CURRICULUM VITAE

PERSONAL INFORMATION

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EDUCATION

Ph.D. in Machine Learning and Computer Vision *2022 -*
Department of Cybernetics, Czech Technical University
Advisor: Prof. Zuzana Kúkelová
Topic: Combining Algebraic and Learning-based Approaches for Camera Geometry Estimation.
Abstract: Camera geometry estimation is a fundamental task in computer vision, often relying on point correspondences as input to determine the camera parameters and their spatial configuration. This problem typically involves estimating models through a hypothesis-and-test framework, such as RANSAC, to robustly identify correct correspondences. A critical aspect of such optimization schemes is to require as few input correspondences as possible to estimate the model, which directly impacts the computational efficiency and robustness. Many camera geometry problems result in complex equation, for which there are no efficient or numerically stable solutions. In this study, we work towards providing approximate solutions to problems of camera geometry estimation, aiming to reduce the complexity of the studied problem configurations, which can lead to more efficient algorithms. Using a set of sampled correspondences to induce or generate additional approximate point correspondences, which we refer to as *virtual correspondences*, can enable us to transform our problem configurations into simpler ones, which can be solved using more efficient solvers. For generating the *virtual correspondences*, one can utilize either handcrafted or learning-based methods. Another way to provide approximate solutions is to relax the problem by not requiring a component, *i.e.* a set of parameters, of the output to be estimated. Instead, this component will be approximated, either by simple sampling strategies, or by employing machine learning algorithms. When considering radial distortion solvers, instead of estimating the radial distortion, we sample the distortion parameters and estimate the relative pose without considering distortion.

M.Sc. in Algorithms, Logic and Discrete Mathematics *2019 - 2021*
National and Kapodistrian University of Athens
National Technical University of Athens
Thesis: "Upper bounds on the number of embeddings of minimally rigid graphs"
Advisor: Prof. Ioannis Z. Emiris
Abstract: In graph theory, a rigid graph is a graph that has a finite number of embeddings in $\mathbb{R}^d$ up to rigid motions, with respect to a set of edge length constraints. An embedding of graph in $\mathbb{R}^d$ is an assignment of vertices to points in $\mathbb{R}^d$, which also induces a set of edge lengths that correspond to the distances between the connected vertices. An important class of rigid graphs is the class of minimally rigid graphs. A minimally rigid graph, is a graph that is rigid and has the property that the removal of any edge yields a graph that is not rigid. It is a major open problem to find tight upper bounds on the number of the embeddings in $\mathbb{R}^d$. For a long period, only the trivial bound of $\mathcal{O}(2^{d\cdot|V|})$ was known on the number of embeddings, that is derived from the direct application of Bézout's Theorem. In [Bartzos et al.], the bound was improved for $d \geq 5$, using matrix permanents. Recently in [Bartzos et al.], the asymptotic bound was improved in all dimension. In the special case of $d = 2$, the asymptotic upper bound was improved to $\mathcal{O}(3.7764^{|V|})$. It is known that the number of solutions of a well-constrained algebraic system is related to the number of embeddings. In particular, the number of the complex solutions of such an algebraic system extends the notion of real embeddings in the complex space, allowing us to bound the complex solutions, using tools from the complex algebraic geometry. In this thesis, by counting outdegree-constrained orientations of a graph that are related to the algebraic bounds [Bartzos et al.],

we improve the existing upper bounds, for the class of minimally rigid graphs, on the number of embeddings. In the case $d = 2$, the bound is improved to $\mathcal{O}(3.46^{|V|})$.

B.Sc. in Computer Science *2014 - 2019*
National and Kapodistrian University of Athens
Speciality: Theoritical Foundations • Data and Knowledge management
Thesis: "VentusNet: Deep Learning for Wind Speed Prediction" • Citation count: 2
Advisor: Prof. Ioannis Z. Emiris
Abstract: In this thesis, we develop a deep neural network architecture based on recurrent layers in order to forecast wind speed sequences. Our network's input is a conjunction of wind measurements and wind speed forecasts from another model. We analyse our data into time series so that, we capitalise on the temporal nature of our data and the recurrent layers. Mean absolute error, mean squared error and the logarithm of the hyperbolic cosine are used as the evaluation metrics of our model. Based on our experimental results, we show that our model achieves to improve that model's forecast whose forecasts are used as features on our model's input.

EMPLOYMENT

Research Associate *Jul 2022 - Sep 2024*
Athena Research Center and Ansys, Greece
The project aims at developing a novel stochastic approach for reducing the construction risk of the new generation of circuits, which will bring a significant progress in Electronic Design Automation of Integrated Circuits. Recent advances in Cloud Computing, Artificial Intelligence, and Internet of Things, create demands for denser and lower consumption Integrated Circuits, which operate on high frequencies, and with ever-increasing data transferring speeds. Under these circumstances, Crosstalk electromagnetic noise appears, and must be addressed during the Circuit Design stage. In this context, we employ Computational Geometry tools to enhance certain procedures such as random-walk-based capacitance extraction.

Research Fellow *May 2022 -*
Visual Recognition Group and Center for Machine Perception, Czechia
Combining Algebraic and Learning-based Approaches for Camera Geometry Estimation.

Research Assistant *Nov 2021 - Mar 2022*
Athena Research Center, Greece
The project aims at developing a novel stochastic approach for reducing the construction risk of the new generation of circuits, which will bring a significant progress in Electronic Design Automation of Integrated Circuits. Recent advances to Cloud Computing, Artificial Intelligence, and Internet of Things, create demands for denser and lower consumption Integrated Circuits, which operate on high frequencies, and with ever-increasing data transferring speeds. Under these circumstances, Crosstalk electromagnetic noise appears, and must be addressed during the Circuit Design stage. In this context, we design a method for spatial indexing data structure for facilitating region queries in the context of random-walk-based capacitance extraction.

INVITATIONS AND TALKS

2024 **Oral presentation** at **ECCV '24** (50SFM Workshop) of paper "*Are Minimal Radial Distortion Solvers Necessary for Relative Pose Estimation?* " in Milan, Italy.

2024 **Poster presentation** at the **International Computer Vision Summer School** (ICVSS) of paper "*Relative pose of three calibrated and partially calibrated cameras from four points using virtual correspondences* " in Sicily, Italy.

TECHNICAL SKILLS

Languages: Python, C/C++, Matlab, Maple, Prolog, Haskell, SQL, HTML, Java(Script), Sage, LaTeX, Bash
Technologies: Tensorflow, PyTorch, Git, Eigen, OpenCV, NumPy, Pandas, Linux, Jira, Confluence

CONFERENCE AND WORKSHOP PUBLICATIONS

In publications marked with (*), the authors are listed alphabetically.

ECCVW 2024 C. Tzamos, V. Kocur, Y. Ding, T. Sattler, Z. Kukelova. Are Minimal Radial Distortion Solvers Necessary for Relative Pose Estimation?. European Conference on Computer Vision Workshops. 2024.
arxiv.org/pdf/2410.05984

ISSAC 2022 (*) E. Bartzos, I.Z. Emiris, I.S. Kotsireas, and C. Tzamos. 2022. *Bounding the Number of Roots of Multi-Homogeneous Systems.* In Proceedings of the 2022 Int'l Symposium on Symbolic and Algebraic Computation (ISSAC '22), July 4–7, 2022, Villeneuve-d'Ascq, France. ACM, New York, NY, USA, 8 pages.
doi.org/10.1145/3476446.3536189

CASC 2021 (*) E. Bartzos, I.Z. Emiris, and C. Tzamos. *The m-Bézout bound and distance geometry.* In F. Boulier, M. England, T.M. Sadykov, and E.V. Vorozhtsov, editors, Computer Algebra in Scientific Computing - 23rd Intern, Workshop, CASC 2021, Sochi, Russia, September 13-17, 2021, Proc., volume 12865 of LNCS, pages 6–20. Springer, 2021.
doi.org/10.1007/978-3-030-85165-1_2

JOURNAL PUBLICATIONS

In publications marked with (*), the authors are listed alphabetically.

J.DAM 2023 (*) E. Bartzos, I.Z. Emiris and C. Tzamos, *An asymptotic upper bound for graph embeddings*, Discrete Applied Mathematics, vol. 327, pp. 157–177, 2023.
doi.org/10.1016/j.dam.2022.12.010

PRE-PRINTS

arXiv 2024 C. Tzamos, V. Kocur, D. Barath, Z. Berger Haladova, T. Sattler, Z. Kukelova. 2024. *Relative pose of three calibrated and partially calibrated cameras from four points using virtual correspondences*, arXiv:2303.16078.
arxiv.org/abs/2303.16078