

Marios Loizou

COMPUTER SCIENCE · RESEARCH ASSOCIATE

2 Adrianou Street, Strovolos, Nicosia, Cyprus, 2019

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Research Interests

My research lies in the intersection of **deep learning**, **computer vision** and **geometry processing**, focusing on data-driven 3D segmentation and 3D shape analysis. I am particularly interested in deep learning architectures that process 3D shape representations and can infer semantics of real world environments. The latter facilitates scene understanding, with key applications in robotics, autonomous navigation, medical diagnosis and entertainment.

Education

University of Cyprus

PHD IN COMPUTER SCIENCE

Thesis: “Graph-based Neural Network Models for 3D Shape Segmentation”

Advisors: Prof. Evangelos Kalogerakis & Dr. Melinos Averkiou

Nicosia, Cyprus

Jan 2018 — Jun 2024

University of Cyprus

MSC. IN COMPUTER SCIENCE

Thesis: “3D Object Tracking via Gauss-Newton Optimization”

Advisors: Prof. Yiorgos Chrysanthou & Dr. Paris Kaimakis

Nicosia, Cyprus

Sep 2016 — Dec 2017

University of Patras

MENG. IN COMPUTER ENGINEERING & INFORMATICS

Thesis: “System Implementation for Virtual Tour Services Using a Panoramic Camera”

Advisor: Prof. Emmanouil Psarakis

Patras, Greece

Sep 2009 — Jul 2016

Work Experience

CYENS Centre of Excellence

RESEARCH ASSOCIATE

- Work under the supervision of Dr. Melinos Averkiou and Prof. Evangelos Kalogerakis, mainly on deep learning approaches for 3D semantic understanding. My work focuses on graph-based neural networks that can process and analyze 3D shape representations.
- Designed and developed a 3D boundary detector [5], that localizes boundary points between semantic parts or geometric patches.
- Actively participated in the collection, annotation and creation of benchmarks for the BuildingNet dataset [4].
- Implemented a prototype deep learning-based retail shelf monitoring application, with the use of Intel RealSense D430 Depth Camera.
- Designed a deep learning architecture that propagates point-wise feature representations across shapes based on a novel cross-shape attention mechanism [2].
- Member of the organizing committee for the 2nd StruCo3D CVPR workshop.
- Responsible for designing and implementing the BuildingNet Challenge on EvalAI.
- Designed a selective editing mask by leveraging image embeddings extracted from a pretrained vision transformer, for synthesizing building facade images from diverse viewpoints [1].

Nicosia Cyprus

Jul 2018 — Present

Teaching Experience

Department of Computer Science, University of Cyprus

TEACHING ASSISTANT

- Postgraduate courses
 - DSC515: Deep Learning
 - CS607: Visual Computing
 - CS653: Computer Games Engineering
 - MAI644: Computer Vision
- Undergraduate courses
 - CS447: Computer Vision

Nicosia Cyprus

Jan 2018 — Present

Fall 2022

Fall 2018, 2019, 2020, 2021; Spring 2024

Spring 2018, 2019, 2020

Fall 2023

Spring 2021, 2022

Publications

- [1] Yiangos Georgiou, **Marios Loizou**, Tom Kelly, Melinos Averkiou. “FacadeNet: Conditional Facade Synthesis via Selective Editing”, *In Proc. WACV*, 2024

- [2] **Marios Loizou**, Siddhant Garg, Dmitry Petrov, Melinos Averkiou, Evangelos Kalogerakis. “Cross-Shape Attention for Part Segmentation of 3D Point Clouds”, *Computer Graphics Forum (Proc. SGP)*, 42(5), 2023
- [3] Gopal Sharma, Bidya Dash, Aruni RoyChowdhury, Matheus Gadelha, **Marios Loizou**, LiangLiang Cao, Rui Wang, Learned-Miller Erik, Subhransu Maji, Evangelos Kalogerakis. “PRI FIT: Learning to Fit Primitives Improves Few Shot Point Cloud Segmentation”, *Computer Graphics Forum (Proc. SGP)*, 42(5), 2022
- [4] Pratheba Selvaraju, Mohamed Nabail, **Marios Loizou**, Maria Maslioukova, Melinos Averkiou, Andreas Andreou, Siddhartha Chaudhuri, Evangelos Kalogerakis, “BuildingNet: Learning to Label 3D Buildings”, *In Proc. ICCV*, 2021
- [5] **Marios Loizou**, Melinos Averkiou, Evangelos Kalogerakis. “Learning Part Boundaries from 3D Point Clouds”, *Computer Graphics Forum (Proc. SGP)*, 39(5), 2020
- [6] **Marios Loizou**, Paris Kaimakis. “Model-Based 3D Visual Tracking of Rigid Bodies using Distance Transform”, *In Proc. VISUAL*, 2019

Projects

Cross-ShapeNet [2] (GitHub Repo, Project Website, SOTA - 3D Semantic Segmentation on PartNet)

- Introducing a deep learning method that enables long range interactions across 3D shapes.
- This method employs a novel cross-attention mechanism to effectively combine point representations from multiple shapes.
- Moreover, key shapes are retrieved from an input shape collection based on the similarity of self-shape representations, enabling efficient cross-shape operations,
- Experimental results demonstrate improvements in fine-grained shape segmentation, achieving state-of-the-art performance on PartNet.

BuildingNet [4] (GitHub Repo, Project Website)

- BuildingNet is a large-scale dataset of 3D semantically-annotated building models.
- The dataset covers several building categories, such as houses, churches, skyscrapers, town halls, libraries, and castles.
- In addition, a graph neural network is proposed that labels building meshes by analyzing spatial and structural relations of their geometric primitives.
- Finally, a benchmark is included for evaluating mesh and point cloud labeling.

PB-DGCNN [5] (GitHub Repo, Project Website)

- A deep learning approach that detects boundaries of parts in 3D shapes represented as point clouds.
- Based on a graph convolutional network architecture, it can output a boundary probability for a point to lie in an area that separates two or more parts in a 3D shape.
- The output per point probability can be used in pairwise terms to improve graph-based semantic segmentation methods by localizing boundaries between semantic part and in the geometric decomposition of point clouds into regions enclosed by sharp boundaries detected by PB-DGCNN.

Visual Tracking [6] (GitHub Repo)

- An edge-based method for achieving 3D object tracking, via Gauss-Newton optimization.
- It relies on natural features observations, like edges, for the detection of interest points.
- Using the 3D pose of the detected object in the previous frame, it can correctly estimate its new 3D position and orientation, in real-time.

Workshops

StruCo3D @ CVPR 2023 Vancouver (Workshop Website, Challenge Website)

- The 2nd workshop on Structural and Compositional Learning on 3D Data.
- BuildingNet Challenge that includes two benchmarks for mesh and point cloud semantic labeling.

Skills

- **Languages:** Greek (Mother Tongue), English (C2)
- **Programming:** Python, C/C++, Bash-Shell, MATLAB
- **Deep Learning Frameworks:** PyTorch, TensorFlow
- **Libraries/APIs:** MinkowskiEngine, OpenCV, OpenGL, Intel RealSense SDK 2.0
- **Version Control:** Git (Bitbucket/GitHub/GitLab)
- **Job Scheduling/Virtualization:** Slurm, Docker
- **Platforms:** Unix/Linux, Windows