Politecnico di Torino
Dipartimento di Automatica e Informatica

PhD in Computer and Control Engineering
XXXVI cycle

ISTITUTO ITALIANO DI TECNOLOGIA

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Cross-Domain 3D Visual Learning

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1. Introduction

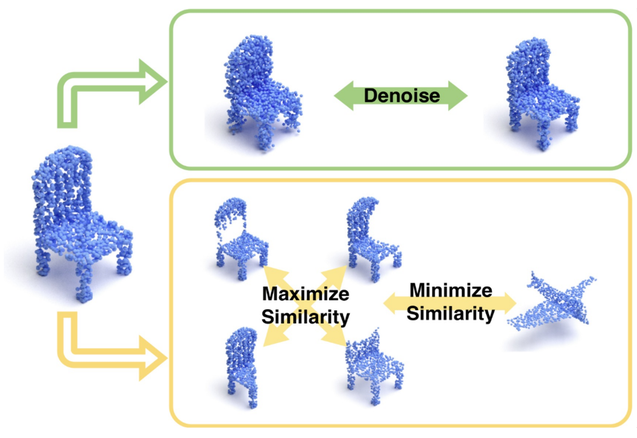
Depth-cameras and **LiDAR** sensors are important tools for agents that need to perceive the world and interact with it, thus 3D data learning algorithms are quickly becoming essential. However, the task of fully understanding the **3D real-world** still remains far-fetched.
My research investigates 3D scenarios with a focus on the introduction of **cross-domain** and **open-set methods for 3D vision applications**.

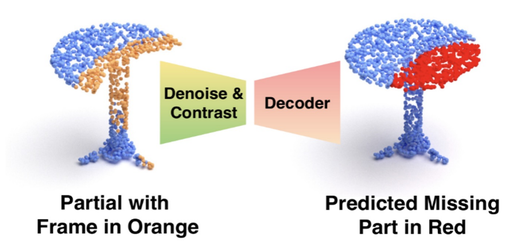
2. Synthetic vs Real-World 3D data

- **Synthetic data** are obtained from human designed CAD models. They exhibit a very **clean geometry** and are **annotated**.
- **Real-World 3D data** are obtained through consumer device 3D sensors, are affected by **occlusion**, **artifacts**, and cluttered with **noise** and **background**. Moreover, real-world 3D scans are **not annotated**.
- **Domain Shift:** Synthetic vs Real World

3. 3D Shape Completion [1]

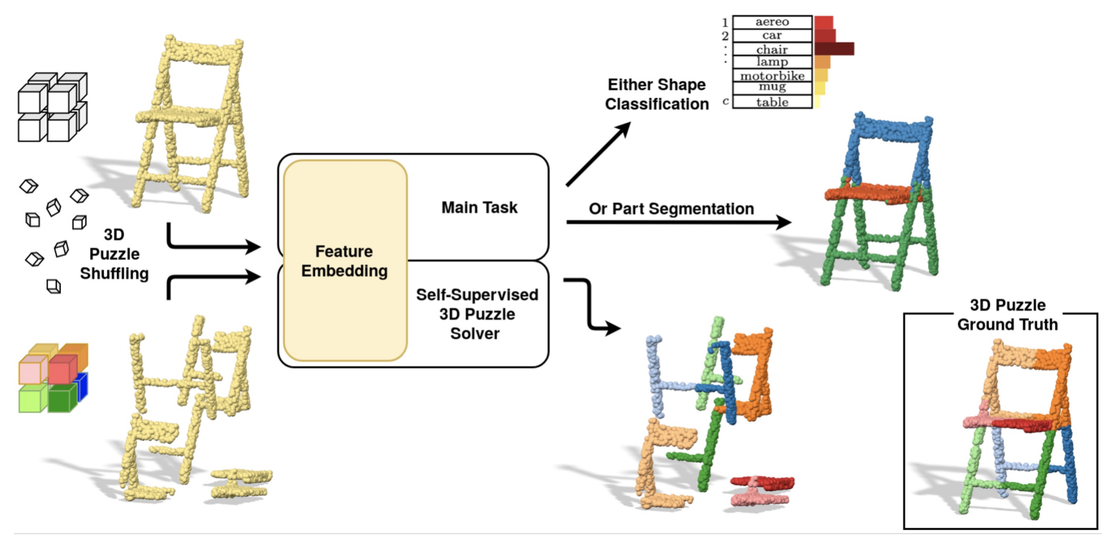
3D Shape Completion aims to estimate the complete geometry of a 3D object from a partial and noisy observation.





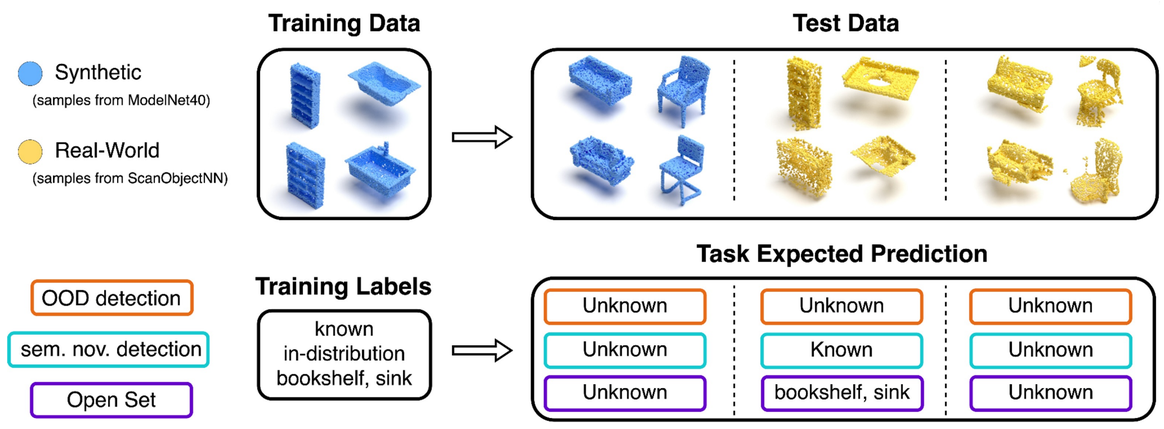
4. 3D Cross-Domain Classification [2]

We propose a **multi-task approach that combines supervised and self-supervised learning**. We use self-supervision for dealing with **data annotation scarcity** and **bridge knowledge between synthetic and real-world** 3D domains.



5. 3D Open Set Learning [3]

Most existing machine learning models rely on the assumption that train and test data are from the same distribution. This assumption fails to hold when models are deployed in the real-world. It is fundamental to build robust models capable of maintaining their **discrimination ability over the known categories while avoiding prediction for unknown categories**.



6. References

[1] *Denoise and Contrast for Category Agnostic Shape Completion,* Alliegro et al. In: CVPR 2021

[2] *Joint Supervised and Self-Supervised Learning for 3D Real World Challenges,* Alliegro et al. In: ICPR 2020

[3] *3DOS: Towards 3D Open Set Learning - Benchmarking and Understanding Semantic Novelty Detection on Pointclouds,* Alliegro et al. In: NeurIPS 2022