

Ilias Theodorakopoulos

PHD IN PATTERN RECOGNITION & MACHINE LEARNING – DATA SCIENTIST

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  Ilias Theodorakopoulos

Personal Info

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| Place of Birth | Aighion, Greece |
| Year of Birth | 1985 |
| Nationality | Greek |
| Home Address | Omagiriou Dios 38 25100, Aigion, Greece |

Education

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| 2010 – 2014 | Doctor of Philosophy (Ph.D.) in <i>PATTERN RECOGNITION</i> , Dpt. of Physics, University of Patras, Patras, Greece <i>Research Field: Pattern Recognition, Manifold Learning</i> <i>Thesis Title: "Pattern recognition on images and multimedia sequences exhibiting manifold structures,"</i> Supervisor: Professor Spiros Fotopoulos Summa Cum Laude, Grade: 10/10 |
| 2007 – 2009 | Master of Science (M.Sc.) in <i>ELECTRONICS ENGINEERING AND COMPUTER SCIENCE</i> , Dpt. of Physics, University of Patras, Greece <i>Thesis Title: "Texture segmentation using multispectral analysis and non-linear dimensionality reduction"</i> Advisor: Professor George Economou Summa Cum Laude, Grade: 8.69/10 |
| 2002 – 2007 | Bachelor of Science (B.Sc.) in <i>PHYSICS</i> , Dpt. of Physics, University of Patras, Patras, Greece <i>Thesis Title: "Motion detection and segmentation in Video sequences"</i> Advisor: Professor George Economou Magna Cum Laude, Grade: 7.49/10 |

Work Experience

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| Jan 2016 – Current | Senior Data Scientist at IRIDA LABS S.A., Patras, Greece <i>Deep Learning</i> Development of systems with deep architectures for image and video analysis. Design of compact architectures targeting on embedded devices. R&D for the following H2020 EU-funded projects: <ul style="list-style-type: none">• "ALOHA- Software framework for runtime-Adaptive and secure deep Learning On Heterogeneous Architectures"• "TeamPlay - Time, Energy and security Analysis for Multi/Many-core heterogenous PLAtforms." |
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July 2015 – Jan 2016 **Systems & Software Engineer** at INFORMATION TECHNOLOGY SUPPORT CENTER, HELLENIC ARMY GENERAL STAFF (HAGS), Athens, Greece
(During compulsory military service)

Administration & maintenance of HAGS's LAN and WAN. Technical support for HAG's IT systems. Development of advanced diagnostic procedures for hardware malfunctions. Personnel training.

Dec 2011 – May 2015 **Computer vision specialist** and **Senior Embedded Software Engineer** at IRIDA LABS S.A., Patras, Greece
R&D and Embedded Software

Development of computer vision, computational imaging and biometric software for embedded hardware. Working with embedded platforms including ARM/Neon, IVP32 processors and TI DSPs.

R&D for various *national and EU funded research projects*.

Teaching

2020-2021 **Academic Fellow.** *Biomedical Engineering Dept., University of West Attica, Athens, Greece.*

Biomedical Signal Processing (Lab)

2017-2019 **Teaching Fellow.** *Electronics Laboratory (ELLAB), Dpt. of Physics, University of Patras, Greece*

Post-graduate course "Machine Learning and Vision". Taught the following sections:

- *Supervised Learning*
- *Independent Component Analysis*
- *Introduction to Sparse and Redundant Representations*
- *Introduction to Neural Networks*
- *Convolutional Neural Networks & Deep Learning*

2011 –2017 **Teaching Fellow.** *Electronics Laboratory (ELLAB), Dpt. of Physics, University of Patras, Greece*

Post-graduate courses: "Machine Vision and Learning", "Selected issues on digital signal processing", "Digital Signal Processing (ELC103)" and "Digital Image Processing (ELC104)". Taught several sections related to:

- *Deep Learning for computer Vision*
- *Sparse and Redundant Representation*
- *Independent Component Analysis (ICA)*
- *Local Image Descriptors*
- *Introduction to Music Information Retrieval.*
- *Signal Processing for Speech & Music*

Graded papers and exams, organized projects and exercises.

Advised ~15 graduate and undergraduate students on their theses in topics related to pattern recognition, machine learning and image analysis.

2008-2013 **Teaching Assistant.** *Electronics Laboratory (ELLAB), Dpt. of Physics, University of Patras, Greece*

Teaching, organizing and supervising the laboratory exercises for the following Undergraduate Courses:

- *Computer programming 1 (CLC109)*
- *Computer programming 2 (CLC110)*
- *Electronics (ECC205)*

Publications – Journals (peer reviewed)

- J1. ES Frima, I. Theodorakopoulos, D. Gidaris et al., "Lung Function Variability in Children and Adolescents With and Without Asthma (LUV Study)," *JMIR Res Protoc*, Protocol for a Prospective, Nonrandomized, Clinical Trial,9(8),2020, <https://doi.org/10.2196/20350>.
- J2. V., Pothos, E. Vassalos, I. Theodorakopoulos, et al., "Deep Learning Inference with Dynamic Graphs on Heterogeneous Platforms," *International Journal of Parallel Programming*, pp 1–19, 2020. <https://doi.org/10.1007/s10766-020-00654-2>
- J3. E. N. Zois, D. Tsourounis, I. Theodorakopoulos, A. Kesidis and G. Economou, "A comprehensive study of sparse representation techniques for offline signature verification", *IEEE Transactions on Biometrics, Behavior, and Identity Science*, 2018. (under review). <https://arxiv.org/abs/1807.05039>
- J4. S. Fouzas, I. Theodorakopoulos, E. Delgado-Eckert et al., "Breath-to-breath variability of exhaled CO2 as a marker of lung dysmaturity in infancy," *Journal of Applied Physiology*, vol. 123, no. 6. pp.1563-1570, Nov., 2017.
- J5. D. Kastaniotis, F. Fotopoulou, I. Theodorakopoulos, G. Economou and S. Fotopoulos,"HEp-2 cell classification with Vector of Hierarchically Aggregated Residuals", *Pattern Recognition*, Vol. 65, pp 47-57, May 2017. <http://dx.doi.org/10.1016/j.patcog.2016.12.013>.
- J6. D. Kastaniotis, I. Theodorakopoulos, G. Economou and S. Fotopoulos, "Gait based recognition via fusing information from Euclidean and Riemannian manifolds", *Pattern Recognition Letters*, Vol. 84, pp 245-251, December 2016, <http://dx.doi.org/10.1016/j.patrec.2016.10.012>.
- J7. D. Kastaniotis, I. Theodorakopoulos and S. Fotopoulos,"Pose-based gait recognition with Local Gradient Descriptors and Hierarchically Aggregated Residuals",*J. Electron. Imaging*. Vol. 25, Issue 6, December 2016. doi:10.1117/1.
- J8. I. Theodorakopoulos, G. Economou, S. Fotopoulos and C. Theoharatos, "Local manifold distance based on neighborhood graph reordering," *Pattern Recognition*, Volume 53, pp. 195-211, May 2016, <http://dx.doi.org/10.1016/j.patcog.2015.12.006>.
- J9. D. Kastaniotis, I. Theodorakopoulos, C. Theoharatos, G. Economou and S. Fotopoulos, "A framework for gait-based recognition using Kinect," *Pattern Recognition Letters*, Volume 68, pp. 327-335, December 2015, <http://dx.doi.org/10.1016/j.patrec.2015.06.020>.
- J10. I. Theodorakopoulos, D. Kastaniotis, G. Economou and S. Fotopoulos, "HEp-2 cells classification via sparse representation of textural features fused into dissimilarity space," *Pattern Recognition*, Volume 47, Issue 7, pp. 2367-2378, July 2014, <http://dx.doi.org/10.1016/j.patcog.2013.09.026>.
- J11. I. Theodorakopoulos, D. Kastaniotis, G Economou and S Fotopoulos, "HEp-2 Cell Classification Using Descriptors Fused into the Dissimilarity Space," *International Journal on Artificial Intelligence Tools*, vol. 23, 2014. <http://dx.doi.org/10.1142/S0218213014600069>.
- J12. I. Theodorakopoulos, D. Kastaniotis, G. Economou, S. Fotopoulos, "Pose-based human action recognition via sparse representation in dissimilarity space", *Journal of Visual Communication and Image Representation*, Volume 25, pp. 12-23, January 2014, <http://dx.doi.org/10.1016/j.jvcir.2013.03.008>.

Publications – Conferences (peer reviewed)

- C1. I. Theodorakopoulos, F. Fotopoulou and G. Economou, "Local Manifold Regularization for Knowledge Transfer in Convolutional Neural Networks," *11th International Conference on Information, Intelligence, Systems and Applications (IISA)*, Piraeus, Greece, 2020 (In Press).

- C2. N. Fragoulis, I. Theodorakopoulos, V. Pothos and E. Vassalos, "Dynamic Pruning of CNN networks," 2019 10th International Conference on Information, Intelligence, Systems and Applications (IISA), PATRAS, Greece, 2019, pp. 1-5. doi: 10.1109/IISA.2019.8900711
- C3. P. Meloni, D. Loi, P. Busia, G. Deriu, A. D. Pimentel, D. Sapra, T. Stefanov, S. Minakova, F. Conti, L. Benini, M. Pintor, B. Biggio, B. Moser, N. Shepeleva, N. Fragoulis, I. Theodorakopoulos, M. Masin, and F. Palumbo, "Optimization and deployment of cnns at the edge: The aloha experience," in *Proceedings of the 16th ACM International Conference on Computing Frontiers, CF '19*, (New York, NY, USA), pp. 326–332, ACM, 2019.
- C4. P. Meloni et al., "Architecture-aware design and implementation of CNN algorithms for embedded inference: the ALOHA project," 2018 30th International Conference on Microelectronics (ICM), Sousse, Tunisia, 2018, pp. 52-55. doi: 10.1109/ICM.2018.8704093
- C5. Meloni, Paolo, et al. "ALOHA: an architectural-aware framework for deep learning at the edge." *Proceedings of the Workshop on INTELLIGENT Embedded Systems Architectures and Applications*. ACM, 2018.
- C6. D. Tsourounis, I. Theodorakopoulos, E. Zois, G. Economou and S. Fotopoulos, "Handwritten Signature Verification via Deep Sparse Coding Architecture", in *proc. of 2018 IEEE Image, Video, and Multidimensional Signal Processing (IVMSP) Workshop*. 10-12 June 2018, Greece.
- C7. E. N. Zois, I. Theodorakopoulos, and G. Economou, "Offline Handwritten Signature Modeling and Verification Based on Archetypal Analysis." *The IEEE International Conference on Computer Vision (ICCV)*. October 2017.
- C8. E. N. Zois, I. Theodorakopoulos, D. Tsourounis et al., "Parsimonious Coding and Verification of Offline Handwritten Signatures." 2017 *IEEE Conference on Computer Vision and Pattern Recognition Workshops (CVPRW)*. pp. 636-645. July 2017.
- C9. I. Theodorakopoulos, D. Kastaniotis, G. Economou and S. Fotopoulos, "HEp-2 Cells Classification Using Morphological Features and a Bundle of Local Gradient Descriptors," *Pattern Recognition Techniques for Indirect Immunofluorescence Images (ISA)*, 2014 1st Workshop on, vol., no., pp.33,36, 24-24 Aug. 2014.
- C10. I. Theodorakopoulos, G Economou and S Fotopoulos, "Unsupervised music segmentation via multi-scale processing of compressive features' representation," in *Digital Signal Processing (DSP)*, 2013 18th International Conference on, 2013, pp. 1-6.
- C11. I. Theodorakopoulos, G Economou and S Fotopoulos, "Collaborative Sparse Representation in Dissimilarity Space for Classification of Visual Information," *Proceedings of the 9th International Symposium on Visual Computing (ISVC)*, pp. 496-506, Rethymnon, Greece, July 29-31, 2013.
- C12. I. Theodorakopoulos, G. Economou, S. Fotopoulos and A. Ifantis, "On-line signature recognition via fusion of dynamic features into dissimilarity space," in *Signal Processing and Information Technology (ISSPIT)*, 2013 IEEE International Symposium on, 2013, pp. 440-445.
- C13. D. Kastaniotis, I. Theodorakopoulos, G. Economou and S. Fotopoulos, "Gait-based gender recognition using pose information for real time applications," *Digital Signal Processing (DSP)*, 2013 18th International Conference on , vol., no., pp.1,6, 1-3 July 2013.
- C14. N.V. Politi-Stergiou, I. Theodorakopoulos, and G. Economou, "Local focus-tolerant image descriptors for classification of biological particles," *Bioinformatics and Bioengineering (BIBE)*, 2013 IEEE 13th International Conference on , vol., no., pp.1,4, 10-13 Nov. 2013. (nominated for best student paper award)
- C15. D. Kastaniotis, I. Theodorakopoulos, G. Economou and S. Fotopoulos, "HEp-2 cells classification using locally aggregated features mapped in the dissimilarity space," *Bioinformatics and Bioengineering (BIBE)*, 2013 IEEE 13th International Conference on , vol., no., pp.1,4, 10-13 Nov. 2013.
- C16. I. Theodorakopoulos, D. Kastaniotis, G Economou and S Fotopoulos, "Hep-2 cells classification via fusion of morphological and textural features," in *Bioinformatics & Bioengineering (BIBE)*, 2012 IEEE 12th International Conference on, 2012, pp. 689-694.
- C17. I. Theodorakopoulos, G Economou and S Fotopoulos, "Face recognition via local sparse coding," in *Computer Vision (ICCV)*, 2011 IEEE International Conference on, 2011, pp. 1647-1652.
- C18. F. Fotopoulou, I Theodorakopoulos and G Economou, "Fusion in phase space for shape retrieval," in *proc. EUSIPCO 2011*, pp. 936-940, Barcelona, Spain, August 29 - September 2 2011.

Abstracts – Conferences (peer reviewed)

- A1. A.-C. Kentgens, O. Lagiou, B. S. Fauchiger, F. Wyler, I. Theodorakopoulos, S. Yammine, S. Fouzas and P. Latzin "Volumetric capnography: a promising lung function test in cystic fibrosis?," *European Respiratory Journal*, 56 (suppl 64) 3954, Sep 2020,; DOI: 10.1183/13993003.congress-2020.3954I.
- A2. S. Fouzas, E. S. Frima, I. Theodorakopoulos, D. Gidaris, N. Karantaglis, G. Chatziparasidis, P. Plotas, I. Giannakopoulos, M. Anthracopoulos and U. Frey, "Fluctuation analysis of FEV1 in healthy children and adolescents: the effect of age," *European Respiratory Journal* 2020 56: 3952; DOI: 10.1183/13993003.congress-2020.3952.
- A3. O. Lagiou, B. Frauchiger, I. Theodorakopoulos, K. Ramsey, P. Latzin and S. Fouzas," Novel capnographic indices estimate ventilation inhomogeneity similarly to Lung Clearance Index," *European Respiratory Journal* 2019 54: OA1594; DOI: 10.1183/13993003.congress-2019.OA1594

Patents

- P1. D. Kastaniotis, **I. Theodorakopoulos** and N. Fragoulis, "Fast, embedded, hybrid video face recognition system", *US Patent App. 15/686,797*, *US Patent 10,509,952*. **Granted 2019**.
- P2. **I. Theodorakopoulos**, N. Fragoulis,"System and a method for camera motion analysis and understanding from a video sequences", *US Patent 9,508,026*. **Granted 2018**.
- P3. N.Fragoulis and **I. Theodorakopoulos**. "System and a method to achieve time-aware approximated inference." *US Patent App. 16/784,140*, published Aug 13, 2020. (pending)
- P4. **I. Theodorakopoulos**, V. Pothos, D. Kastaniotis and N. Fragoulis,"Parsimonious inference on convolutional neural networks",*US Patent App. 15/815,171*, published May 17, 2018. (pending)

Technical Reports

- T1. I.Theodorakopoulos et al.," Parsimonious Inference on Convolutional Neural Networks: Learning and applying on-line kernel activation rules", *arXiv:1701.05221v4 [cs.CV]*, 2017.
- T2. N. Fragoulis , I. Theodorakopoulos, D. Kastaniotis and V.K. Pothos, "A fast, implementation of a deep vanilla Convolutional Neural Network for Image Recognition, On Qualcomm Snapdragon 820", *Technical Report, Irida Labs S.A., October 2016*. DOI: 10.13140/RG.2.2.29675.13607
- T3. N. Fragoulis, V.K. Pothos, D. Kastaniotis, and I. Theodorakopoulos, "A fast, embedded implementation of a Convolutional Neural Network for Image Recognition-Revisited", *Technical Report, Irida Labs S.A., August 2016*. DOI: 10.13140/RG.2.1.1778.9681

Scholarships / Funding

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| 2020-2021 | National and EU (ESF) funding for the project: « New knowledge-transfer and regularization techniques for training Convolutional Neural Networks with limited data ». |
| 2020-2022 | Greek State Scholarships Foundation (IKY) Funding for my research proposal: « Architectures of Convolutional Neural Networks with Structural Plasticity » |
| 2018 | European Society for Pediatric Research (ESPR). Young Investigator START-UP Awards 2018. « Derivation of respiratory rate from pulse oximetry using deep learning » |
| 2011-2014 | Ph.D. Research funding program: "Heracleitus II: Investing in knowledge society through the European Social Fund." |

Honors and Degrees (selected)

- "Outstanding Reviewer Award" στο συνέδριο **CVPR 2020**.
- **Award** from the European Society for Paediatric Research (ESPR) for my research proposal «**Derivation of respiratory rate from pulse oximetry using deep learning**» in the context of Young Investigator START-UP Awards 2018.

International scientific contests:

- *Performance Evaluation of Indirect Immunofluorescence Image Analysis Systems*, hosted by ICPR 2014. **(3d place)**
- *Competition on Cells Classification by Fluorescent Image Analysis*, hosted by ICIP 2013. (9th place)
- *1st Biometric Recognition with Portable Devices Competition (MobBIO 2013)*, Hosted by ICIAR 2013. **(1st place)**
- *HEp-2 Cells Classification contest*, hosted by ICPR 2012. (10th place)

Student Contests:

- *7th Pan-Hellenic Astronomy Contest 2002*. (14th place)
- *6th Pan-Hellenic Astronomy Contest 2001*. (28th place)

Summer Schools & Workshops (selected)

1. "Space Training Course for Young Scientists and Professionals on Earth Observation", Corallia, 7-11 December 2015, Athens, Greece.
2. INRIA Summer School, "Visual Recognition and Machine Learning", 9-13 July 2012, Grenoble, France.
3. Workshop on "Quantum probability and Information". University of Patras, 2005, Patras, Greece.

Peer Reviewing (selected)

Reviewer in (among others) the following highly-valued scientific journal:

- PLOS ONE (eISSN: 1932-6203)
- Neurocomputing (ISSN: 0925-2312)
- Information Sciences (ISSN: 0020-0255)
- Pattern Recognition (ISSN: 0031-3203)
- Computer Methods and Programs in Biomedicine (ISSN: 0169-2607)
- IEEE Journal of Biomedical and Health Informatics (ISSN: 2168-2194)
- IEEE Transactions on Biomedical Engineering (ISSN: 1558-2531)
- IEEE Transactions on Information Forensics & Security (ISSN: 1556-6013)
- IEEE Transactions on Image Processing (ISSN: 1057-7149)
- IEEE Transactions on Cybernetics (ISSN: 2168-2267)
- IEEE Transactions on Information Forensics & Security (ISSN: 1556-6013)
- IEEE Transactions on Biometrics, Behavior, and Identity Science (ISSN: 2637-6407)
- IEEE Access (ISSN: 2169-3536)
- Neural Computing and Applications (ISSN: 0941-0643)
- Symmetry (ISSN 2073-8994)
- Journal of Visual Communication and Image Representation (ISSN: 1047-3203)
- European Journal of Operational Research (ISSN: 0377-2217)
- Pattern Recognition Letters (ISSN: 0167-8655)
- Biomedical Signal Processing and Control (ISSN: 1746-8094)

- Artificial Intelligence in Medicine (ISSN: 0933-3657)
- Expert Systems With Applications (ISSN: 0957-4174)
- Electronics Letters (ISSN:0013-5194)
- Sensors (ISSN: 1424-8220)
- Computers in Biology and Medicine (ISSN: 0010-4825)

Reviewer for the following highly-valued scientific conferences:

- IEEE Winter Conference on Applications of Computer Vision (WACV 2019, 2020 & 2021)
- IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR 2020)
- Asian Conference on Computer Vision (ACCV 2021)

Professional Skills

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| Expert Level | Machine Learning, Computer Vision, Pattern Recognition, Image & Signal Processing, System Identification, Graphical Pattern Recognition, Optimization, Embedded Software Development. |
| Basic/Interm. Level | Digital Systems Design, Analog Electronics (active filters, instrumentation amplifiers etc.) |
| Languages | Greek (native), English (C2 Level) |

Programming Skills

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| Expert Level | C/C++, MatLab, Python, SIMD programming (ARM/Neon, Snapdragon Hexagon DSP, TI DSPs, Cadence DPUs). |
| Basic/Interm. Level | R, Fortran, VHDL, HTML 5, MySQL, CUDA, CuDnn. |
| Development Tools | Matlab/Octave, Microsoft Visual Studio, Eclipse-based IDEs, Cadence/TI/Arm SDKs, OrCAD, Android Studio. |

Other Training and Certifications

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| First Aid / Rescue | Trained paramedic/rescuer from the "Volunteers Samaritans, Rescuers and Lifeguards Corp" of the Hellenic Red Cross. |
| Scuba Diving | "Open Water Diver" certification in scuba diving from the international organization PADI. |
| Offshore Sailing | Certified offshore sailing skipper. |
| Driving | European Driving license (cat. B) |

Interests – Activities

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| Research | Machine and Deep Learning, Computer Vision, Pattern Recognition, Biomedical image & signal analysis, Biometrics, Distributed Optimization, Graphical methods for Pattern Recognition. |
| Hobbies | Offshore sailing, Scuba diving, Skiing, music production, books, travelling. |