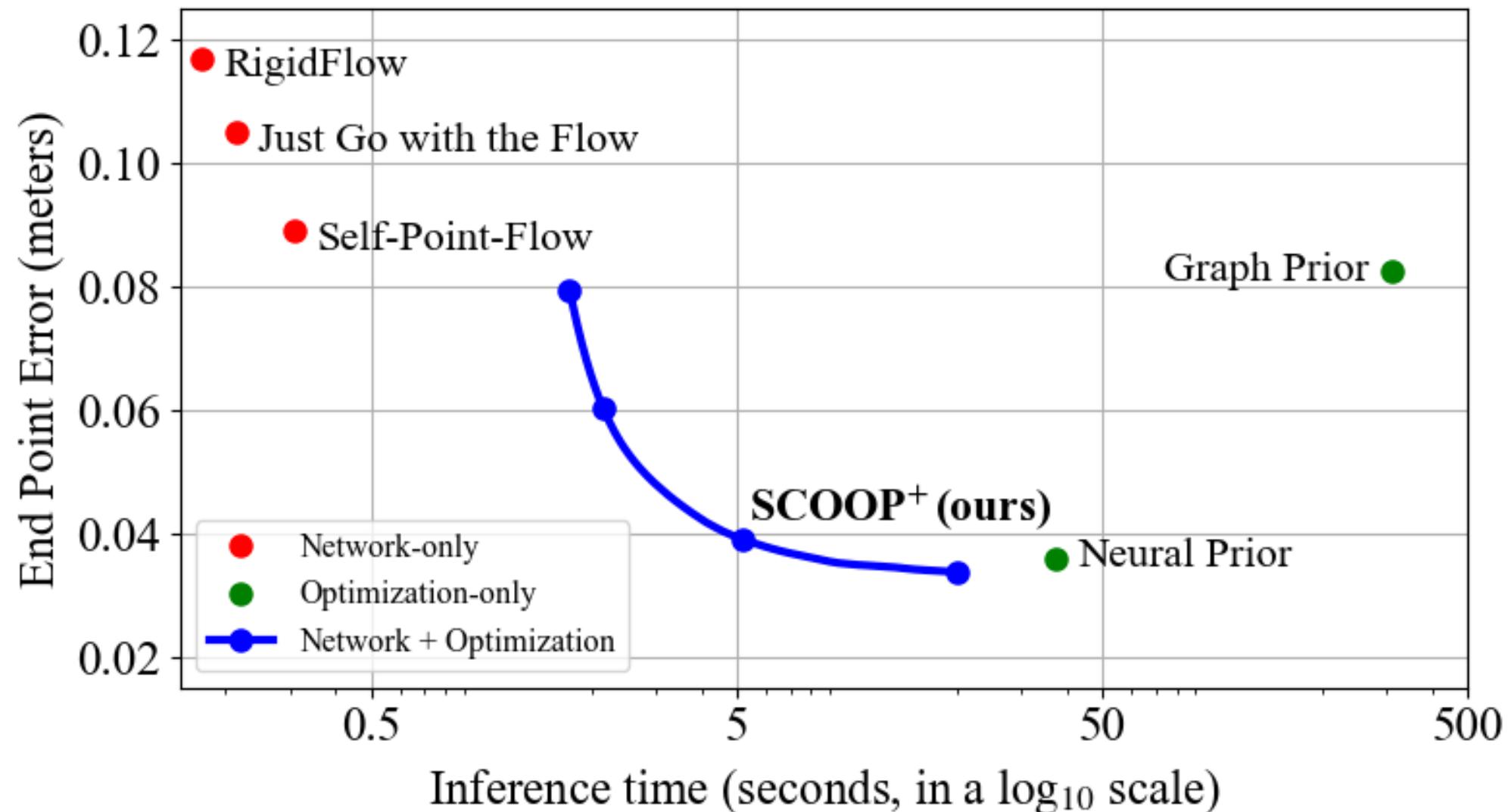
Flow Error *vs.* Inference Time



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Flow Error *vs.* Inference Time

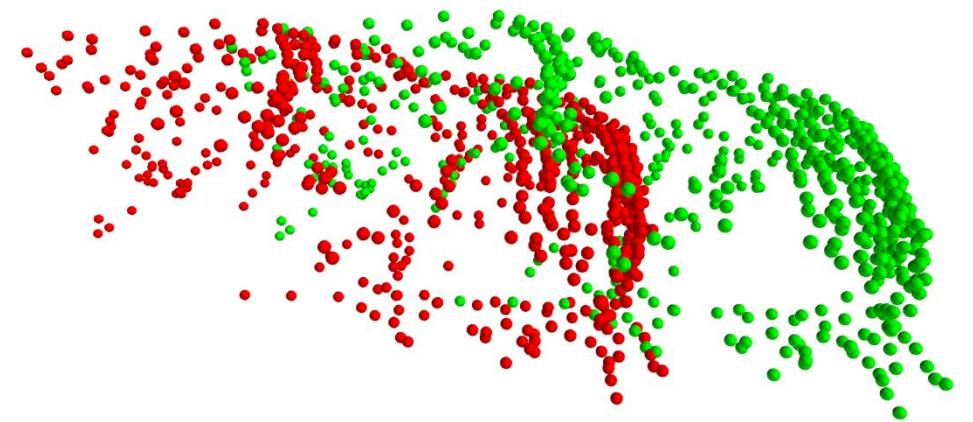


Summary

- A new method for scene flow estimation

Pure correspondence learning and
direct refinement optimization

SCOOP



Summary

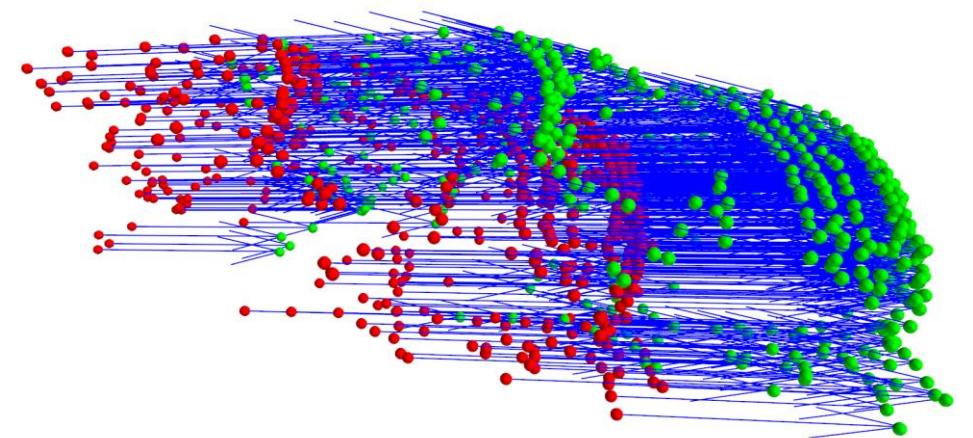
- A new method for scene flow estimation

Pure correspondence learning and
direct refinement optimization

- Achieves state-of-the-art results

Using a fraction of the training data

SCOOP



Summary

- A new method for scene flow estimation

Pure correspondence learning and
direct refinement optimization

- Achieves state-of-the-art results

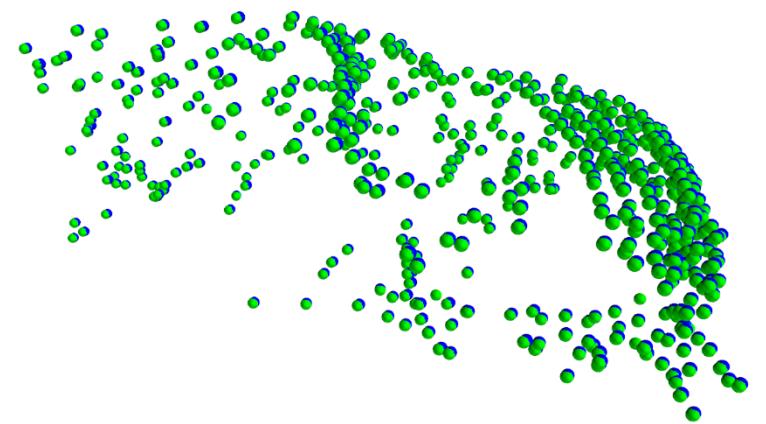
Using a fraction of the training data

- Our code is publicly available

<https://github.com/italang/SCOOP>



SCOOP



THANK YOU!